WQ XX-XXXX

CONCEPTUAL
County of Orange/Santa Ana Region Priority Project Water Quality Management Plan (WQMP)

Project Name:

EL TORO 100-ACRE PARCEL DEVELOPMENT

IRVINE, CA 90242

Prepared for:

Orange County Public Works

County Executive Office – Land Development

445 Civic Center Drive West, 2nd Floor

Santa Ana, CA

Prepared by:

Tait & Associates, Inc.

701 N. Parkcenter Drive

Santa Ana, CA 92705

714-560-8200

September 15, 2015
Revised November 19, 2015
Revised December 1, 2015

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REGISTERED PROFESSIONAL ENGINEER
D. TODD SCHMIEDER
No. C 37167
EXP. 6-30-16
CIVIL
STATE OF CALIFORNIA

September 15, 2015
Revised November 19, 2015
Revised December 1, 2015

County of Orange
Orange County Public Works - Grading Section
300 North Flower Street - P.O. Box 4048
Santa Ana, California 92702-4048 (714) 667-8871

OC Great Park

C-WQMP

Conceptual WQMP
REVIEW SHEET

Permits Numbers: TBD

Plan Date	*Date Received*	*Date Reviewed*	*Plan Check Status*
11/19/2015	11/23/2015	12/01/2015	Approval

By the Consulting Firm: Tait & Associates, Inc. (714) 560-8200

Project: El Toro 100-acre Parcel Development
Site Address: OC Great Park, Irvine, CA 90242
APN: 580-081-47, 52, 53, 70, 71, and 73
Civil Engineer: Todd Schmieder, tschmieder@tait.com

Developer/Owner: OCPW, CEO - Land Development
Address: 445 Civic Center Drive West, 2nd Floor
Contact: Eric Hull, eric.hull@ocpw.ocgov.com
Tel: (714) 667-8833, Cell: (714) 415-8099

The Conceptual WQMP was approved based on the conditions below:

I. Project Site Condition:
Project Area: 108.86 acres – 2103 Multi-Family Residential Units, Multi-Use Office, Retail, Hotel and Park/Open Space.
Impervious Area: Project Site: 97.97 acres / Drainage Area: 122.86 acres (Assumed: 90%)
Pervious Area: Project Site: 10.89 acres / Drainage Area: 13.65 acres (Assumed: 10%)
Priority Project Category: New development greater than 10,000 square feet.

II. Proposed BMPs:

1. Bio-treatment & Hydromodification BMPs for Streets:
   a) BIO-1: Bio-retention with underdrain (Cudo Water Storage System) for Hydromodification and LID/DCV.
   b) BIO-7: proprietary vegetated bio-treatment system (Modular Wetland System MWS Units).

2. Bio-treatment & Hydromodification BMPs for Development Sites:
   Proposed Treatment & Hydromodification Control BMPs:
   c) Infiltration BMP (INF) or Biotreatment BMP (BIO) for Hydromodification and LID/DCV. The details of the proposed BMP for each individual development site is to be determined in future permit application.

III. Approval:
The locations, section details, and the treatment areas of the above BMPs as shown in the WQMP Exhibit were reasonable and adequate to meet the water quality and hydromodification requirements set forth in, Order No. R8-2009-0030 /NPDES No. CAS618030, of Santa Ana Regional Water Quality Control Board. The above referenced conceptual WQMP was approved.

Report Reviewed by: J T Yean **Date: 12-02-2015**
J.T. Yean, Civil Engineer

Project Owner's Certification			
Planning Application No. (If applicable)	T.B.D.	Grading Permit No.	T.B.D.
Tract/Parcel Map and Lot(s) No.	Lot 284 Block 155, M.B. 1/88 Lot 285, 286 Block 140, M.B. 1/88	Building Permit No.	T.B.D.
Address of Project Site and APN (If no address, specify Tract/Parcel Map and Lot Numbers)			Address: T.B.D. APN: 580-081-47, 52, 53, 70, 71, 73

This Water Quality Management Plan (WQMP) has been prepared for Orange County Public Works by Tait & Associates, Inc. The WQMP is intended to comply with the requirements of the County of Orange NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan , including the ongoing operation and maintenance of all best management practices (BMPs), and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

Owner:			
Title	County of Orange		
Company	County Executive Office – Land Development		
Address	445 Civic Dr. West, 2nd Floor, Santa Ana, CA		
Email	T.B.D.		
Telephone #	714-667-9673		
I understand my responsibility to implement the provisions of this WQMP including the ongoing operation and maintenance of the best management practices (BMPs) described herein.			
Owner Signature		Date	

Preparer (Engineer): Todd Schmieder, P.E.			
Title	Project Manager	PE Registration #	C37167
Company	Tait & Associates		
Address	701 N. Parkcenter Drive, Santa Ana, CA 92705		
Email	tschmieder@tait.com		
Telephone #	714-560-8200		
I hereby certify that this Water Quality Management Plan is in compliance with, and meets the requirements set forth in, Order No. R8-2009-0030/NPDES No. CAS618030, of the Santa Ana Regional Water Quality Control Board.			
Preparer Signature		Date	
Place Stamp Here			

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Attachments

Attachment A. .....Educational Materials

Attachment B.....Hydrology, HCOC Backup Calculations (2yr, 24hr AES files), and Bio-filtration basin calculations

Attachment C..... Supporting Maps & Exhibits

Attachment D..... OC-Specific Design Criteria and Considerations & Proprietary BMP information and details

Attachment E.....Infiltration Feasibility worksheet/Summary of Harvested Water Demand and Feasibility Worksheet/Soils Report Information

Attachment F.....Operations and Maintenance (O&M) & Inspection Form

Attachment G.....Conditions of Approval

Attachment H.....California Department of Public Health Regulations

Section I Permit(s) and Water Quality Conditions of Approval or Issuance

Project Infomation			
Permit/Application No. (If applicable)	T.B.D.	Grading or Building Permit No. (If applicable)	T.B.D.
Address of Project Site (or Tract Map and Lot Number if no address) and APN	Lot 284 Block 155, M.B. 1/88 Lot 285, 286 Block 140, M.B. 1/88 APN: 580-081-47, 52, 53, 70, 71, 73		

Water Quality Conditions of Approval or Issuance	
Water Quality Conditions of Approval or Issuance applied to this project. (Please list verbatim.)	Conditions of Approval have not yet been applied.

Conceptual WQMP	
Was a Conceptual Water Quality Management Plan previously approved for this project?	No.

Watershed-Based Plan Conditions	
Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS.	Borrego Creek – No TMDLs San Diego Creek/Newport Bay – Sediment, Nutrient, Toxics, Fecal Coliform

Section II Project Description

II.1 Project Description

Description of Proposed Project		
Development Category (From Model WQMP, Table 7.11-2; or -3):	This project is considered a priority project under the following categories: **Category 1** – New development projects that create 10,000 square feet or more of impervious surface (collectively over the entire site). This category includes commercial, industrial, residential, mixed-use, and public projects on private, or public, property that falls under the planning and building authority or the Permittees. **Category 3** – Restaurants where the land area of development is 5,000 square feet or more including parking area. This category is defined as facilities that sell prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared food and drinks for immediate consumption (SIC code 5812). **Category 6** – Parking lots 5,000 square feet for more including associated drive isle, and potentially exposed to urban stormwater runoff. A parking lot is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce.	
Project Area (ft^2):	Number of Dwelling Units: The project is planned as a Mixed Use Development consisting of: Multi-Family Residential Units =2103 Multi-Use Office – 1,876,000s.f. Retail – 220,000s.f. Hotel – 242 rooms Covering Approx. 108 acres Development is currently established to include 30 Planning Areas, which for the preparation of this conceptual WQMP are broken down as follow: PA1-6 & PA20021 = Multi-Family Residential, PA7-9 & PA17-19 = Mixed Use Retail, PA10-16 = Multi-Use Office, and PA-A to PA-J = Park/Open Space.	SIC Code Major Groups 53: General Merchandise Stores, 54: Food Stores, 56: Apparel and Accessory Stores, 58: Eating and Drinking Places, 59: Miscellaneous Retail, 70: Hotels, Rooming Houses, Camps, and other Lodging Places, 72: Personal Services, 73: Business Services, 80: Health Services, 81: Legal Services

Project Area	Pervious		Impervious	
	Area (acres or sq ft)	Percentage	Area (acres or sq ft)	Percentage
Pre-Project Conditions Marshburn Channel *Outfall 1*	48.52 acres	85%	8.56 acres	15%
Pre-Project Conditions Bee Canyon Channel *Outfall 2*	37.1 acres	50%	37.1 acres	50%
Pre-Project Conditions Agua Chinon Channel *Outfall 3*	2.62 acres	50%	2.62 acres	50%
Post-Project Conditions Marshburn Channel *Outfall 1*	4.99 acres	10%	44.93 acres	90%
Post-Project Conditions Bee Canyon Channel *Outfall 2*	8.33 acres	10%	74.93 acres	90%
Post-Project Conditions Agua Chinon Channel *Outfall 3*	0.33 acres	10%	3.0 acres	90%
Drainage Patterns/Connections	The proposed site drainage patterns have been designed to closely match the existing drainage patterns (see the Proposed Condition Hydrology Map in *Attachment B*). Runoff will typically flow in a north to south and west to east direction, except for Planning Areas PA-5, PA-14 and PA-20 which will be designed to convey flow in a north to south and west to east direction due to the location of the downstream receiving drainage system. Runoff from each Planning Area will be collected in one of several storm drain systems. Before entering the storm drain system, each Planning Area will treat its runoff for pollutants in accordance with current WQMP requirements and mitigate any increase in flow resulting from development. The proposed storm drain systems will discharges off-site at the same locations as the existing site. Street related storm water runoff will also be treated for pollutants in accordance with current WQMP requirements prior to interception by the streets' storm drain systems.			

Storm water runoff from the project will be intercepted by three separate watersheds. These watersheds are:

Marshburn Channel – Outfall 1 (OCFCD F16)

The tributary area discharging to the Marshburn Channel is 49.92 acres. In the existing condition, an existing concrete trap channel leading to an existing 60" SSRP (located within Caltrans State Right of way for SR-133) has a capacity of 100 cfs and any flow exceeding the trap channel capacity would overtopped the railway south of the project. As part of the SR-133 improvements the existing 60" SSRP was designed to receive all of the runoff from an ultimate upstream condition that was assumed to contain a commercial land use for the former El Toro MCAS area within the project study area with no stormwater overtopping the railroad. The proposed project will include improving the existing trap channel leading to the 60" SSRP to fulfil runoff demands from the project.

Bee Canyon Channel – Outfall 2 (OCFCD F17)

The tributary area discharging to Bee Canyon Channel is 83.26 acres. Runoff is shown contributing from a fully commercial proposed project site to Bee Canyon Channel. Bee Canyon Channel has been adequately design to accommodate a 100-year storm event for a fully built-out development area within the Irvine Great Park. Bee Canyon Channel has previously been designed to accept runoff from the proposed project site, however a minor diversion is proposed to accommodate storm water runoff from Planning Areas PA-05 and PA-20 and a minor amount from PA-E, as defined in the project's Drainage Study.

Agua Chinon Channel – Outfall 3 (OCFCD F18)

The tributary area discharging to Agua Chinon Channel is 3.33 acres. The proposed project will continue to discharge runoff to the Agua Chinon Channel (Planning Area 14), but the tributary area and peak discharge will decrease. Based off of these facts and how small of a contribution these flows are to the Agua Chinon Channel, no problems are anticipated with continued discharge to this body of water. As a result there will be another small stormwater runoff diversion to the Bee Canyon Channel, as defined in the project's drainage Study.

Marshburn Channel, Bee Canyon Channel, and Agua Chinon Channel all discharge to the San Diego Creek Channel which is tributary to the Newport Bay and ultimately the Pacific Ocean.

Narrative Project Description: (Use as much space as necessary.)	The project resides on County land that was formally the El Toro Marine Base. The proposed project will involve fully developing the site area as a Mixed Use Development. Site grading to be accomplished to closely match existing drainage patterns. The proposed site includes 30 Planning Areas (PAs) that will be designed at a later date. This study addresses stormwater runoff from the project area as a whole with assumptions for future Planning Area land use and stormwater management.

II.2 Potential Stormwater Pollutants

Based on Table 2.1 "Anticipated and Potential Pollutants Generated by Land Use Type" in the Technical Guidance Document, under the category of Attached and Detached Residential Development, Commercial/Industrial Development, Restaurants, and Parking Lots, the pollutants of concerns are listed below.

Pollutants of Concern			
Pollutant	Check One for each: E=Expected to be of concern N=Not Expected to be of concern		Additional Information and Comments
Suspended-Solid/ Sediment	E ☒	N ☐	
Nutrients	E ☒	N ☐	
Heavy Metals	E ☒	N ☐	
Pathogens (Bacteria/Virus)	E ☒	N ☐	
Pesticides	E ☒	N ☐	
Oil and Grease	E ☒	N ☐	
Toxic Organic Compounds	E ☒	N ☐	
Trash and Debris	E ☒	N ☐	

II.3 Hydrologic Conditions of Concern

☐ No – Show map

☒ Yes – Describe applicable hydrologic conditions of concern below.

Per Section 2.2.3.1 in the TGD and the map provided in Appendix XVI, the project site is located in a potential area of erosion, habitat, & physical structure susceptibility due to the presence of an un-stabilized natural drainage channels downstream of the project area. See the HCOC map in Appendix C for project site and drainage channel locations.

The calculations shown on the following pages indicate that the post-development peak flow and runoff volume for the project will increase with the proposed improvements due to a decrease in the pervious area. Therefore the project has been determined to have HCOC's.

The results for the 2 year 24 hour storm event calculations for peak flows, time of concentrations and runoff volumes are as follows:

	Total Area (acres)		**Peak Flow Rate (cfs)**		**Time of Concentration (min.)**		**Volume (ft^3)**	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Outfall 1	57.00	49.60	23.80	44.08	36.87	14.28	71,438	163,350
Outfall 2	74.00	83.30	52.63	65.28	25.16	18.37	154,638	250,034
Outfall 3	5.20	3.30	6.19	4.92	10.70	8.47	9,148	14,375
Totals	**136.2** (1)	**136.2** (1)	**82.62**	**114.28**	----	----	**235,224**	**427,759**
Increase % or Amount	**0**		**38%**		------		**82%**	

(1) The Total Area figures includes approximately 21 acres of the OCTA Parcel, 0.5-acre of the City of Irvine property and 6.47 acres of the 2nd Harvest property in addition to the 100-Acre Parcel area.

See Appendix B for HCOC Flow Rate, Time of Concentration & Volume Calculations for each drainage area.

II.4 Post Development Drainage Characteristics

The proposed site drainage patterns have been designed to closely match the existing drainage patterns (see the Proposed Condition Hydrology Map in *Attachment B*). Runoff will flow in a westerly direction and be collected in one of several storm drain systems. Before entering the storm drain system, each Planning Area will treat its runoff for pollutants in accordance with current WQMP requirements and mitigate any increase in flow resulting from development. The proposed storm drain systems will discharges off-site at the same locations as the existing site. Refer to Section II.1 for drainage pattern descriptions for Outfalls 1 through 3.

II.5 Property Ownership/Management

Orange County Public Works

County Executive Office – Land Development

445 Civic Center Drive West, 2nd Floor

Santa Ana, CA

SECTION III

Section III Site Description

III.1 Physical Setting

Fill out table with relevant information. *Refer to Section 2.3.1 in the Technical Guidance Document (TGD).*

Name of Planned Community/Planning Area (if applicable)	El Toro Development
Location/Address	The project resides on County land that was formally the El Toro Marine Base. In general, the El Toro 100-Acre Parcel Development is an irregular shaped linear area located west-southwest of the existing main runway and southerly of future Marine Way. The area is bounded by railroad lines to the south, future Marine Way to the north, and existing undeveloped areas to the east and west. This area currently consists of unoccupied land and abandoned warehouse buildings. Building 317 is located in the central portion of the 100-Acre Parcel along the southwestern boundary and is currently planned for potential reuse as a retail facility. East of Building 317 is the existing 2nd Harvest Food Bank warehouse which will remain in operation
General Plan Land Use Designation	Existing = O.C. Great Park Proposed = O.C. Great Park
Zoning	Existing = Institutional Proposed = Trails & Transit Oriented Development
Acreage of Project Site	108.86
Predominant Soil Type	The project site location resides within the hydrology soil group B.

III.2 Site Characteristics

Site Characteristics	
Precipitation Zone	The rainfall zone for the project has a design capture storm depth of 0.80" based on the Rainfall zones map on the TGD figure XVI. See Attachment C.
Topography	Topography of the project site is relatively flat with a very gentle slope downward to the west and ground surface elevations ranging from +280 to +218 feet above mean sea level. The western half of the project predominately consists of barren grassland and the existing "Perimeter Road", a paved 2-lane road. The eastern half of the project consists of several large industrial buildings, abandoned railroad tracks, barren grassland, cracked and weathered asphalt surfaces, and a newly improved warehouse building occupied by the 2nd Harvest Food Bank.
Drainage Patterns/Connections	The proposed site drainage patterns have been designed to closely match the existing drainage patterns (see the Proposed Condition Hydrology Map in *Attachment B*). Runoff will flow in a westerly direction and ultimately be collected in one of three existing storm drain systems (Marshburn Channel, Bee Canyon Channel, or Agua Chinon Channel). Before entering the on-site storm drain lines, each Planning Area will treat its runoff for pollutants in accordance with the Final WQMP requirements and mitigate any increase in flow resulting from development. The proposed storm drain system will connect to the existing drainage systems via underground storm drain lines. Storm water runoff from street areas will also be treated in accordance with the Final WQMP requirements prior to collection by the various street storm drain systems.
Soil Type, Geology, and Infiltration Properties	The project site location resides within the hydrology soil group B. Group B soils are typically silt loams and loams. They have a moderate infiltration rate when thoroughly wetted and consist chiefly of moderately deep to deep and moderately well to well drained soils with moderately fine to moderately coarse texture.

Hydrogeologic (Groundwater) Conditions	The historic high groundwater was reported to be as shallow as 60 feet below the existing ground surface. The groundwater plume located beneath the project site has been identified to be a "Protected Plume Area" due its contamination as a result of the former MCAS operations.
Geotechnical Conditions (relevant to infiltration)	The young alluvial fan deposits were encountered at or near the ground surface and underlying the fill material and consisted mostly of interbedded loose to medium dense sands, silty sands, and clayey sands and firm to very stiff sandy silts, silty clay, sandy clay, and clay.
Off-Site Drainage	There is not off-site drainage run-on to the project site. All on-site flows will contribute stormwater discharge to the three outfalls existing storm drain systems based on existing flow volumes being conveyed from the site.
Utility and Infrastructure Information	The proposed utilities will be located under asphaltic paving with surface drainage; infiltration impacting the subsurface utilities is not a concern for the proposed project.

III.3 Watershed Description

Receiving Waters	Agua Chinon Channel (OCFCD F18) Bee Canyon Channel (OCFCD F17) Marshburn Channel (OCFCD F16) San Diego Creek Reach 2 San Diego Creek Reach 1 Newport Bay, Upper Newport Bay, Lower
303(d) Listed Impairments	San Diego Creek Reach 2 – Indicator Bacteria, Nutrients, Sedimentation/Siltation, Unknown Toxicity San Diego Creek Reach 1 – Fecal Coliform, Nutrients, Pesticides, Sedimentation/Siltation, Selenium, Toxaphene Newport Bay, Upper – Chlordane, Copper, DDT, Indicator Bacteria, Metals, Nutrients, PCBs, Pesticides, Sediment Toxicity, Sedimentation/Siltation Newport Bay, Lower – Chlordane, Copper, DDT, Indicator Bacteria, Nutrients, PCBs, Pesticides, Sediment Toxicity
Applicable TMDLs	San Diego Creek/Newport Bay (Sediment, Nutrients, Toxics, Fecal Coliform
Pollutants of Concern for the Project	Suspended-Solid/ Sediment, Nutrients, Heavy Metals, Pathogens (Bacteria/Virus), Pesticides, Oil and Grease, Toxic Organic Compounds, Trash and Debris
Environmentally Sensitive and Special Biological Significant Areas	None

SECTION IV

Section IV Best Management Practices (BMPs)

IV. 1 Project Performance Criteria

(NOC Permit Area only) Is there an approved WIHMP or equivalent for the project area that includes more stringent LID feasibility criteria or if there are opportunities identified for implementing LID on regional or sub-regional basis?	YES ☐	NO ☒
If yes, describe WIHMP feasibility criteria or regional/sub-regional LID opportunities.	There are currently no applicable approved WHIMP's within the watershed for this project.	

Project Performance Criteria	
If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP)	Hydrologic Conditions of Concern are considered to exist if any streams located downstream from the project are determined to be potentially susceptible to hydromodification impacts if either the post-development runoff volume or time of concentration for the 2-year, 24-hour storm exceeds the pre-development runoff volume or the time of concentration for the 2-year, 24-hour storm event by more than 5 percent. This project is located within an area of hydrologic concern (HCOC's) and will increase the peak flow, volumes and decrease the time of concentration for the storm event described above, therefore, this project is considered for Hydrologic Conditions of Concern. For this project, HCOC for the **Stormwater Design Volume** is not the controlling sizing standard as dictated in Appendix I of the Technical Guidance Document. The difference in runoff volume form the 2-year, 24-hour storm from the pre- to post-project is **not** greater than the runoff volume from the 85th storm depth (Design Capture Volume, DCV) by at least 5 percent. This project has utilized the County of Orange approved AES (Advanced Engineering Software) software for the 2-year, 24-hour storm event for both

	pre and post development volume calculations. The resultant files are included in Attachment B. HCOC will be mitigated through the use of underground detention basins to store the difference in runoff volumes. These basins are designed to discharge at an allowable flow rate equal to the existing peak runoff for the 100-year storm event. In addition, the proposed bio-treatment BMPs will also detain runoff to serve as additional mitigation to address the project HCOC's.
List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP)	Infiltration is not feasible for this project due to site location over an existing contaminated groundwater plume. The project site is located over a County of Orange designated "Plume Protection Boundary "are within of the former El Toro Marine Base (See Attachment C, "North Orange County Ground Water Protection Areas"). Harvest and Reuse BMP's are not an option for this project. This project does not consist of enough landscape for irrigation reuse. In addition, dual plumbed recycled water systems are not accepted by the California State Health Department (See section 60313.General Requirements, attachment H for a copy of the "Regulations Related to Recycled Water"). "No person other than a recycled water agency shall deliver recycled water to a dual plumbed facility." Evapotranspiration and Evaporation BMP's are not feasible for this project. This project will utilize Bio-treatment BMP's for the DCV for this project where feasible.
List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP)	Since Infiltration BMP's, Evapotranspiration and Evaporation BMP's are not feasible for this project, the project will utilize Bio-treatment BMPs and Proprietary Bio-treatment BMPs. For locations where the LID performance criteria cannot be meet, Bio-treatment BMPs and Proprietary Bio-treatment BMPs have been sized for the Volume-Based method; however, the developer for each Planning Area will be able to consider alternative LID treatment approaches to satisfy their Final WQMP requirements. Bio-treatment systems for the project's private streets will also consist of Bio-filtration System that in conjunction with Underground Stormwater Storage System have been sized for the Volume-Based method for Bio-treatment BMPs.
Calculate LID design storm capture volume for Project.	See the following pages for calculations. The calculations have been broken down by Drainage Management Areas (DMA's).

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 1) for PA-01

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	3.67	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.80	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.75	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	7,993	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 2) for PA-02

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	4.76	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.80	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.75	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	10,367	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 3) for PA-03

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	5.14	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.80	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.75	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	11,195	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 4) for PA-04

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	5.47	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.80	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.75	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	11,914	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 5) for PA-05

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	4.24	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.80	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.75	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	9,235	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 6) for PA-06

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.53	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.80	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.75	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	3,332	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 7) for PA-07

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	2.76	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.80	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.75	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	6,011	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 8) for PA-08

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	3.00	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	7,231	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 9) for the northerly portion of PA-09

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.36	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	3,278	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 10) for the southerly portion of PA-09

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	5.93	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	14,293	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 11) for PA-10

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	4.26	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	10,268	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 12) for PA-11

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	3.48	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	8,388	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 13) for PA-12

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	2.55	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	6,146	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 14) for PA-13

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	2.58	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	6,219	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 15) for PA-14

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	3.33	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	8,026	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 16) for PA-15

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	3.92	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	9,448	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 17) for PA-16

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	4.77	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	11,497	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 18) for PA-17 (Building 317 Planning Area)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	4.41	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	10,630	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 19) for PA-18

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	3.63	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	8,749	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 20) for PA-19

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	3.64	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.80	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.75	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	7,928	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA 21) for PA 20

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	2.70	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.80	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.75	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	5,881	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-A) for PA-A

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	2.77	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.15	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.26	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	2,091	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-B) for PA-B

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.90	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.15	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.26	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	680	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-C) For PA-C

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.59	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.15	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.26	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	445	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-D) for PA-D

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.19	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.15	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.26	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	898	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-E1) for the westerly portion of PA-E adjacent to and north of PA-04

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.56	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.15	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.26	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	423	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-E2) for the easterly portion of PA-E adjacent to and north of PA-05, PA-B and PA-06

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.86	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.15	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.26	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	649	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-F) for PA-F

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.87	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.15	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.26	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	657	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-G) for PA-G

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.82	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.15	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.26	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	619	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-H) for PA-H

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.66	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.15	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.26	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	498	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-I) for PA-I

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.83	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.15	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.26	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	627	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-J) for PA-J

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.94	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.15	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.26	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	710	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST1) for the proposed Optional Ridge Valley Extension

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.67	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	1,615	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 96′ long by 3′ deep.

(6′ x 96′ x 3′) x 95% void space = 1,641 cu-ft Volume Provided

A MWS-L-4-4 has a 2280 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST2) for south half of "A" Street from Ridge Valley Extension to "E" Street (adjacent to PA-01, PA-02 and PA-03)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.12	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	2,700	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 160′ long by 3′ deep.

(6′ x 160′ x 3′) x 95% void space = 2,736 cu-ft Volume Provided

A MWS-L-4-6 has a 3200 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST3) for south half of "A" Street from Ridge Valley Extension to "E" Street (adjacent to PA-01, PA-02 and PA-03)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	2.19	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	5,279	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 310′ long by 3′ deep.

(6′ x 310′ x 3′) x 95% void space = 5,301 cu-ft Volume Provided

A MWS-L-4-13 has a 6261 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST4) for south half of "A" Street from "E" Street to Bee Canyon Channel (adjacent to PA-20)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.63	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	1,519	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 90′ long by 3′ deep.

(6′ x 90′ x 3′) x 95% void space = 1,539 cu-ft Volume Provided

A MWS-L-4-4 has a 2280 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST5) for north half of "A" Street from "E" Street to Bee Canyon Channel (adjacent to PA-04 and PA-05)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.31	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	3,158	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 186′ long by 3′ deep.

(6′ x 186′ x 3′) x 95% void space = 3,181 cu-ft Volume Provided

A MWS-L-4-6 has a 3200 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST6) for north half of "A" Street from Bee Canyon Channel to "G" Street (adjacent to PA-B and PA-06)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.64	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	1,543	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 92′ long by 3′ deep.

(6′ x 92′ x 3′) x 95% void space = 1,573 cu-ft Volume Provided

A MWS-L-4-4 has a 2280 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST7) for south half of "A" Street from Bee Canyon Channel to "G" Street (adjacent to PA-A)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.22	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	530	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 32′ long by 3′ deep.

(6′ x 32′ x 3′) x 95% void space = 547 cu-ft Volume Provided

A MWS-L-4-4 has a 2280 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST8) for south half of "A" Street from "G" Street to "I" Street (adjacent to PA-19 and PA-18)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.66	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	1,591	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 94′ long by 3′ deep.

(6′ x 94′ x 3′) x 95% void space = 1,607 cu-ft Volume Provided

A MWS-L-4-4 has a 2280 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST9)) for north half of "A" Street from "G" Street to "I" Street (adjacent to PA-07 and PA-08)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.48	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	3,567	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 210′ long by 3′ deep.

(6′ x 210′ x 3′) x 95% void space = 3,591 cu-ft Volume Provided

A MWS-L-4-8 has a 5036 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST10) for south half of "B" Street from "I" Street to "J" Street (adjacent to PA-17 / Building 317)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	2.08	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	5,013	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 294′ long by 3′ deep.

(6′ x 294′ x 3′) x 95% void space = 5,027 cu-ft Volume Provided

A MWS-L-4-8 has a 5036 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST11) for north half of "B" Street from "I" Street to "J" Street (adjacent to PA-17 / Building 317)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.29	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	3,109	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 182′ long by 3′ deep.

(6′ x 182′ x 3′) x 95% void space = 3,112 cu-ft Volume Provided

A MWS-L-4-6 has a 3200 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST12) for north half of "A" Street from "J" Street to "K" Street (adjacent to PA-10)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.27	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	3,061	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 180′ long by 3′ deep.

(6′ x 180′ x 3′) x 95% void space = 3,078 cu-ft Volume Provided

A MWS-L-4-6 has a 3200 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST13) for south half of "A" Street from "J" Street to "K" Street (adjacent to PA-16)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.45	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	1,085	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 64′ long by 3′ deep.

(6′ x 64′ x 3′) x 95% void space = 1,094 cu-ft Volume Provided

A MWS-L-4-4 has a 2280 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST14) for south half of "A" Street from along west side of 2nd Harvest Parcel

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.97	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	2,338	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 138′ long by 3′ deep.

(6′ x 138′ x 3′) x 95% void space = 2,360 cu-ft Volume Provided

A MWS-L-4-6 has a 3200 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST15) for North half of "A" Street from along west side of 2nd Harvest Parcel and adjacent to PA-11

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.61	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	1,470	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 86′ long by 3′ deep.

(6′ x 86′ x 3′) x 95% void space = 1,471 cu-ft Volume Provided

A MWS-L-4-4 has a 2280 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST16) for North half of "A" Street from along east side of 2nd Harvest Parcel and adjacent to PA-11

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.65	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	1,567	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 92′ long by 3′ deep.

(6′ x 92′ x 3′) x 95% void space = 1,573 cu-ft Volume Provided

A MWS-L-4-4 has a 2280 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST17) for south half of "A" Street from along east side of 2nd Harvest Parcel

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.33	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	795	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 48′ long by 3′ deep.

(6′ x 48′ x 3′) x 95% void space = 821 cu-ft Volume Provided

A MWS-L-4-4 has a 2280 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST18) for north half of "A" Street from "L" Street to "M" Street (adjacent to PA-12 and PA-13)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.46	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	3,519	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 206′ long by 3′ deep.

(6′ x 206′ x 3′) x 95% void space = 3,522 cu-ft Volume Provided

A MWS-L-4-8 has a 5036 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST19) for south side of "A" Street from "L" Street to "M" Street (adjacent to PA-15 and PA-14)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.14	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	2,748	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 162′ long by 3′ deep.

(6′ x 162′ x 3′) x 95% void space = 2,770 cu-ft Volume Provided

A MWS-L-4-6 has a 3200 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST20) for "L" Street south of "A" Street (adjacent to PA-15 and 2nd Harvest)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.73	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	1,760	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 104′ long by 3′ deep.

(6′ x 104′ x 3′) x 95% void space = 1,778 cu-ft Volume Provided

A MWS-L-4-4 has a 2280 cu-ft Drain Down @ 48 hours.

Worksheet B: Simple Design Capture Volume Sizing Method (DMA-ST21) for south half of "A" Street from Ridge Valley Extension to "E" Street (adjacent to PA-01, PA-02 and PA-03)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.80	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.28	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.83	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	675	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N.A.	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N.A.	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N.A.	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N.A.	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N.A.	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N.A.	sq-ft

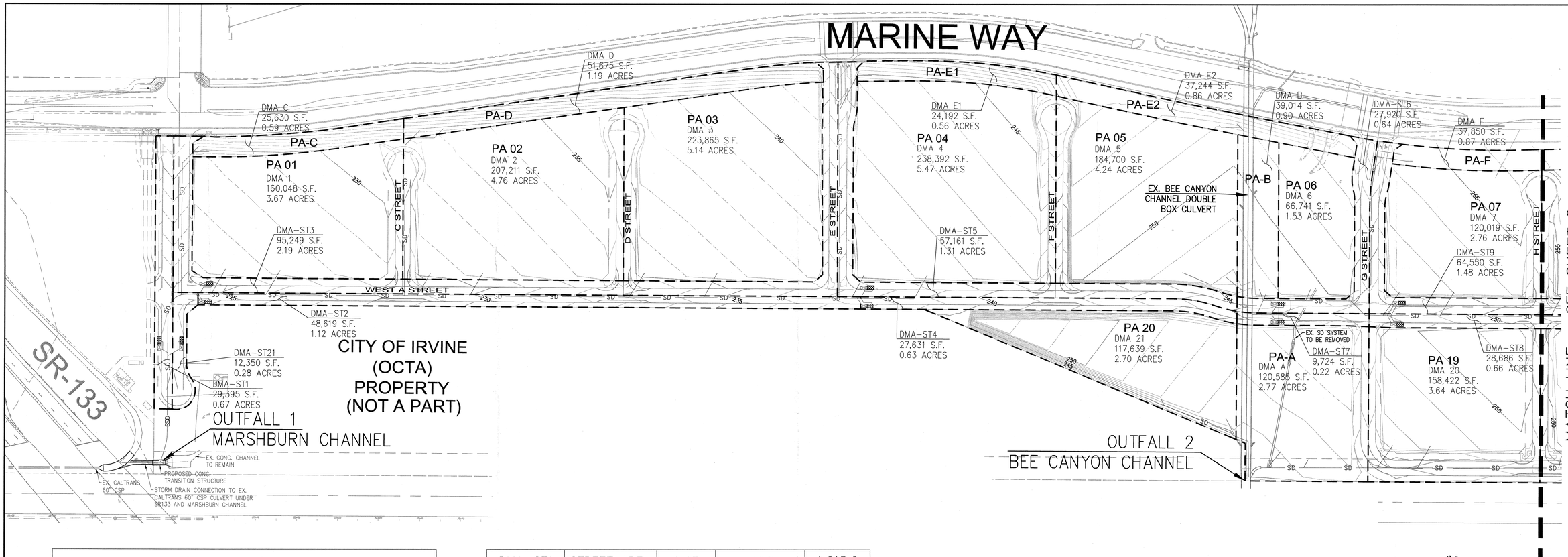
This DMA will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

6′ wide by 40′ long by 3′ deep.

(6′ x 40′ x 3′) x 95% void space = 684 cu-ft Volume Provided

A MWS-L-4-4 has a 2280 cu-ft Drain Down @ 48 hours.

DMA'S AND PA'S EXHIBIT & TABLE



DMA's & PA's TABLE

DMA#	PA#	AREA (ACRES)	IMPERVIOUS	DCV (CU.FT)
DMA 1	PA 01	3.67	80%	7,993.0
DMA 2	PA 02	4.76	80%	10,367.0
DMA 3	PA 03	5.14	80%	11,195.0
DMA 4	PA 04	5.47	80%	11,914.0
DMA 5	PA 05	4.24	80%	9,235.0
DMA 6	PA 06	1.53	80%	3,332.0
DMA 7	PA 07	2.76	80%	6,011.0
DMA 20	PA 19	3.64	80%	7,928.0
DMA A	PA-A	2.77	15%	2,091.0
DMA 21	PA 20	2.70	80%	5,881.0
DMA B	PA-B	0.90	15%	680.0
DMA C	PA-C	0.59	15%	445.0
DMA D	PA-D	1.19	15%	898.0
DMA E1	PA-E1	0.56	15%	423.0
DMA E2	PA-E2	0.86	15%	649.0
DMA F	PA-F	0.87	15%	657.0

DMA-ST1	STREET AREA	0.67	90%	1,615.0
DMA-ST2	STREET AREA	1.12	90%	2,700.0
DMA-ST3	STREET AREA	2.19	90%	5,279.0
DMA-ST4	STREET AREA	0.63	90%	1,519.0
DMA-ST5	STREET AREA	1.31	90%	3,158.0
DMA-ST6	STREET AREA	0.64	90%	1,543.0
DMA-ST7	STREET AREA	0.22	90%	530.0
DMA-ST8	STREET AREA	0.66	90%	1,591.0
DMA-ST9	STREET AREA	1.48	90%	3,567.0
DMA-ST21	STREET AREA	0.28	90%	675.0
TOTAL				101,876.0

N

0 100 150 200
(IN FEET)
1 INCH = 100 FEET

NOTES:

(A) SEE SECTION VI OF THE CONCEPTUAL WQMP FOR THE WQMP BMP PLOT PLAN AND DETAILS FOR THE MODULAR WETLANDS SYSTEM UNIT, BIO-TREATMENT SYSTEMS AND THE UNDERGROUND DETENTION BASIN SYSTEM.

(B) THE PROPOSED MODULAR WETLAND SYSTEMS, BIO-TREATMENT SYSTEMS AND UNDERGROUND DETENTION BASINS DEPICTED ON THE OVERALL 100-ACRE PARCEL BMP EXHIBIT ARE IDENTIFIED FOR PLANNING PURPOSES ONLY AND ACTUAL SYSTEMS PROPOSED WILL BE IDENTIFIED IN SEPARATE FINAL WQMP REPORTS FOR THE BACKBONE STREETS AND THE PROJECT'S PLANNING AREAS.

LEGEND

- DMA — DRAINAGE MANAGEMENT AREA
- PA-# — DEVELOPER PLANNING AREA
- PA-(LETTER) — OPEN SPACE/PARK PLANNING AREA
- ST — STREET
- CONTRIBUTORY AREA TO EACH DMA
- SD — STORM DRAIN LINE (BACKBONE IMPROVEMENT)
- STREET CATCH BASIN
- STREET MODULAR WETLAND UNIT (BIOFILTRATION)

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SECTION IV.1 DMA's AND PA's EXHIBIT & TABLE

EL TORO 100-ACRE PARCEL DEVELOPMENT PLAN- COUNTY OF ORANGE
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UNINCORPORATED TERRITORY OF THE COUNTY OF ORANGE
IRVINE, CALIFORNIA

DRAWN: RH
DATE: 2015.06.29
CHECKED: - -
DATE: - -
REVISION #: - -
DATE: - -
JOB NO: SP7531

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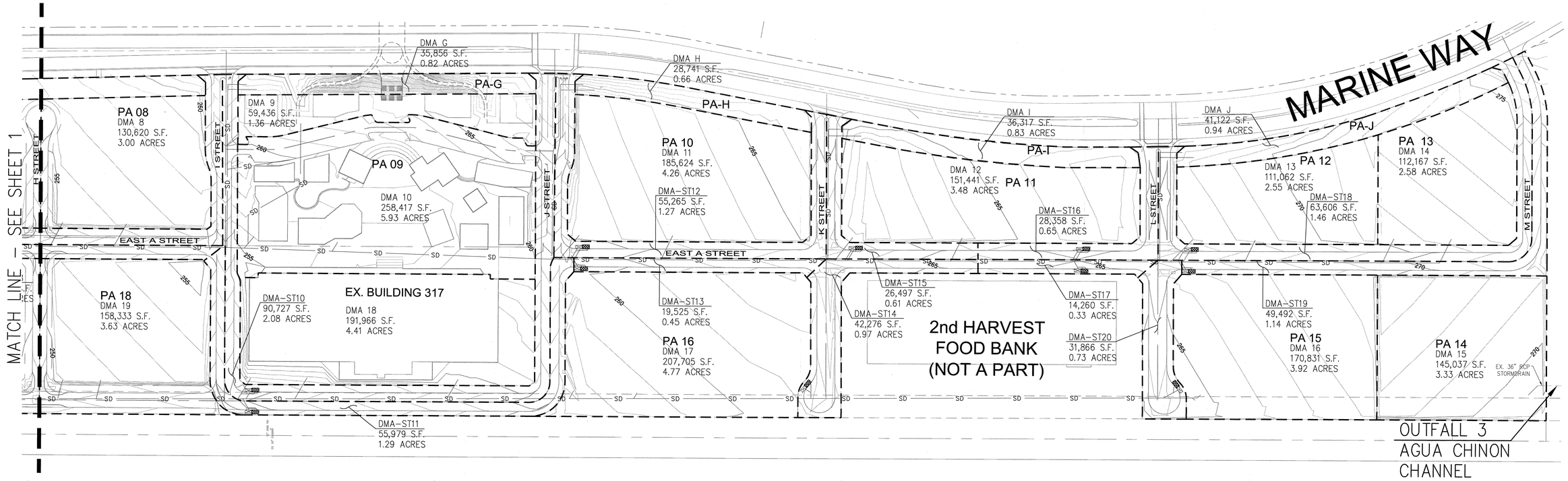

DMA's & PA's TABLE

DMA#	PA#	AREA (ACRES)	IMPERVIOUS	DCV (CU.FT)
DMA 8	PA 08	3.00	90%	7,231.0
DMA 9	PA 09	1.36	90%	3,278.0
DMA 10	PA 09	5.93	90%	14,293.0
DMA 11	PA 10	4.26	90%	10,268.0
DMA 12	PA 11	3.48	90%	8,388.0
DMA 13	PA 12	2.55	90%	6,146.0
DMA 14	PA 13	2.58	90%	6,219.0
DMA 15	PA 14	3.33	90%	8,026.0
DMA 16	PA 15	3.92	90%	9,448.0
DMA 17	PA 16	4.77	90%	11,497.0
DMA 18	EX. BLDG. 317	4.41	90%	10,630.0
DMA 19	PA 18	3.63	90%	8,749.0
DMA G	PA-G	0.82	15%	619.0
DMA H	PA-H	0.66	15%	498.0
DMA I	PA-I	0.83	15%	627.0
DMA J	PA-J	0.94	15%	710.0

DMA-ST10	STREET AREA	2.08	90%	5,013.0
DMA-ST11	STREET AREA	1.29	90%	3,109.0
DMA-ST12	STREET AREA	1.27	90%	3,061.0
DMA-ST13	STREET AREA	0.45	90%	1,085.0
DMA-ST14	STREET AREA	0.97	90%	2,338.0
DMA-ST15	STREET AREA	0.61	90%	1,470.0
DMA-ST16	STREET AREA	0.65	90%	1,567.0
DMA-ST17	STREET AREA	0.33	90%	795.0
DMA-ST18	STREET AREA	1.46	90%	3,519.0
DMA-ST19	STREET AREA	1.14	90%	2,748.0
DMA-ST20	STREET AREA	0.73	90%	1,760.0
TOTAL				133,092.0

N

0 100 150 200
(IN FEET)
1 INCH = 100 FEET

NOTES:

(A) SEE SECTION VI OF THE CONCEPTUAL WQMP FOR THE WQMP BMP PLOT PLAN AND DETAILS FOR THE MODULAR WETLANDS SYSTEM UNIT, BIO-TREATMENT SYSTEMS AND THE UNDERGROUND DETENTION BASIN SYSTEM.

(B) THE PROPOSED MODULAR WETLAND SYSTEMS, BIO-TREATMENT SYSTEMS AND UNDERGROUND DETENTION BASINS DEPICTED ON THE OVERALL 100-ACRE PARCEL BMP EXHIBIT ARE IDENTIFIED FOR PLANNING PURPOSES ONLY AND ACTUAL SYSTEMS PROPOSED WILL BE IDENTIFIED IN SEPARATE FINAL WQMP REPORTS FOR THE BACKBONE STREETS AND THE PROJECT'S PLANNING AREAS.

LEGEND

- DMA — DRAINAGE MANAGEMENT AREA
- PA-# — DEVELOPER PLANNING AREA
- PA-(LETTER) — OPEN SPACE/PARK PLANNING AREA
- ST — STREET
- CONTRIBUTORY AREA TO EACH DMA
- SD — STORM DRAIN LINE (BACKBONE IMPROVEMENT)
- STREET CATCH BASIN
- STREET MODULAR WETLAND UNIT (BIOFILTRATION)

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SECTION IV.1 DMA's AND PA's EXHIBIT & TABLE

EL TORO 100-ACRE PARCEL DEVELOPMENT PLAN- COUNTY OF ORANGE
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IV.2. Site Design and Drainage

The proposed site drainage patterns have been designed to closely match the existing drainage patterns (see the Proposed Condition Hydrology Map in *Attachment B*). Runoff will flow in a westerly direction and be collected in one of several storm drain systems. Before entering the storm drain system, each Planning Area will treat its runoff for pollutants in accordance with current WQMP requirements and mitigate any increase in flow resulting from development. The proposed storm drain systems will discharges off-site at the same locations as the existing site.

IV.3 LID BMP Selection and Project Conformance Analysis

IV.3.1 Hydrologic Source Controls (HSCs)

Name	Included?
Localized on-lot infiltration	☐
Impervious area dispersion (e.g. roof top disconnection)	☐
Street trees (canopy interception)	☒
Residential rain barrels (not actively managed)	☐
Green roofs/Brown roofs	☐
Blue roofs	☐
Impervious area reduction (e.g. permeable pavers, site design)	☒
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐

IV.3.2 Infiltration BMPs

Infiltration is not feasible for this project due to site location. The site is located within the El Toro Marine Base Plume Protection Boundary. See Attachment C, "North Orange County Ground Water Protection Areas". For Planning Area 1-21 & A - J, this project will utilize Bio-treatment BMP's for the DCV for this project. The streets will utilize Cudo Water Storage System or similar systemS to detain the DCV and then a Proprietary Bio-treatment BMP's, in the form of Modular Wetlands Units for storm water treatment. In addition, see Attachment E "Infiltration Feasibility Worksheet".

Name	Included?
Bioretention without underdrains	☐
Rain gardens	☐
Porous landscaping	☐
Infiltration planters	☐
Retention swales	☐
Infiltration trenches	☐
Infiltration basins	☐
Drywells	☐
Subsurface infiltration galleries	☐
French drains	☐
Permeable asphalt	☐
Permeable concrete	☐
Permeable concrete pavers	☐
Other:	☐
Other:	☐

No Calculations required, since infiltration BMP's not being utilized.

IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

Name	Included?
All HSCs; *See Section IV.3.1*	☐
Surface-based infiltration BMPs	☐
Biotreatment BMPs	☒
Above-ground cisterns and basins	☐
Underground detention	☐
Other:	☐
Other:	☐
Other:	☐

Evapotranspiration, Rainwater Harvesting BMPs are not proposed.

The project's proposed site landscape treatments and proposed Biotreatment BMPs will result in some evapotranspiration and evaporation potential: however, these benefits based on their limited footprints are not quantifiable. See section IV3.4. Evapotranspiration and Evaporation BMP's are not feasible for this project.

Dual plumbed recycled water systems are not accepted by the California State Health Department (See section 60313.General Requirements, attachment H for a copy of the "Regulations Related to Recycled Water"). "No person other than a recycled water agency shall deliver recycled water to a dual plumbed facility."

Rainwater harvest for irrigation reuse is not feasible for this project due to the landscape area required. Per the TGD, the site requires 86.21 acres of landscape area for irrigation reuse, but only has an effective area of 10.89 Acres provided.

See Attachment E: Summary of Harvested Water Demand and Feasibility" for calculations.

IV.3.4 Biotreatment BMPs

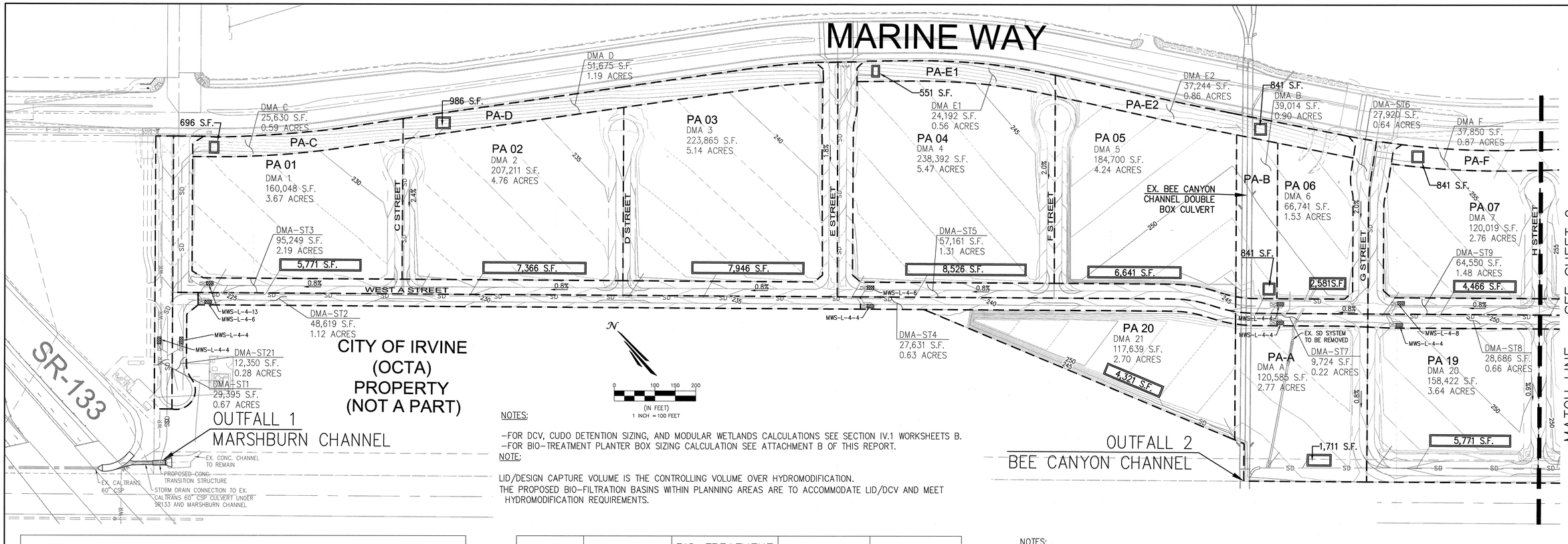
For Planning Area 1-21 & A - J, this project will utilize Bio-treatment BMP's for the DCV for this project. The streets will utilize Cudo Water Storage System or similar systems to detain the DCV (Volume based method) and then a Proprietary Bio-treatment BMP's, in the form of Modular Wetlands Units for storm water treatment.

Name	Included?
Bioretention with underdrains	☒
Stormwater planter boxes with underdrains	☐
Rain gardens with underdrains	☐
Constructed wetlands	☐
Vegetated swales	☐
Vegetated filter strips	☐
Proprietary vegetated biotreatment systems	☒
Wet extended detention basin	☐
Dry extended detention basins	☐
Other:	☐
Other:	☐

Bio-filtration basin calculations for the proposed bio-treatment systems are provided in Attachment B for Planning Areas 1-21 & A - J.

The street have been designed to capture the DCV in an underground detention system "Cudo Water Storage System" where storm water will then be treated by a Proprietary Bio-treatment BMP's, in the form of Modular Wetlands Unit. These units have been sized to draw down the DCV in less than 48 hours. For calculations, see Section IV.1 of this report.

BIO-TREATMENT BMPs EXHIBIT & TABLE



NOTES:

-FOR DCV, CUDO DETENTION SIZING, AND MODULAR WETLANDS CALCULATIONS SEE SECTION IV.1 WORKSHEETS B.
-FOR BIO-TREATMENT PLANTER BOX SIZING CALCULATION SEE ATTACHMENT B OF THIS REPORT.

NOTE:

LID/DESIGN CAPTURE VOLUME IS THE CONTROLLING VOLUME OVER HYDROMODIFICATION.
THE PROPOSED BIO-FILTRATION BASINS WITHIN PLANNING AREAS ARE TO ACCOMMODATE LID/DCV AND MEET HYDROMODIFICATION REQUIREMENTS.

BIO-TREATMENT BMPs TABLE

DMA#	PA#	MODEL (1)	SIZE	DCV (CU-FT)
DMA 1	PA 01	BIO-TREATMENT PLANTER BOX	5,771 SF	7,993
DMA 2	PA 02	BIO-TREATMENT PLANTER BOX	7,366 SF	10,367
DMA 3	PA 03	BIO-TREATMENT PLANTER BOX	7,946 SF	11,195
DMA 4	PA 04	BIO-TREATMENT PLANTER BOX	8,526 SF	11,914
DMA 5	PA 05	BIO-TREATMENT PLANTER BOX	6,641 SF	9,235
DMA 6	PA 06	BIO-TREATMENT PLANTER BOX	2,581 SF	3,332
DMA 7	PA 07	BIO-TREATMENT PLANTER BOX	4,466 SF	6,011
DMA 20	PA 19	BIO-TREATMENT PLANTER BOX	5,771 SF	7,928
DMA A	PA-A	BIO-TREATMENT PLANTER BOX	1,711 SF	2,091
DMA 21	PA 20	BIO-TREATMENT PLANTER BOX	4,321 SF	5,881
DMA B	PA-B	BIO-TREATMENT PLANTER BOX	841 SF	680
DMA C	PA-C	BIO-TREATMENT PLANTER BOX	696 SF	445
DMA D	PA-D	BIO-TREATMENT PLANTER BOX	986 SF	898
DMA E1	PA-E1	BIO-TREATMENT PLANTER BOX	551 SF	423
DMA E2	PA-E2	BIO-TREATMENT PLANTER BOX	841 SF	649
DMA F	PA-F	BIO-TREATMENT PLANTER BOX	841 SF	657

BIO-TREATMENT BMPs TABLE

DMA#	PA#	MODULAR WETLANDS (1)	SIZE	CUDO DETENTION SIZE (95% VOID)	DETENTION VOLUME PROVIDED	DCV (CU-FT)
DMA-ST1	STREET AREA	MWS-L-4-4	5' X 5'	6' X 3' X 96'	1,641	1,615
DMA-ST2	STREET AREA	MWS-L-4-6	5' X 7'	6' X 3' X 160'	2,736	2,700
DMA-ST3	STREET AREA	MWS-L-4-13	5' X 14'	6' X 3' X 310'	5,301	5,279
DMA-ST4	STREET AREA	MWS-L-4-4	5' X 5'	6' X 3' X 90'	1,539	1,519
DMA-ST5	STREET AREA	MWS-L-4-6	5' X 7'	6' X 3' X 186'	3,181	3,158
DMA-ST6	STREET AREA	MWS-L-4-4	5' X 5'	6' X 3' X 92'	1,573	1,543
DMA-ST7	STREET AREA	MWS-L-4-4	5' X 5'	6' X 3' X 32'	547	530
DMA-ST8	STREET AREA	MWS-L-4-4	5' X 5'	6' X 3' X 94'	1,607	1,591
DMA-ST9	STREET AREA	MWS-L-4-8	5' X 9'	6' X 3' X 210'	3,591	3,567
DMA-ST21	STREET AREA	MWS-L-4-4	5' X 5'	6' X 3' X 40'	684	675

NOTES:

(A) SEE SECTION VI OF THE CONCEPTUAL WQMP FOR THE WQMP BMP PLOT PLAN AND DETAILS FOR THE MODULAR WETLANDS SYSTEM UNIT, BIO-TREATMENT SYSTEMS AND THE UNDERGROUND DETENTION BASIN SYSTEM.

(B) THE PROPOSED MODULAR WETLAND SYSTEMS, BIO-TREATMENT SYSTEMS AND UNDERGROUND DETENTION BASINS DEPICTED ON THE OVERALL 100-ACRE PARCEL BMP EXHIBIT ARE IDENTIFIED FOR PLANNING PURPOSES ONLY AND ACTUAL SYSTEMS PROPOSED WILL BE IDENTIFIED IN SEPARATE FINAL WQMP REPORTS FOR THE BACKBONE STREETS AND THE PROJECT'S PLANNING AREAS.

(1) PROPOSED MODEL TYPE FOR PRELIMINARY DESIGN AND SIZING PURPOSES ONLY AND FINAL MODEL TYPE AND SYSTEM TO BE DETERMINED DURING FINAL DESIGN FOR BACKBONE STREETS AND PLANNING AREAS.

LEGEND

- CATCH BASIN (BACKBONE IMPROVEMENT)
- SD — STORM DRAIN LINE (BACKBONE IMPROVEMENT)
- MWU X-XX MODULAR WETLAND SYSTEM (BACKBONE IMPROVEMENT)
- X,XXX S.F. BIO-TREATMENT SYSTEM (DEVELOPER IMPROVEMENT)
- DMA DRAINAGE MANAGEMENT AREA
- PA-# DEVELOPER PLANNING AREA
- PA-(LETTER) OPEN SPACE/PARK PLANNING AREA
- ST STREET
- CONTRIBUTORY AREA TO EACH DMA
- STREET MODULAR WETLAND UNIT (BIOFILTRATION)

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SECTION IV.3.4 BIO-TREATMENT BMPs EXHIBIT & TABLE

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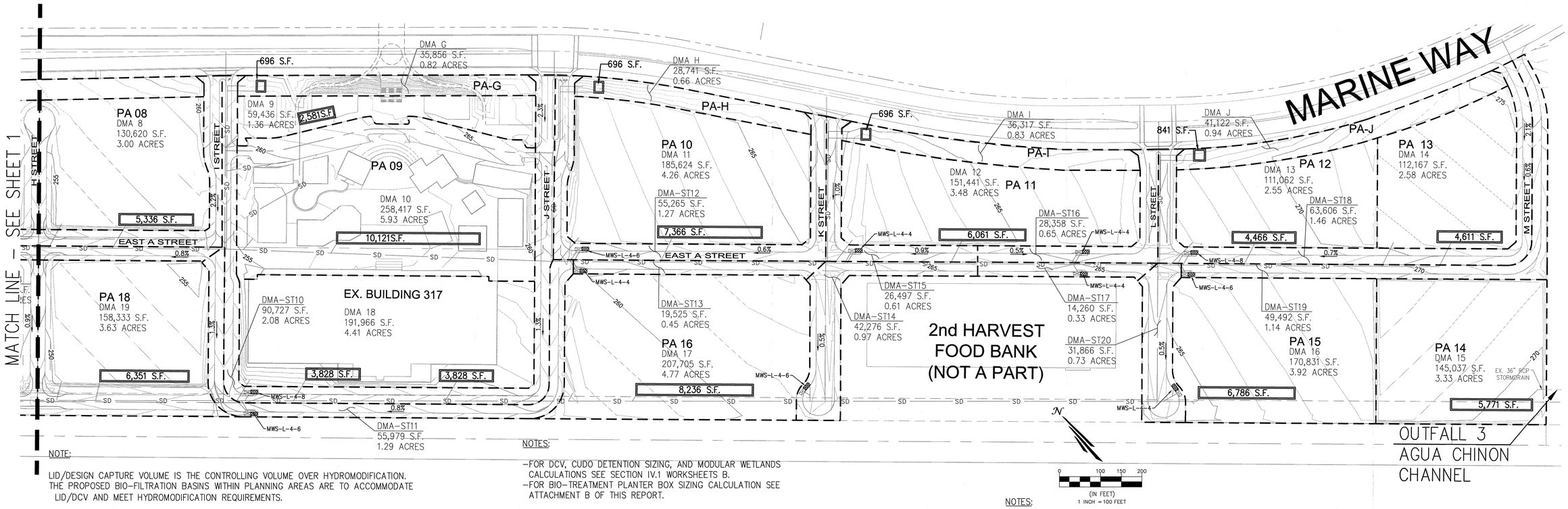

NOTE:

LID/DESIGN CAPTURE VOLUME IS THE CONTROLLING VOLUME OVER HYDROMODIFICATION. THE PROPOSED BIO-FILTRATION BASINS WITHIN PLANNING AREAS ARE TO ACCOMMODATE LID/DCV AND MEET HYDROMODIFICATION REQUIREMENTS.

NOTES:

-FOR DCV, CUDO DETENTION SIZING, AND MODULAR WETLANDS CALCULATIONS SEE SECTION IV.1 WORKSHEETS B.
-FOR BIO-TREATMENT PLANTER BOX SIZING CALCULATION SEE ATTACHMENT B OF THIS REPORT.

NOTES:

(A) SEE SECTION VI OF THE CONCEPTUAL WQMP FOR THE WQMP BMP PLOT PLAN AND DETAILS FOR THE MODULAR WETLANDS SYSTEM UNIT, BIO-TREATMENT SYSTEMS AND THE UNDERGROUND DETENTION BASIN SYSTEM.

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(1) PROPOSED MODEL TYPE FOR PRELIMINARY DESIGN AND SIZING PURPOSES ONLY AND FINAL MODEL TYPE AND SYSTEM TO BE DETERMINED DURING FINAL DESIGN FOR BACKBONE STREETS AND PLANNING AREAS.

BIO-TREATMENT BMPs TABLE

DMA#	PA#	MODEL (1)	SIZE	DCV (CU-FT)
DMA 8	PA 08	BIO-TREATMENT PLANTER BOX	5,336 SF	7,231
DMA 9	PA 09	BIO-TREATMENT PLANTER BOX	2,581 SF	3,278
DMA 10	PA 09	BIO-TREATMENT PLANTER BOX	10,121 SF	14,293
DMA 11	PA 10	BIO-TREATMENT PLANTER BOX	7,366 SF	10,268
DMA 12	PA 11	BIO-TREATMENT PLANTER BOX	6,061 SF	8,388
DMA 13	PA 12	BIO-TREATMENT PLANTER BOX	4,466 SF	6,146
DMA 14	PA 13	BIO-TREATMENT PLANTER BOX	4,611 SF	6,219
DMA 15	PA 14	BIO-TREATMENT PLANTER BOX	5,771 SF	8,026
DMA 16	PA-15	BIO-TREATMENT PLANTER BOX	6,786 SF	9,448
DMA 17	PA 16	BIO-TREATMENT PLANTER BOX	8,236 SF	11,497
DMA 18	EX. BLDG. 317	BIO-TREATMENT PLANTER BOX	7,656 SF	10,630
DMA 19	PA-18	BIO-TREATMENT PLANTER BOX	6,351 SF	8,749
DMA G	PA-G	BIO-TREATMENT PLANTER BOX	696 SF	619
DMA H	PA-H	BIO-TREATMENT PLANTER BOX	696 SF	498
DMA I	PA-I	BIO-TREATMENT PLANTER BOX	696 SF	627
DMA J	PA-J	BIO-TREATMENT PLANTER BOX	841 SF	710

BIO-TREATMENT BMPs TABLE

DMA#	PA#	MODULAR WETLANDS (1)	SIZE	CUDO DETENTION SIZE (95% VOID)	DETENTION VOLUME PROVIDED	DCV (CU-FT)
DMA-ST10	STREET AREA	MWS-L-4-8	5' X 9'	6' X 3' X 294'	5,027	5,013
DMA-ST11	STREET AREA	MWS-L-4-6	5' X 7'	6' X 3' X 182'	3,112	3,109
DMA-ST12	STREET AREA	MWS-L-4-6	5' X 7'	6' X 3' X 180'	5,078	3,061
DMA-ST13	STREET AREA	MWS-L-4-4	5' X 5'	6' X 3' X 64'	1,094	1,085
DMA-ST14	STREET AREA	MWS-L-4-6	5' X 7'	6' X 3' X 138'	2,360	2,338
DMA-ST15	STREET AREA	MWS-L-4-4	5' X 5'	6' X 3' X 86'	1,471	1,470
DMA-ST16	STREET AREA	MWS-L-4-4	5' X 5'	6' X 3' X 92'	1,573	1,494
DMA-ST17	STREET AREA	MWS-L-4-4	5' X 5'	6' X 3' X 48'	795	795
DMA-ST18	STREET AREA	MWS-L-4-8	5' X 9'	6' X 3' X 206'	3,522	3,447
DMA-ST19	STREET AREA	MWS-L-4-6	5' X 7'	6' X 3' X 162'	2,770	2,748
DMA-ST20	STREET AREA	MWS-L-4-4	5' X 5'	6' X 3' X 104'	1,778	1,760

LEGEND

- CATCH BASIN (BACKBONE IMPROVEMENT)
- SD — STORM DRAIN LINE (BACKBONE IMPROVEMENT)
- MWU X-XX MODULAR WETLAND SYSTEM (BACKBONE IMPROVEMENT)
- X,XXX S.F. — BIO-TREATMENT SYSTEM (DEVELOPER IMPROVEMENT)
- DMA — DRAINAGE MANAGEMENT AREA
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- ST — STREET
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SECTION IV.3.4 BIO-TREATMENT BMPs EXHIBIT & TABLE

EL TORO 100-ACRE PARCEL DEVELOPMENT PLAN- COUNTY OF ORANGE
LOWE ENTERPRISES REAL ESTATE GROUP
UNINCORPORATED TERRITORY OF THE COUNTY OF ORANGE
IRVINE, CALIFORNIA

DRAWN: RH
DATE: 2015.06.29
CHECKED: --
DATE: --
REVISION #: --
DATE: --
JOB NO: SP7531

Dec 01, 2015 – 4:04pm by mdeligarza K:\Drawings\SP\SP7531 Lowe El Toro\Eng\WQMP\100 acre Parcel Revised.DWG

IV.3.5 Hydromodification Control BMPs

Hydromodification BMPs are required for this site as the 2-year, 24-hour pre-developed site has a lower peak flow and higher time of concentration than the 2-year, 24-hour post-developed site. A combination of hydromodification control BMPs will be utilized for this project.

Hydromodification Control BMPs	
BMP Name	**BMP Description**
Bioretention with Underdrains	Biotreatment BMPs are a broad class of LID BMPs that reduce stormwater volume to the maximum extent practicable, treat stormwater using a suite of treatment mechanisms characteristic of biologically active systems, and discharge water to the downstream storm drain system or directly to receiving waters. Treatment mechanisms include media filtration (through biologically-active media), vegetative filtration (straining, sedimentation, interception and stabilization of particles resulting from shallow flow through vegetation), general sorption processes, biologically-mediated transformations, and other processes to address both suspended and dissolved constituents.
Proprietary Vegetated Biotreatment Systems	Proprietary Vegetated Biotreatment Systems fall under the category of Biotreatment BMPs. See above.
Underground Detention System	Underground detention system will be designed to retain excess runoff from the proposed site to match the existing site conditions 2 year peak flows or the DCV, whichever volume is greater. For this project, the DCV is the greater of the two.

This project has utilized the County of Orange approved AES (Advanced Engineering Software) software for the 2-year, 24-hour storm event for both pre and post development volume calculations. The overall project has been broken into three master watersheds (Marshburn Channel, Bee Canyon Channel, and Agua Chinon Channel). A pre- and post-project AES volume file has been generated for each watershed. The resultant files are included in Attachment B. These files have been added together to generate a **total** pre- and post-project volume as shown in the table in Section II.3. **Pre = 235, 224 cu-ft** & **Post = 427,759 cu-ft.** The pre- and post-project volumes have been broken down by percentage based on each individual DMA's. The volume of each DMA has been pro-rated based on the individual DMA's area divided by the total project area. The calculations are shown on the following pages.

2 YEAR 24 HOUR CALCULATIONS

Given: Total Acres for all DMA's – 108.3 acres
Pre-development Total Volume – 235,224 cu-ft (From AES Files)
Post-development Total Volume – 427,759 cu-ft (From AES Files)

Calculations:

DMA 1
DMA 1 = 3.67 ac
3.67 ac/108.3 ac = 0.0339
Pre = 0.0339 x 235,224 cu-ft = **7,974.8 cu-ft**
Post = 0.0339 x 427,759 cu-ft = **14,501.0 cu-ft**

DMA 2
DMA 2 = 4.76 ac
4.76 ac/108.3 ac = 0.0440
Pre = 0.0440 x 235,224 cu-ft = **10,349.9 cu-ft**
Post = 0.0440 x 427,759 cu-ft = **18,821.4 cu-ft**

DMA 3
DMA 3 = 5.14 ac
5.14 ac/108.3 ac = 0.0475
Pre = 0.0475 x 235,224 cu-ft = **11,173.1 cu-ft**
Post = 0.0475 x 427,759 cu-ft = **20,318.6 cu-ft**

DMA 4
DMA 4 = 5.47 ac
5.47 ac/108.3 ac = 0.0505
Pre = 0.0505 x 235,224 cu-ft = **11,878.8 cu-ft**
Post = 0.0505 x 427,759 cu-ft = **21,601.8 cu-ft**

DMA 5
DMA 5 = 4.24 ac
4.24 ac/108.3 ac = 0.0392
Pre = 0.0392 x 235,224 cu-ft = **9,220.8 cu-ft**
Post = 0.0392 x 427,759 cu-ft = **16,768.2 cu-ft**

DMA 6

DMA 6 = 1.53 ac

1.53 ac/108.3 ac = 0.0141

Pre = 0.0141 x 235,224 cu-ft = **3,316.7 cu-ft**

Post = 0.0141 x 427,759 cu-ft = **6,031.4 cu-ft**

DMA 7

DMA 7 = 2.76 ac

2.76 ac/108.3 ac = 0.0255

Pre = 0.0255 x 235,224 cu-ft = **5,998.7 cu-ft**

Post = 0.0255 x 427,759 cu-ft = **10,907.9 cu-ft**

DMA 8

DMA 8 = 3.00 ac

3.00 ac/108.3 ac = 0.0277

Pre = 0.0277 x 235,224 cu-ft = **6,515.7 cu-ft**

Post = 0.0277 x 427,759 cu-ft = **11,848.9 cu-ft**

DMA 9

DMA 9 = 1.36 ac

1.36 ac/108.3 ac = 0.0126

Pre = 0.0126 x 235,224 cu-ft = **2,963.8 cu-ft**

Post = 0.0126 x 427,759 cu-ft = **5,389.8 cu-ft**

DMA 10

DMA 10= 5.93 ac

5.93 ac/108.3 ac = 0.0548

Pre = 0.0548 x 235,224 cu-ft = **11,878.8 cu-ft**

Post = 0.0548 x 427,759 cu-ft = **23,441.2 cu-ft**

DMA 11

DMA 11= 4.26 ac

4.26 ac/108.3 ac = 0.0393

Pre = 0.0393 x 235,224 cu-ft = **9,244.3 cu-ft**

Post = 0.0393 x 427,759 cu-ft = **16,810.9 cu-ft**

DMA 12
DMA 12 = 3.48 ac
3.48 ac/108.3 ac = 0.0321
Pre = 0.0321 x 235,224 cu-ft = **7,550.7 cu-ft**
Post = 0.0321 x 427,759 cu-ft = **13,731.1 cu-ft**

DMA 13
DMA 13 = 2.55 ac
2.55 ac/108.3 ac = 0.0235
Pre = 0.0235 x 235,224 cu-ft = **5,527.8 cu-ft**
Post = 0.0235 x 427,759 cu-ft = **10,052.3 cu-ft**

DMA 14
DMA 14 = 2.58 ac
2.58 ac/108.3 ac = 0.0238
Pre = 0.0238 x 235,224 cu-ft = **5,598.3 cu-ft**
Post = 0.0238 x 427,759 cu-ft = **10,180.7 cu-ft**

DMA 15
DMA 15 = 3.33 ac
3.33 ac/108.3 ac = 0.0307
Pre = 0.0307 x 235,224 cu-ft = **7,222.0 cu-ft**
Post = 0.0307 x 427,759 cu-ft = **13,132.2 cu-ft**

DMA 16
DMA 16 = 3.92 ac
3.92 ac/108.3 ac = 0.0362
Pre = 0.0362 x 235,224 cu-ft = **8,515.1 cu-ft**
Post = 0.0362 x 427,759 cu-ft = **15,484.9 cu-ft**

DMA 17
DMA 17 = 4.77 ac
4.77 ac/108.3 ac = 0.0440
Pre = 0.0440 x 235,224 cu-ft = **10,349.9 cu-ft**
Post = 0.0440 x 427,759 cu-ft = **18,821.4 cu-ft**

DMA 18
DMA 18 = 4.41 ac
4.41 ac/108.3 ac = 0.0407
Pre = 0.0407 x 235,224 cu-ft = **9,573.6 cu-ft**
Post = 0.0407 x 427,759 cu-ft = **17,409.8 cu-ft**

DMA 19
DMA 19 = 3.63 ac
3.63 ac/108.3 ac = 0.0335
Pre = 0.0335 x 235,224 cu-ft = **7,880.0 cu-ft**
Post = 0.0335 x 427,759 cu-ft = **14,329.9 cu-ft**

DMA 20
DMA 20 = 3.64 ac
3.64 ac/108.3 ac = 0.0336
Pre = 0.0336 x 235,224 cu-ft = **7,903.5 cu-ft**
Post = 0.0336 x 427,759 cu-ft = **14,372.7 cu-ft**

DMA 21
DMA 21 = 2.70 ac
2.70 ac/108.3 ac = 0.0249
Pre = 0.0249 x 235,224 cu-ft = **5,857.1 cu-ft**
Post = 0.0249 x 427,759 cu-ft = **10,651.2 cu-ft**

DMA A
DMA A = 2.77 ac
2.77 ac/108.3 ac = 0.0256
Pre = 0.0256 x 235,224 cu-ft = **6,021.7 cu-ft**
Post = 0.0256 x 427,759 cu-ft = **10,950.6 cu-ft**

DMA B
DMA B = 0.90 ac
0.90 ac/108.3 ac = 0.0083
Pre = 0.0083 x 235,224 cu-ft = **1,952.4 cu-ft**
Post = 0.0083 x 427,759 cu-ft = **3,550.4 cu-ft**

DMA C
DMA C = 0.59 ac
0.59 ac/108.3 ac = 0.0054
Pre = 0.0054 x 235,224 cu-ft = **1,270.2 cu-ft**
Post = 0.0054 x 427,759 cu-ft = **2,309.9 cu-ft**

DMA D
DMA D = 1.19 ac
1.19 ac/108.3 ac = 0.0110
Pre = 0.0110 x 235,224 cu-ft = **2,587.5 cu-ft**
Post = 0.0110 x 427,759 cu-ft = **4,705.3 cu-ft**

DMA E1
DMA E1 = 0.56 ac
0.56 ac/108.3 ac = 0.0052
Pre = 0.0052 x 235,224 cu-ft = **1,223.2 cu-ft**
Post = 0.0052 x 427,759 cu-ft = **2,224.3 cu-ft**

DMA E2
DMA E2 = 0.86 ac
0.86 ac/108.3 ac = 0.0079
Pre = 0.0079 x 235,224 cu-ft = **1,858.3 cu-ft**
Post = 0.0079 x 427,759 cu-ft = **3,379.3 cu-ft**

DMA F
DMA F = 0.87 ac
0.87 ac/108.3 ac = 0.0080
Pre = 0.0080 x 235,224 cu-ft = **1,881.8 cu-ft**
Post = 0.0080 x 427,759 cu-ft = **3,422.1 cu-ft**

DMA G
DMA G = 0.82 ac
0.82 ac/108.3 ac = 0.0076
Pre = 0.0076 x 235,224 cu-ft = **1,787.7 cu-ft**
Post = 0.0076 x 427,759 cu-ft = **3,251.0 cu-ft**

DMA H

DMA H = 0.66 ac

0.66 ac/108.3 ac = 0.0061

Pre = 0.0061 x 235,224 cu-ft = **1,434.9 cu-ft**

Post = 0.0061 x 427,759 cu-ft = **2,609.3 cu-ft**

DMA I

DMA I = 0.83 ac

0.83 ac/108.3 ac = 0.0077

Pre = 0.0077 x 235,224 cu-ft = **1,811.2 cu-ft**

Post = 0.0077 x 427,759 cu-ft = **3,293.7 cu-ft**

DMA J

DMA J = 0.94 ac

0.94 ac/108.3 ac = 0.0087

Pre = 0.0087 x 235,224 cu-ft = **2,046.4 cu-ft**

Post = 0.0087 x 427,759 cu-ft = **3,721.5 cu-ft**

DMA-ST1

DMA-ST1 = 0.67 ac

0.67 ac/108.3 ac = 0.0062

Pre = 0.0062 x 235,224 cu-ft = **1,458.4 cu-ft**

Post = 0.0062 x 427,759 cu-ft = **2,652.1 cu-ft**

DMA-ST2

DMA-ST2 = 1.12 ac

1.12 ac/108.3 ac = 0.0103

Pre = 0.0103 x 235,224 cu-ft = **2,422.8 cu-ft**

Post = 0.0103 x 427,759 cu-ft = **4,405.9 cu-ft**

DMA-ST3

DMA-ST3 = 2.19 ac

2.19 ac/108.3 ac = 0.0202

Pre = 0.0202 x 235,224 cu-ft = **4,751.5 cu-ft**

Post = 0.0202 x 427,759 cu-ft = **8,640.7 cu-ft**

DMA-ST4
DMA-ST4 = 0.63 ac
0.63 ac/108.3 ac = 0.0058
Pre = 0.0058 x 235,224 cu-ft = **1,364.3 cu-ft**
Post = 0.0058 x 427,759 cu-ft = **2,481.0 cu-ft**

DMA-ST5
DMA-ST5 = 1.31 ac
1.31 ac/108.3 ac = 0.0121
Pre = 0.0121 x 235,224 cu-ft = **2,846.2 cu-ft**
Post = 0.0121 x 427,759 cu-ft = **5,175.9 cu-ft**

DMA-ST6
DMA-ST6 = 0.64 ac
0.64 ac/108.3 ac = 0.0059
Pre = 0.0059 x 235,224 cu-ft = **1,387.8 cu-ft**
Post = 0.0059 x 427,759 cu-ft = **2,523.8 cu-ft**

DMA-ST7
DMA-ST7 = 0.22 ac
0.22 ac/108.3 ac = 0.0020
Pre = 0.0020 x 235,224 cu-ft = **470.4 cu-ft**
Post = 0.0020 x 427,759 cu-ft = **855.5 cu-ft**

DMA-ST8
DMA-ST8 = 0.66 ac
0.66 ac/108.3 ac = 0.0060
Pre = 0.0060 x 235,224 cu-ft = **1,411.3 cu-ft**
Post = 0.0060 x 427,759 cu-ft = **2,566.6 cu-ft**

DMA-ST9
DMA-ST9 = 1.48 ac
1.48 ac/108.3 ac = 0.0137
Pre = 0.0137 x 235,224 cu-ft = **3,222.6 cu-ft**
Post = 0.0137 x 427,759 cu-ft = **5,860.3 cu-ft**

DMA-ST10
DMA-ST10 = 2.08 ac
2.08 ac/108.3 ac = 0.0192
Pre = 0.0192 x 235,224 cu-ft = **4,516.3 cu-ft**
Post = 0.0192 x 427,759 cu-ft = **8,213.0 cu-ft**

DMA-ST11
DMA-ST11 = 1.29 ac
1.29 ac/108.3 ac = 0.0119
Pre = 0.0119 x 235,224 cu-ft = **2,799.4 cu-ft**
Post = 0.0119 x 427,759 cu-ft = **5,090.3 cu-ft**

DMA-ST12
DMA-ST12 = 1.27 ac
1.27 ac/108.3 ac = 0.0117
Pre = 0.0117 x 235,224 cu-ft = **2,752.1 cu-ft**
Post = 0.0117 x 427,759 cu-ft = **5,004.8 cu-ft**

DMA-ST13
DMA-ST13 = 0.45 ac
0.45 ac/108.3 ac = 0.0042
Pre = 0.0042 x 235,224 cu-ft = **987.9 cu-ft**
Post = 0.0042 x 427,759 cu-ft = **1,796.6 cu-ft**

DMA-ST14
DMA-ST14 = 0.97 ac
0.97 ac/108.3 ac = 0.0090
Pre = 0.0090 x 235,224 cu-ft = **2,117.0 cu-ft**
Post = 0.0090 x 427,759 cu-ft = **3,849.8 cu-ft**

DMA-ST15
DMA-ST15 = 0.61 ac
0.61 ac/108.3 ac = 0.0056
Pre = 0.0056 x 235,224 cu-ft = **1,317.3 cu-ft**
Post = 0.0056 x 427,759 cu-ft = **2,395.5 cu-ft**

DMA-ST16
DMA-ST16 = 0.65 ac
0.65 ac/108.3 ac = 0.0060
Pre = 0.0060 x 235,224 cu-ft = **1,411.3 cu-ft**
Post = 0.0060 x 427,759 cu-ft = **2,566.6 cu-ft**

DMA-ST17
DMA-ST17 = 0.33 ac
0.33 ac/108.3 ac = 0.0030
Pre = 0.0030 x 235,224 cu-ft = **705.7 cu-ft**
Post = 0.0030 x 427,759 cu-ft = **1,283.3 cu-ft**

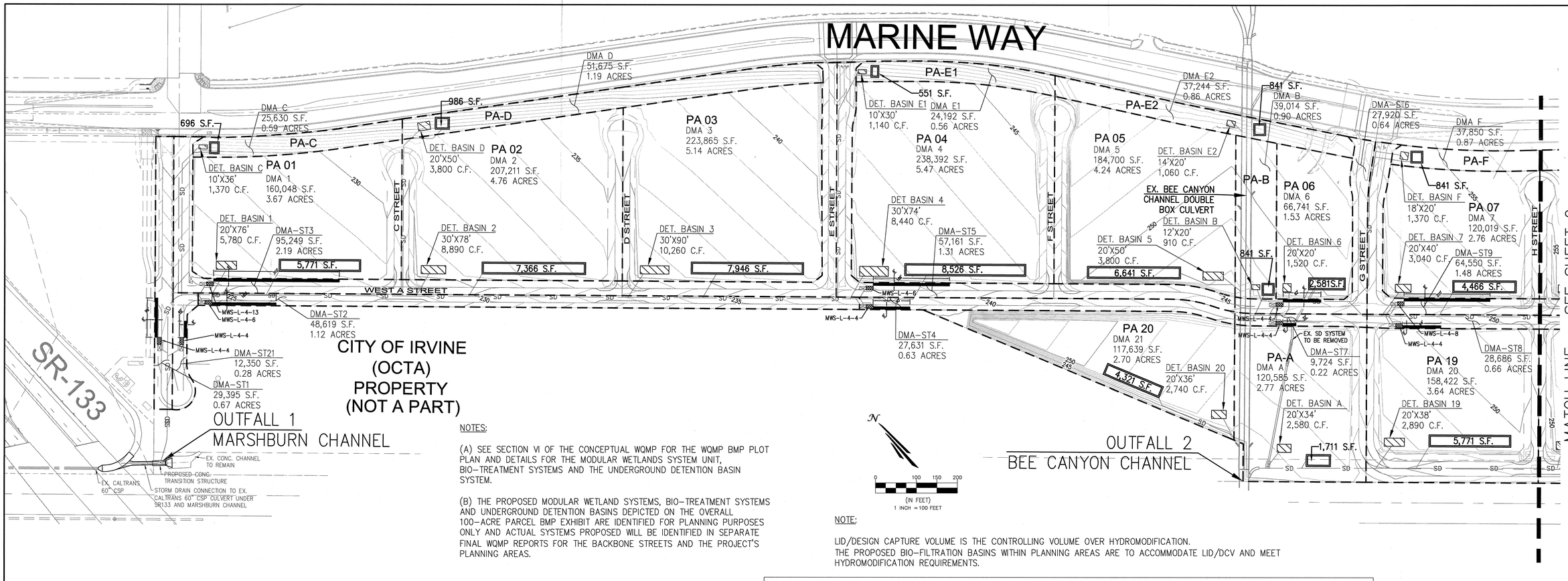
DMA-ST18
DMA-ST18 = 1.46 ac
1.46 ac/108.3 ac = 0.0135
Pre = 0.0135 x 235,224 cu-ft = **3,175.5 cu-ft**
Post = 0.0135 x 427,759 cu-ft = **5,774.7 cu-ft**

DMA-ST19
DMA-ST19 = 1.14 ac
1.14 ac/108.3 ac = 0.0105
Pre = 0.0105 x 235,224 cu-ft = **2,469.9 cu-ft**
Post = 0.0105 x 427,759 cu-ft = **4,491.5 cu-ft**

DMA-ST20
DMA-ST20 = 0.73 ac
0.73 ac/108.3 ac = 0.0067
Pre = 0.0067 x 235,224 cu-ft = **1,576.0 cu-ft**
Post = 0.0067 x 427,759 cu-ft = **2,866.0 cu-ft**

DMA-ST21
DMA-ST21 = 0.28 ac
0.28 ac/108.3 ac = 0.0026
Pre = 0.0026 x 235,224 cu-ft = **611.6 cu-ft**
Post = 0.0026 x 427,759 cu-ft = **1,112.2 cu-ft**

HYDROMODIFICATION BMP EXHIBIT & TABLE



NOTES:

(A) SEE SECTION VI OF THE CONCEPTUAL WQMP FOR THE WQMP BMP PLOT PLAN AND DETAILS FOR THE MODULAR WETLANDS SYSTEM UNIT, BIO-TREATMENT SYSTEMS AND THE UNDERGROUND DETENTION BASIN SYSTEM.

(B) THE PROPOSED MODULAR WETLAND SYSTEMS, BIO-TREATMENT SYSTEMS AND UNDERGROUND DETENTION BASINS DEPICTED ON THE OVERALL 100-ACRE PARCEL BMP EXHIBIT ARE IDENTIFIED FOR PLANNING PURPOSES ONLY AND ACTUAL SYSTEMS PROPOSED WILL BE IDENTIFIED IN SEPARATE FINAL WQMP REPORTS FOR THE BACKBONE STREETS AND THE PROJECT'S PLANNING AREAS.

NOTE:

LID/DESIGN CAPTURE VOLUME IS THE CONTROLLING VOLUME OVER HYDROMODIFICATION. THE PROPOSED BIO-FILTRATION BASINS WITHIN PLANNING AREAS ARE TO ACCOMMODATE LID/DCV AND MEET HYDROMODIFICATION REQUIREMENTS.

NOTE:
TOTAL VOLUME PROVIDED = DETENTION BASIN VOLUME PLUS BIO-TREATMENT VOLUME

HCOC TABLE

DMA#	AREA (ACRES)	EX. VOL (CU-FT)(1)	PROJ. VOL (CU-FT)(1)	DELTA (CU-FT)	DETENTION BASIN VOL. (CU-FT)(2)	BIO-TREATMENT VOL. (CU-FT)(3)	TOTAL VOL. PROVIDED (CU-FT)
DMA 1	3.67	7,974.8	14,501.0	6,526.2	5,780	7,993	13,773
DMA 2	4.76	10,349.9	18,821.4	8,471.5	8,890	10,367	19,257
DMA 3	5.14	11,173.1	20,318.6	9,145.5	10,260	11,195	21,455
DMA 4	5.47	11,878.8	21,601.8	9,723.0	8,440	11,914	20,354
DMA 5	4.24	9,220.8	16,768.2	7,547.4	3,800	9,235	13,035
DMA 6	1.53	3,316.7	6,031.4	2,714.7	1,520	3,332	4,852
DMA 7	2.76	5,998.7	10,907.9	4,909.2	3,040	6,011	9,051
DMA 20	3.64	7,903.5	14,372.7	6,469.2	3,800	7,928	11,728
DMA A	2.77	6,021.7	10,950.6	4,928.9	2,580	2,091	4,671
DMA 21	2.70	1,952.4	10,651.2	8,698.8	2,740	5,881	8,621
DMA B	0.90	1,952.4	3,550.4	1,598.0	910	680	1,590
DMA C	0.59	1,270.2	2,309.9	1,039.7	1,370	445	1,815
DMA D	1.19	2,587.5	4,705.3	2,117.8	3,800	898	4,698
DMA E1	0.56	1,223.2	2,224.3	1,001.1	1,140	423	1,563
DMA E2	0.86	1,858.3	3,379.3	1,521.0	1,060	649	1,709
DMA F	0.87	1,881.8	3,422.1	1,540.3	1,370	657	2,027
TOTALS	41.65			77,952.3			140,199

HCOC TABLE

DMA#	AREA (ACRES)	EX. VOL (CU-FT)(1)	PROJ. VOL (CU-FT)(1)	DELTA (CU-FT)	DCV (CU-FT) (BIO-TREATMENT VOL.)	DETENTION VOLUME PROVIDED (CU-FT)
DMA-ST1	0.67	1,458.5	2,652.1	1,193.6	1,615	1,641
DMA-ST2	1.12	2,422.8	4,405.9	1,983.1	2,700	2,736
DMA-ST3	2.19	4,751.5	8,640.7	3,889.2	5,279	5,301
DMA-ST4	0.63	1,364.3	2,481.0	1,116.7	1,519	1,539
DMA-ST5	1.31	2,846.2	5,175.9	2,329.7	3,158	3,181
DMA-ST6	0.64	1,387.8	2,523.8	1,136.0	1,543	1,573
DMA-ST7	0.22	470.4	855.5	385.1	530	547
DMA-ST8	0.66	1,411.3	2,566.6	1,155.3	1,591	1,607
DMA-ST9	1.48	3,222.6	5,860.3	2,637.7	3,567	3,591
DMA-ST21	0.28	611.6	1,112.2	500.60	675	684
TOTALS	9.20			16,327.0	22,177	22,400

LEGEND

- CATCH BASIN (BACKBONE IMPROVEMENT)
- SD — STORM DRAIN LINE (BACKBONE IMPROVEMENT)
- MWU X-XX MODULAR WETLAND SYSTEM (BACKBONE IMPROVEMENT)
- X,XXX S.F. — BIO-TREATMENT SYSTEM (DEVELOPER IMPROVEMENT)
- DMA — DRAINAGE MANAGEMENT AREA
- PA-# — DEVELOPER PLANNING AREA
- PA-(LETTER) — OPEN SPACE/PARK PLANNING AREA
- ST — STREET
- CONTRIBUTORY AREA TO EACH DMA
- STORMWATER DETENTION SYSTEM
- STREET MODULAR WETLAND UNIT (BIOFILTRATION)
- STREET "LOW FLOW" STORMWATER STORAGE CONTAINMENT CHAMBER (ASSUMES 3' DEPTH WITH 6" WIDTH)

(1) ESTIMATE PLANNING AREA EXISTING AND PROJECT VOLUMES DEVELOPED BASED ON PRORATION OF EACH AREA OVER THE TOTAL PROJECT AREA FOR THE 100-ACRE PARCELS IDENTIFIED IN ATTACHMENT B OF THE CONCEPTUAL WQMP.

(2) BACKBONE STREET DELTA DETENTION VOLUMES TO BE ACCOMADATED IN APPLICABLE "NUMBERED" PLANNING AREAS AS PART OF THE FINAL DESIGN. INFORMATION PRESENTED IN THE CONCEPTUAL WQMP FOR THE 100-ACRE PARCELS FOR THE TOTAL PROJECT EXCEED THE DELTA 2-YR 24-HR REQUIREMENT FOR HCOC'S.

(3) BACKBONE STREET MODULAR WETLAND SYSTEMS ARE TO BE DESIGNED AS A "FLOW-BASED" TREATMENT UNITS AND NOT VOLUME BASED.

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REAL ESTATE GROUP

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SECTION IV.3.5 HYDROMODIFICATION BMP EXHIBIT & TABLE

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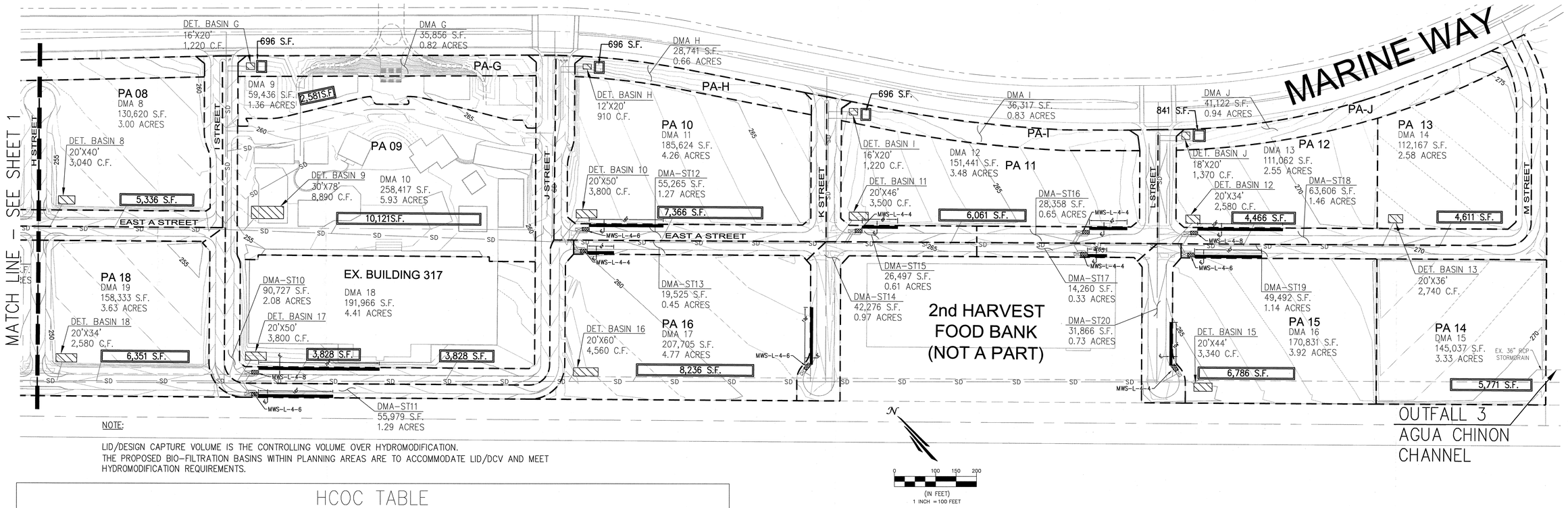
Dec 01, 2015 – 4:05pm by mdelagarza K:\Drawings\SP\SP7531 Lowe El Toro\Eng\WQMP\100 acre Parcel Revised.DWG



NOTE:

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THE PROPOSED BIO-FILTRATION BASINS WITHIN PLANNING AREAS ARE TO ACCOMMODATE LID/DCV AND MEET HYDROMODIFICATION REQUIREMENTS.

HCOC TABLE

DMA#	AREA (ACRES)	EX. VOL. (CU-FT)(1)	PROJ. VOL (CU-FT)(1)	DELTA (CU-FT)	DETENTION BASIN VOL. (CU-FT)(2)	BIO-TREATMENT VOL. (CU-FT)(3)	TOTAL VOL. PROVIDED (CU-FT)
DMA 8	3.00	6,515.7	11,848.9	5,333.2	3,040	7,231	10,271
DMA 9	1.36	2,963.8	5,389.8	2,426.0		3,278	3,278
DMA 10	5.93	11,878.8	23,441.2	11,562.4	8,890	14,293	23,183
DMA 11	4.26	9,244.3	16,810.9	7,566.6	3,800	10,268	14,068
DMA 12	3.48	7,550.7	13,731.1	6,180.4	3,500	8,388	11,888
DMA 13	2.55	5,527.8	10,052.3	4,524.5	2,580	6,146	8,726
DMA 14	2.58	5,598.3	10,180.7	4,582.4	2,740	6,219	8,959
DMA 15	3.33	7,222.0	13,132.2	5,910.2		8,026	8,026
DMA 16	3.92	8,515.1	15,484.9	6,969.8	3,340	9,448	12,788
DMA 17	4.77	10,349.9	18,821.4	8,471.5	4,560	11,497	16,057
DMA 18	4.41	9,573.6	17,409.8	7,836.2	2,580	10,630	13,210
DMA 19	3.63	7,880.0	14,329.9	6,449.9	2,890	8,749	11,639
DMA G	0.82	1,787.7	3,251.0	1,463.3	1,220	619	1,839
DMA H	0.66	1,434.9	2,609.3	1,174.4	910	498	1,408
DMA I	0.83	1,811.2	3,293.7	1,482.5	1,220	627	1,847
DMA J	0.94	2,046.4	3,721.5	1,675.1	1,370	710	2,080
TOTALS	46.47			83,608.4			149,267

HCOC TABLE

DMA#	AREA (ACRES)	EX. VOL. (CU-FT)(1)	PROJ. VOL (CU-FT)(1)	DELTA (CU-FT)	DCV (CU-FT) (BIO-TREATMENT VOL.)	DETENTION VOLUME PROVIDED (CU-FT)
DMA-ST10	2.08	4,516.3	8,213.0	3,696.7	5,013	5,027
DMA-ST11	1.29	2,799.4	5,090.3	2,290.9	3,109	3,112
DMA-ST12	1.27	2,752.1	5,004.8	2,252.7	3,061	5,078
DMA-ST13	0.45	987.9	1,796.6	808.7	1,085	1,094
DMA-ST14	0.97	2,117.0	3,849.8	1,732.8	2,338	2,360
DMA-ST15	0.61	1,317.3	2,395.5	1,078.2	1,470	1,471
DMA-ST16	0.65	1,411.3	2,566.6	1,155.3	1,494	1,573
DMA-ST17	0.33	705.7	1,283.3	577.6	795	795
DMA-ST18	1.46	3,175.5	5,774.7	2,599.2	3,447	3,522
DMA-ST19	1.14	2,469.9	4,491.5	2,021.6	2,748	2,770
DMA-ST20	0.73	1,576.0	2,866.0	1,290.0	1,760	1,778
TOTALS	10.98			19,503.7	26,320.0	28,580.0

NOTE:
TOTAL VOLUME PROVIDED = DETENTION BASIN VOLUME PLUS BIO-TREATMENT VOLUME

NOTES:

(A) SEE SECTION VI OF THE CONCEPTUAL WQMP FOR THE WQMP BMP PLOT PLAN AND DETAILS FOR THE MODULAR WETLANDS SYSTEM UNIT, BIO-TREATMENT SYSTEMS AND THE UNDERGROUND DETENTION BASIN SYSTEM.

(B) THE PROPOSED MODULAR WETLAND SYSTEMS, BIO-TREATMENT SYSTEMS AND UNDERGROUND DETENTION BASINS DEPICTED ON THE OVERALL 100-ACRE PARCEL BMP EXHIBIT ARE IDENTIFIED FOR PLANNING PURPOSES ONLY AND ACTUAL SYSTEMS PROPOSED WILL BE IDENTIFIED IN SEPARATE FINAL WQMP REPORTS FOR THE BACKBONE STREETS AND THE PROJECT'S PLANNING AREAS.

(1) ESTIMATE PLANNING AREA EXISTING AND PROJECT VOLUMES DEVELOPED BASED ON PRORATION OF EACH AREA OVER THE TOTAL PROJECT AREA FOR THE 100-ACRE PARCELS IDENTIFIED IN ATTACHMENT B OF THE CONCEPTUAL WQMP.

(2) BACKBONE STREET DELTA DETENTION VOLUMES TO BE ACCOMADATED IN APPLICABLE "NUMBERED" PLANNING AREAS AS PART OF THE FINAL DESIGN. INFORMATION PRESENTED IN THE CONCEPTUAL WQMP FOR THE 100-ACRE PARCELS FOR THE TOTAL PROJECT EXCEED THE DELTA 2-YR 24-HR REQUIREMENT FOR HCOC'S.

(3) BACKBONE STREET MODULAR WETLAND SYSTEMS ARE TO BE DESIGNED AS A "FLOW-BASED" TREATMENT UNITS AND NOT VOLUME BASED.

LEGEND

- CATCH BASIN (BACKBONE IMPROVEMENT)
- SD — STORM DRAIN LINE (BACKBONE IMPROVEMENT)
- MWU X-XX MODULAR WETLAND SYSTEM (BACKBONE IMPROVEMENT)
- X,XXX S.F. — BIO-TREATMENT SYSTEM (DEVELOPER IMPROVEMENT)
- DMA — DRAINAGE MANAGEMENT AREA
- PA-# — DEVELOPER PLANNING AREA
- PA-(LETTER) — OPEN SPACE/PARK PLANNING AREA
- ST — STREET
- CONTRIBUTORY AREA TO EACH DMA
- STORMWATER DETENTION SYSTEM
- STREET MODULAR WETLAND UNIT (BIOFILTRATION)
- STREET "LOW FLOW" STORMWATER STORAGE CONTAINMENT CHAMBER (ASSUMES 3' DEPTH WITH 6' WIDTH)

TAIT RISING TO THE CHALLENGE

LOWE ENTERPRISES REAL ESTATE GROUP

ktgy Architecture+Planning

COUNTY OF ORANGE CALIFORNIA

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TAIT Since 1944
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NO.	DESCRIPTION	BY	DATE	CHK
	REVISIONS			

SECTION IV.3.5 HYDROMODIFICATION BMP EXHIBIT & TABLE

EL TORO 100-ACRE PARCEL DEVELOPMENT PLAN- COUNTY OF ORANGE
LOWE ENTERPRISES REAL ESTATE GROUP
UNINCORPORATED TERRITORY OF THE COUNTY OF ORANGE
IRVINE, CALIFORNIA

DRAWN: RH
DATE: 2015.06.29
CHECKED: --
DATE: --
REVISION #: --
DATE: --
JOB NO: SP7531

Dec 01, 2015 – 4:07pm by mdalgarza K:\Drawings\SP\SP7531 Lowe El Toro\Eng\WQMP\100 acre Parcel Revised.DWG

IV.3.6 Regional/Sub-Regional LID BMPs

Regional/Sub Regional LID BMPs are not applicable for the project.

IV.3.7 Treatment Control BMPs

Treatment Control BMPs will not be used for this project.

Treatment Control BMPs	
BMP Name	**BMP Description**

IV.3.8 Non-structural Source Control BMPs

For PA 01 thru PA07, and PA 19 & 20 (Multi-Family Residential)

Non-Structural Source Control BMPs				
Identifier	Name	Check One		If not applicable, state brief reason
		Included	Not Applicable	
N1	Education for Property Owners, Tenants and Occupants	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	This project is a multi-family development.
N6	Local Industrial Permit Compliance	☐	☒	Local agency does not have a local industrial permit applicable for the project.
N7	Spill Contingency Plan	☐	☒	The project will not have bulk storage of liquids.
N8	Underground Storage Tank Compliance	☐	☒	The project is not proposing the use of storage tanks.
N9	Hazardous Materials Disclosure Compliance	☐	☒	This project is a multi-family development.
N10	Uniform Fire Code Implementation	☐	☒	This project is a multi-family development.
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☐	☒	The project does not have individual businesses.
N13	Housekeeping of Loading Docks	☐	☒	The project does not have loading docks.
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	This project does not have retail gasoline Outlets

For PA 01 thru PA07 & PA 19 thru PA 21 (Multi-Family Residential)

N1-Education for property Owners, Tenants and occupants

Education materials will be provided to homeowners at close of escrow by owner/developer and periodically thereafter by the Home Owners Association (HOA) to inform homeowners of their potential impacts to downstream water quality. Materials include those described in Section VII of this WQMP and provided in Attachment A of this WQMP. Additional education material may be found in the following website: http://www.ocwatershed.com/PublicEd/resources/business-brochures.html

N2-Activity Restrictions

Activity restrictions to minimize potential impacts to water quality and with the purpose of protecting water quality will be prescribed by the project's Covenant, Conditions and Restrictions (CC&R's), or other equally effective measure. These may include restrictions or guideline for activities such as home repair/painting, landscaping, vehicle washing/repair, proper disposal of residential waste and chemical/fluids.

N3-Common Area Landscape Management

Ongoing maintenance is conducted to minimize erosion and over-irrigation, conserve water and reduce pesticide and fertilizer applications.

All maintenance must be consistent with the City of Irvine requirements. Proper maintenance practices should help reduce and/or eliminate pollution from pesticides, nutrients, trash/debris and sediments. The project common area landscape maintenance should be consistent with the documents included in Attachment A.

N4-BMP Maintenance

BMP maintenance, implementation schedules and responsible parties are included with each specific BMP narrative in section V.

N11-Common area litter control

The homeowners or a HOA will be required to implement trash management and litter control procedures in the common areas aimed at reducing pollution of drainage water. The homeowners or a HOA may contract with their landscape maintenance firm to provide this service with regularly scheduled maintenance, which should consist of litter patrol, emptying of trash receptacles in common areas, and noting trash disposal violations and reporting the violations for investigation.

N14-Common area catch basin inspection

The homeowners or a HOA must ensure that the on-site drain inlets, grates, and drain pipes will be periodically inspected visually. Cleaning should take place in the late summer/early fall prior to

the start of the rainy season. If necessary, clean, repair, or replace any drainage facility prior to the start of each rainy season (no later than October 15 of each year). As required by the Technical Guidance Document, at least 80% of the project's private drainage facilities must be inspected, cleaned/maintained annually, with 100% of facilities inspected and maintained within a two-year perior.

N15-Street Sweeping Private Streets and Parking Lots

The homeowners or a HOA must sweep outdoor streets regularly (minimum monthly), and prior to the storm season (no later than October 15 each year). Sweeping shall be done with a vacuum-type sweeper. Under no circumstances are streets or driveways/drive isles are to be rinsed or washed with water unless said rinse/wash water is collected and disposed of properly (i.e. into the sewer).

For PA 08 thru PA 18 (Mixed Use Retail and Commercial)

Non-Structural Source Control BMPs				
Identifier	**Name**	**Check One**		**If not applicable, state brief reason**
		Included	**Not Applicable**	
N1	Education for Property Owners, Tenants and Occupants	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	
N6	Local Industrial Permit Compliance	☐	☒	Local agency does not have a local industrial permit applicable for the project.
N7	Spill Contingency Plan	☐	☒	The project will not have outdoor bulk storage of liquids
N8	Underground Storage Tank Compliance	☐	☒	The project is not proposing the use of storage tanks.
N9	Hazardous Materials Disclosure Compliance	☒	☐	
N10	Uniform Fire Code Implementation	☒	☐	
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☒	☐	
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	This project does not have retail gasoline Outlets

For PA 08 thru PA 18 (Mixed Use Retail and Commercial)

N1-Education for property Owners, Tenants and occupants & N-12 Employee Training

The property owner shall prepare a training manual for all existing and future employees. The manual shall include information regarding proper practices that contribute to the protection of the stormwater quality. Training shall be provided upon hire of new associates. A copy of the training manual shall remain in the building at all times for employees to use as needed. The manual shall include all Educational Material included on Attachment A of this report. Additional education material may be found in the following website:
http://www.ocwatershed.com/PublicEd/resources/business-brochures.html

N2-Activity Restrictions

The property owner shall ensure that the rules and guidelines as determined on the project conditions, covenants and restrictions (CC&R's) and lease terms or other policies are followed at all times once the project is operations. Prohibited activities for the project that promoted water quality includes:

- Prohibit discharges of fertilizer, pesticides, or animal wastes to streets or storm drains.
- Prohibit blowing or sweeping of debris (leaf litter, grass clippings, litter, etc.) into streets or storm drains.
- Requirement to keep dumpster lids closed at all times.
- Prohibit vehicle washing, maintenance, or repair on the premised or restrict those activities to designated areas.

N3-Common Area Landscape Management

Specific practices are followed for landscape maintenance as identified on the landscape specification as set forth by the City of Irvine. Ongoing maintenance is conducted to minimize erosion and over-irrigation, conserve water and reduce pesticide and fertilizer applications.

All maintenance must be consistent with the City of Irvine requirements. Proper maintenance practices should help reduce and/or eliminate pollution from pesticides, nutrients, trash/debris and sediments. The project common area landscape maintenance should be consistent with the following documents included in Attachment A:

- Building and Ground Maintenance Guidelines
- Housekeeping practices
- Plaza and sidewalk cleaning
- Landscape maintenance

N4-BMP Maintenance

BMP maintenance, implementation schedules and responsible parties are included with each specific BMP narrative in section V.

N5-Title 22 CCR compliance

Hazardous waste shall be managed properly trough compliance with applicable title 22 regulations.

Storage and transportation of hazardous materials shall be per the title 22 of the California Code of Regulations and the Health and Safety Code.

N9-Hazardous Material Disclosure Compliance

The Owner is responsible for obtaining the required permits for the use and transportation of hazardous materials. Permits may be required from the County of Orange Health Department, City of Irvine, and other local authorities.

N10-Uniform Fire Code Implementation

The Owner is responsible for complying with the Orange County Fire Authority requirements regarding proper management of hazardous materials and emergency response plans. An inventory of hazardous materials should be maintained on-site and an emergency response plans should be established.

N11-Common area litter control

The Owner will be required to implement trash management and litter control procedures in the common areas aimed at reducing pollution of drainage water. The Owner may contract with their landscape maintenance firm to provide this service with regularly scheduled maintenance, which should consist of litter patrol, emptying of trash receptacles in common areas, and noting trash disposal violations and reporting the violations to the Owner for investigation.

N13-Housekeeping of Loading Docks

Loading docks typically found at large retail and warehouse type commercial and industrial facilities shall be kept in a clean and orderly condition through a regular program of sweeping and litter control and immediate cleanup of spills and broken containers. Cleanup procedures should minimize or eliminate the use of water if plumed to the storm sewer. If wash water is used, it must be disposed of in an approved manner and not discharged to the storm drain system. If there are no other alternatives, discharge of non-stormwater flow to the sanitary sewer must be at an acceptable discharge point such as a cleanout, oil/water separator, grease interceptor, or industrial sewer connection. All sewer discharges shall be in accordance with the Orange County Sanitation District's Wastewater Discharge Regulations and/or Washwater Disposal Guidelines.

N14-Common area catch basin inspection

The Owner must ensure that the on-site drain inlets, grates, and drain pipes will be periodically inspected visually. Cleaning should take place in the late summer/early fall prior to the start of the rainy season. If necessary, clean, repair, or replace any drainage facility prior to the start of each

rainy season (no later than October 15 of each year). Also refer to "Drainage Facility Operations and Maintenance" in Attachment A.

N15-Street Sweeping Private Streets and Parking Lots

The Owner must sweep outdoor lots regularly (minimum monthly), and prior to the storm season (no later than October 15 each year). Sweeping shall be done with a vacuum-type sweeper. Under no circumstances are outdoor areas/lots to be rinsed or washed with water unless said rinse/wash water is collected and disposed of properly (i.e. into the sewer).

For PA-A thru PA-J (Parks)

Non-Structural Source Control BMPs				
Identifier	Name	Check One		If not applicable, state brief reason
		Included	Not Applicable	
N1	Education for Property Owners, Tenants and Occupants	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	This project is a park development.
N6	Local Industrial Permit Compliance	☐	☒	Local agency does not have a local industrial permit applicable for the parks.
N7	Spill Contingency Plan	☐	☒	The parks will not have bulk storage of liquids.
N8	Underground Storage Tank Compliance	☐	☒	The project is not proposing the use of storage tanks.
N9	Hazardous Materials Disclosure Compliance	☐	☒	This project is a park development.
N10	Uniform Fire Code Implementation	☐	☒	This project is a park development.
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☐	☒	The parks do not have individual businesses.
N13	Housekeeping of Loading Docks	☐	☒	The parks do not have loading docks.
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☐	☐	The parks do not have streets.
N16	Retail Gasoline Outlets	☐	☒	This parks do not have retail gasoline Outlets

For PA-A thru PA-J (Parks)

N1-Education for property Owners, Tenants and occupants & N-12 Employee Training

The park owner shall prepare a training manual for all park personnel. The manual shall include information regarding proper practices that contribute to the protection of the stormwater quality. Training shall be provided upon hire of new park personnel. A copy of the training manual shall remain in the building at all times for park personnel to use as needed. The manual shall include all Educational Material included on Attachment A of this report. Additional education material may be found in the following website: http://www.ocwatershed.com/PublicEd/resources/business-brochures.html

N2-Activity Restrictions

Activity restrictions to minimize potential impacts to water quality and with the purpose of protecting water quality will be prescribed by the project's Covenant, Conditions and Restrictions (CC&R's), or other equally effective measure.

N3-Common Area Landscape Management

Ongoing maintenance is conducted to minimize erosion and over-irrigation, conserve water and reduce pesticide and fertilizer applications.

All maintenance must be consistent with the City of Irvine requirements. Proper maintenance practices should help reduce and/or eliminate pollution from pesticides, nutrients, trash/debris and sediments. The project common area landscape maintenance should be consistent with the documents included in Attachment A.

N4-BMP Maintenance

BMP maintenance, implementation schedules and responsible parties are included with each specific BMP narrative in section V.

N11-Common area litter control

The park owners will be required to implement trash management and litter control procedures in the common areas aimed at reducing pollution of drainage water. The park owners may contract with their landscape maintenance firm to provide this service with regularly scheduled maintenance, which should consist of litter patrol, emptying of trash receptacles in common areas, and noting trash disposal violations and reporting the violations for investigation.

N14-Common area catch basin inspection

The park owners must ensure that the on-site drain inlets, grates, and drain pipes will be periodically inspected visually. Cleaning should take place in the late summer/early fall prior to the start of the rainy season. If necessary, clean, repair, or replace any drainage facility prior to the start of each rainy season (no later than October 15 of each year). As required by the Technical Guidance Document, at least 80% of the project's private drainage facilities must be inspected and maintained annually, with 100% of facilities inspected and maintained within a two-year period.

IV.3.9 Structural Source Control BMPs

For PA 01 thru PA07 & PA 19 thru PA 21 (Multi-Family Residential)

Structural Source Control BMPs				
Identifier	**Name**	**Check One**		**If not applicable, state brief reason**
		Included	**Not Applicable**	
S1	Provide storm drain system stenciling and signage	☒	☐	
S2	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	This project is a multi-family development.
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☒	☐	
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☐	☒	The site is relatively flat. Slopes adjacent to the site are the responsibility of others.
	Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)	☐	☒	This project is not located within the San Diego Regional Water Quality Control Board.
S6	Dock areas	☐	☒	This project is a multi-family development.
S7	Maintenance bays	☐	☒	This project is a multi-family development.
S8	Vehicle wash areas	☐	☒	This project is a multi-family development.
S9	Outdoor processing areas	☐	☒	This project is a multi-family development.
S10	Equipment wash areas	☐	☒	This project is a multi-family development.

S11	Fueling areas	☐	☒	This project is a multi-family development.
S12	Hillside landscaping	☐	☒	The site is relatively flat. Hillsides adjacent to the site are the responsibility of others.
S13	Wash water control for food preparation areas	☐	☒	This project is a multi-family development.
S14	Community car wash racks	☐	☒	Community car wash racks are not proposed for this project.

For PA 01 thru PA07 & PA 19 thru PA 21 (Multi-Family Residential)

S1-Provide storm drain system stenciling and signage

All catch basins/inlets/outlets on site must be marked using the City's "No Dumping – Drains to Ocean" curb marker or stenciled. An approved stencil shall be used to paint this message on the top of curb directly above the inlet, and on one side of the curb face. Labeling for catch basins is to be inspected regularly and maintained so as to be reasonably legible at all times. The inspection and maintenance is to be performed by the homeowners or a HOA. This stencil is to alert the public/employees to the destination of pollutants discharged into the storm water.

S3-Design and construct trash and waste storage areas to reduce pollution introduction

The homeowners or a HOA shall post signs on trash enclosure gates that state "Keep Dumpster Lids Closed." The homeowners or a HOA will monitor dumpster usage such that dumpsters are not overfilled and the dumpster lids can close completely. The homeowners or a HOA shall increase the trash pickup schedule as necessary to prevent dumpsters from overfilling. The homeowners or a HOA will observe and damage to the trash enclosure wall and any discharge from the trash storage area.

S4-Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control

All irrigation systems will be inspected to ensure that the systems are functioning properly and that the programmable timers are set correctly.

For PA 08 thru PA 18 (Mixed Use Retail and Commercial)

Structural Source Control BMPs				
Identifier	**Name**	**Check One**		**If not applicable, state brief reason**
		Included	**Not Applicable**	
S1	Provide storm drain system stenciling and signage	☒	☐	
S2	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	No outdoor storage is proposed for this site.
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☒	☐	
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☐	☒	The site is relatively flat. Slopes adjacent to the site are the responsibility of others.
	Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)	☐	☒	This project is not located within the San Diego Regional Water Quality Control Board.
S6	Dock areas	☒	☐	
S7	Maintenance bays	☐	☒	The project does not have maintenance bays.
S8	Vehicle wash areas	☐	☒	The project does not have vehicle wash areas.
S9	Outdoor processing areas	☐	☒	The project does not have outdoor processing areas.
S10	Equipment wash areas	☐	☒	The project does not have equipment wash areas.
S11	Fueling areas	☐	☒	The project does not have fueling areas.
S12	Hillside landscaping	☐	☒	The project does not have hillside landscaping.
S13	Wash water control for food preparation areas	☒	☐	
S14	Community car wash racks	☐	☒	The project does not have car wash racks.

For PA 08 thru PA 18 (Mixed Use Retail and Commercial)

S1-Provide storm drain system stenciling and signage

All catch basins/inlets/outlets on site must be marked using the City's "No Dumping – Drains to Ocean" curb marker or stenciled. An approved stencil shall be used to paint this message on the top of curb directly above the inlet, and on one side of the curb face. Labeling for catch basins is to be inspected regularly and maintained so as to be reasonably legible at all times. The inspection and maintenance is to be performed by the Owner. This stencil is to alert the public/employees to the destination of pollutants discharged into the storm water.

S3-Design and construct trash and waste storage areas to reduce pollution introduction

The owner shall post signs on trash enclosure gates that state "Keep Dumpster Lids Closed." The Owner will monitor dumpster usage such that dumpsters are not overfilled and the dumpster lids can close completely. The Owner shall increase the trash pickup schedule as necessary to prevent dumpsters from overfilling. The Owner will observe and damage to the trash enclosure wall and any discharge from the trash storage area.

S4-Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control

All irrigation systems will be inspected to ensure that the systems are functioning properly and that the programmable timers are set correctly.

S6-Dock Areas

Loading/unloading dock areas shall include the following:

- Cover loading dock areas, or design drainage to preclude run-on and runoff, unless the material loaded and unloaded at the docks does not have potential to contribute to stormwater pollution, and this use is ensured for the life of the facility.
- This project will not have direct connections to the municipal storm drain system from below grade loading docks or similar structures.
- Housekeeping of loading docks will be consistent with N13

S13-Wash water control for food preparation areas

Food establishments (per State Health & Safety Code 27520) shall have either contained areas or sinks, each with sanitary sewer connections for disposal of wash waters containing kitchen and food wastes. If located outside, the contained areas or sinks shall also be structurally covered to prevent entry of stormwater. Adequate signs shall be provided and appropriately placed stating the prohibition of discharging washwater to the storm drain system.

For PA-A thru PA-J (Parks)

Structural Source Control BMPs				
Identifier	**Name**	**Check One**		**If not applicable, state brief reason**
		Included	**Not Applicable**	
S1	Provide storm drain system stenciling and signage	☒	☐	
S2	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	This project is a park development.
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☒	☐	
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☒	☐	
	Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)	☐	☒	This project is not located within the San Diego Regional Water Quality Control Board.
S6	Dock areas	☐	☒	The parks do not contain docks.
S7	Maintenance bays	☐	☒	The parks do not contain maintenance bays.
S8	Vehicle wash areas	☐	☒	The parks do not contain vehicle wash areas.
S9	Outdoor processing areas	☐	☒	The parks do not contain outdoor processing areas.
S10	Equipment wash areas	☐	☒	The parks do not contain equipment wash areas.
S11	Fueling areas	☐	☒	The parks do not contain fueling

				areas.
S12	Hillside landscaping	☐	☒	The parks contain slopes, but not hillsides.
S13	Wash water control for food preparation areas	☐	☒	The parks do not contain food preparation areas.
S14	Community car wash racks	☐	☒	The parks do not contain car wash racks.

For PA-A thru PA-J (Parks)

S1-Provide storm drain system stenciling and signage

All catch basins/inlets/outlets on site must be marked using the City's "No Dumping – Drains to Ocean" curb marker or stenciled. An approved stencil shall be used to paint this message on the top of curb directly above the inlet, and on one side of the curb face. Labeling for catch basins is to be inspected regularly and maintained so as to be reasonably legible at all times. The inspection and maintenance is to be performed by the park owners. This stencil is to alert the public/employees to the destination of pollutants discharged into the storm water.

S3-Design and construct trash and waste storage areas to reduce pollution introduction

The park owners shall post signs on trash enclosure gates that state "Keep Dumpster Lids Closed." The park owners will monitor dumpster usage such that dumpsters are not overfilled and the dumpster lids can close completely. The park owners shall increase the trash pickup schedule as necessary to prevent dumpsters from overfilling. The park owners will observe and damage to the trash enclosure wall and any discharge from the trash storage area.

S4-Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control

All irrigation systems will be inspected to ensure that the systems are functioning properly and that the programmable timers are set correctly.

S-5-Protect slopes and channels and provide energy dissipation

The parks have been designed to safely convey runoff from the top of the slopes. Permanent stabilization BMPs will be installed on disturbed slopes at the onset of the project. Slopes will be vegetated with native or drought tolerant vegetation. Channels will be designed with velocity dissipation devices to reduce or eliminate potential erosion. These measures will be implemented to be consistent with local codes and ordinances.

IV.4 Alternative Compliance Plan (If Applicable)

IV.4.1 Water Quality Credits

Description of Proposed Project				
Project Types that Qualify for Water Quality Credits (Select all that apply):				
☐ Redevelopment projects that reduce the overall impervious footprint of the project site.	☐ Brownfield redevelopment, meaning redevelopment, expansion, or reuse of real property which may be complicated by the presence or potential presence of hazardous substances, pollutants or contaminants, and which have the potential to contribute to adverse ground or surface WQ if not redeveloped.		☒ Higher density development projects which include two distinct categories (credits can only be taken for one category): those with more than seven units per acre of development (lower credit allowance); vertical density developments, for example, those with a Floor to Area Ratio (FAR) of 2 or those having more than 18 units per acre (greater credit allowance).	
☒ Mixed use development, such as a combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that can demonstrate environmental benefits that would not be realized through single use projects (e.g. reduced vehicle trip traffic with the potential to reduce sources of water or air pollution).		☒ Transit-oriented developments, such as a mixed use residential or commercial area designed to maximize access to public transportation; similar to above criterion, but where the development center is within one half mile of a mass transit center (e.g. bus, rail, light rail or commuter train station). Such projects would not be able to take credit for both categories, but may have greater credit assigned		☐ Redevelopment projects in an established historic district, historic preservation area, or similar significant city area including core City Center areas (to be defined through mapping).
☐ Developments with dedication of undeveloped portions to parks, preservation areas and other pervious uses.	☐ Developments in a city center area.	☐ Developments in historic districts or historic preservation areas.	☐ Live-work developments, a variety of developments designed to support residential and vocational needs together – similar to criteria to mixed use development; would not be able to take credit for both categories.	☐ In-fill projects, the conversion of empty lots and other underused spaces into more beneficially used spaces, such as residential or commercial areas.
Calculation of Water Quality Credits (if applicable)	To be provided for Final WQMP.			

IV.4.2 Alternative Compliance Plan Information

None

Section V Inspection/Maintenance Responsibility for BMPs

For PA 01 thru PA07 & PA 19 thru PA 21 (Multi-Family Residential)

The responsible party of inspection and Maintenance for the plan will be the project owner. The "Owners" as referred below is Orange County Public Works and their information is listed below:

Orange County Public Works
County Executive Office – Land Development
445 Civic Center Drive West, 2nd Floor
Santa Ana, CA

The owner shall verify BMP implementation and ongoing maintenance through inspection, self-certification or other equally effective measure. The certification shall verify that the inspection and maintenance of all BMPs are performed in accordance with the requirements of this WQMP.

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
Non-Structural Source Control BMPs			
N1 – Education for Property Owners, Tenants and Occupants	County of Orange	Educational materials will be provided to homeowners at close of escrow by the developer and thereafter on an annual basis by the Owners. Materials shall include those shown in Section VII and provided in Attachment A of this WQMP.	At close of escrow and annually
N2 – Activity Restrictions	County of Orange	The County of Orange will prescribe activity restrictions to protect surface water quality, through a Covenant, Conditions and Restrictions (CC&Rs) agreement, or other equally effective measure, for the property. Upon takeover of the site responsibilities by the Owners, the Owners shall be responsible for ensuring residents compliance.	Ongoing

N3 – Common Area Landscape Management	County of Orange	Maintenance shall be consistent with County requirements; any fertilizer and/or pesticide usage shall be consistent with County guidelines for use of fertilizers and pesticides (OC DAMP Section 5.5). Maintenance includes mowing, weeding, and debris removal on a weekly basis. Trimming, replanting, and replacement of mulch shall be performed on an as-needed basis. Trimmings, clippings, and other waste shall be properly disposed of off-site in accordance with local regulations. Materials temporarily stockpiled during maintenance activities shall be placed away from water courses and drain inlets.	Weekly
N4 – BMP Maintenance	County of Orange	Maintenance of BMPs implemented at the project site shall be performed at the frequency prescribed in this WQMP. Records of inspections and BMP maintenance shall be maintained by the responsible party and documented with the WQMP, and shall be available for review upon request.	Ongoing
N11 – Common Area Litter Control	County of Orange	Litter patrol, violations investigation, reporting and other litter control activities shall be performed by the Owners in conjunction with maintenance activities for common areas.	Weekly
N14 – Common Area Catch Basin Inspection	County of Orange	Catch basins inlets, area drains, curb-and-gutter systems and other drainage systems shall be inspected prior to Oct. 1st of each year and after large storm events. If necessary, drains shall be cleaned prior to any succeeding rain events. 80% of private facilities shall be inspected and cleaned annually, with 100% of private facilities inspected and maintained within a	Annual

		2-year period.	
N15 – Street Sweeping Private Streets	County of Orange	Private streets and public streets shall be swept at a minimum of monthly, and prior to the start of the rainy season (Oct. 1st).	Monthly
Structural Source Control BMPs			
S1 – Provide Storm Drain System Stencilling and Signage	County of Orange	Storm drain stencils shall be inspected for legibility, at a minimum, once prior to the storm season, no later than Oct. 1st each year. Those determined to be illegible will be re-stencilled as soon as possible.	Annual
S3 – Design and Construct Trash and Waste Storage Areas to Reduce Pollution Introduction	County of Orange	The owner shall post signs on trash enclosure gates that state "Keep Dumpster Lids Closed." The Owners will monitor dumpster usage such that dumpsters are not overfilled and the dumpster lids can close completely. The Owners shall increase the trash pickup schedule as necessary to prevent dumpsters from overfilling. The Owners will observe and damage to the trash enclosure wall and any discharge from the trash storage area.	Continually
S4 – Use Efficient Irrigation Systems & Landscape Design, Water Conservation, Smart Controllers, and Source Control	County of Orange	In conjunction with routine maintenance activities, verify that landscape design continues to function properly by adjusting overspray to hardscape areas to be eliminated, and to verify that irrigation timing and cycle lengths are adjusted in accordance with water demands, given time of year, weather, day or night time	Weekly

		temperatures based on system specifications and local climate patterns.	
Infiltration BMPs			
N.A.	N.A.	N.A.	N.A.
Biotreatment BMPs			
Biotreatment BMP (Bio-filtration Basins)	County of Orange	Visual Inspection for trash and debris accumulation and dispose of any trash and debris accumulation. Inspect for standing water, and vegetation condition per the specifications included in the manual.	Prior and following the rainy season
Proprietary Biotreatment (Modular Wetlands)	County of Orange	Refer to the "Maintenance Guidelines for Modular Wetlands System – Linear" in Attachment D for inspection/maintenance activities required.	Refer to the "Maintenance Guidelines for Modular Wetlands System – Linear" in Attachment D for minimum frequency of activities.
Treatment Control BMPs			
N.A.	N.A.	N.A.	N.A.

For PA 08 thru PA 18 (Mixed Use Retail and Commercial)

The responsible party of inspection and Maintenance for the plan will be the project owner. The "Owners" as referred below is Orange County Public Works and their information is listed below:

Orange County Public Works
County Executive Office – Land Development
445 Civic Center Drive West, 2nd Floor
Santa Ana, CA

The owner shall verify BMP implementation and ongoing maintenance through inspection, self-certification or other equally effective measure. The certification shall verify that the inspection and maintenance of all BMPs are performed in accordance with the requirements of this WQMP.

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
Non-Structural Source Control BMPs			
N1 – Education for Property Owners, Tenants and Occupants	County of Orange	Educational materials will be provided to the property owner by the developer and thereafter on an annual basis by the Owners. Materials shall include those shown in Section VII and provided in Attachment A of this WQMP.	Annually
N2 – Activity Restrictions	County of Orange	The County of Orange will prescribe activity restrictions to protect surface water quality, through a Covenant, Conditions and Restrictions (CC&Rs) agreement, or other equally effective measure, for the property. Upon takeover of the site responsibilities by the Owners. The Owners shall be responsible for ensuring occupants compliance.	Ongoing

N3 – Common Area Landscape Management	County of Orange	Maintenance shall be consistent with County requirements; any fertilizer and/or pesticide usage shall be consistent with County guidelines for use of fertilizers and pesticides (OC DAMP Section 5.5). Maintenance includes mowing, weeding, and debris removal on a weekly basis. Trimming, replanting, and replacement of mulch shall be performed on an as-needed basis. Trimmings, clippings, and other waste shall be properly disposed of off-site in accordance with local regulations. Materials temporarily stockpiled during maintenance activities shall be placed away from water courses and drain inlets.	Weekly
N4 – BMP Maintenance	County of Orange	Maintenance of BMPs implemented at the project site shall be performed at the frequency prescribed in this WQMP. Records of inspections and BMP maintenance shall be maintained by the responsible party and documented with the WQMP, and shall be available for review upon request.	Ongoing
N11 – Common Area Litter Control	County of Orange	Litter patrol, violations investigation, reporting and other litter control activities shall be performed by the Owners in conjunction with maintenance activities for common areas.	Weekly
N13 – Housekeeping of Loading Docks	County of Orange	Loading docks shall be kept in a clean and orderly condition through a regular program of sweeping and litter control and immediate cleanup of spills and broken containers.	Ongoing
N14 – Common Area Catch Basin Inspection	County of Orange	Catch basins inlets, area drains, curb-and-gutter systems and other drainage systems shall be inspected prior to Oct. 1st of each year and after large storm events. If	Annual

		necessary, drains shall be cleaned prior to any succeeding rain events. 80% of private facilities shall be inspected and cleaned annually, with 100% of private facilities inspected and maintained within a 2-year period.	
N15 – Street Sweeping Private Streets	County of Orange	Private streets and public streets shall be swept at a minimum of monthly, and prior to the start of the rainy season (Oct. 1st).	Monthly
Structural Source Control BMPs			
S1 – Provide Storm Drain System Stencilling and Signage	County of Orange	Storm drain stencils shall be inspected for legibility, at a minimum, once prior to the storm season, no later than Oct. 1st each year. Those determined to be illegible will be re-stencilled as soon as possible.	Annual
S3 – Design and Construct Trash and Waste Storage Areas to Reduce Pollution Introduction	County of Orange	The owners shall post signs on trash enclosure gates that state "Keep Dumpster Lids Closed." The Owners will monitor dumpster usage such that dumpsters are not overfilled and the dumpster lids can close completely. The Owners shall increase the trash pickup schedule as necessary to prevent dumpsters from overfilling. The Owners will observe and damage to the trash enclosure wall and any discharge from the trash storage area.	Continually
S4 – Use Efficient Irrigation Systems & Landscape Design, Water Conservation, Smart Controllers, and	County of Orange	In conjunction with routine maintenance activities, verify that landscape design continues to function properly by adjusting overspray to hardscape areas to be eliminated, and to verify that irrigation timing and cycle lengths are adjusted in accordance with	Weekly

Source Control		water demands, given time of year, weather, day or night time temperatures based on system specifications and local climate patterns.	
S6-Loading Areas	County of Orange	Loading docks shall be kept in a clean and orderly condition through a regular program of sweeping and litter control and immediate cleanup of spills and broken containers	Ongoing
S13-Wash Water Control for Food Preparation Areas	County of Orange	Ensure areas or sinks, each with sanitary sewer connections for disposal of wash waters containing kitchen and food wastes. If located outside, the contained areas or sinks shall also be structurally covered to prevent entry of stormwater. Maintain signs stating the prohibition of discharging washwater to the storm drain system.	Ongoing
Infiltration BMPs			
N.A.	N.A.	N.A.	N.A.
Biotreatment BMPs			
Biotreatment BMP (Bio-filtration Basins)	County of Orange	Visual Inspection for trash and debris accumulation and dispose of any trash and debris accumulation. Inspect for standing water, and vegetation condition per the specifications included in the manual.	Prior and following the rainy season
Proprietary Biotreatment (Modular	County of Orange	Refer to the "Maintenance Guidelines for Modular Wetlands System – Linear" in Attachment D	Refer to the "Maintenance Guidelines for

Wetlands)		for inspection/maintenance activities required.	Modular Wetlands System – Linear" in Attachment D for minimum frequency of activities.
Treatment Control BMPs			
N.A.	N.A.	N.A.	N.A.

For PA-A thru PA-J (Parks/Open Space)

The responsible party of inspection and Maintenance for the plan will be the project owner. The "Owners" as referred below is Orange County Public Works and their information is listed below:

Orange County Public Works
County Executive Office – Land Development
445 Civic Center Drive West, 2nd Floor
Santa Ana, CA

The owner shall verify BMP implementation and ongoing maintenance through inspection, self-certification or other equally effective measure. The certification shall verify that the inspection and maintenance of all BMPs are performed in accordance with the requirements of this WQMP.

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
Non-Structural Source Control BMPs			
N1 – Education for Property Owners, Tenants and Occupants	County of Orange	Educational materials will be provided to the park owner by the developer and thereafter on an annual basis. Materials shall include those shown in Section VII and provided in Attachment A of this	At close of escrow and annually

		WQMP.	
N2 – Activity Restrictions	County of Orange	The County of Orange will prescribe activity restrictions to protect surface water quality, through a Covenant, Conditions and Restrictions (CC&Rs) agreement, or other equally effective measure, for the property. Upon takeover of the site responsibilities by the park owners. The park owners shall be responsible for ensuring compliance.	Ongoing
N3 – Common Area Landscape Management	County of Orange	Maintenance shall be consistent with County requirements; any fertilizer and/or pesticide usage shall be consistent with County guidelines for use of fertilizers and pesticides (OC DAMP Section 5.5). Maintenance includes mowing, weeding, and debris removal on a weekly basis. Trimming, replanting, and replacement of mulch shall be performed on an as-needed basis. Trimmings, clippings, and other waste shall be properly disposed of off-site in accordance with local regulations. Materials temporarily stockpiled during maintenance activities shall be placed away from water courses and drain inlets.	Weekly
N4 – BMP Maintenance	County of Orange	Maintenance of BMPs implemented at the project site shall be performed at the frequency prescribed in this WQMP. Records of inspections and BMP maintenance shall be maintained by the responsible party and documented with the WQMP, and shall be available for review upon request.	Ongoing

N11 – Common Area Litter Control	County of Orange	Litter patrol, violations investigation, reporting and other litter control activities shall be performed by the park owners in conjunction with maintenance activities for common areas.	Weekly
N14 – Common Area Catch Basin Inspection	County of Orange	Catch basins inlets, area drains, curb-and-gutter systems and other drainage systems shall be inspected prior to Oct. 1st of each year and after large storm events. If necessary, drains shall be cleaned prior to any succeeding rain events. 80% of private facilities shall be inspected and cleaned annually, with 100% of private facilities inspected and maintained within a 2-year period.	Annual
Structural Source Control BMPs			
S1 – Provide Storm Drain System Stencilling and Signage	County of Orange	Storm drain stencils shall be inspected for legibility, at a minimum, once prior to the storm season, no later than Oct. 1st each year. Those determined to be illegible will be re-stencilled as soon as possible.	Annual
S3 – Design and Construct Trash and Waste Storage Areas to Reduce Pollution Introduction	County of Orange	The owner shall post signs on trash enclosure gates that state "Keep Dumpster Lids Closed." The park owners will monitor dumpster usage such that dumpsters are not overfilled and the dumpster lids can close completely. The park owners shall increase the trash pickup schedule as necessary to prevent dumpsters from overfilling. The park owners will observe and damage to the trash enclosure wall and any discharge from the trash storage area.	Continually

S4 – Use Efficient Irrigation Systems & Landscape Design, Water Conservation, Smart Controllers, and Source Control	County of Orange	In conjunction with routine maintenance activities, verify that landscape design continues to function properly by adjusting overspray to hardscape areas to be eliminated, and to verify that irrigation timing and cycle lengths are adjusted in accordance with water demands, given time of year, weather, day or night time temperatures based on system specifications and local climate patterns.	Weekly
S4 – Protect slopes and channels and provide energy dissipation	County of Orange	Ensure permanent stabilization BMPs are functioning properly. Ensure slopes vegetation is healthy and established. Repair or replace areas where vegetation has died or washed away. Ensure channels do not show signs of erosion. Repair or replace velocity dissipation devices and vegetation in channel areas.	Weekly
Infiltration BMPs			
N.A.	N.A.	N.A.	N.A.
Biotreatment BMPs			
Biotreatment BMP (Bio-filtration Basins)	County of Orange	Visual Inspection for trash and debris accumulation and dispose of any trash and debris accumulation. Inspect for standing water, and vegetation condition per the specifications included in the manual.	Prior and following the rainy season
Treatment Control BMPs			
N.A.	N.A.	N.A.	N.A.

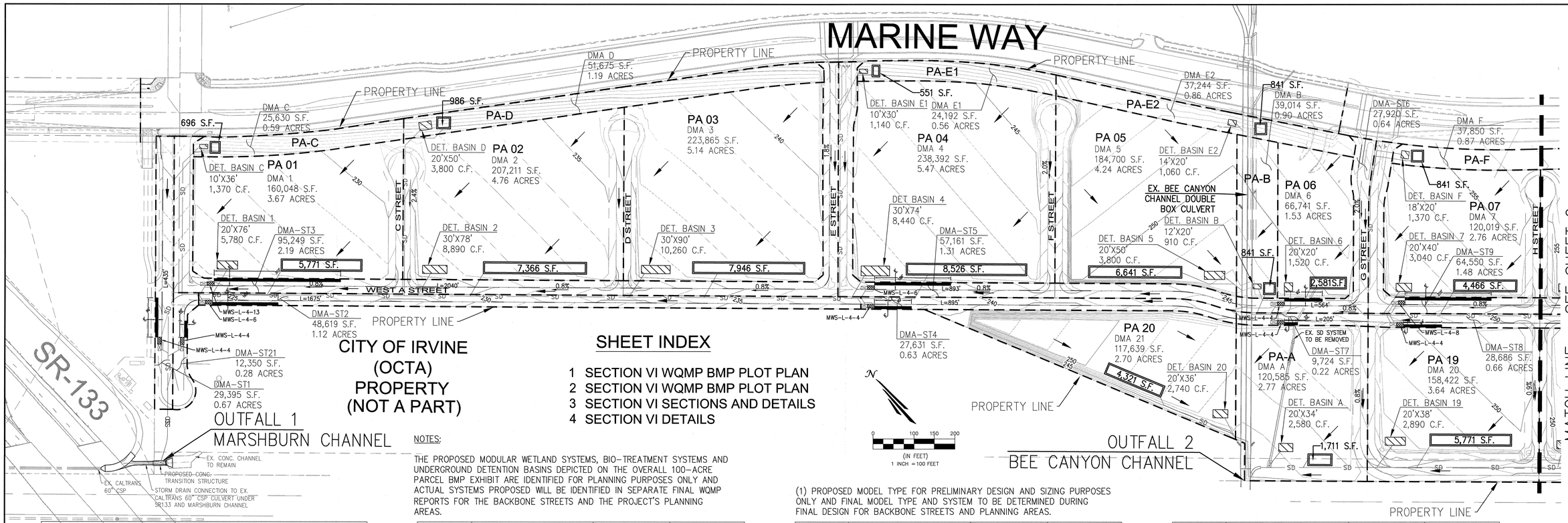
Section VI BMP Exhibit (Site Plan)

VI.1 BMP Exhibit (Site Plan)

See the following page for the WQMP Plot Plan.

VI.2 Submittal and Recordation of Water Quality Management Plan

Upon approval of the Final Project-Specific WQMP, three copies of the approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) will be submitted. In addition, these documents will be submitted in a PDF format.



CITY OF IRVINE
(OCTA)
PROPERTY
(NOT A PART)

SHEET INDEX

1 SECTION VI WQMP BMP PLOT PLAN
2 SECTION VI WQMP BMP PLOT PLAN
3 SECTION VI SECTIONS AND DETAILS
4 SECTION VI DETAILS

NOTES:

THE PROPOSED MODULAR WETLAND SYSTEMS, BIO-TREATMENT SYSTEMS AND UNDERGROUND DETENTION BASINS DEPICTED ON THE OVERALL 100-ACRE PARCEL BMP EXHIBIT ARE IDENTIFIED FOR PLANNING PURPOSES ONLY AND ACTUAL SYSTEMS PROPOSED WILL BE IDENTIFIED IN SEPARATE FINAL WQMP REPORTS FOR THE BACKBONE STREETS AND THE PROJECT'S PLANNING AREAS.

(1) PROPOSED MODEL TYPE FOR PRELIMINARY DESIGN AND SIZING PURPOSES ONLY AND FINAL MODEL TYPE AND SYSTEM TO BE DETERMINED DURING FINAL DESIGN FOR BACKBONE STREETS AND PLANNING AREAS.

WQMP BMPs SUMMARY TABLE

DMA#	BMP(1)	SIZING/ DIMENSIONS	CAPACITIES (CU-FT)
DMA 1	BIO-TREATMENT PLANTER BOX	5,771 SF (29'X199')	7,993
DMA 2	BIO-TREATMENT PLANTER BOX	7,366 SF (29'X254')	10,367
DMA 3	BIO-TREATMENT PLANTER BOX	7,946 SF (29'X274')	11,195
DMA 4	BIO-TREATMENT PLANTER BOX	8,526 SF (29'X294')	11,914
DMA 5	BIO-TREATMENT PLANTER BOX	6,641 SF (29'X229')	9,235
DMA 6	BIO-TREATMENT PLANTER BOX	2,581 SF (29'X89')	3,332
DMA 7	BIO-TREATMENT PLANTER BOX	4,466 SF (29'X154')	6,011
DMA 20	BIO-TREATMENT PLANTER BOX	5,771 SF (29'X199')	7,928
DMA A	BIO-TREATMENT PLANTER BOX	1,711 SF (29'X59')	2,091
DMA 21	BIO-TREATMENT PLANTER BOX	4,321 SF (29'X149')	5,881
DMA B	BIO-TREATMENT PLANTER BOX	841 SF (29'X29')	680
DMA C	BIO-TREATMENT PLANTER BOX	696 SF (29'X24')	445
DMA D	BIO-TREATMENT PLANTER BOX	986 SF (29'X34')	898
DMA E1	BIO-TREATMENT PLANTER BOX	551 SF (29'X19')	423
DMA E2	BIO-TREATMENT PLANTER BOX	841 SF (29'X29')	649
DMA F	BIO-TREATMENT PLANTER BOX	841 SF (29'X29')	657

WQMP BMPs SUMMARY TABLE

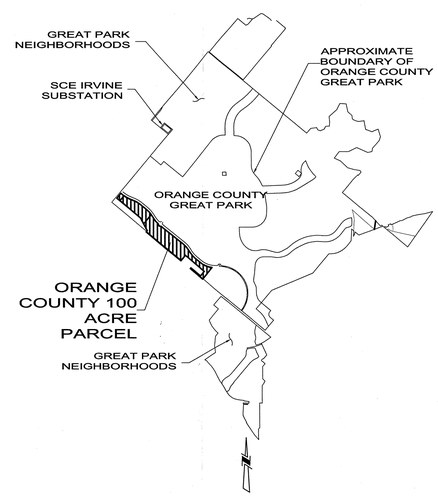
DMA#	BMP(1)	SIZING/ DIMENSIONS	48 HR DRAW DOWN TIME (CU-FT)	BMP(1)	CUDO DETENTION SIZE (95% VOID)	DETENTION VOLUME PROVIDED
DMA-ST1	MWS-L-4-4	5' X 5'	2280	CUDO SYSTEM	6' X 3' X 96'	1,641
DMA-ST2	MWS-L-4-6	7' X 5'	3200	CUDO SYSTEM	6' X 3' X 160'	2,736
DMA-ST3	MWS-L-4-13	14' X 5'	6261	CUDO SYSTEM	6' X 3' X 310'	5,301
DMA-ST4	MWS-L-4-4	5' X 5'	2280	CUDO SYSTEM	6' X 3' X 90'	1,539
DMA-ST5	MWS-L-4-6	7' X 5'	3200	CUDO SYSTEM	6' X 3' X 186'	3,181
DMA-ST6	MWS-L-4-4	5' X 5'	2280	CUDO SYSTEM	6' X 3' X 92'	1,573
DMA-ST7	MWS-L-4-4	5' X 5'	2280	CUDO SYSTEM	6' X 3' X 32'	547
DMA-ST8	MWS-L-4-4	5' X 5'	2280	CUDO SYSTEM	6' X 3' X 94'	1,607
DMA-ST9	MWS-L-4-8	9' X 5'	5036	CUDO SYSTEM	6' X 3' X 210'	3,591
DMA-ST21	MWS-L-4-4	5' X 5'	2280	CUDO SYSTEM	6' X 3' X 40'	684

NOTE:

LID/DESIGN CAPTURE VOLUME IS THE CONTROLLING VOLUME OVER HYDROMODIFICATION. THE PROPOSED BIO-FILTRATION BASINS WITHIN PLANNING AREAS ARE TO ACCOMMODATE LID/DCV AND MEET HYDROMODIFICATION REQUIREMENTS.

LEGEND

- CATCH BASIN (BACKBONE IMPROVEMENT)
- SD — STORM DRAIN LINE (BACKBONE IMPROVEMENT)
- MWU X-XX — MODULAR WETLAND SYSTEM (BACKBONE IMPROVEMENT)
- X,XXX S.F. — BIO-FILTRATION SYSTEM (DEVELOPER IMPROVEMENT)
- DMA — DRAINAGE MANAGEMENT AREA
- PA-# — DEVELOPER PLANNING AREA
- PA-(LETTER) — OPEN SPACE/PARK PLANNING AREA
- ST — STREET
- CONTRIBUTORY AREA TO EACH DMA
- FLOW LINE
- FLOW DIRECTION
- L=XXX' — FLOW LENGTH
- PROPERTY LINE
- STORMWATER DETENTION SYSTEM
- STREET MODULAR WETLAND UNIT (BIOFILTRATION)
- STREET "LOW FLOW" STORMWATER STORAGE CONTAINMENT CHAMBER (ASSUMES 3' DEPTH WITH 6' WIDTH)



LOCATION/VICINITY MAP
NOT TO SCALE

ENGINEER SEAL
REGISTERED PROFESSIONAL ENGINEER
TODD SCHMIEDER
No. C37167
EXP. 6-30-16
CIVIL
STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:

TODD SCHMIEDER, P.E. R.C.E. C37167 11-19-15 DATE

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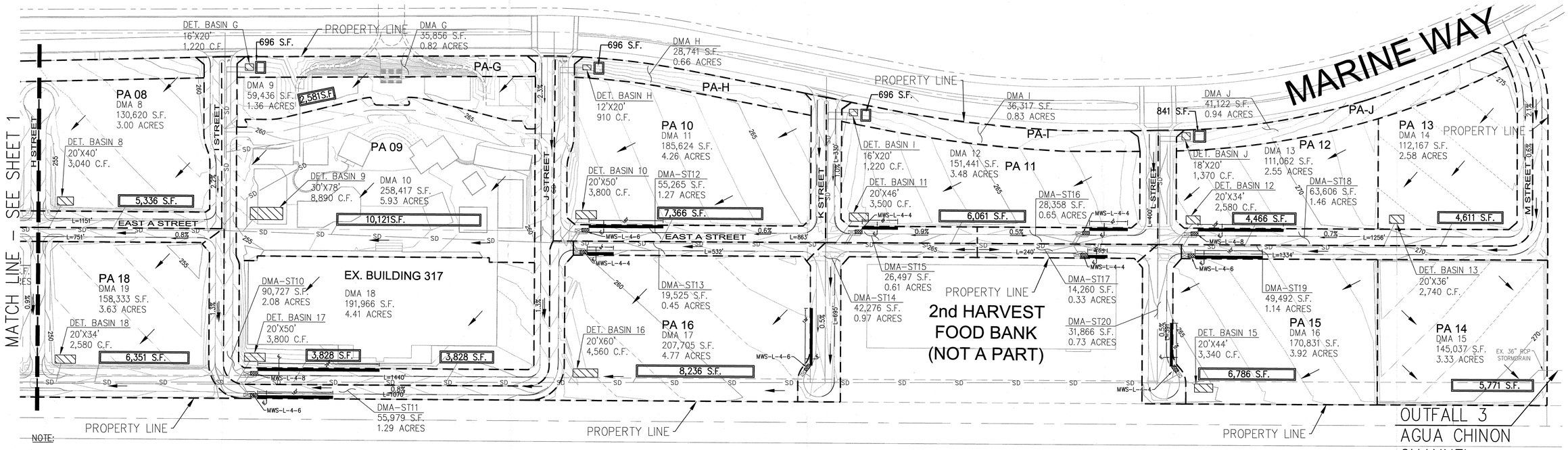
FOR REVIEW ONLY - NOT FOR CONSTRUCTION

SECTION VI WQMP BMP PLOT PLAN

EL TORO 100-ACRE PARCEL DEVELOPMENT PLAN- COUNTY OF ORANGE
LOWE ENTERPRISES REAL ESTATE GROUP
UNINCORPORATED TERRITORY OF THE COUNTY OF ORANGE
IRVINE, CALIFORNIA

DRAWN: RH
DATE: 2015.06.29
APPROVED: --
DATE: --
REVISION #: --
DATE: --
JOB NO: SP7531

Dec 01, 2015 – 4:09pm by mdelagarza K:\Drawings\SP\SP7531 Lowe El Toro\Eng\WQMP\100 acre Parcel Revised.DWG



NOTE:

LID/DESIGN CAPTURE VOLUME IS THE CONTROLLING VOLUME OVER HYDROMODIFICATION. THE PROPOSED BIO-FILTRATION BASINS WITHIN PLANNING AREAS ARE TO ACCOMMODATE LID/DCV AND MEET HYDROMODIFICATION REQUIREMENTS.

WQMP BMPs SUMMARY TABLE

DMA#	BMP (1)	SIZE/ DIMENSIONS	CAPACITIES (CU-FT)
DMA 8	BIO-TREATMENT PLANTER BOX	5,336 SF (29'X184')	7,231
DMA 9	BIO-TREATMENT PLANTER BOX	2,581 SF (29'X89')	3,278
DMA 10	BIO-TREATMENT PLANTER BOX	10,121 SF (29'X349')	14,293
DMA 11	BIO-TREATMENT PLANTER BOX	7,366 SF (29'X254')	10,268
DMA 12	BIO-TREATMENT PLANTER BOX	6,061 SF (29'X209')	8,388
DMA 13	BIO-TREATMENT PLANTER BOX	4,466 SF (29'X154')	6,146
DMA 14	BIO-TREATMENT PLANTER BOX	4,611 SF (29'X159')	6,219
DMA 15	BIO-TREATMENT PLANTER BOX	5,771 SF (29'X199')	8,026
DMA 16	BIO-TREATMENT PLANTER BOX	6,786 SF (29'X234')	9,448
DMA 17	BIO-TREATMENT PLANTER BOX	8,236 SF (29'X284')	11,497
DMA 18	BIO-TREATMENT PLANTER BOX	7,656 SF (29'X264')	10,630
DMA 19	BIO-TREATMENT PLANTER BOX	6,351 SF (29'X219')	8,749
DMA G	BIO-TREATMENT PLANTER BOX	696 SF (29'X24')	619
DMA H	BIO-TREATMENT PLANTER BOX	696 SF (29'X24')	498
DMA I	BIO-TREATMENT PLANTER BOX	696 SF (29'X24')	627
DMA J	BIO-TREATMENT PLANTER BOX	841 SF (29'X29')	710

(1) PROPOSED MODEL TYPE FOR PRELIMINARY DESIGN AND SIZING PURPOSES ONLY AND FINAL MODEL TYPE AND SYSTEM TO BE DETERMINED DURING FINAL DESIGN FOR BACKBONE STREETS AND PLANNING AREAS.

WQMP BMPs SUMMARY TABLE

DMA#	BMP(1)	SIZING/ DIMENSIONS	48 HR DRAW DOWN TIME (CU-FT)	BMP(1)	CUDO DETENTION SIZE (95% VOID)	DETENTION VOLUME PROVIDED
DMA-ST10	MWS-L-4-8	5' X 9'	5036	CUDO SYSTEM	6' X 3' X 294'	5,027
DMA-ST11	MWS-L-4-6	5' X 7'	3200	CUDO SYSTEM	6' X 3' X 182'	3,112
DMA-ST12	MWS-L-4-6	5' X 7'	3200	CUDO SYSTEM	6' X 3' X 180'	5,078
DMA-ST13	MWS-L-4-4	5' X 5'	2280	CUDO SYSTEM	6' X 3' X 64'	1,094
DMA-ST14	MWS-L-4-6	5' X 7'	3200	CUDO SYSTEM	6' X 3' X 138'	2,360
DMA-ST15	MWS-L-4-4	5' X 5'	2280	CUDO SYSTEM	6' X 3' X 86'	1,471
DMA-ST16	MWS-L-4-4	5' X 5'	2280	CUDO SYSTEM	6' X 3' X 92'	1,573
DMA-ST17	MWS-L-4-4	5' X 5'	2280	CUDO SYSTEM	6' X 3' X 48'	795
DMA-ST18	MWS-L-4-8	5' X 9'	5036	CUDO SYSTEM	6' X 3' X 206'	3,522
DMA-ST19	MWS-L-4-6	5' X 7'	3200	CUDO SYSTEM	6' X 3' X 162'	2,770
DMA-ST19	MWS-L-4-4	5' X 5'	2280	CUDO SYSTEM	6' X 3' X 104'	1,778

N

(IN FEET)
1 INCH = 100 FEET

NOTES:

THE PROPOSED MODULAR WETLAND SYSTEMS, BIO-TREATMENT SYSTEMS AND UNDERGROUND DETENTION BASINS DEPICTED ON THE OVERALL 100-ACRE PARCEL BMP EXHIBIT ARE IDENTIFIED FOR PLANNING PURPOSES ONLY AND ACTUAL SYSTEMS PROPOSED WILL BE IDENTIFIED IN SEPARATE FINAL WQMP REPORTS FOR THE BACKBONE STREETS AND THE PROJECT'S PLANNING AREAS.

LEGEND

- CATCH BASIN (BACKBONE IMPROVEMENT)
- SD — STORM DRAIN LINE (BACKBONE IMPROVEMENT)
- MWU X-XX — MODULAR WETLAND SYSTEM (BACKBONE IMPROVEMENT)
- X,XXX S.F. — BIO-FILTRATION SYSTEM (DEVELOPER IMPROVEMENT)
- DMA — DRAINAGE MANAGEMENT AREA
- PA-# — DEVELOPER PLANNING AREA
- PA-(LETTER) — OPEN SPACE/PARK PLANNING AREA
- ST — STREET
- CONTRIBUTORY AREA TO EACH DMA
- FLOW LINE
- FLOW DIRECTION
- L=XXX' — FLOW LENGTH
- PROPERTY LINE
- STORMWATER DETENTION SYSTEM
- STREET MODULAR WETLAND UNIT (BIOFILTRATION)
- STREET "LOW FLOW" STORMWATER STORAGE CONTAINMENT CHAMBER (ASSUMES 3' DEPTH WITH 6' WIDTH)

ENGINEER SEAL

REGISTERED PROFESSIONAL ENGINEER TODD SCHMIEDER No. C37167 EXP. 6-30-15 CIVIL STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:

TODD SCHMIEDER, P.E. R.C.E. C37167 11-19-15 DATE

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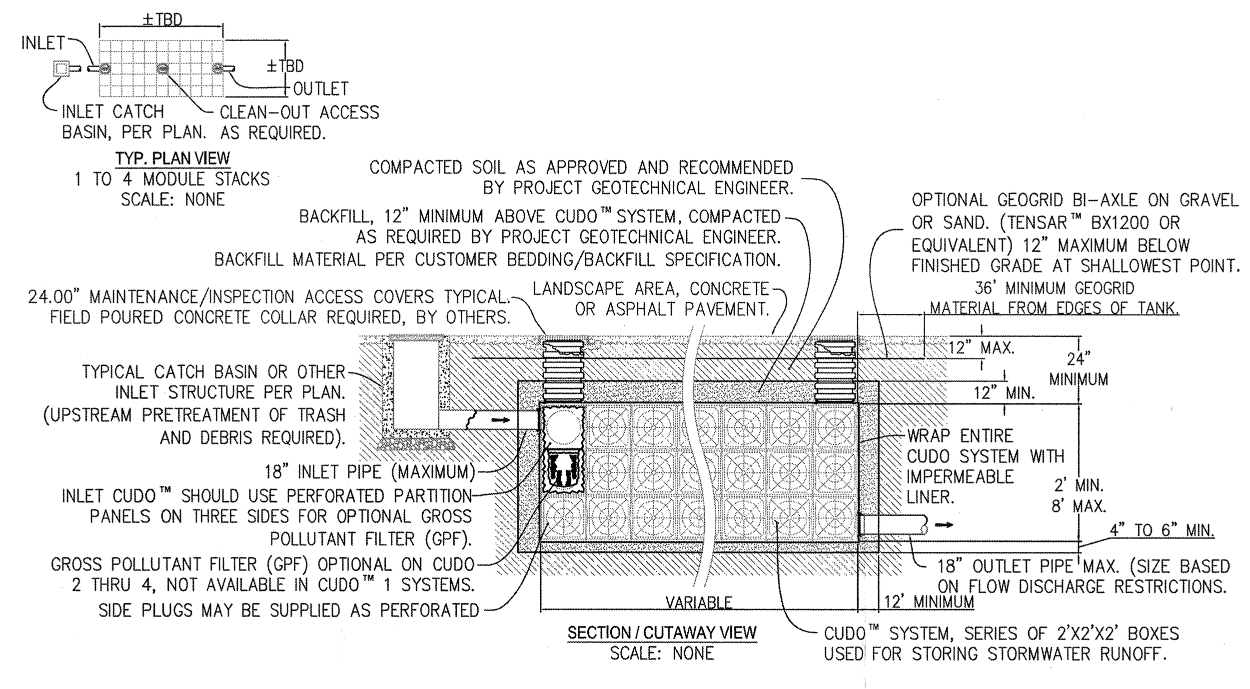
	REVISIONS			

SECTION VI WQMP BMP PLOT PLAN

EL TORO 100-ACRE PARCEL DEVELOPMENT PLAN- COUNTY OF ORANGE
LOWIE ENTERPRISES REAL ESTATE GROUP
UNINCORPORATED TERRITORY OF COUNTY OF ORANGE
IRVINE, CALIFORNIA

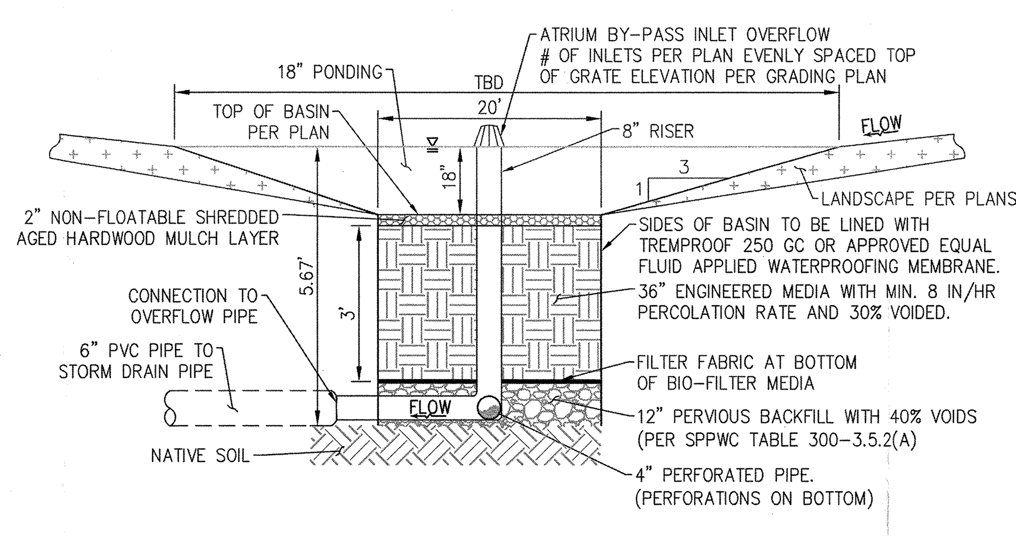
DRAWN: RH
DATE: 2015.05.29
CHECKED: -
DATE: -
REVISION #: -
DATE: -
JOB NO: SP7531

Dec 01, 2015 – 4:13pm by mdelagarza K:\Drawings\SP\SP7531 Lowe El Toro\Eng\WQMP\100 acre Parcel Revised.DWG



ONSITE UNDERGROUND DETENTION BASIN
CONCEPT FOR PLANNING AREAS

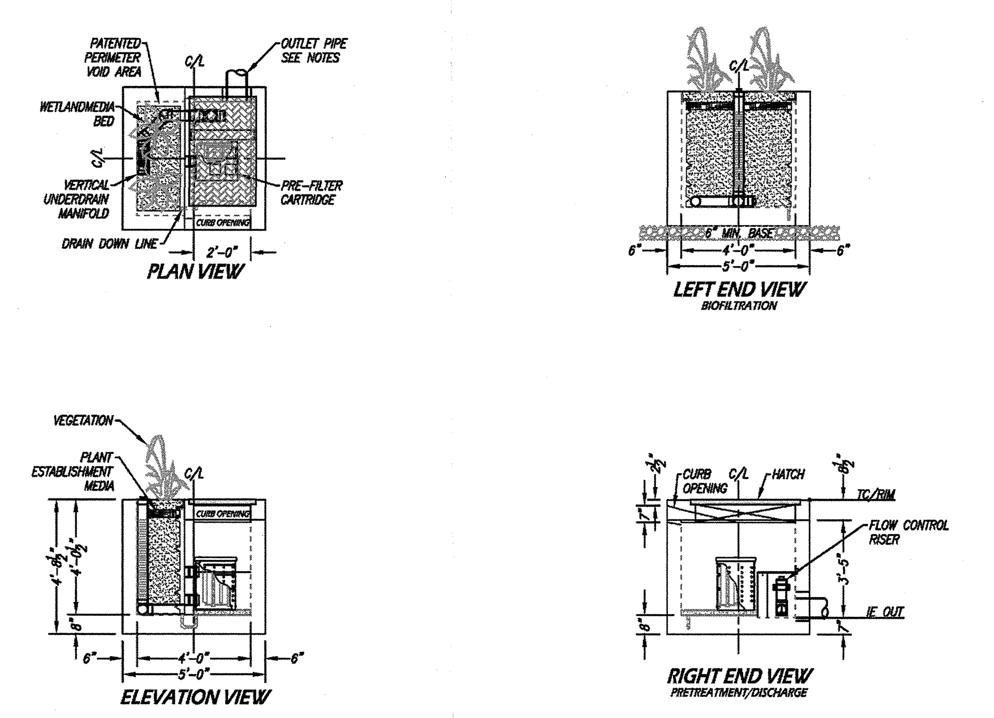
NTS (PROVIDED FOR CAPACITY SIZING ONLY)



ONSITE BIO-FILTRATION CONCEPT
FOR PLANNING AREAS

NTS (PROVIDED FOR CAPACITY SIZING ONLY)

SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	24" x 42"	N/A	N/A
WETLANDMEDIA VOLUME (CY)			0.83
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø1.03"
MAXIMUM PICK WEIGHT (LBS)			9000
NOTES:			



INSTALLATION NOTES
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

GENERAL NOTES
1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

TREATMENT FLOW (CFS)	0.052
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

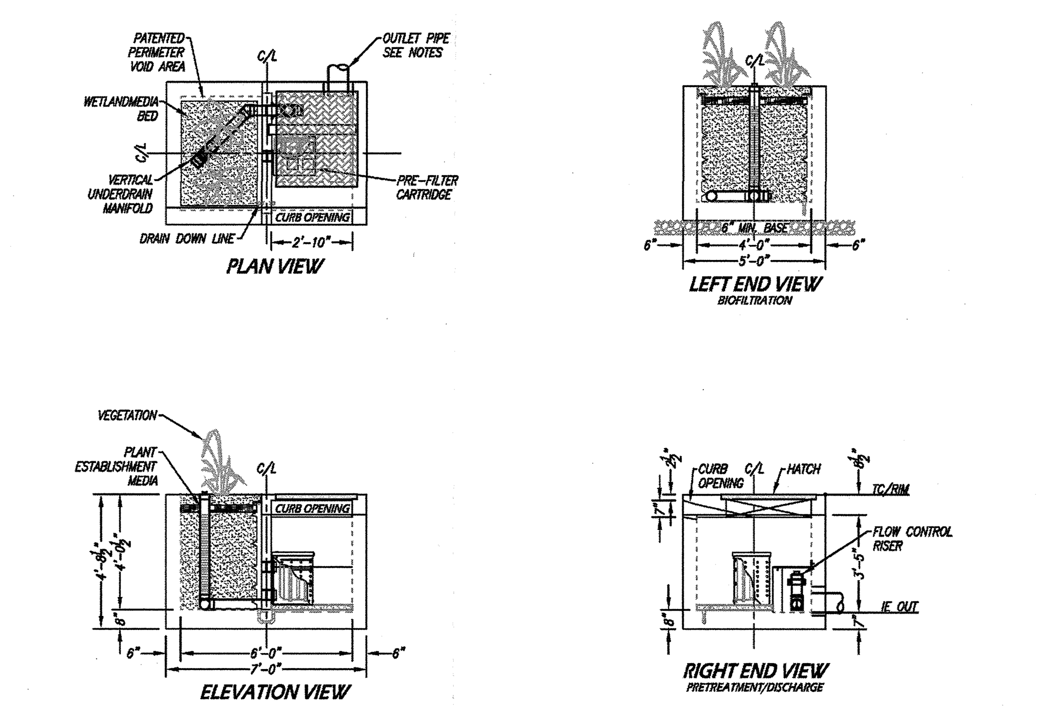
THE PRODUCT DESCRIBED MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

PROPRIETARY AND CONFIDENTIAL:
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF MODULAR WETLANDS SYSTEMS. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF MODULAR WETLANDS SYSTEMS IS PROHIBITED.

MODULAR WETLANDS

MWS-L-4-4-C
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	30" X 36"	N/A	N/A
WETLANDMEDIA VOLUME (CY)			1.48
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø1.22"
MAXIMUM PICK WEIGHT (LBS)			TBD
NOTES:			



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TREATMENT FLOW (CFS)	0.073
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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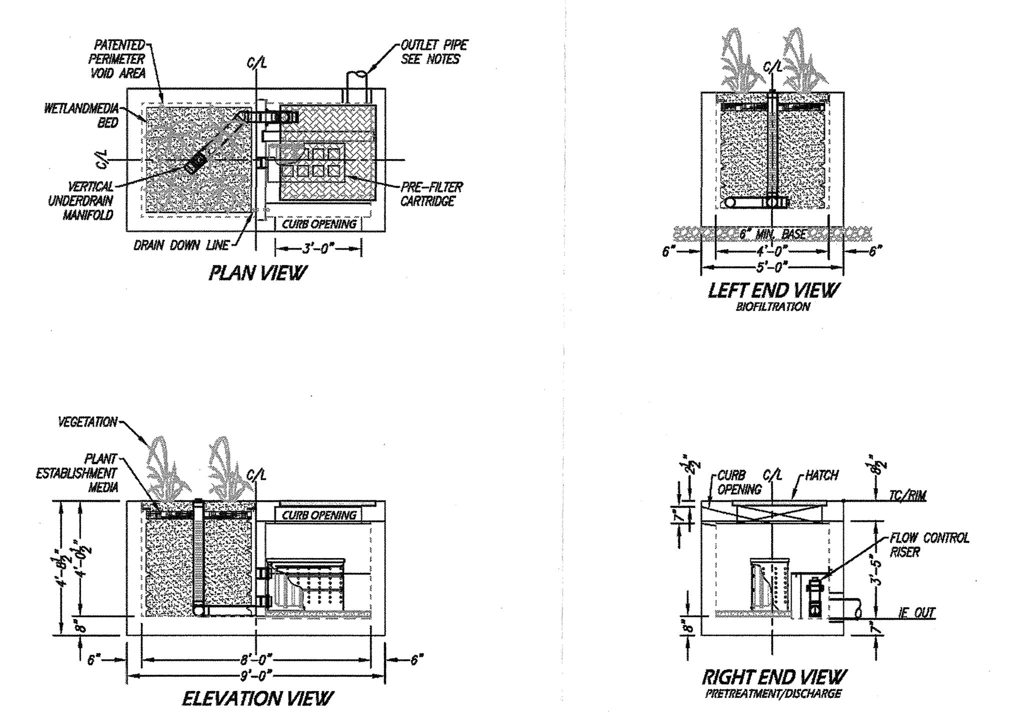
MODULAR WETLANDS

MWS-L-4-6-C
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	36" X 36"	N/A	N/A
WETLANDMEDIA VOLUME (CY)			2.03
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø1.53"
MAXIMUM PICK WEIGHT (LBS)			15000
NOTES:			



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TREATMENT FLOW (CFS)	0.115
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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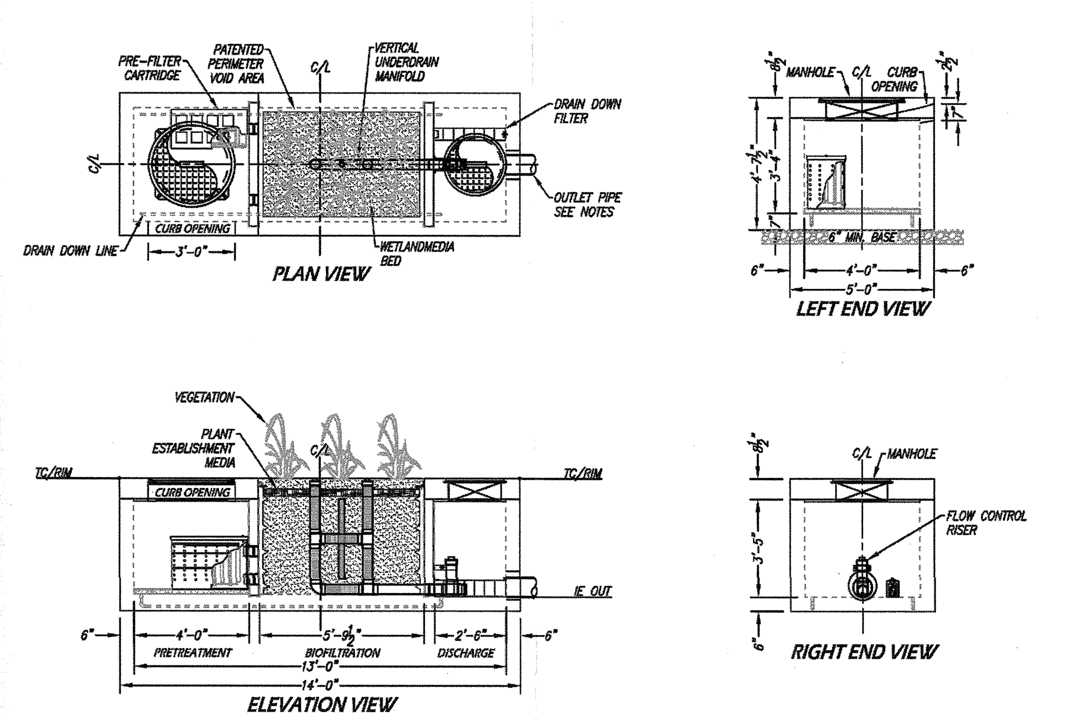
MODULAR WETLANDS

MWS-L-4-8-C
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			3.05
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø1.71"
MAXIMUM PICK WEIGHT (LBS)			27000
NOTES:			



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TREATMENT FLOW (CFS)	0.144
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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MODULAR WETLANDS

MWS-L-4-13-C
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

NOTE:

LID/DESIGN CAPTURE VOLUME IS THE CONTROLLING VOLUME OVER HYDROMODIFICATION. THE PROPOSED BIO-FILTRATION BASINS WITHIN PLANNING AREAS ARE TO ACCOMMODATE LID/DCV AND MEET HYDROMODIFICATION REQUIREMENTS.

NOTES:

THE PROPOSED MODULAR WETLAND SYSTEMS, BIO-TREATMENT SYSTEMS AND UNDERGROUND DETENTION BASINS DEPICTED ON THE OVERALL 100-ACRE PARCEL BMP EXHIBIT ARE IDENTIFIED FOR PLANNING PURPOSES ONLY AND ACTUAL SYSTEMS PROPOSED WILL BE IDENTIFIED IN SEPARATE FINAL WQMP REPORTS FOR THE BACKBONE STREETS AND THE PROJECT'S PLANNING AREAS.

ENGINEER SEAL
REGISTERED PROFESSIONAL ENGINEER D. TODD SCHMIEDER No. C37167 EXP. 6-30-15 CIVIL STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:
TODD SCHMIEDER, P.E. R.C.E. C37167 11-19-15 DATE

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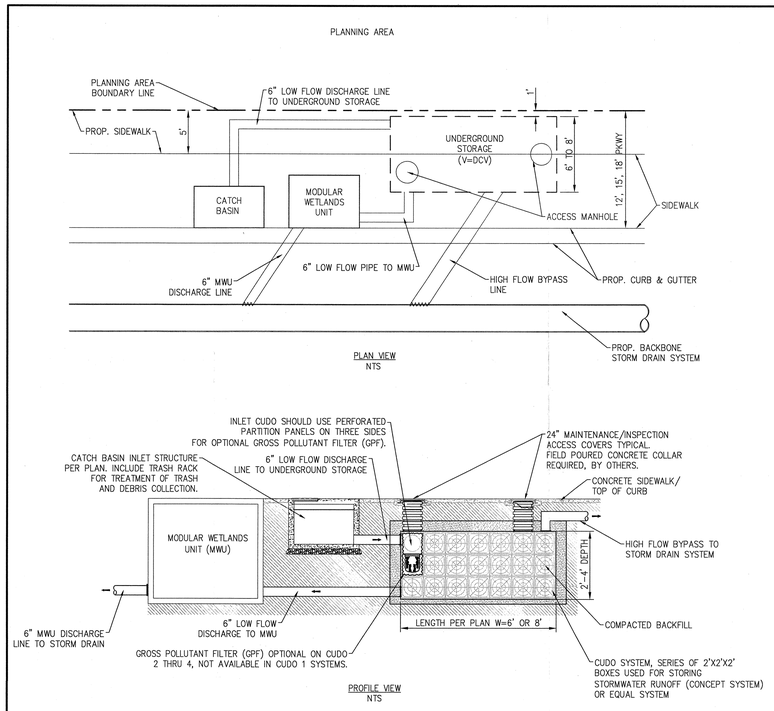
	REVISIONS			

SECTION VI SECTIONS AND DETAILS

EL TORO DEVELOPMENT AREA - COUNTY OF ORANGE
LOWE ENTERPRISES REAL ESTATE GROUP
UNINCORPORATED TERRITORY OF THE COUNTY OF ORANGE
IRVINE, CALIFORNIA

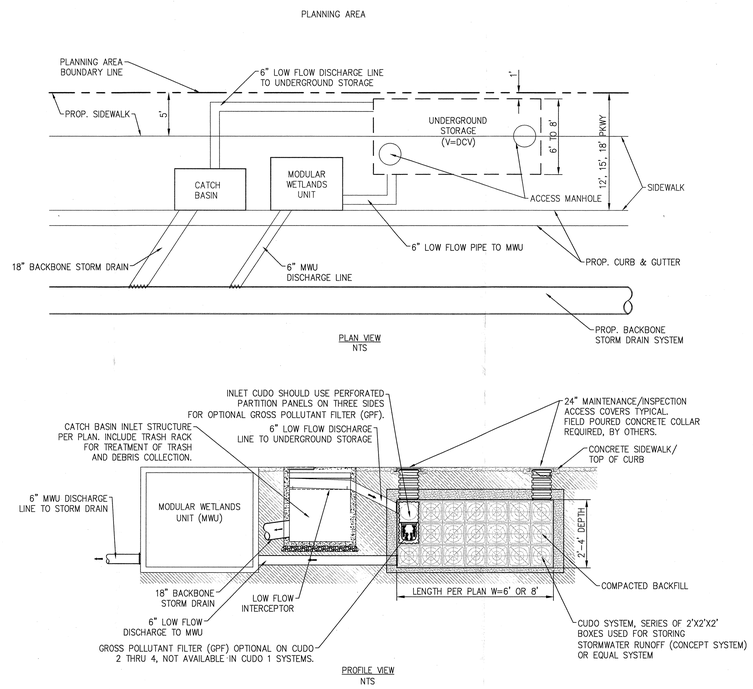
DRAWN: RH
DATE: 2014.09.05
CHECKED: -
DATE: -
REVISION #: -
DATE: -
JOB NO: SP7531

Dec 01, 2015 – 4:57pm by mdelagarza K:\Drawings\SP\SP7531 Lowe El Toro\Eng\WQMP\100 acre Parcel Revised.DWG



STREET STORMWATER RUNOFF WQMP BMP SYSTEM

OPTION A CONCEPT (NTS)



PRIVATE STREET STORMWATER RUNOFF WQMP BMP SYSTEM

OPTION B CONCEPT (NTS)

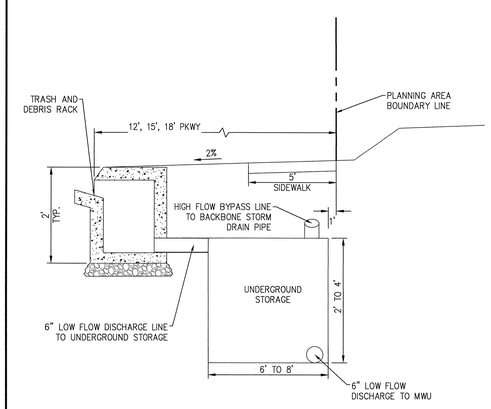
NOTE:

(1) USE OF OPTION A OR B TO BE DETERMINED IN FINAL DESIGN OF STREET BASED ON SITE IMPROVEMENTS.

(2) CONFIGURATION AND PLACEMENT OF STREET BMPS TO BE SET IN FINAL DESIGN. LOCATIONS AND NUMBER OF SYSTEMS DEPICTED HEREON ARE SUBJECT TO CHANGE.

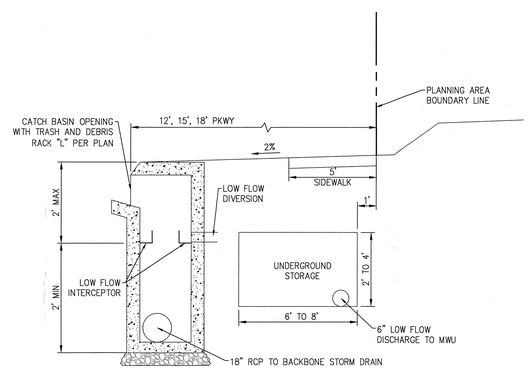
NOTE:

LID/DESIGN CAPTURE VOLUME IS THE CONTROLLING VOLUME OVER HYDROMODIFICATION. THE PROPOSED BIO-FILTRATION BASINS WITHIN PLANNING AREAS ARE TO ACCOMMODATE LID/DCV AND MEET HYDROMODIFICATION REQUIREMENTS.



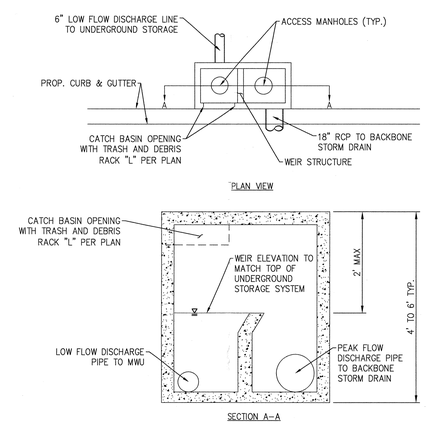
OPTION A

FULL CAPTURE CONCEPT SECTION VIEW (NTS)



OPTION B

TROUGH DIVERSION CONCEPT SECTION VIEW (NTS)



OPTION B

WEIR DIVERSION CONCEPT SECTION VIEW (NTS)

NOTES:

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ENGINEER SEAL

REGISTERED PROFESSIONAL ENGINEER TODD SCHMIEDER No. C37167 EXP. CIVIL STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:

TODD SCHMIEDER, P.E. R.C.E. C37167 11-18-15 DATE

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	REVISIONS			

SECTION V/ DETAILS

EL TORO DEVELOPMENT AREA - COUNTY OF ORANGE
LOWE ENTERPRISES REAL ESTATE GROUP
UNINCORPORATED TERRITORY OF THE COUNTY OF ORANGE
IRVINE, CALIFORNIA

DRAWN: RH
DATE: 2014.09.05
CHECKED: --
DATE: --
REVISION #: --
DATE: --
JOB NO: SP7531

Dec 01, 2015 - 4:26pm by mdelagarza K:\Drawings\SP\SP7531 Lowe El Toro\Eng\WQMP\100 acre Parcel Revised.DWG

SECTION VII

Section VII Educational Materials

Education Materials			
Residential Material (http://www.ocwatersheds.com)	**Check If Applicable**	**Business Material (http://www.ocwatersheds.com)**	**Check If Applicable**
The Ocean Begins at Your Front Door	☒	Tips for the Automotive Industry	☐
Tips for Car Wash Fund-raisers	☒	Tips for Using Concrete and Mortar	☒
Tips for the Home Mechanic	☒	Tips for the Food Service Industry	☒
Homeowners Guide for Sustainable Water Use	☒	Proper Maintenance Practices for Your Business	☒
Household Tips	☒	**Other Material**	**Check If Attached**
Proper Disposal of Household Hazardous Waste	☒		
Recycle at Your Local Used Oil Collection Center (North County)	☐	Tips for Protecting Your Watershed	☒
Recycle at Your Local Used Oil Collection Center (Central County)	☐	R-1 AUTOMOBILE REPAIR AND MAINTENANCE	☒
Recycle at Your Local Used Oil Collection Center (South County)	☒	R-2 AUTOMOBILE WASHING	☒
Tips for Maintaining a Septic Tank System	☐	R-3 AUTOMOBILE PARKING	☒
Responsible Pest Control	☒	R-4 HOME AND GARDEN CARE ACTIVITIES	☒
Sewer Spill	☒	R-5 DISPOSAL OF PET WASTES	☒
Tips for the Home Improvement Projects	☒	R-6 DISPOSAL OF GREEN WASTES	☒
Tips for Horse Care	☐	R-7 HOUSEHOLD HAZARDOUS WASTE	☒
Tips for Landscaping and Gardening	☒	R-8 WATER CONSERVATION	☒
Tips for Pet Care	☒	IC2 ANIMAL HANDLING AREAS	☒
Tips for Pool Maintenance	☒	IC3 BUILDING MAINTENANCE	☒
Tips for Residential Pool, Landscape and Hardscape Drains	☒	IC4 CARPET CLEANING	☒
Tips for Projects Using Paint	☒	IC5 CONCRETE AND ASPHALT PRODUCTION, APPLICATION, AND CUTTING	☒

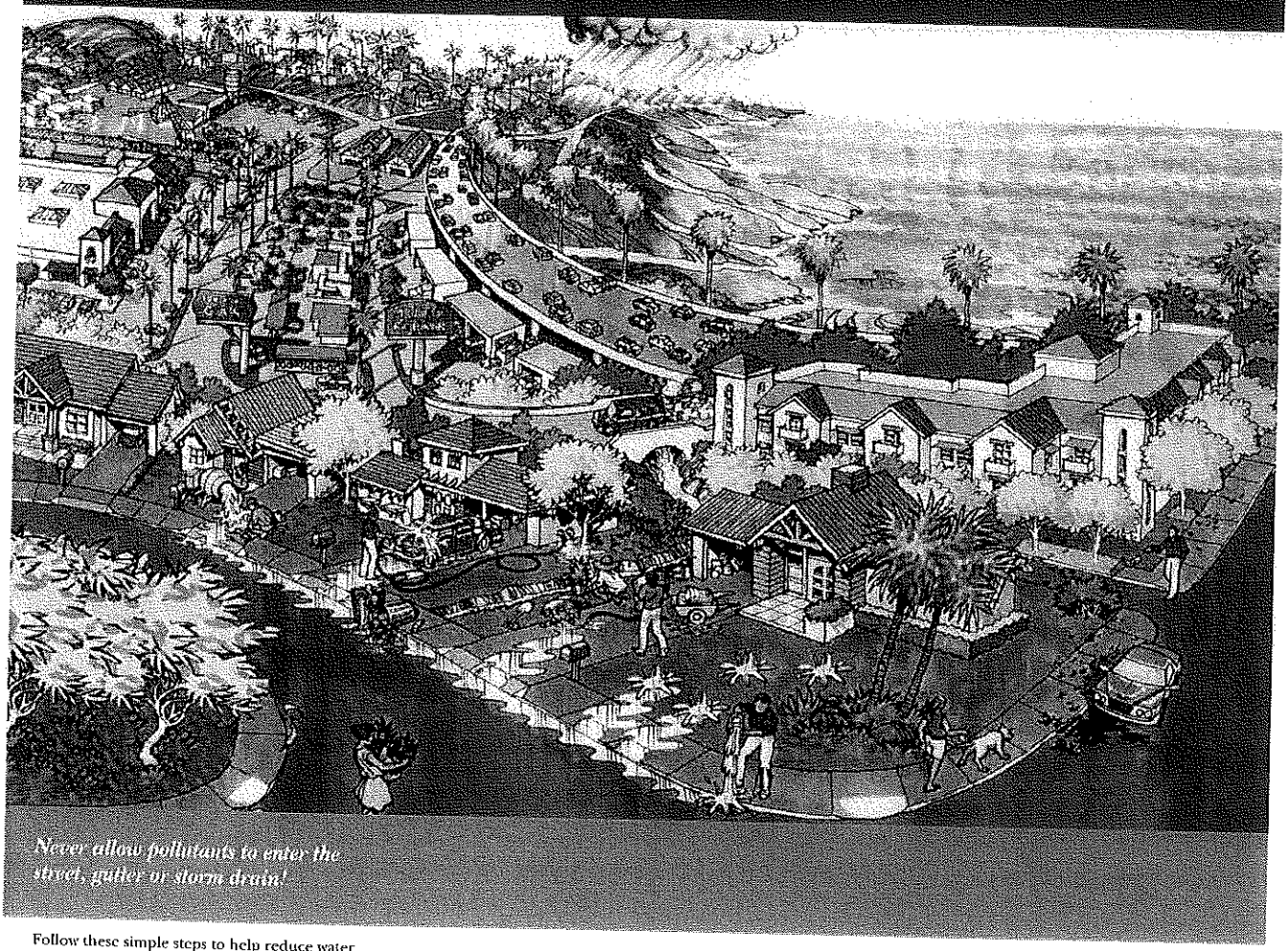
Education Materials			
Other Material (http://www.ocwatersheds.com)	**Check If Applicable**		**Check If Applicable**
IC6 CONTAIMINATED OR ERODIBLE SURFACES AREAS	☒	FF-6 MATERIAL LOADING AND UNLOADING	☒
IC7 LANDSCAPE MAINTENANCE	☒	FF-11 VEHICLE AND EQUIPMENT CLEANING	☒
IC10 OUTDOOR LOADING/UNLOADING OF MATERIALS	☒	FF-12 VEHICLE AND EQUIPMENT STORAGE	☒
IC11 OUTDOOR PROCESS EQUIPMENT OPERATIONS AND MAINTENANCE	☒	FF-13 WASTE HANDLING AND DISPOSAL	☒
IC12 OUTDOOR STORAGE OF RAW MATERIALS, PRODUCTS, AND CONTAINERS	☒		
IC14 PAINTING, FINISHING, AND COATINGS OF VEHICLES, BOATS, BUILDINGS, AND EQUIPMENT	☒		
IC15 PARKING AND STORAGE AREA MAINTENANCE	☒	FP-3 ROADS, STREETS, AND HIGHWAYS OPERATIONS AND MAINTENANCE	☒
IC16 POOL AND FOUNTAIN CLEANING	☒	R-1 AUTOMOBILE REPAIR AND MAINTENANCE	☒
IC17 SPILL PREVENTION AND CLEANUP	☒	FP-5 SOLID WASTE HANDLING	☒
IC19 VEHICLE AND EQUIPMENT MAINTENANCE AND REPAIR	☒	FP-6 WATER AND SEWER UTILITY OPERATIONS AND MAINTENANCE	☒
IC20 VEHICLE AND EQUIPMENT WASHING AND STEAM CLEANING	☒	DF-1 DRAINAGE FACILITY OPERATIONS AND MAINTENANCE	☒
IC21 WASTE HANDLING AND DISPOSAL	☒		☐
IC22 EATING AND DRINKING ESTABLISHMENTS	☒		☐
IC23 FIRE SPRINKLER TESTING/MAINTENANCE	☒		☐
FP-2 LANDSCAPE MAINTENANCE	☒		☐
FP-4 SIDEWALK, PLAZA, AND FOUTAIN MAINTENANCE AND CLEANING	☒		☐
FF-3 EQUIPMENT MAINTENANCE AND REPAIR	☒		☐

A

Attachment A

Educational Materials

The Ocean Begins at Your Front Door



Never allow pollutants to enter the street, gutter or storm drain!

Follow these simple steps to help reduce water pollution:

Household Activities

- Do not rinse spills with water. Use dry cleanup methods such as applying cat litter or another absorbent material, sweep and dispose of in the trash. Take items such as used or excess batteries, oven cleaners, automotive fluids, painting products and cathode ray tubes, like TVs and computer monitors, to a Household Hazardous Waste Collection Center (HHWCC).
- For a HHWCC near you call (714) 834-6752 or visit www.ocfdfills.com.
- Do not hose down your driveway, sidewalk or patio to the street, gutter or storm drain. Sweep up debris and dispose of it in the trash.

Automotive

- Take your vehicle to a commercial car wash whenever possible. If you wash your vehicle at home, choose soaps, cleaners, or detergents labeled non-toxic, phosphate-free or biodegradable. Vegetable and citrus-based products are typically safest for the environment.
- Do not allow washwater from vehicle washing to drain into the street, gutter or storm drain. Excess washwater should be disposed of in the sanitary sewer (through a sink or toilet) or onto an absorbent surface like your lawn.
- Monitor your vehicles for leaks and place a pan under leaks. Keep your vehicles well maintained to stop and prevent leaks.
- Never pour oil or antifreeze in the street, gutter or storm drain. Recycle these substances at a service station, a waste oil collection center or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit www.1800cleanup.org.

Pool Maintenance

- Pool and spa water must be dechlorinated and free of excess acid, alkali or color to be allowed in the street, gutter or storm drain.
- When it is not raining, drain dechlorinated pool and spa water directly into the sanitary sewer.
- Some cities may have ordinances that do not allow pool water to be disposed of in the storm drain. Check with your city.

Landscape and Gardening

- Do not over-water. Water your lawn and garden by hand to control the amount of water you use or set irrigation systems to reflect seasonal water needs. If water flows off your yard onto your driveway or sidewalk, your system is over-watering. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of waste by composting, hauling it to a permitted landfill, or as green waste through your city's recycling program.
- Follow directions on pesticides and fertilizer, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Take unwanted pesticides to a HHWCC to be recycled. For locations and hours of HHWCC, call (714) 834-6752 or visit www.ocfdfills.com.

Trash

- Place trash and litter that cannot be recycled in securely covered trash cans.
- Whenever possible, buy recycled products.
- Remember: Reduce, Reuse, Recycle.

Pet Care

- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash. Pet waste, if left outdoors, can wash into the street, gutter or storm drain.
- If possible, bathe your pets indoors. If you must bathe your pet outside, wash it on your lawn or another absorbent/permeable surface to keep the washwater from entering the street, gutter or storm drain.
- Follow directions for use of pet care products and dispose of any unused products at a HHWCC.

Common Pollutants

House Maintenance
- Detergents, cleansers and solvents
- Oil and other paints
- Sanitizing pool chemicals
- Garden chemicals and others

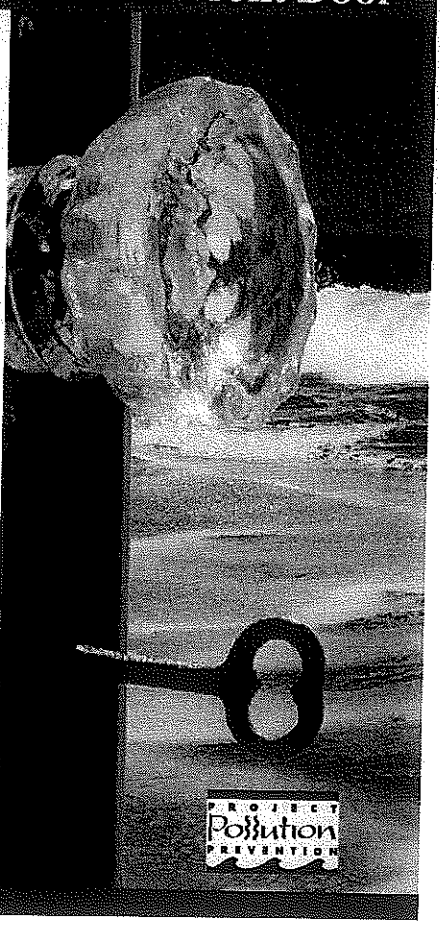
Lawn and Garden
- Pet and animal waste
- Pesticides
- Clippings, leaves and soil
- Fertilizer

Automobile
- Oil and grease
- Radiator fluids and antifreeze
- Cleaning chemicals
- Brake pad dust

The Ocean Begins at Your Front Door

Even if you live miles from the Pacific Ocean, you may be unknowingly polluting it.

Dumping one quart of motor oil into a storm drain can contaminate 250,000 gallons of water.



Did You Know?

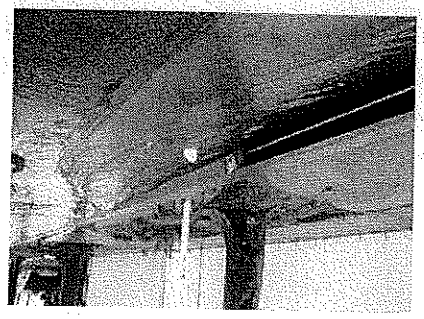
- Most people believe that the largest source of water pollution in urban areas comes from specific sources such as factories and sewage treatment plants. In fact, the largest source of water pollution comes from city streets, neighborhoods, construction sites and parking lots. This type of pollution is sometimes called "non-point source" pollution.
- There are two types of non-point source pollution: stormwater and urban runoff
- Stormwater runoff results from rainfall. When rainstorms cause large volumes of water to rinse the urban landscape, picking up pollutants along the way.
- Urban runoff can happen any time of the year when excessive water use from irrigation, vehicle washing and other sources carries trash, lawn clippings and other urban pollutants into storm drains.

Where Does It Go?

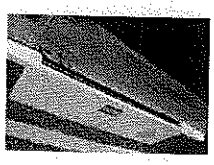
- Anything we use outside homes, vehicles and businesses – like motor oil, paint, pesticides, fertilizers and cleaners – can be blown or washed into storm drains.
- A little water from a garden hose or rain can also send materials into storm drains.
- Storm drains are separate from our sanitary sewer systems; unlike water in sanitary sewers (from sinks or toilets), water in storm drains is not treated before entering our waterways.

Sources of Non-Point Source Pollution

- Automotive leaks and spills.
- Improper disposal of used oil and other engine fluids.
- Metals found in vehicle exhaust, weathered paint, rust, metal plating and tires.
- Pesticides and fertilizers from lawns, gardens and farms.
- Improper disposal of cleaners, paint and paint removers.
- Soil erosion and dust debris from landscape and construction activities.
- Litter, lawn clippings, animal waste, and other organic matter.
- Oil stains on parking lots and paved surfaces.



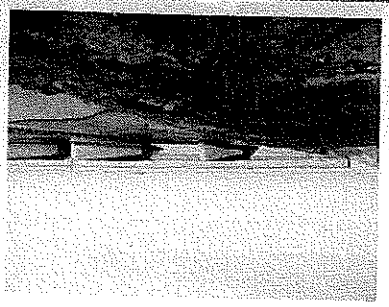
The Effect on the Ocean



Non-point source pollution can have a serious impact on water quality in Orange County. Pollutants from the storm drain system can harm marine life as well as coastal and wetland habitats. They can also degrade recreation areas such as beaches, harbors and bays.

Stormwater quality management programs have been developed throughout Orange County to educate and encourage the public to protect water quality, monitor runoff in the storm drain system, investigate illegal dumping and maintain storm drains.

Support from Orange County residents and businesses is needed to improve water quality and reduce urban runoff pollution. Proper use and disposal of materials will help stop pollution before it reaches the storm drain and the ocean.



For More Information

California Environmental Protection Agency
www.calepa.ca.gov

- **Air Resources Board**
  www.arb.ca.gov
- **Department of Pesticide Regulation**
  www.cdpr.ca.gov
- **Department of Toxic Substances Control**
  www.dtsc.ca.gov
- **Integrated Waste Management Board**
  www.ciwmb.ca.gov
- **Office of Environmental Health Hazard Assessment**
  www.oehha.ca.gov
- **State Water Resources Control Board**
  www.waterboards.ca.gov

Earth 911 - Community-Specific Environmental Information 1-800-cleanup or visit www.1800cleanup.org

Health Care Agency's Ocean and Bay Water Closure and Posting Hotline
(714) 433-6400 or visit www.ocbeachinfo.com

Integrated Waste Management Dept. of Orange County (714) 834-6752 or visit www.oclandfills.com for information on household hazardous waste collection centers, recycling centers and solid waste collection

O.C. Agriculture Commissioner
(714) 447-7100 or visit www.ocagcomm.com

Stormwater Best Management Practice Handbook
Visit www.cabmphandbooks.com

UC Master Gardener Hotline
(714) 708-1646 or visit www.uccemg.com

The Orange County Stormwater Program has created and moderates an electronic mailing list to facilitate communications, take questions and exchange ideas among its users about issues and topics related to stormwater and urban runoff and the implementation of program elements. To join the list, please send an email to ocstormwaterinfo-join@list.ocwatersheds.com

Orange County Stormwater Program

Aliso Viejo	(949)	425-2535
Anaheim Public Works Operations	(714)	765-6860
Brea Engineering	(714)	990-7666
Buena Park Public Works	(714)	562-3655
Costa Mesa Public Services	(714)	754-5323
Cypress Public Works	(714)	229-6710
Dana Point Public Works	(949)	248-3584
Fountain Valley Public Works	(714)	593-4441
Fullerton Engineering Dept.	(714)	738-6853
Garden Grove Public Works	(714)	741-5956
Huntington Beach Public Works	(714)	536-5431
Irvine Public Works	(949)	724-6315
La Habra Public Services	(562)	905-9792
La Palma Public Works	(714)	690-3310
Laguna Beach Water Quality	(949)	497-0378
Laguna Hills Public Services	(949)	707-2650
Laguna Niguel Public Works	(949)	362-4337
Laguna Woods Public Works	(949)	639-0500
Lake Forest Public Works	(949)	461-3480
Los Alamitos Community Dev	(562)	431-3538
Mission Viejo Public Works	(949)	470-3056
Newport Beach, Code & Water Quality Enforcement	(949)	644-3215
Orange Public Works	(714)	532-6480
Placentia Public Works	(714)	993-8245
Rancho Santa Margarita	(949)	635-1800
San Clemente Environmental Programs	(949)	361-6143
San Juan Capistrano Engineering	(949)	234-4413
Santa Ana Public Works	(714)	647-3380
Seal Beach Engineering	(562)	431-2527 x317
Stanton Public Works	(714)	379-9222 x204
Tustin Public Works/Engineering	(714)	573-3150
Villa Park Engineering	(714)	998-1500
Westminster Public Works/Engineering	(714)	898-3311 x446
Yorba Linda Engineering	(714)	961-7138
Orange County Stormwater Program	(877)	897-7455

Orange County 24-Hour
Water Pollution Problem Reporting Hotline
1-877-89-SPILL (1-877-897-7455)

Online Water Pollution Problem Reporting Form
www.ocwatersheds.com

PROJECT Pollution PREVENTION

Printed on Recycled Paper

Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Washwater, oil and residue from car washing should not flow into the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump soap, oil or dirty water into the ocean, so don't let it enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL**
(1-877-897-7455)
or visit
www.ocwatersheds.com

To report a spill,
call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline
at **1-877-89-SPILL**
(1-877-897-7455)

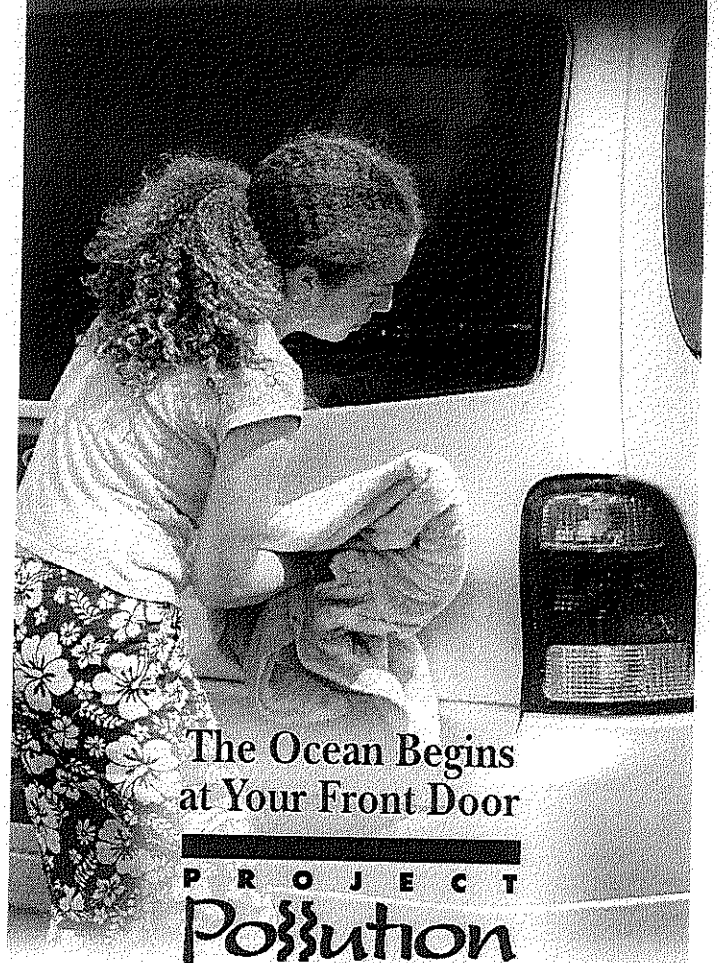
For emergencies, dial 911.

The tips contained in this brochure provide useful information about how you can keep soap, oil and washwater from car wash activities from entering the storm drain system. If you have other suggestions, please contact your city's stormwater representative or call the Orange County Stormwater Program.

Printed on Recycled Paper

Help Prevent Ocean Pollution:

Tips for Car Wash Fund-Raisers



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Car Wash Fund-Raisers

Before beginning your car wash fund-raiser

- Partner with a professional car wash and avoid the pollution that parking lot car washes can produce.

- Hold a meeting with all participants to explain the proper procedures that should be followed when washing cars.
- Remove all trash and debris from the car washing area.
- Select only soaps, cleaners or detergents labeled "non-toxic," "phosphate-free," or "biodegradable." The safest products for the environment are vegetable-based or citrus-based soaps. However, even these soaps can be toxic for the environment, so never let any products enter the street, gutter or storm drain.
- Do not use acid based wheel cleaners or engine degreasers.
- Select a site where the washwater can soak into grass, gravel, or be diverted to nearby landscaping. This will allow the washwater to filter through the vegetation and/or soil instead of flowing directly into a storm drain.
- Divert the washwater to an area where the water can pool and evaporate throughout the day, or arrange to dispose of the washwater down a sanitary sewer drain. For details, refer to Factsheet *IC24 Wastewater Disposal Guidelines located* at **www.ocwatersheds.com/StormWater/documents_bmp_existing_development.asp#res**
- If there is a storm drain on-site, block it with sandbags. At the end of the day, dispose of the sandbags by dumping the contents in an authorized landscaped area.

During the fund-raiser

- Never let any trash or washwater enter the street, gutter or storm drain.
- Shake car mats in a trash can or vacuum them. Do not shake dirt from car mats directly onto the ground.
- Use a bucket of soapy water to re-soap rags or sponges throughout the day rather than adding soap directly to them.
- Wring sponges and washrags into buckets, not the ground.
- Conserve water by using a spray nozzle with an automatic shut-off. Turn off the water or kink the hose when not in use.
- Always empty buckets into the sanitary sewer system (e.g. sinks or toilets) or a landscaped area rather than pouring the water on concrete or asphalt.

After the fund-raiser

- Remember to clean up. Have a volunteer walk the perimeter of the site to pick up trash and debris and dispose of it properly.

PROJECT Pollution PREVENTION

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, not properly disposing of used oil is illegal and can lead to fines. If you pour or drain oil onto driveways, sidewalks or streets, it can be washed into the storm drain.

Help prevent water pollution by taking your used oil and oil filters to a used oil collection center. Most major automotive maintenance centers will accept up to five gallons of used motor oil at no cost. For a list of locations, please visit www.cleanup.org.

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** **(1-877-897-7455)** or visit **www.ocwatersheds.com.**

For information about the proper disposal of household hazardous waste, call the **Household Waste Hotline** at **1-877-89-SPILL** **(1-877-897-7455)** or visit **www.oclandfills.com.**

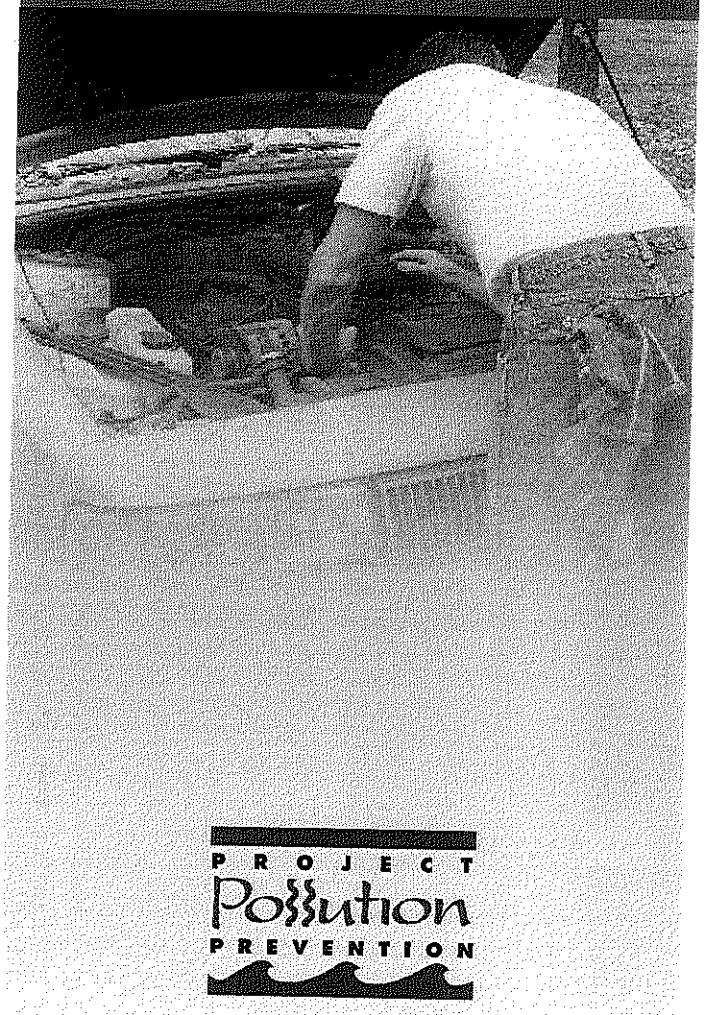
For additional information about the nearest oil recycling center, call the **Used Oil Program** at **1-800-CLEANUP** or visit **www.cleanup.org.**

RECYCLE USED OIL

emc/rev9/08

Help Prevent Ocean Pollution:

Tips for the Home Mechanic



PROJECT Possution PREVENTION

The Ocean Begins at Your Front Door

Tips for the Home Mechanic

WORK SITE

- Locate the storm drains on or near your property. Do not allow used oil or any materials to flow into these drains.
- Examine your home for sources of pollution.
- Perform automotive projects under cover and in a controlled area to prevent stormwater runoff.
- Sweep or vacuum your automotive workspace regularly
- Use a damp mop to clean work areas. Never hose down surfaces into the street, gutter or storm drain.

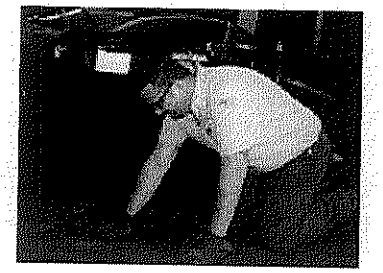
- Pour mop water into a sink or toilet. Never dispose of water in a parking lot, street, gutter or storm drain.

PREVENT LEAKS AND SPILLS

- Keep absorbent materials such as rags and/or cat litter in the work area
- Empty drip pans into a labeled, seal container before they are full
- Wipe up any spills or repair leaks as they happen. Don't let them sit.
- Place large pans under any wrecked cars until all fluids are drained.
- Promptly dispose of collected fluids into a hazardous waste drum or deliver them to an oil recycling center. Used oil recycling locations can be found at http://www.ochealthinfo.com/regulatory/usedoil.htm

CLEANING SPILLS

- Clean up spills immediately by using absorbent material such as rags, cat litter or sand. If the material spilled is hazardous, dispose of the rag, litter or sand in the same manner as hazardous waste. If the material spill is non-hazardous, dispose of it in the trash.



- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at 1-877-89-SPILL (1-877-897-7455) or visit www.ocwatersheds.com to fill out an incident report.
- Report emergencies to 911.

VEHICLE FLUID MANAGEMENT

- Vehicle fluids are hazardous waste and must be stored and disposed of in accordance with all local, state and federal laws.
- Designate an area to drain vehicle fluids away from storm drains and sanitary drains.
- When possible, drain vehicle fluids indoors or within covered areas, and only over floors that are constructed of a non-porous material such as concrete. Asphalt and dirt floors absorb spilled or leaked fluids, making the cleanup extremely difficult.

PROJECT Pollution PREVENTION

The Pollution Solution

1 Pesticides and Herbicides

Pollution:

Solution:

2 Oil and Solvents

Pollution:

Solution:

3 Mulch

Pollution:

Solution:

4 Fertilizer

Pollution:

Solution:

5 Yard Waste

Pollution:

Solution:

6 Motor Oil, Vehicle Fluids

Pollution:

Solution:

A TEAM EFFORT

The Orange County Stormwater Program has teamed with the Municipal Water District of Orange County (MWDOC) and the University of California Cooperative Extension Program (UCCE) to develop this pamphlet.

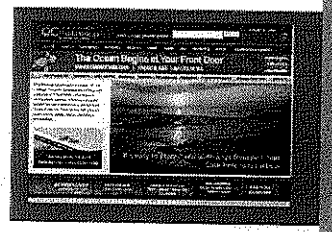
Low Impact Development (LID) and sustainable water use prevents water pollution and conserves water for drinking and reuse. Reducing your water use and the amount of water flowing from your home protects the environment and saves you money.

Thank you for making water protection a priority!

For more information, please visit:
www.ocwatersheds.com/publiced/

www.mwdoc.com

www.uccemg.com



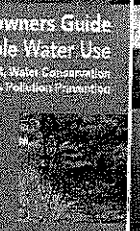
To report a spill, call the Orange County 24-Hour Water Pollution Prevention Reporting Hotline at 1-877-89-SPILL (1-877-897-7455)

Special Thanks to
The City of Los Angeles Stormwater Program for the use of its artwork

The Metropolitan Water District of Southern California for the use of the California-Friendly Plant and native Habitat photos

Homeowners Guide for Sustainable Water Use

Low Impact Development, Water Conservation & Pollution Prevention



The Ocean Begins at Your Front Door

RUNOFF, RAINWATER AND REUSE

Where Does Water Runoff Go?

Stormwater, or water from rainfall events, and runoff from outdoor water use such as sprinklers and hoses flows from homes directly into catch basins and the storm drain system. After entering the storm drain, the water flows untreated into streams, rivers, bays and ultimately the Pacific Ocean. Runoff can come from lawns, gardens, driveways, sidewalks and roofs. As it flows over hard, impervious surfaces, it picks up pollutants. Some pollutants carried by the water runoff include trash, pet waste, pesticides, fertilizer, motor oil and more.

Water Conservation

Pollution not only impairs the water quality for habitat and recreation, it can also reduce the water available for reuse. Runoff allowed to soak into the ground is cleaned as it percolates through the soil, replenishing depleted groundwater supplies. Groundwater provides at least 50% of the total water for drinking and other indoor household activities in north and central Orange County. When land is covered with roads, parking lots, homes, etc., there is less land to take in the water and more hard surfaces over which the water can flow.

In Orange County, 60-70% of water used by residents and businesses goes to irrigation and other outdoor uses. Reusing rainwater to irrigate our lawn not only reduces the impact of water pollution from runoff, but it also is a great way to conserve our precious water resources and replenish our groundwater basin.

What is Low Impact Development (LID)?

Low Impact Development (LID) is a method of development that seeks to maintain the natural hydrologic character of an area. LID provides a more sustainable and pollution-preventative approach to water management.

[illegible] water quality regulations require implementation of LID in new and redevelopment and encourage implementation of LID on the same site [illegible] in order to [illegible] endangered species habitat, reduce pollution in our environment, conserve [illegible] and [illegible].

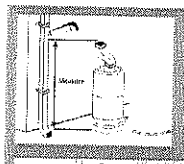
Permeable pavement allows water to pass through and be absorbed into the ground, recharging the water table and preventing the water from runoff.

OPTIONS FOR RAINWATER HARVESTING AND REUSE

Rainwater harvesting is a great way to save money, prevent pollution and reduce potable water use. To harvest your rainwater simply redirect the runoff from roofs and downspouts to rain barrels. Rain gardens are another option, these reduce runoff, as well as encourage infiltration.

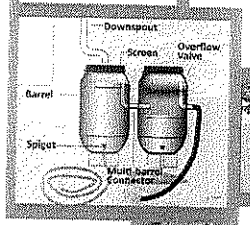
Downspout Disconnection/Redirection

Disconnecting downspouts from pipes running to the gutter prevents runoff from transporting pollutants to the storm drain. Once disconnected, downspouts can be redirected to rain gardens or other vegetated areas, or be connected to a rain barrel.



Rain Barrels

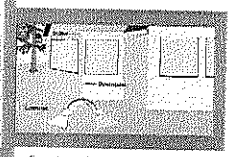
Rain barrels capture rainwater flow from roofs for reuse in landscape irrigation. Capacity of rain barrels needed for your home will depend on the amount of roof area and rainfall received. When purchasing your rain barrel, make sure it includes a screen, a spigot to siphon water for use, an overflow tube to allow for excess water to run out and a connector if you wish to connect multiple barrels to add capacity of water storage.



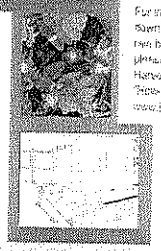
Mosquito growth prevention is very important when installing a rain barrel. The best way to prevent mosquito breeding is to eliminate entry points by ensuring all openings are sealed tightly. If these methods are unsuccessful, products are available to kill mosquito larvae, but that are harmless to humans and humans. Regular application of these products is essential. Please visit the Orange County Vector Control website for more information at www.ocvcd.org/publications.htm.

Rain Gardens

Rain gardens allow runoff to be directed from your roof downspout into a landscaped area. Vegetation and rocks in the garden will slow the flow of water to allow for infiltration into the soil. Plants and soil particles will absorb pollutants from the rain runoff. In addition to native plant palette, rain gardens can be maintained all year with minimal additional irrigation. These plants are adapted to the same and climate of Southern California, require less water and can reduce your water bill.



Before modifying your yard to install a rain garden, please consult your local building and/or planning department to ensure your garden plan follows pertinent building codes and ordinances. Building codes and ordinances, some home owner associations also have guidelines for yard modifications. If your property is on hill areas or includes exposed slopes, please seek professional advice before proceeding with changes.



For information on how to disconnect a downspout or to install and maintain a rain barrel or rain garden at your home please see the Los Angeles Rainwater Harvesting Program, A Homeowner's "How To" Guide, November 2006 at www.lacitysanitation.org/rain/

OTHER WATER CONSERVATION AND POLLUTION PREVENTION TECHNIQUES

Native Vegetation and Maintenance

"California Friendly" plants or native vegetation can significantly reduce water use. These plants often require far less fertilizers and pesticides, which are two significant pollutants found in Orange County waterways. Replacing water "thirsty" plants and grass types with water efficient natives is a great way to save water and reduce the need for potentially harmful pesticides and fertilizer.

Please see the California Friendly Garden Guide produced by the Metropolitan Water District of Southern California and associated Southern California Water Agencies for a catalog of California friendly plants and other garden resources at www.bewaterwise.com/landscape.html.

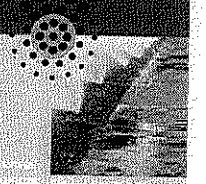
Weed Free Yards

Weeds are water thieves. They often reproduce quickly and rob your yard of both water and nutrients. Weed your yard by hand if possible. If you use herbicides to control the weeds, use only the amount recommended on the label and never use it if rain is forecast within the next 48 hours.

Soil Amendments

Soil amendments such as green waste (e.g. grass clippings, compost, etc.) can be a significant source of nutrients and can help keep the soil near the roots of plants moist. However, they can cause algal blooms if they get into our waterways, which reduces the amount of oxygen in the water and impacts most aquatic organisms. It is important to apply soil amendments more than 48 hours prior to predicted rainfall.

IRRIGATE EFFICIENTLY



Set a timer for your sprinklers

Water at Sunrise

Water by hand

Fix leaks

Do your part to prevent water pollution in our creeks, rivers, bays and ocean.

Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common household activities can lead to water pollution if you're not careful.

REMEMBER THE WATER IN YOUR STORM DRAIN IS NOT TREATED BEFORE IT ENTERS OUR WATERWAYS

Litter, oil, chemicals and other substances that are left on your yard or driveway can be blown or washed into storm drains that flow to the ocean. Over-watering your lawn and washing your car can also flush materials into the storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated.

You would never pour soap, fertilizers or oil into the ocean, so don't let them enter streets, gutters or storm drains. Follow the easy tips in this brochure to help prevent water pollution.

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

To report a spill,
call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline
1-877-89-SPILL (1-877-897-7455).

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while performing everyday household activities. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

GENUINE RECYCLED PAPER
50% PRE-CONSUMER AND 15% POST-CONSUMER

RECYCLE USED OIL

Help Prevent Ocean Pollution:

Household Tips

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Pollution Prevention

Household Activities

- **Do not rinse spills with water!** Sweep outdoor spills and dispose of in the trash. For wet spills like oil, apply cat litter or another absorbent material, then sweep and bring to a household hazardous waste collection center (HHWCC).
- Securely cover trash cans.
- Take household hazardous waste to a household hazardous waste collection center.
- Store household hazardous waste in closed, labeled containers inside or under a cover.
- Do not hose down your driveway, sidewalk or patio. Sweep up debris and dispose of in trash.
- Always pick up after your pet. Flush waste down the toilet or dispose of in the trash.
- Bathe pets indoors or have them professionally groomed.

Household Hazardous Wastes include:

- **Batteries**
- **Paint thinners, paint strippers and removers**
- **Adhesives**
- **Drain openers**
- **Oven cleaners**
- **Wood and metal cleaners and polishes**
- **Herbicides and pesticides**
- **Fungicides/wood preservatives**
- **Automotive fluids and products**
- **Grease and rust solvents**
- **Thermometers and other products containing mercury**
- **Fluorescent lamps**
- **Cathode ray tubes, e.g. TVs, computer monitors**
- **Pool and spa chemicals**

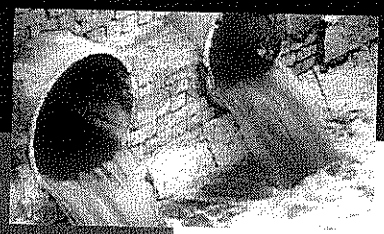
Gardening Activities

- Follow directions on pesticides and fertilizers, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Water your lawn and garden by hand to control the amount of water you use. Set irrigation systems to reflect seasonal water needs. If water flows off your yard and onto your driveway or sidewalk, your system is over-watering.
- Mulch clippings or leave them on the lawn. If necessary, dispose in a green waste container.
- Cultivate your garden often to control weeds.

Washing and Maintaining Your Car

- Take your car to a commercial car wash whenever possible.
- Choose soaps, cleaners, or detergents labeled "non-toxic," "phosphate free" or "biodegradable." Vegetable and citrus-based products are typically safest for the environment, **but even these should not be allowed into the storm drain.**
- Shake floor mats into a trash can or vacuum to clean.
- Do not use acid-based wheel cleaners and "hose off" engine degreasers at home. They can be used at a commercial facility, which can properly process the washwater.
- **Do not dump washwater onto your driveway, sidewalk, street, gutter or storm drain.** Excess washwater should be disposed of in the sanitary sewers (through a sink, or toilet) or onto an absorbent surface like your lawn.
- Use a nozzle to turn off water when not actively washing down automobile.
- Monitor vehicles for leaks and place pans under leaks. Keep your car well maintained to stop and prevent leaks.
- Use cat litter or other absorbents and sweep to remove any materials deposited by vehicles. Contain sweepings and dispose of at a HHWCC.
- Perform automobile repair and maintenance under a covered area and use drip pans or plastic sheeting to keep spills and waste material from reaching storm drains.
- **Never pour oil or antifreeze in the street, gutter or storm drains.** Recycle these substances at a service station, HHWCC, or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit www.ciwmb.ca.gov/UsedOil.

For locations and hours of Household Hazardous Waste Collection Centers in Anaheim, Huntington Beach, Irvine and San Juan Capistrano, call (714)834-6752 or visit www.oclandfills.com.



Do your part to prevent water pollution in our creeks, rivers, bays and ocean.

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, not properly disposing of household hazardous waste can lead to water pollution. Batteries, electronics, paint, oil, gardening chemicals, cleaners and other hazardous materials cannot be thrown in the trash. They also must never be poured or thrown into yards, sidewalks, driveways, gutters or streets. Rain or other water could wash the materials into the storm drain and eventually into our waterways and the ocean. In addition, hazardous waste must not be poured in the sanitary sewers (sinks and toilets).

NEVER DISPOSE OF HOUSEHOLD HAZARDOUS WASTE IN THE TRASH, STREET, GUTTER, STORM DRAIN OR SEWER.

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com**

To Report Illegal Dumping of Household Hazardous Waste call 1-800-69-TOXIC

To report a spill, call the **Orange County 24-Hour Water Pollution Problem Reporting Hotline 1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

RECYCLE USED OIL

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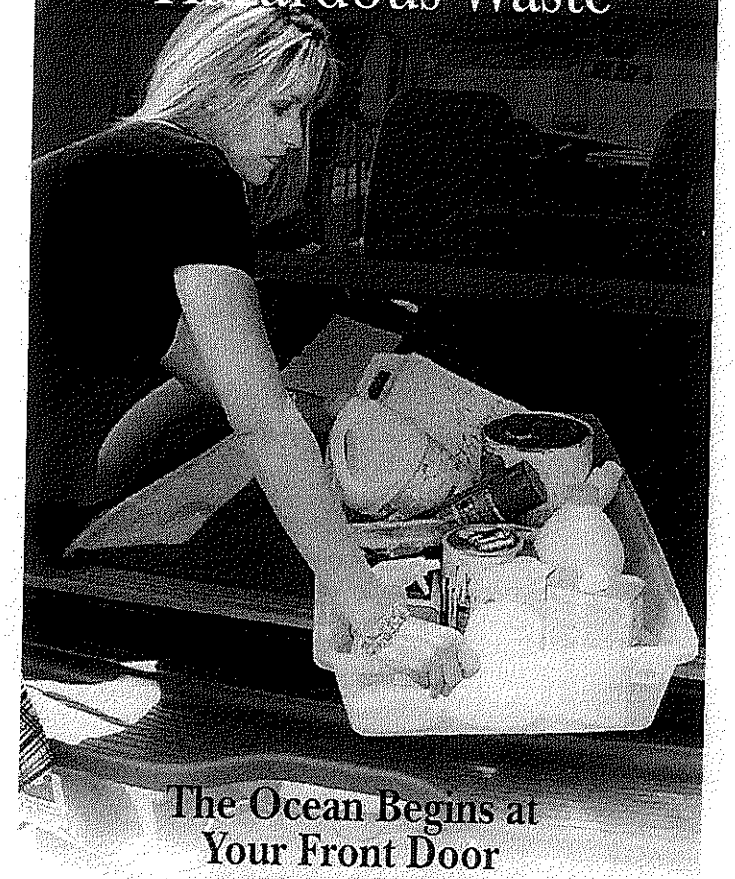
Help Prevent Ocean Pollution:

Proper Disposal of Household Hazardous Waste



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

ORANGE COUNTY

Pollution Prevention

Leftover household products that contain corrosive, toxic, ignitable, or reactive ingredients are considered to be "household hazardous waste" or "HHW." HHW can be found throughout your home, including the bathroom, kitchen, laundry room and garage.

WHEN POSSIBLE, USE NON-HAZARDOUS OR LESS-HAZARDOUS PRODUCTS.

Disposal of HHW down the drain, on the ground, into storm drains, or in the trash is illegal and unsafe.

Proper disposal of HHW is actually easy. Simply drop them off at a Household Hazardous Waste Collection Center (HHWCC) for free disposal and recycling. Many materials including anti-freeze, latex-based paint, motor oil and batteries can be recycled. Some centers have a "Stop & Swap" program that lets you take partially used home, garden, and automobile products free of charge. There are four HHWCCs in Orange County:

Anaheim:.....1071 N. Blue Gum St
Huntington Beach:.....17121 Nichols St
Irvine:..... 6411 Oak Canyon
San Juan Capistrano:... 32250 La Pata Ave

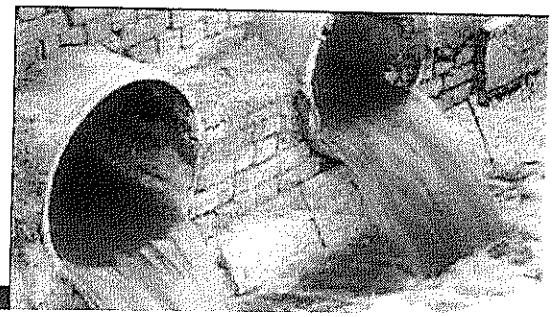
Centers are open Tuesday-Saturday, 9 a.m.-3 p.m. Centers are closed on rainy days and major holidays. For more information, call **(714) 834-6752** or visit **www.oclandfills.com.**

Common household hazardous wastes

- Batteries
- Paint and paint products
- Adhesives
- Drain openers
- Household cleaning products
- Wood and metal cleaners and polishes
- Pesticides
- Fungicides/wood preservatives
- Automotive products (antifreeze, motor oil, fluids)
- Grease and rust solvents
- Fluorescent lamps
- Mercury (thermometers & thermostats)
- All forms of electronic waste including computers and microwaves
- Pool & spa chemicals
- Cleaners
- Medications
- Propane (camping & BBQ)
- Mercury-containing lamps
- Television & monitors (CRTs, flatscreens)

Tips for household hazardous waste

- Never dispose of HHW in the trash, street, gutter, storm drain or sewer.
- Keep these materials in closed, labeled containers and store materials indoors or under a cover.
- When possible, use non-hazardous products.
- Reuse products whenever possible or share with family and friends.
- Purchase only as much of a product as you'll need. Empty containers may be disposed of in the trash.
- HHW can be harmful to humans, pets and the environment. Report emergencies to 911.



Did you know that just one quart of oil can pollute 250,000 gallons of water?

A clean ocean and healthy creeks, rivers, bays and beaches are important to Orange County. However, not properly disposing of used oil can lead to water pollution. If you pour or drain oil onto driveways, sidewalks or streets, it can be washed into the storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering the ocean. Help prevent water pollution by taking your used oil to a used oil collection center.

Included in this brochure is a list of locations that will accept up to five gallons of used motor oil at no cost. Many also accept used oil filters. Please contact the facility before delivering your used oil. This listing of companies is for your reference and does not constitute a recommendation or endorsement of the company.

Please note that used oil filters may not be disposed of with regular household trash. They must be taken to a household hazardous waste collection or recycling center in Anaheim, Huntington Beach, Irvine or San Juan Capistrano. For information about these centers, visit www.oclandfills.com.

Please do not mix your oil with other substances!

For more information, please call the Orange County Stormwater Program at 1-877-89-SPILL (1-877-897-7455) **or visit www.watersheds.com.**

For information about the proper disposal of household hazardous waste, call the Household Waste Hotline at (714) 834-6752 or visit www.oclandfills.com.

RECYCLE USED OIL

For additional information about the nearest oil recycling center, call the Used Oil Program at 1-800-CLEANUP or visit www.cleanup.org.

Help Prevent Ocean Pollution:

Recycle at Your Local Used Oil Collection Center

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

SOUTH COUNTY

Used Oil Collection Centers

ALISO VIEJO

Big O Tires
27812 Aliso Creek Rd, Suite E-100
(949) 362-4225

Econo Lube N' Tune
22932 Glenwood Dr.
(949) 643-9667

Jiffy Lube
27832 Aliso Creek Road
(949) 362-0005

Pep Boys
26881 Aliso Creek Road
(949) 362-9254

DANA POINT

Dana Point Fuel Dock
34661 Puerto Pl. (949) 496-6113

EZ Lube Inc.
34242 Doheny Park Rd.
(949) 477-1223

FOOTHILL RANCH

USA Express Tire & Service
26492 Town Center Dr.
(714) 826-1001

LAGUNA BEACH

USA Express Tire & Service Inc.
350 Broadway (949) 494-7111

LAKE FOREST

Big O Tires
20742 Lake Forest Dr.
(949) 443-4155

EZ Lube
26731 Rancho Parkway
(949) 465-9912

Firestone Store
24421 Rockfield Blvd.
(949) 581-2660

Jiffy Lube
20781 Lake Forest Dr.
(949) 583-0470

Kragen Auto Parts
24601 Raymond Way
(949) 829-8292

Pep Boys
22671 Lake Forest Dr.
(949) 855-9593

Ryan's Foothill Ranch Transmission
20622 Pascal Way (949) 770-6888

USA Express Tire & Service
24561 Trabuco Rd (949) 454-8001

LAGUNA NIGUEL

Econo Lube N Tune
27912 Forbes Rd. (949) 364-5833

Laguna Niguel Auto Center
26042 Cape Dr. #12
(949) 582-2191

LAGUNA HILLS

David J Phillips Buick
24888 Alicia Pkwy.
(949) 831-0434

EZ Lube
24281 Moulton Pkwy.
(949) 830-9840

EZ Lube
26921 Moulton Pkwy.
(949) 751-3436

Kragen Auto Parts
26562 Moulton Ave.
(949) 831-0434

Firestone Store
24196 Laguna Hills Mall
(949) 581-4700

MISSION VIEJO

AAA Complete Auto Care & Tire
27913 Center Street
(949) 347-8200

Autobahn West
25800 Jeronimo Rd. Suite 401
(949) 770-2312

Auto Zone
22942 Los Alisos (949) 830-8181

Econo Lube & Tune
25902 El Paseo (949) 582-5483

Jiffy Lube
27240 La Paz Rd. (949) 455-0470

Kragen Auto Parts
24510 Alicia Pkwy. (949) 951-9175

Mission Viejo Chevron
27742 Crown Vly. Pkwy.
(949) 364-0137

Oilmax 10 Minute Lube
25800 Jeronimo Rd. #300
(949) 859-9271

Ramona Auto Service
27210 La Paz Rd. (949) 583-1233

RANCHO SANTA MARGARITA

Jiffy Lube
23401 Antonio Parkway
(949) 589-7447

SAN CLEMENTE

EZ Lube
525 Avenida Pico (949) 940-1850

Kragen Auto Parts
1113 S. El Camino Real
(949) 492-9850

Kragen Auto Parts
400 Camino de Estrella
(949) 240-9195

San Clemente Car Wash & Oil
1731 N. El Camino Real
(949) 847-4924

SAN JUAN CAPISTRANO

Saturn of San Juan Capistrano
33033 Camino Capistrano
(949) 248-5411

Texaco Xpress Lube
27201 Ortega Hwy.
(949) 489-8008

This information was provided by the County of Orange Integrated Waste Management Department and the California Integrated Waste Management Board (CIWMB).

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities such as pest control can lead to water pollution if you're not careful. Pesticide treatments must be planned and applied properly to ensure that pesticides do not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump pesticides into the ocean, so don't let it enter the storm drains. Pesticides can cause significant damage to our environment if used improperly. If you are thinking of using a pesticide to control a pest, there are some important things to consider.

For more information, please call
University of California Cooperative Extension Master Gardeners at
(714) 708-1646
or visit these Web sites:
www.uccemg.org
www.ipm.ucdavis.edu

For instructions on collecting a specimen sample visit the Orange County Agriculture Commissioner's website at:
http://www.ocagcomm.com/ser_lab.asp

To report a spill, call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline at 1-877-89-SPILL (1-877-897-7455).

For emergencies, dial 911.

Information From:
Cheryl Wilen, Area IPM Advisor; Darren Haver, Watershed Management Advisor; Mary Louise Flint, IPM Education and Publication Director; Pamela M. Geisel, Environmental Horticulture Advisor; Carolyn L. Unruh, University of California Cooperative Extension staff writer. Photos courtesy of the UC Statewide IPM Program and Darren Haver.

Funding for this brochure has been provided in full or in part through an agreement with the State Water Resources Control Board (SWRCB) pursuant to the Costa-Machado Water Act of 2000 (Prop. 13).

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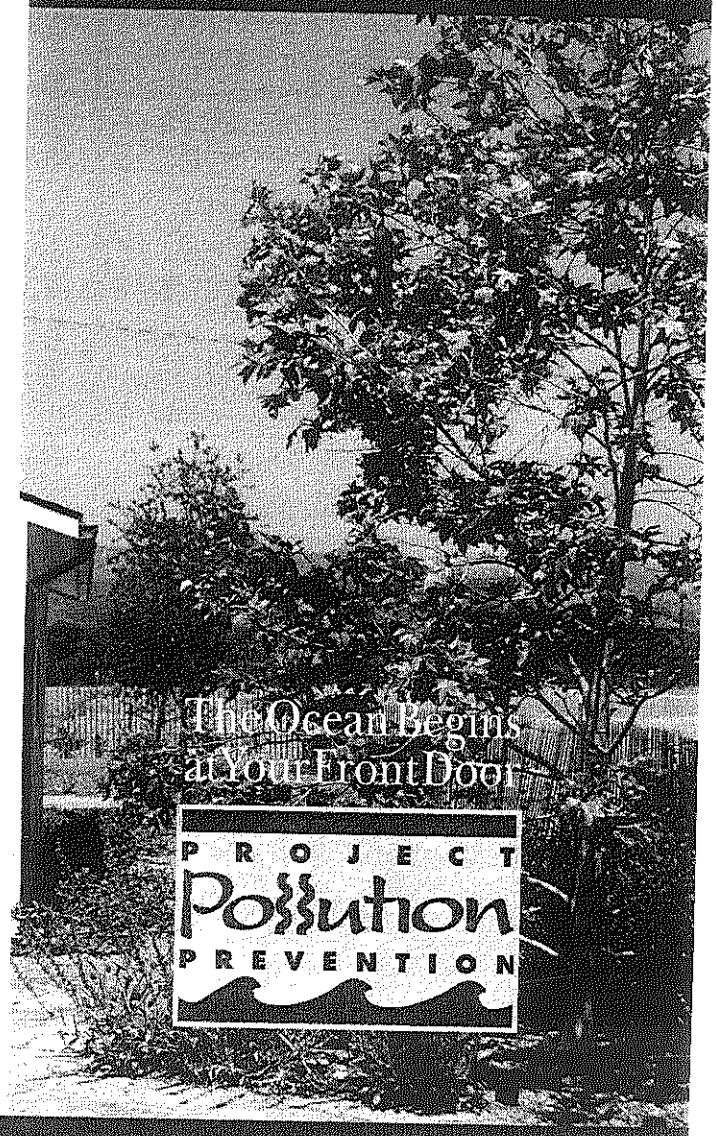
Help Prevent Ocean Pollution:

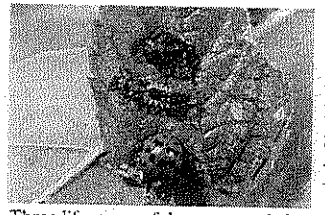
Responsible Pest Control



Tips for Pest Control

Key Steps to Follow:

Step 1: **Correctly identify the pest (insect, weed, rodent, or disease) and verify that it is actually causing the problem.**



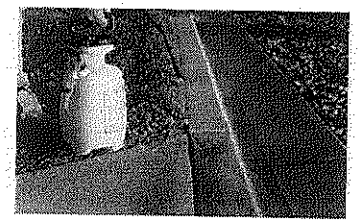
Three life stages of the common lady beetle, a beneficial insect.

This is important because beneficial insects are often mistaken for pests and sprayed with pesticides needlessly.

Consult with a Certified Nursery Professional at a local nursery or garden center or send a sample of the pest to the Orange County Agricultural Commissioner's Office.

Determine if the pest is still present – even though you see damage, the pest may have left.

Step 2: **Determine how many pests are present and causing damage.**



Small pest populations may be controlled more safely using non-pesticide techniques. These include removing food sources, washing off leaves with a strong stream of water, blocking entry into the home using caulking and replacing problem plants with ones less susceptible to pests.

Integrated Pest Management (IPM) usually combines several least toxic pest control methods for long-term prevention and management of pest problems without harming you, your family, or the environment.

UC CE University of California Cooperative Extension

Step 3: **If a pesticide must be used, choose the least toxic chemical.**

Obtain information on the least toxic pesticides that are effective at controlling the target pest from the UC Statewide Integrated Pest Management (IPM) Program's Web site at www.ipm.ucdavis.edu.

Seek out the assistance of a Certified Nursery Professional at a local nursery or garden center when selecting a pesticide. Purchase the smallest amount of pesticide available.

Apply the pesticide to the pest during its most vulnerable life stage. This information can be found on the pesticide label.

Step 4: **Wear appropriate protective clothing.**

Follow pesticide labels regarding specific types of protective equipment you should wear. Protective clothing should always be washed separately from other clothing.

Step 5: **Continuously monitor external conditions when applying pesticides such as weather, irrigation, and the presence of children and animals.**

Never apply pesticides when rain is predicted within the next 48 hours. Also, do not water after applying pesticides unless the directions say it is necessary.

Apply pesticides when the air is still; breezy conditions may cause the spray or dust to drift away from your targeted area.

In case of an emergency call 911 and/or the regional poison control number at (714) 634-5988 or (800) 544-4404 (CA only).

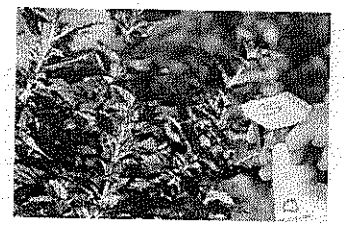
For general questions you may also visit www.calpoison.org.

Step 6: **In the event of accidental spills, sweep up or use an absorbent agent to remove any excess pesticides. Avoid the use of water.**

Be prepared. Have a broom, dust pan, or dry absorbent material, such as cat litter, newspapers or paper towels, ready to assist in cleaning up spills.

Contain and clean up the spill right away. Place contaminated materials in a doubled plastic bag. All materials used to clean up the spill should be properly disposed of according to your local Household Hazardous Waste Disposal site.

Step 7: **Properly store and dispose of unused pesticides.**



Purchase Ready-To-Use (RTU) products to avoid storing large concentrated quantities of pesticides.

Store unused chemicals in a locked cabinet.

Unused pesticide chemicals may be disposed of at a Household Hazardous Waste Collection Center.

Empty pesticide containers should be triple rinsed prior to disposing of them in the trash.

Household Hazardous Waste Collection Center
(714) 834-6752
www.oclandfills.com

PROJECT Pollution PREVENTION

Sewage Spill Regulatory Requirements

Allowing sewage to discharge to a gutter or storm drain may subject you to penalties and/or out-of-pocket costs to reimburse cities or public agencies for clean-up efforts.

Here are the pertinent codes, fines, and agency contact information that apply.

Orange County Stormwater Program
24 Hour Water Pollution Reporting Hotline
1-877-89-SPILL (1-877-897-7455)

- County and city water quality ordinances prohibit discharges containing pollutants.

Orange County Health Care Agency Environmental Health
(714) 433-6419

California Health and Safety Code, Sections 5410-5416

- No person shall discharge raw or treated sewage or other waste in a manner that results in contamination, pollution or a nuisance.
- Any person who causes or permits a sewage discharge to any state waters:
  - must immediately notify the local health agency of the discharge.
  - shall reimburse the local health agency for services that protect the public's health and safety (water-contact receiving waters).
  - who fails to provide the required notice to the local health agency is guilty of a misdemeanor and shall be punished by a fine (between $500–$1,000) and/or imprisonment for less than one year.

Regional Water Quality Control Board

Santa Ana Region	San Diego Region
(951) 782-4130	(858) 467-2952

- Requires the prevention, mitigation, response to and reporting of sewage spills.

California Office of Emergency Services
(800) 852-7550

California Water Code, Article 4, Chapter 4, Sections 13268-13271
California Code of Regulations, Title 23, Division 3, Chapter 9.2, Article 2, Sections 2250-2260

- Any person who causes or permits sewage in excess of 1,000 gallons to be discharged to state waters **shall immediately notify the Office of Emergency Services.**
- Any person who fails to provide the notice required by this section is **guilty of a misdemeanor** and shall be punished by a fine (less than $20,000) and/or imprisonment for not more than one year.

Sewage Spill
Reference Guide

Your Responsibilities as a Private Property Owner

Residences
Businesses
Homeowner/Condominium Associations
Federal and State Complexes
Military Facilities

Orange County Sanitation District

Health Care Agency
Environmental Health

PROJECT Pollution PREVENTION

www.ocwatersheds.com

This brochure was designed courtesy of Orange County Sanitation District (OCSD). For additional information, call (714) 962-2411, or visit their website at www.ocsd.com

What is a Sewage Spill?

Sewage spills occur when the wastewater being transported via underground pipes overflows through a manhole, cleanout or broken pipe. Sewage spills can cause health hazards, damage to homes and businesses, and threaten the environment, local waterways and beaches.

Common Causes of Sewage Spills

Grease builds up inside and eventually blocks sewer pipes. Grease gets into the sewer from food establishments, household drains, as well as from poorly maintained commercial grease traps and interceptors.

Structure problems caused by tree roots in the lines, broken/cracked pipes, missing or broken cleanout caps or undersized sewers can cause blockages.

Infiltration and inflow (I/I) impacts pipe capacity and is caused when groundwater or rainwater enters the sewer system through pipe defects and illegal connections.

You Are Responsible for a Sewage Spill Caused by a Blockage or Break in Your Sewer Lines!

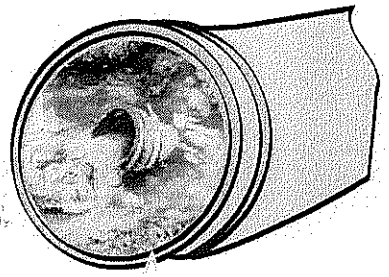
Time is of the essence in dealing with sewage spills. You are required to **immediately**:

Control and minimize the spill. Keep spills contained on private property and out of gutters, storm drains and public waterways by shutting off or not using the water.

Use sandbags, dirt and/or plastic sheeting to prevent sewage from entering the storm drain system.

Clear the sewer blockage. Always wear gloves and wash your hands. It is recommended that a plumbing professional be called for clearing blockages and making necessary repairs.

Always notify your city sewer/public works department or public sewer district of sewage spills. If the spill enters the storm drains also notify the Health Care Agency. In addition, if it exceeds 1,000 gallons notify the Office of Emergency Services. Refer to the numbers listed in this brochure.



Overflowing cleanout pipe located on private property.

You Could Be Liable

Allowing sewage from your home, business or property to discharge to a gutter or storm drain may subject you to penalties and/or out-of-pocket costs to reimburse cities or public agencies for clean-up and enforcement efforts. See Regulatory Codes & Fines section for pertinent codes and fines that apply.

What to Look For

Sewage spills can be a very noticeable gushing of water from a manhole or a slow water leak that may take time to be noticed. Don't dismiss unaccounted-for wet areas.

Look for:

- Drain backups inside the building.
- Wet ground and water leaking around manhole lids onto your street.
- Leaking water from cleanouts or outside drains.
- Unusual odorous wet areas: sidewalks, external walls or ground/landscape around a building.

Caution

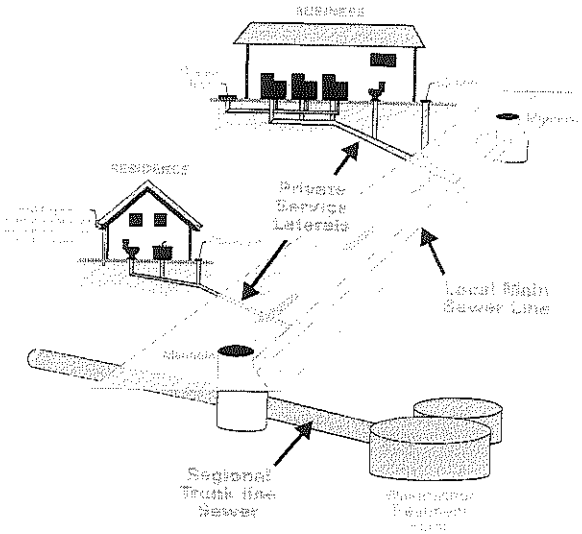
Keep people and pets away from the affected area. Untreated sewage has high levels of disease-causing viruses and bacteria. Call your local health care agency listed on the back for more information.

If You See a Sewage Spill Occurring, Notify Your City Sewer/Public Works Department or Public Sewer District IMMEDIATELY!

How a Sewer System Works

A property owner's sewer pipes are called service laterals and are connected to larger local main and regional trunk lines. Service laterals run from the connection at the home to the connection with the public sewer (including the area under the street). These laterals are the responsibility of the property owner and must be maintained by the property owner. Many city agencies have adopted ordinances requiring maintenance of service laterals. Check with your city sewer/local public works department for more information.

Operation and maintenance of **local and regional sewer lines** are the responsibility of the city sewer/public works departments and public sewer districts.



How You Can Prevent Sewage Spills

1. **Never put grease down garbage disposals, drains or toilets.**
2. **Perform periodic cleaning to eliminate grease, debris and roots in your service laterals.**
3. **Repair any structural problems in your sewer system and eliminate any rainwater infiltration/inflow leaks into your service laterals.**

Preventing Grease Blockages

The drain is not a dump! Recycle or dispose of grease properly and never pour grease down the drain.

Homeowners should mix fats, oils and grease with absorbent waste materials such as paper, coffee grounds, or kitty litter and place it in the trash. Wipe food scraps from plates and pans and dump them in the trash.

Restaurants and commercial food service establishments should always use "Kitchen Best Management Practices." These include:

- Collecting all cooking grease and liquid oil from pots, pans and fryers in covered grease containers for recycling.
- Scraping or dry-wiping excess food and grease from dishes, pots, pans and fryers into the trash.
- Installing drain screens on all kitchen drains.
- Having spill kits readily available for cleaning up spills.
- Properly maintaining grease traps or interceptors by having them serviced regularly. Check your local city codes.

Orange County Agency Responsibilites

- **City Sewer/Public Works Departments—** Responsible for protecting city property and streets, the local storm drain system, sewage collection system and other public areas.
- **Public Sewer/Sanitation District—** Responsible for collecting, treating and disposing of wastewater.
- **County of Orange Health Care Agency—** Responsible for protecting public health by closing ocean/bay waters and may close food-service businesses if a spill poses a threat to public health.
- **Regional Water Quality Control Boards—** Responsible for protecting State waters.
- **Orange County Stormwater Program—** Responsible for preventing harmful pollutants from being discharged or washed by stormwater runoff into the municipal storm drain system, creeks, bays and the ocean.

You Could Be Liable for Not Protecting the Environment

Local and state agencies have legal jurisdiction and enforcement authority to ensure that sewage spills are remedied.

They may respond and assist with containment, relieving pipe blockages, and/or clean-up of the sewage spill, especially if the spill is flowing into storm drains or onto public property.

A property owner may be charged for costs incurred by these agencies responding to spills from private properties.

Report Sewage Spills!

City Sewer/Public Works Departments

Aliso Viejo	(949) 425-2500
Anaheim	(714) 765-6860
Brea	(714) 990-7691
Buena Park	(714) 562-3655
Costa Mesa	(949) 645-8400
Cypress	(714) 229-6760
Dana Point	(949) 248-3562
Fountain Valley	(714) 593-4600
Fullerton	(714) 738-6897
Garden Grove	(714) 741-5375
Huntington Beach	(714) 536-5921
Irvine	(949) 453-5300
Laguna Beach	(949) 497-0765
Laguna Hills	(949) 707-2650
Laguna Niguel	(949) 362-4337
Laguna Woods	(949) 639-0500
La Habra	(562) 905-9792
Lake Forest	(949) 461-3480
La Palma	(714) 690-3310
Los Alamitos	(562) 431-3538
Mission Viejo	(949) 831-2500
Newport Beach	(949) 644-3011
Orange	(714) 532-6480
Orange County	(714) 567-6363
Placentia	(714) 993-8245
Rancho Santa Margarita	(949) 635-1800
San Clemente	(949) 366-1553
San Juan Capistrano	(949) 443-6363
Santa Ana	(714) 647-3380
Seal Beach	(562) 431-2527
Stanton	(714) 379-9222
Tustin	(714) 962-2411
Villa Park	(714) 998-1500
Westminster	(714) 893-3553
Yorba Linda	(714) 961-7170

Public Sewer/Water Districts

Costa Mesa Sanitary District	(714) 393-4433/ (949) 645-8400
El Toro Water District	(949) 837-0660
Emerald Bay Service District	(949) 494-8571
Garden Grove Sanitary District	(714) 741-5375
Irvine Ranch Water District	(949) 453-5300
Los Alamitos/Rossmoor Sewer District	(562) 431-2223
Midway City Sanitary District (Westminster)	(714) 893-3553
Moulton Niguel Water District	(949) 831-2500
Orange County Sanitation District	(714) 962-2411
Santa Margarita Water District	(949) 459-6420
South Coast Water District	(949) 499-4555
South Orange County Wastewater Authority	(949) 234-5400
Sunset Beach Sanitary District	(562) 493-9932
Trabuco Canyon Sanitary District	(949) 858-0277
Yorba Linda Water District	(714) 777-3018

Other Agencies

Orange County Health Care Agency	(714) 433-6419
Office of Emergency Services	(800) 852-7550

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Home improvement projects and work sites must be maintained to ensure that building materials do not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump building materials into the ocean, so don't let them enter the storm drains. Follow these tips to help prevent water pollution.

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

To report a spill,
call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline
at **1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while performing home improvement projects. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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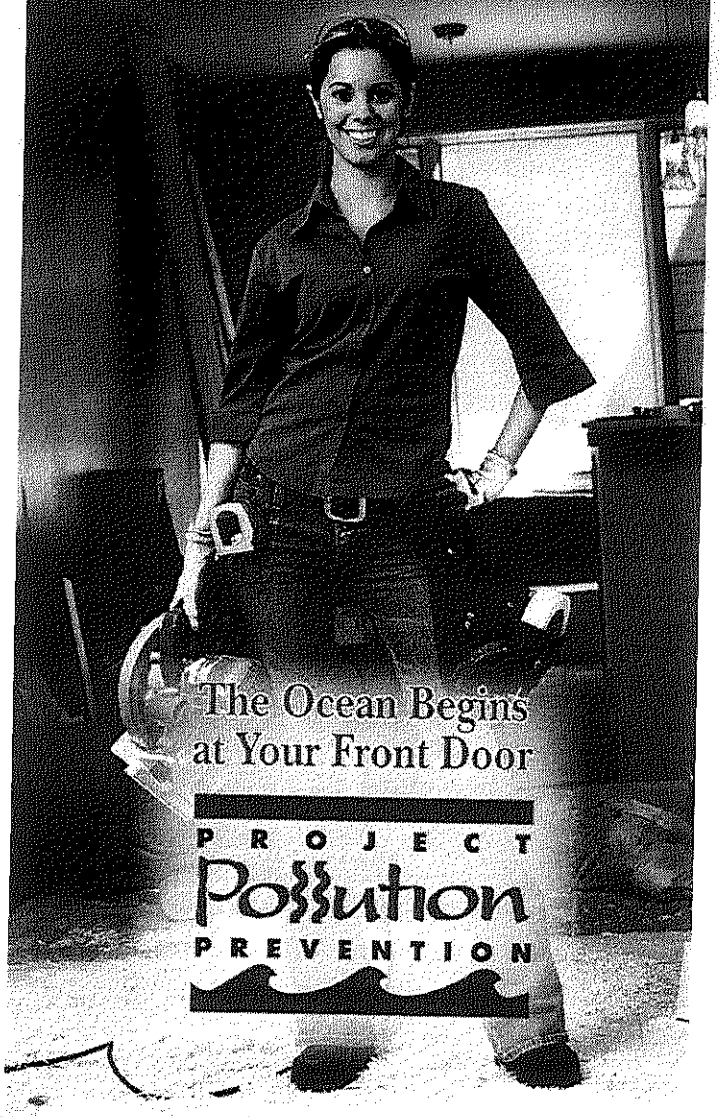
Help Prevent Ocean Pollution:

Tips for Home Improvement Projects

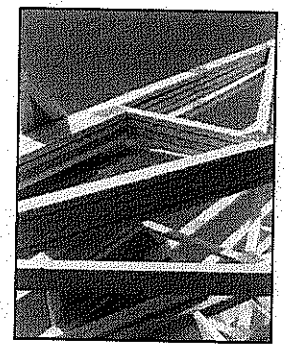


Tips for Home Improvement Projects

Home improvement projects can cause significant damage to the environment. Whether you hire a contractor or work on the house yourself, it is important to follow these simple tips while renovating, remodeling or improving your home:

General Construction

- Schedule projects for dry weather.
- Keep all construction debris away from the street, gutter and storm drain.
- Store materials under cover with temporary roofs or plastic sheets to eliminate or reduce the possibility that rainfall, runoff or wind will carry materials from the project site to the street, storm drain or adjacent properties.

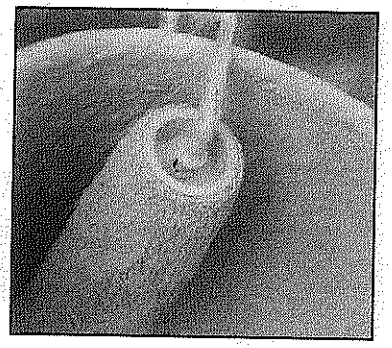


Building Materials

- Never hose materials into a street, gutter or storm drain.
- Exposed piles of construction material should not be stored on the street or sidewalk.
- Minimize waste by ordering only the amount of materials needed to complete the job.
- Do not mix more fresh concrete than is needed for each project.
- Wash concrete mixers and equipment in a designated washout area where the water can flow into a containment area or onto dirt.
- Dispose of small amounts of dry excess materials in the trash. Powdery waste, such as dry concrete, must be properly contained within a box or bag prior to disposal. Call your local trash hauler for weight and size limits.

Paint

- Measure the room or object to be painted, then buy only the amount needed.
- Place the lid on firmly and store the paint can upside-down in a dry location away from the elements.
- Tools such as brushes, buckets and rags should never be washed where excess water can drain into the street, gutter or storm drain. All tools should be rinsed in a sink connected to the sanitary sewer.
- When disposing of paint, never put wet paint in the trash.
- Dispose of water-based paint by removing the lid and letting it dry in the can. Large amounts must be taken to a Household Hazardous Waste Collection Center (HHWCC).
- Oil-based paint is a household hazardous waste. All leftover paint should be taken to a HHWCC.



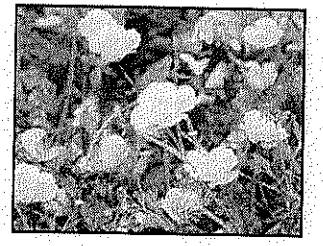
- For HHWCC locations and hours, call **(714) 834-6752** or visit **www.oclandfills.com**.

Erosion Control

- Schedule grading and excavation projects for dry weather.
- When temporarily removing soil, pile it in a contained, covered area where it cannot spill into the street, or obtain the required temporary encroachment or street closure permit and follow the conditions instructed by the permit.
- When permanently removing large quantities of soil, a disposal location must be found prior to excavation. Numerous businesses are available to handle disposal needs. For disposal options, visit **www.ciwmb.ca.gov/SWIS**.
- Prevent erosion by planting fast-growing annual and perennial grasses. They will shield and bind the soil.

Recycle

- Use a construction and demolition recycling company to recycle lumber, paper, cardboard, metals, masonry (bricks, concrete, etc.), carpet, plastic, pipes (plastic, metal and clay), drywall, rocks, dirt and green waste.



- For a listing of construction and demolition recycling locations in your area, visit **www.ciwmb.ca.gov/recycle.**

Spills

- Clean up spills immediately by using an absorbent material such as cat litter, then sweep it up and dispose of it in the trash.
- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at **(714) 567-6363** or visit **www.ocwatersheds.com** to fill out an incident reporting form.

PROJECT Pollution PREVENTION

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Fertilizers, pesticides and other chemicals that are left on yards or driveways can be blown or washed into storm drains that flow to the ocean. Overwatering lawns can also send materials into storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never pour gardening products into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

UCCE Master Gardener Hotline:
(714) 708-1646

To report a spill,
call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline
1-877-89-SPILL (1-877-897-7455).

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while landscaping or gardening. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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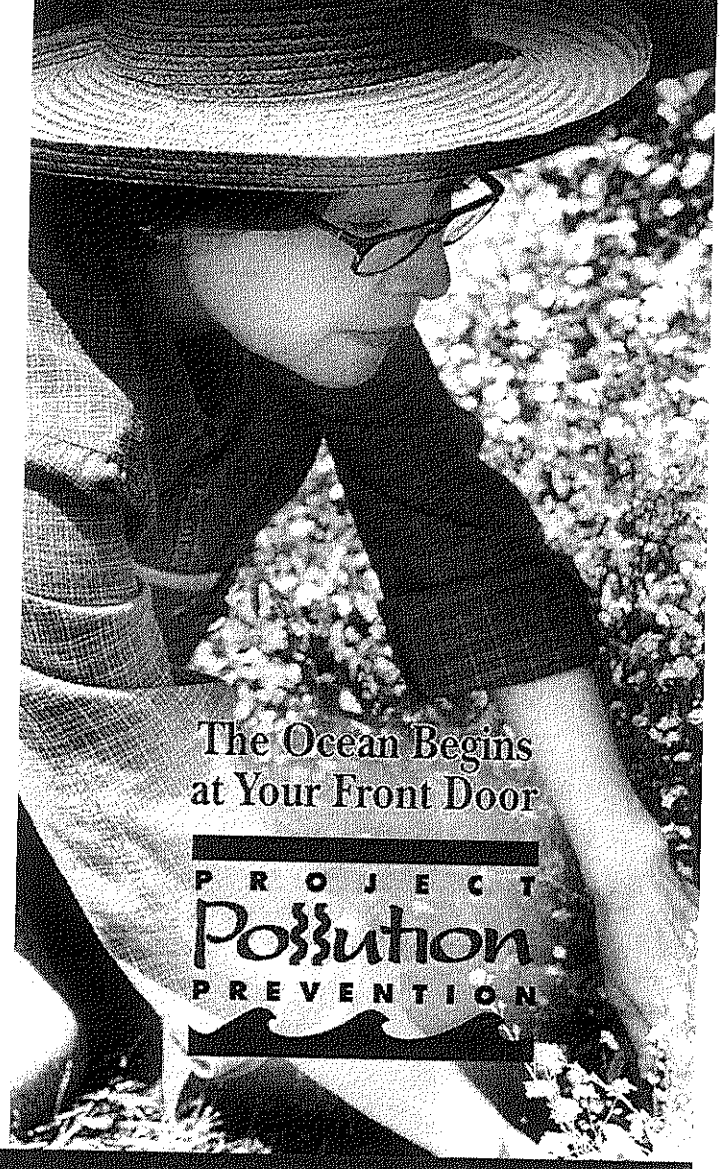
Help Prevent Ocean Pollution:

Tips for Landscape & Gardening



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Landscape & Gardening

Never allow gardening products or polluted water to enter the street, gutter or storm drain.

General Landscaping Tips

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.

- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.

- Plant native vegetation to reduce the amount of water, fertilizers, and pesticide applied to the landscape.

- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.

Garden & Lawn Maintenance

- Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro spray systems. Periodically inspect and fix leaks and misdirected sprinklers.

- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.

- Use slow-release fertilizers to minimize leaching, and use organic fertilizers.

- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.

- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.

- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains. Dispose of empty containers in the trash.

- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting. For more information, visit **www.ipm.ucdavis.edu**.

- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.

- Take unwanted pesticides to a Household Hazardous Waste Collection Center to be recycled. Locations are provided below.

Household Hazardous Waste Collection Centers

Anaheim:	1071 N. Blue Gum St.
Huntington Beach:	17121 Nichols St.
Irvine:	6411 Oak Canyon
San Juan Capistrano:	32250 La Pata Ave.

For more information, call (714) 834-6752 or visit www.oclandfills.com

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Pet waste and pet care products can be washed into the storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never put pet waste or pet care products into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

To report a spill,
call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline
1-877-89-SPILL (1-877-897-7455).

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while caring for your pet. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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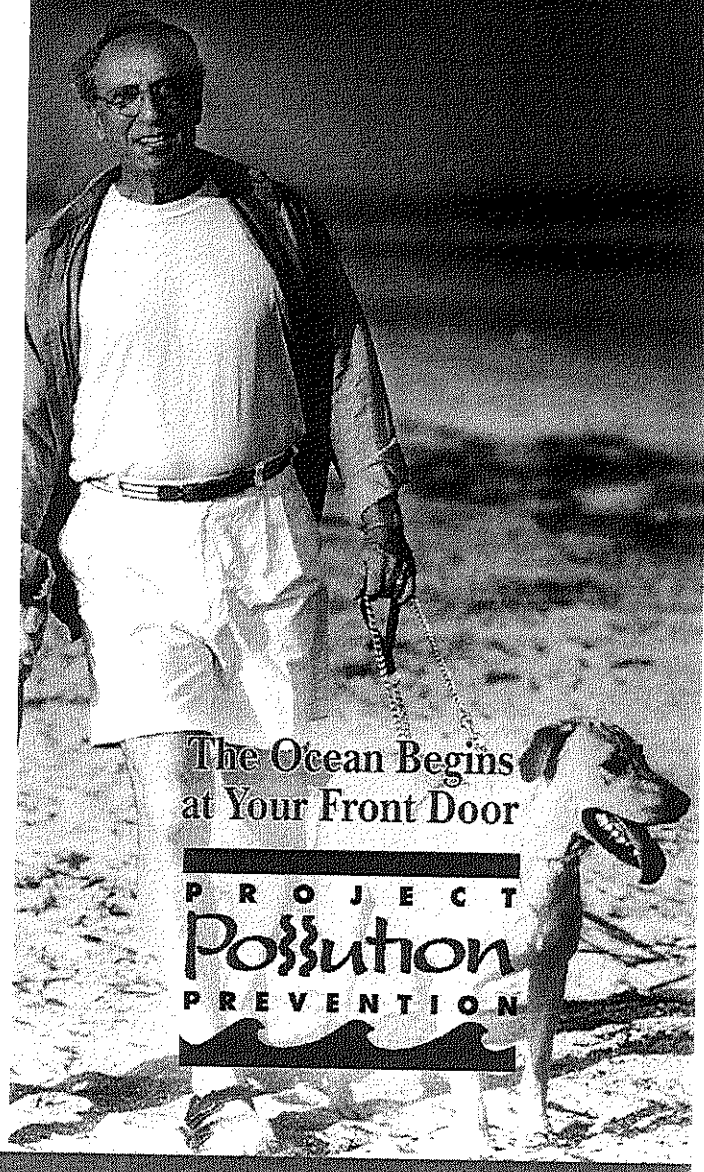
Help Prevent Ocean Pollution:

Tips for Pet Care



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Pet Care

Never let any pet care products or washwater run off your yard and into the street, gutter or storm drain.

Washing Your Pets

Even biodegradable soaps and shampoos can be harmful to marine life and the environment.

- If possible, bathe your pets indoors using less-toxic shampoos or have your pet professionally groomed. Follow instructions on the products and clean up spills.

- If you bathe your pet outside, wash it on your lawn or another absorbent/ permeable surface to keep the washwater from running into the street, gutter or storm drain.

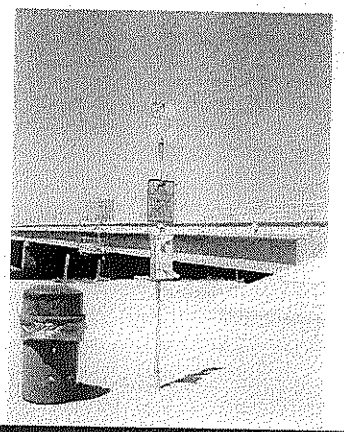
Flea Control

- Consider using oral or topical flea control products.

- If you use flea control products such as shampoos, sprays or collars, make sure to dispose of any unused products at a Household Hazardous Waste Collection Center. For location information, call **(714) 834-6752.**

Why You Should Pick Up After Your Pet

It's the law! Every city has an ordinance requiring you to pick up after your pet. Besides being a nuisance, pet waste can lead to water pollution, even if you live inland. During rainfall, pet waste left outdoors can wash into storm drains. This waste flows directly into our waterways and the ocean where it can harm human health, marine life and the environment.



As it decomposes, pet waste demands a high level of oxygen from water. This decomposition can contribute to killing marine life by reducing the amount of dissolved oxygen available to them.

Have fun with your pets, but please be a responsible pet owner by taking care of them and the environment.

- Take a bag with you on walks to pick up after your pet.

- Dispose of the waste in the trash or in a toilet.

PROJECT Pollution PREVENTION

Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Swimming pools and spas are common in Orange County, but they must be maintained properly to guarantee that chemicals aren't allowed to enter the street, where they can flow into the storm drains and then into the waterways. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump pool chemicals into the ocean, so don't let it enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com**

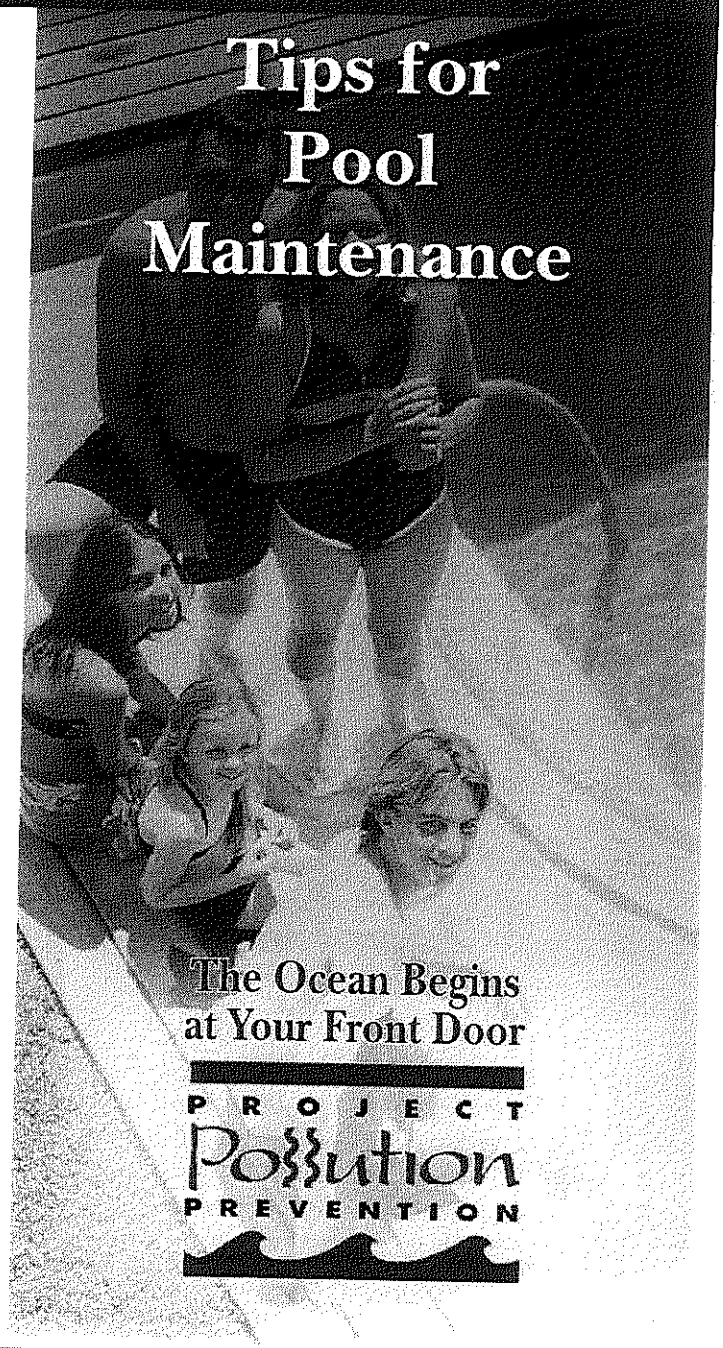
To report a spill, call the **Orange County 24-Hour Water Pollution Reporting Hotline 1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while maintaining your pool. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

Help Prevent Ocean Pollution:

Tips for Pool Maintenance

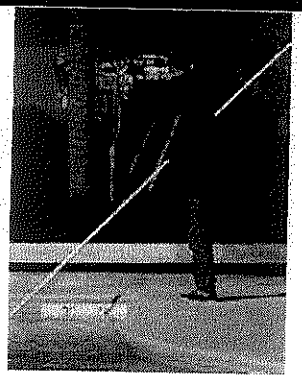


The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Pool Maintenance

Many pools are plumbed to allow the pool to drain directly to the sanitary sewer. If yours is not, follow these instructions for disposing of pool and spa water.



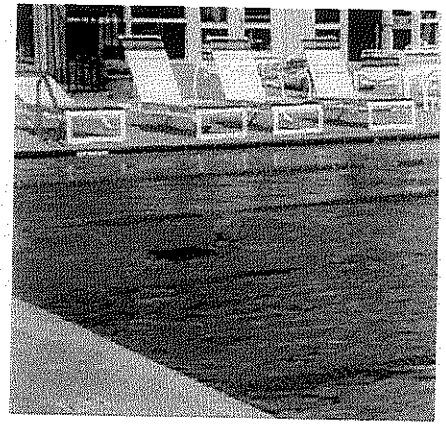
Acceptable and Preferred Method of Disposal

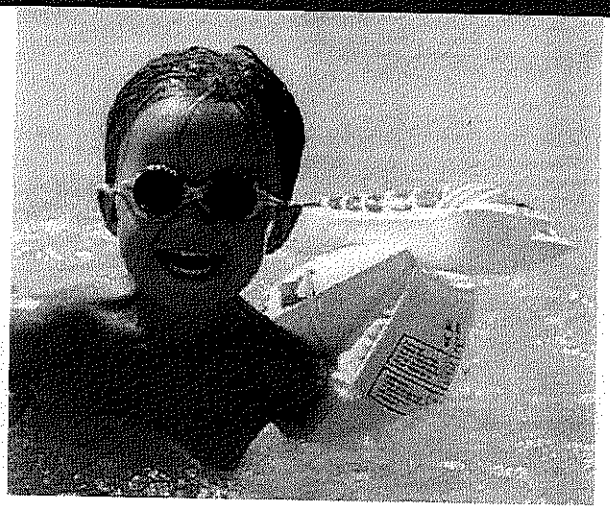
When you cannot dispose of pool water in the sanitary sewer, the release of dechlorinated swimming pool water is allowed if all of these tips are followed:

- The residual chlorine does not exceed 0.1 mg/l (parts per million).
- The pH is between 6.5 and 8.5.
- The water is free of any unusual coloration, dirt or algae.
- There is no discharge of filter media.
- There is no discharge of acid cleaning wastes.
- Some cities may have ordinances that do not allow pool water to be disposed into a storm drain. Check with your city.

How to Know if You're Following the Standards

You can find out how much chlorine is in your water by using a pool testing kit. Excess chlorine can be removed by discontinuing the use of chlorine for a few days prior to discharge or by purchasing dechlorinating chemicals from a local pool supply company. Always make sure to follow the instructions that come with any products you use.





Doing Your Part

By complying with these guidelines, you will make a significant contribution toward keeping pollutants out of Orange County's creeks, streams, rivers, bays and the ocean. This helps to protect organisms that are sensitive to pool chemicals, and helps to maintain the health of our environment.

PROJECT Pollution PREVENTION

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

To report a spill,
call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline
at **1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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Help Prevent Ocean Pollution:

Tips for Residential Pool, Landscape and Hardscape Drains

The Ocean Begins at Your Front Door

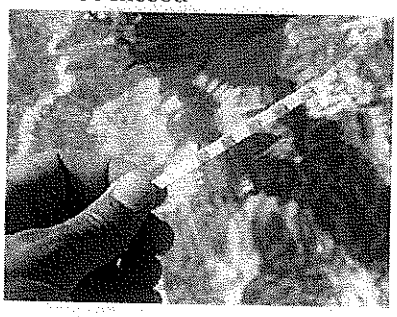
PROJECT Pollution PREVENTION

Tips for Residential Pool, Landscape and Hardscape Drains

Pool Maintenance

All pool water discharged to the curb, gutter or permitted pool drain from your property must meet the following water quality criteria:

- The residual chlorine does not exceed 0.1 mg/L (parts per million).
- The pH is between 6.5 and 8.5.
- The water is free of any unusual coloration.
- There is no discharge of filter media or acid cleaning wastes.



Some cities have ordinances that do not allow pool water to be discharged to the storm drain. Check with your city.

Landscape and Hardscape Drains

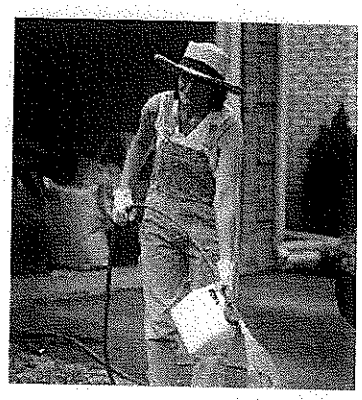
The following recommendations will help reduce or prevent pollutants from your landscape and hardscape drains from entering the street, gutter or storm drain. Unlike water that enters the sewer (from sinks and toilets), water that enters a landscape or hardscape drain is not treated before entering our creeks, rivers, bays and ocean.

Household Activities

- Do not rinse spills of materials or chemicals to any drain.
- Use dry cleanup methods such as applying cat litter or another absorbent material, then sweep it up and dispose of it in the trash. If the material is hazardous, dispose of it at a Household Hazardous Waste Collection Center (HHWCC). For locations, call **(714) 834-6752** or visit **www.oclandfills.com**.
- Do not hose down your driveways, sidewalks or patios to your landscape or hardscape drain. Sweep up debris and dispose of it in the trash.
- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash.
- Do not store items such as cleaners, batteries, automotive fluids, paint products, TVs, or computer monitors uncovered outdoors. Take them to a HHWCC for disposal.

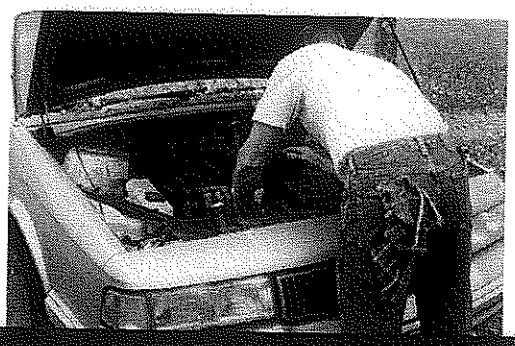
Yard Maintenance

- Do not overwater. Water by hand or set automated irrigation systems to reflect seasonal water needs.
- Follow directions on pesticides and fertilizers (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Cultivate your garden often to control weeds and reduce the need to use chemicals.



Vehicle Maintenance

- Never pour oil or antifreeze down your landscape or hardscape drain. Recycle these substances at a service station, a waste collection center or used oil recycling center. For locations, contact the Used Oil Program at **1-800-CLEANUP** or visit **www.CLEANUP.org**.
- Whenever possible, take your vehicle to a commercial car wash.
- If you do wash your vehicle at home, do not allow the washwater to go down your landscape or hardscape drain. Instead, dispose of it in the sanitary sewer (a sink or toilet) or onto an absorbent surface such as your lawn.
- Use a spray nozzle that will shut off the water when not in use.



Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities such as painting can lead to water pollution if you're not careful. Paint must be used, stored and disposed of properly to ensure that it does not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump paint into the ocean, so don't let it enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

To report a spill,
call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline
at **1-877-89-SPILL** (1-877-897-7455).

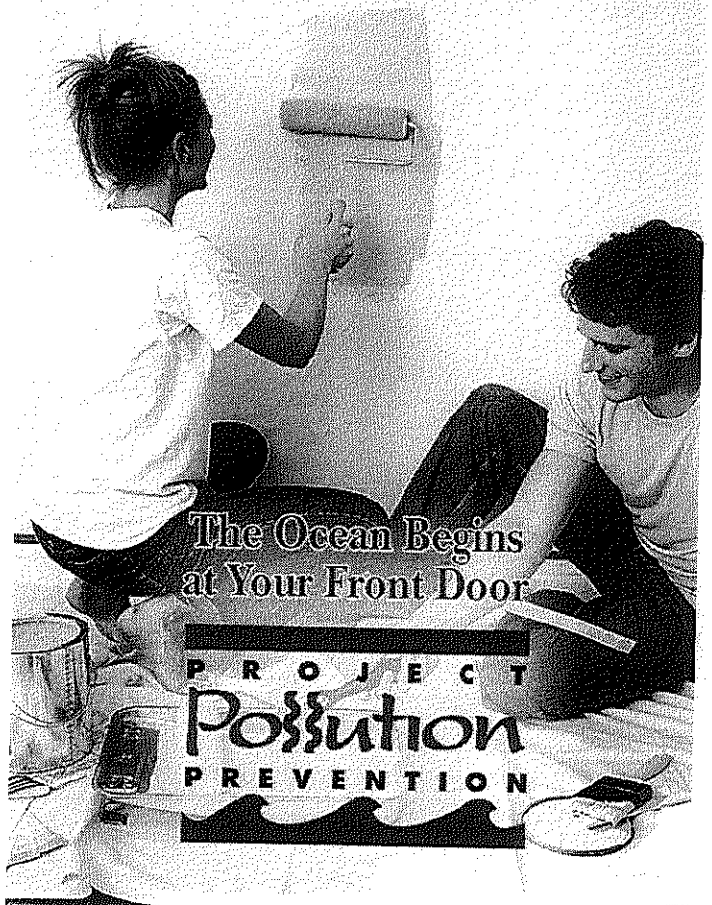
For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while using, storing and disposing of paint. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

Printed on Recycled Paper

Help Prevent Ocean Pollution:

Tips for Projects Using Paint



Tips for Projects Using Paint

Paint can cause significant damage to our environment. Whether you hire a contractor or do it yourself, it is important to follow these simple tips when purchasing, using, cleaning, storing and disposing of paint.

Purchasing Paint

- Measure the room or object to be painted, then buy only the amount needed.
- Whenever possible, use water-based paint since it usually does not require hazardous solvents such as paint thinner for cleanup.

Painting

- Use only one brush or roller per color of paint to reduce the amount of water needed for cleaning.
- Place open paint containers or trays on a stable surface and in a position that is unlikely to spill.
- Always use a tarp under the area or object being painted to collect paint drips and contain spills.

Cleaning

- Never clean brushes or rinse paint containers in the street, gutter or storm drain.
- For oil-based products, use as much of the paint on the brushes as possible. Clean brushes with thinner. To reuse thinner, pour it through a fine filter (e.g. nylon, metal gauze or filter paper) to remove solids such as leftover traces of paint.
- For water-based products, use as much of the paint on the brushes as possible, then rinse in the sink.
- Collect all paint chips and dust. Chips and dust from marine paints or paints containing lead, mercury or tributyl tin are hazardous waste. Sweep up and dispose of at a Household Hazardous Waste Collection Center (HHWCC).

Storing Paint

- Store paint in a dry location away from the elements.
- Store leftover water-based paint, oil-based paint and solvents separately in original or clearly marked containers.
- Avoid storing paint cans directly on cement floors. The bottom of the can will rust much faster on cement.
- Place the lid on firmly and store the paint can upside-down to prevent air from entering. This will keep the paint usable longer. Oil-based paint is usable for up to 15 years. Water-based paint remains usable for up to 10 years.

Alternatives to Disposal

- Use excess paint to apply another coat, for touch-ups, or to paint a closet, garage, basement or attic.
- Give extra paint to friends or family. Extra paint can also be donated to a local theatre group, low-income housing program or school.
- Take extra paint to an exchange program such as the **"Stop & Swap"** that allows you to drop off or pick up partially used home care products free of charge. **"Stop & Swap"** programs are available at most HHWCCs.
- For HHWCC locations and hours, call **(714) 834-6752** or visit **www.oclandfills.com**.

Disposing of Paint

- Never put wet paint in the trash.

For water-based paint:

- If possible, brush the leftover paint on cardboard or newspaper. Otherwise, allow the paint to dry in the can with the lid off in a well-ventilated area protected from the elements, children and pets. Stirring the paint every few days will speed up the drying.
- Large quantities of extra paint should be taken to a HHWCC.
- Once dried, paint and painted surfaces may be disposed of in the trash. When setting a dried paint can out for trash collection, leave the lid off so the collector will see that the paint has dried.

For oil-based paint:

- Oil-based paint is a household hazardous waste. All leftover paint should be taken to a HHWCC.

Aerosol paint:

- Dispose of aerosol paint cans at a HHWCC.

Spills

- Never hose down pavement or other impermeable surfaces where paint has spilled.
- Clean up spills immediately by using an absorbent material such as cat litter. Cat litter used to clean water-based paint spills can be disposed of in the trash. When cleaning oil-based paint spills with cat litter, it must be taken to a HHWCC.
- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at **(714) 567-6363** or visit **www.ocwatersheds.com** to fill out an incident reporting form.

PROJECT Pollution PREVENTION

Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Materials and excess concrete or mortar can be blown or washed into the storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never throw building materials into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

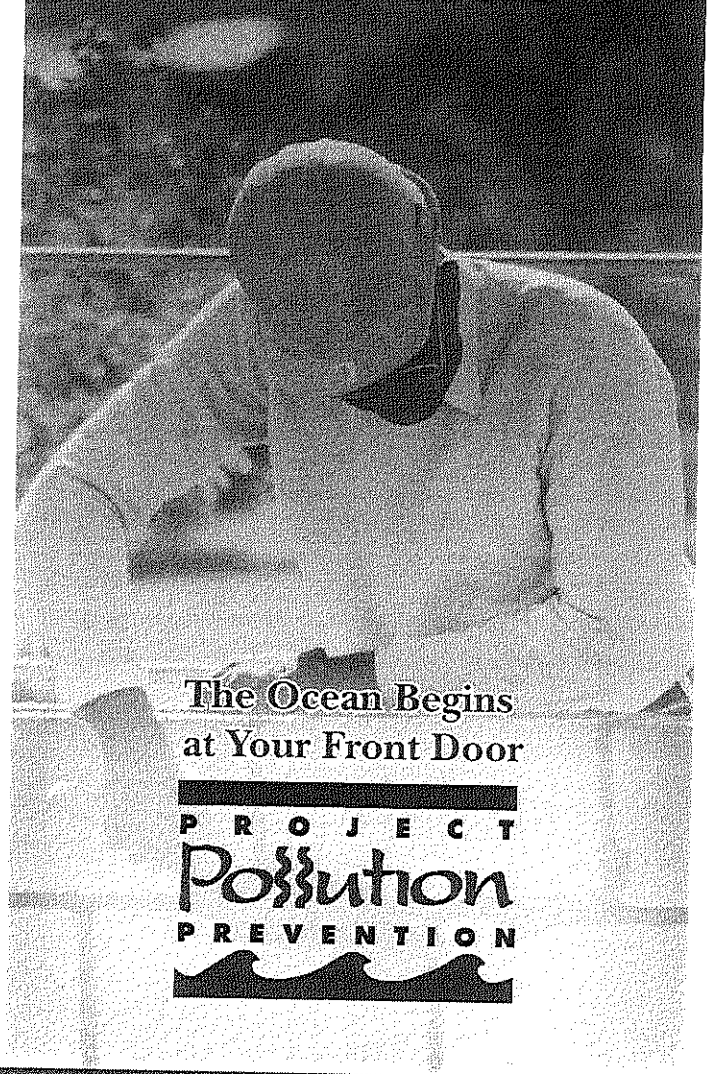
For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com.**

To report a spill, call the **Orange County 24-Hour Water Pollution Reporting Hotline** at **1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

The Tips contained in this brochure provide useful information about how you can keep materials and washwater from entering the storm drain system. If you have other suggestions for how water and materials may be contained, please contact your city's stormwater representative or call the Orange County Stormwater Program.

Tips for Using Concrete and Mortar



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Using Concrete and Mortar

Never allow materials or washwater to enter the street or storm drain.

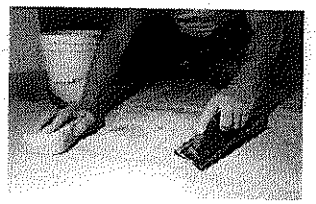
Before the Project

- Schedule projects for dry weather.
- Store materials under cover, with temporary roofs or plastic sheets, to eliminate or reduce the possibility that the materials can be carried from the project site to streets, storm drains or adjacent properties via rainfall, runoff or wind.
- Minimize waste by ordering only the amount of materials needed to complete the job.
- Take measures to block nearby storm drain inlets.

During the Project

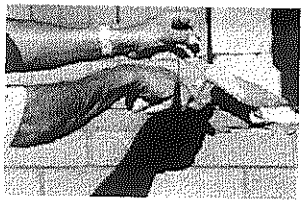
- Set up and operate small mixers on tarps or heavy drop cloths.
- Do not mix more fresh concrete or cement than is needed for the job.

- When breaking up pavement, pick up all chunks and pieces and recycle them at a local construction and demolition recycling company. (See information to the right)
- When making saw cuts in pavement, protect nearby storm drain inlets during the saw-cutting operation and contain the slurry. Collect the slurry residue from the pavement or gutter and remove from the site.



Clean-Up

- Dispose of small amounts of dry concrete, grout or mortar in the trash.
- Never hose materials from exposed aggregate concrete, asphalt or similar treatments into a street, gutter, parking lot, or storm drain.
- Wash concrete mixers and equipment in designated washout areas where the water can flow into a containment area or onto dirt. Small amounts of dried material can be disposed of in the trash. Large amounts should be recycled at a local construction and demolition recycling company. (See information below)



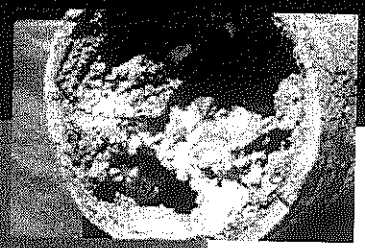
- Recycle cement wash water by pumping it back into cement mixers for reuse.

Spills

- Never hose down pavement or impermeable surfaces where fluids have spilled. Use an absorbent material such as cat litter to soak up a spill, then sweep and dispose in the trash.
- Clean spills on dirt areas by digging up and properly disposing of contaminated dry soil in trash.
- Immediately report significant spills to the County's 24-Hour Water Pollution Problem Reporting Hotline at 714-567-6363 or log onto the County's website at www.ocwatersheds.com and fill out an incident reporting form.

For a list of construction and demolition recycling locations in your area visit www.ciwmb.ca.gov/Recycle/.

For additional information on how to control, prevent, remove, and reduce pollution refer to the Stormwater Best Management Practice Handbook, available on-line at www.cabmphandbooks.com.



Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. Fats, oils and grease from restaurants and food service facilities can cause sewer line blockages that may result in sewage overflow into your facility and into storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways and should never contain washwater, trash, grease or other materials.

You would never dump oil and trash into the ocean, so don't let it enter the storm drains. Follow these tips to help prevent water pollution.

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com**

Report sewage spills and discharges that are not contained to your site to the **Orange County 24-Hour Water Pollution Problem Reporting Hotline** at **1-877-89-SPILL** (1-877-897-7455)

For emergencies, dial 911.

CALIFORNIA Restaurant ASSOCIATION

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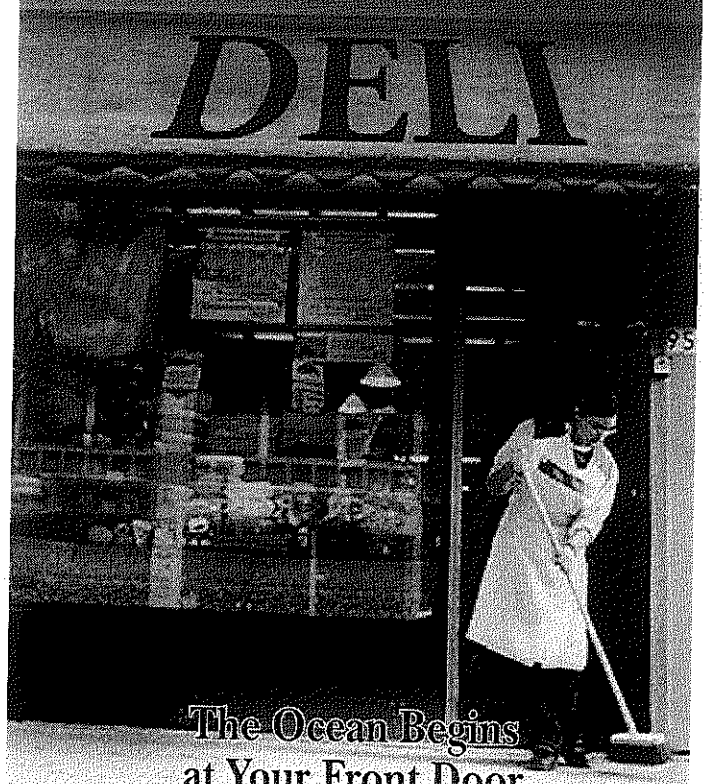
Help Prevent Ocean Pollution:

Tips for the Food Service Industry



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

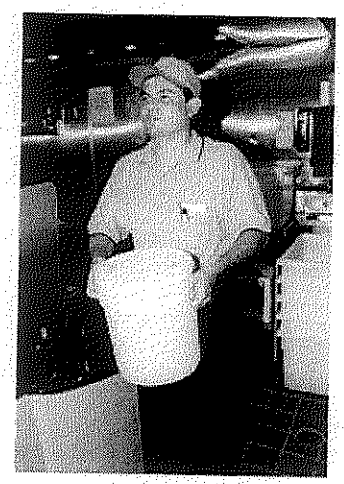
Best Kitchen Practices

Food Waste Disposal

- Scrape food waste off of plates, utensils, pots, food preparation and cooking areas and dispose of it in the trash.
- Never put food waste down the drain. Food scraps often contain grease, which can clog sewer pipes and result in sewage backups and overflows.

Grease & Oil Disposal

- Never put oil or grease down the drain. Contain grease and oil by using covered grease storage containers or installing a grease interceptor.
- Never overfill your grease storage container or transport it without a cover.
- Grease control devices must be emptied and cleaned by permitted companies.
- Keep maintenance records on site.



- For a list of oil/grease recycling companies, contact the CIWMB at **www.ciwmb.ca.gov/foodwaste/render.htm** or contact your local sanitation district.

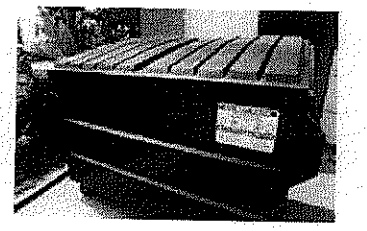
Minor Spill Cleanup

- Always use dry cleanup methods, such as a rag, damp mop or broom.
- Never hose a spill into the street, gutter or storm drain.

Major Spill Cleanup

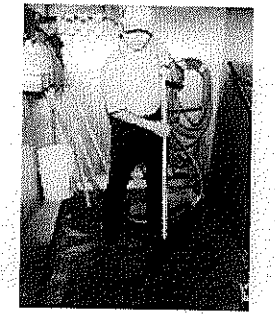
- Have spill containment and clean-up kits readily available, and train all employees on how to use them.
- Immediately contain and clean the spill using dry methods.
- If the spill leaves your site, call **(714) 567-6363**.

Dumpster Cleanup



- Pick up all debris around the dumpster.
- Always keep the lid on the dumpster closed.
- Never pour liquids into the dumpster or hose it out.

Floor Mat Cleaning



- Sweep the floor mats regularly, discarding the debris into the trash.
- Hose off the mats in a mop sink, at a floor drain, or in an outdoor area that can contain the water.
- Never hose the mats in an area where the wastewater can flow to the street, gutter or storm drain.

Washwater Disposal

- Dispose of washwater in a mop sink or an area with a floor drain.
- Never dispose of washwater in the street, gutter or storm drain.

PROJECT Pollution PREVENTION

Preventing water pollution at your commercial/industrial site

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many landscape and building maintenance activities can lead to water pollution if you're not careful. Paint, chemicals, plant clippings and other materials can be blown or washed into storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never pour soap or fertilizers into the ocean, so why would you let them enter the storm drains? Follow these easy tips to help prevent water pollution.

Some types of industrial facilities are required to obtain coverage under the State General Industrial Permit. For more information visit:
www.swrcb.ca.gov/stormwater/industrial.html

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

To report a spill,
call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline
at **1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

RECYCLE USED OIL

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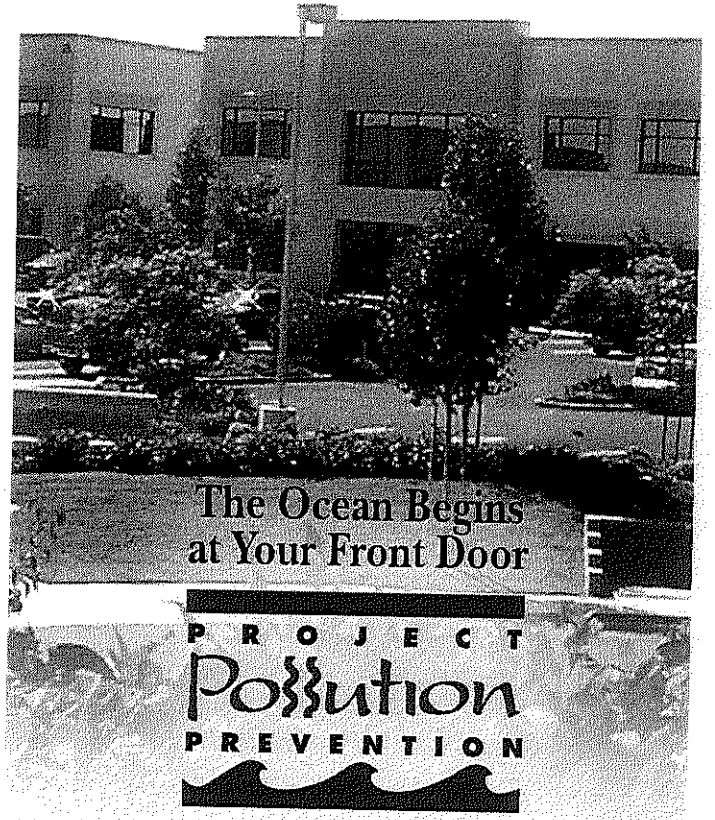
Help Prevent Ocean Pollution:

Proper Maintenance Practices for Your Business



Proper Maintenance Practices for your Business

Landscape Maintenance

- Compost grass clippings, leaves, sticks and other vegetation, or dispose of it at a permitted landfill or in green waste containers. Do not dispose of these materials in the street, gutter or storm drain.
- Irrigate slowly and inspect the system for leaks, overspraying and runoff. Adjust automatic timers to avoid overwatering.
- Follow label directions for the use and disposal of fertilizers and pesticides.
- Do not apply pesticides or fertilizers if rain is expected within 48 hours or if wind speeds are above 5 mph.
- Do not spray pesticides within 100 feet of waterways.
- Fertilizers should be worked into the soil rather than dumped onto the surface.
- If fertilizer is spilled on the pavement or sidewalk, sweep it up immediately and place it back in the container.

Building Maintenance

- Never allow washwater, sweepings or sediment to enter the storm drain.
- Sweep up dry spills and use cat litter, towels or similar materials to absorb wet spills. Dispose of it in the trash.
- If you wash your building, sidewalk or parking lot, you **must** contain the water. Use a shop vac to collect the water and contact your city or sanitation agency for proper disposal information. Do not let water enter the street, gutter or storm drain.
- Use drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of materials in the trash.
- Use a ground cloth or oversized tub for mixing paint and cleaning tools.
- Use a damp mop or broom to clean floors.
- Cover dumpsters to keep insects, animals, rainwater and sand from entering. Keep the area around the dumpster clear of trash and debris. Do not overfill the dumpster.
- Call your trash hauler to replace leaking dumpsters.
- Do not dump any toxic substance or liquid waste on the pavement, the ground, or near a storm drain. Even materials that seem harmless such as latex paint or biodegradable cleaners can damage the environment.

NEVER DISPOSE OF ANYTHING IN THE STORM DRAIN.

- Recycle paints, solvents and other materials. For more information about recycling and collection centers, visit **www.oclandfills.com**.
- Store materials indoors or under cover and away from storm drains.
- Use a construction and demolition recycling company to recycle lumber, paper, cardboard, metals, masonry, carpet, plastic, pipes, drywall, rocks, dirt, and green waste. For a listing of construction and demolition recycling locations in your area, visit **www.ciwmb.ca.gov/recycle.**
- Properly label materials. Familiarize employees with Material Safety Data Sheets.

PROJECT Pollution PREVENTION

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, if we are not careful, our daily activities can lead directly to water pollution problems. Water that drains through your watershed can pick up pollutants which are then transported to our waterways and beautiful ocean.

You can prevent water pollution by taking personal action and by working with members of your watershed community to prevent urban runoff from entering your waterway.

For more information,
please call the
Orange County Stormwater Program
at **1.877.89.SPILL**
or visit
www.ocwatersheds.com

To report a spill,
call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline
at **1.877.89.SPILL.**

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help protect your watershed. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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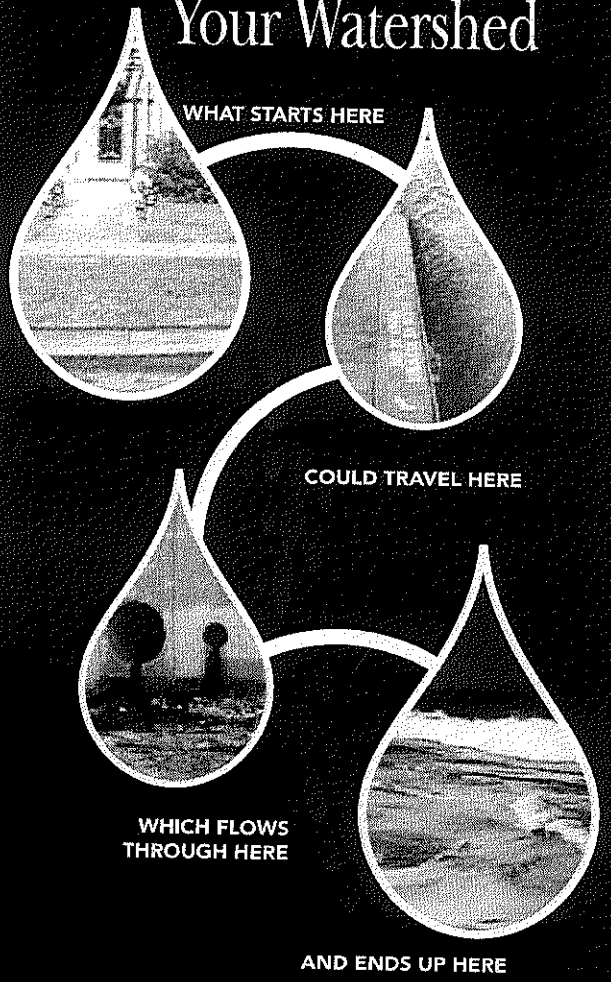
Help Prevent Ocean Pollution:
Tips For Protecting Your Watershed



The Ocean Begins at Your Front Door

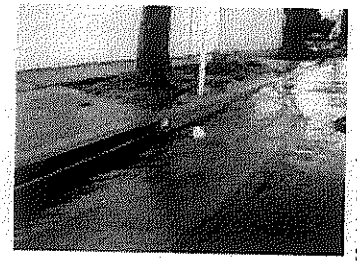
PROJECT Pollution PREVENTION

Tips for Protecting Your Watershed

My Watershed. Our Ocean.

Water + shed, *noun: A region of land within which water flows down into a specified water body, such as a river, lake, sea, or ocean; a drainage basin or catchment basin.*

Orange County is comprised of 11 major watersheds into which most of our water flows, connecting all of Orange County to the Pacific Ocean.



As water from rain (stormwater) or sprinklers and hoses (urban runoff) runs down your driveway and into your neighborhood streets, sidewalks and gutters, it flows into storm drains that lead to waterways within your watershed. The waterways from other cities merge as they make their way through our watersheds until all the runoff water in Orange County meets at the Pacific Ocean. The water that reaches our ocean is not pure. As it flows through the watershed, it picks up pollutants such as litter, cigarette butts, fertilizer, pesticides, pet waste, motor oil and lawn clippings. Unlike water that enters the sewer (from sinks and toilets), water that enters the storm drain is not treated before it flows, ultimately, to the ocean.

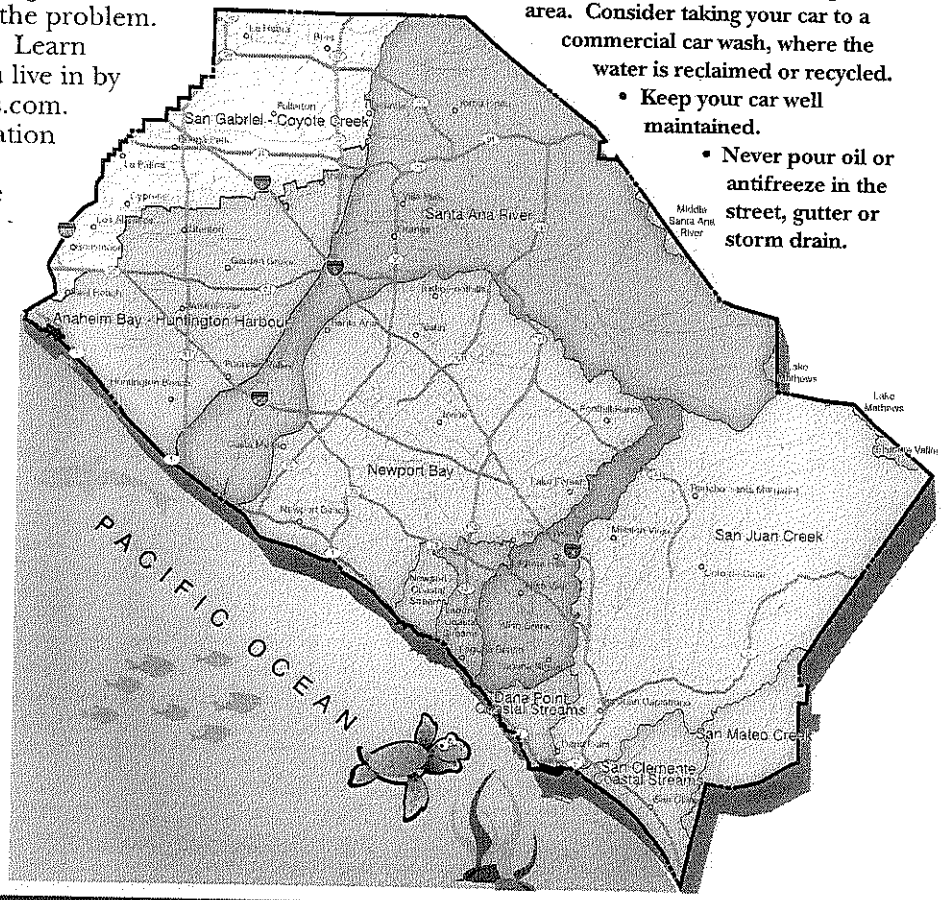
Water quality can be improved by "Adopting Your Watershed." Through this effort, we are challenging citizens and organizations to join the Orange County Stormwater Program and others who are working to protect and restore our creeks, rivers, bays and ocean.

There are many opportunities to get involved:

- Appreciate your watershed - explore the creeks, trails and ocean and make observations about its conditions. If you see anything abnormal (such as dead fish, oil spills, leaking barrels, and other pollution) contact the Orange County 24-hour water pollution problem reporting hotline at 1.877.89.SPILL to report the problem.
- Research your watershed. Learn about what watershed you live in by visiting www.ocwatersheds.com.
- Find a watershed organization in your community and volunteer to help. If there are no active groups, consider starting your own.
- Visit EPA's Adopt Your Watershed's Catalog of Watershed Groups at www.epa.gov/adopt to locate groups in your community.
- Organize or join in a creek, river, bay or ocean cleanup event such as Coastal & Inner Coastal Cleanup Day that takes place the 3rd Saturday of every September. For more information visit www.coast4u.org.

Follow these simple tips to protect the water quality of your watershed:

- **Sweep up debris and dispose of it in the trash. Do not hose down driveways or sidewalks into the street or gutter.**
- **Use dry cleanup methods such as cat litter to absorb spills and sweep up residue.**
- **Set your irrigation systems to reflect seasonal water needs or use weather-based controllers. Inspect for runoff regularly.**
- **Cover trashcans securely.**
- **Take hazardous waste to a household hazardous waste collection center. (For example, paint, batteries and petroleum products)**
- **Pick up after your pet.**
- **Follow application and disposal directions for pesticides and fertilizers.**
- **If you wash your car at home, wash it on your lawn or divert the runoff onto a landscaped area. Consider taking your car to a commercial car wash, where the water is reclaimed or recycled.**
- **Keep your car well maintained.**
- **Never pour oil or antifreeze in the street, gutter or storm drain.**



R-1
AUTOMOBILE REPAIR AND MAINTENANCE

Automobile repair and maintenance activities have the potential to contribute directly to storm drain systems primarily through spills or the dumping of waste fluids being conveyed to the storm drain. Automotive fluids, such as oils, greases, and solvents, are hydrocarbon based, and may contain metals, chlorinated hydrocarbons, and other toxic compounds. Removal of caked dirt and grime from an automobile increases the sediment load to the storm drain system. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	
Bacteria	
Foaming Agents	
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	
Other	

Think before conducting automobile repair and maintenance activities. Remember - The ocean starts at your front door.

Required Activities

- Recycle used oil and antifreeze by taking them to service stations and other recycling centers. Never pour oil in storm drains or other areas.
- Do not perform repair and maintenance activities during rain events.
- Immediately clean up and contain any spills. Dispose of all waste and adsorbent materials properly.
- Store hazardous materials and wastes (including, but not limited to, fluids, solvents, parts containing fluids, batteries) indoors, under cover, or in watertight containers.
- Perform automobile maintenance and repairs over impervious surfaces such as concrete, so spills and waste material should be readily cleaned up. Use drip pans, plastic sheeting, etc. to contain spills and waste material.
- Dispose of cleaning solvents at the designated hazardous waste center.

RECYCLE USED OIL

Recommended Activities

- Conduct auto repair activities at a commercial repair facility
- Perform automobile repair and maintenance activities under a covered area.
- Do not buy fluids containing target pollutants (e.g. degreasers containing PERC).
- Monitor parked or stored vehicles and equipment for leaks and place pans under leaks to collect fluids for proper disposal or recycling.

For additional information contact:
County of Orange, OC **Watershed**
Main: (714) 955-0600 Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com

R-2
AUTOMOBILE WASHING

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	X
Bacteria	
Foaming Agents	X
Metals	X
Hydrocarbons	X
Hazardous Materials	x
Pesticides and Herbicides	
Other	

Automobile washing activities have the potential to contribute pollutants because road dust washed from vehicles may contain metals and hydrocarbons. Any leaking fluids washed from the automobile may be carried to the storm drain by the wash water. Detergents used for automobile washing may also contain phosphorus and foaming agents, which contribute to the eutrophication of receiving waterbodies. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

Think before conducting automobile washing activities. Remember - The ocean starts at your front door.

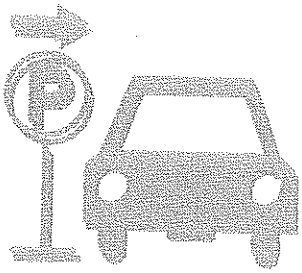
Required Activities

- Shake floor mats into trashcan or vacuum to clean. Do not shake over ground.
- If using cleaners (such as acid based wheel cleaners) use a rag to wipe them on and off, do not rinse them off with water.
- If possible, divert runoff from automobile washing to a grassy surface large enough to contain and allow complete infiltration
- Dispose of excess wash water into the sanitary sewer (i.e. via sink, or toilet) or onto a landscaped area that will allow for complete infiltration.
- Conduct engine degreasing at a commercial facility that is set up to handle that type of waste.

Recommended Activities

- When possible, use commercial wash facilities
- Wash vehicles over pervious surfaces such as lawns and gravel areas
- Choose soaps, cleaners, or detergents labeled "non-toxic", "phosphate free", or "biodegradable". Vegetable and citrus-based products are typically safest for the environment.
- Turn off water when not actively washing down automobile.
- If available, use established neighborhood wash areas, where runoff is properly controlled and managed.

For additional information contact:
County of Orange, OC **Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com



R-3
AUTOMOBILE PARKING

Parked automobiles may contribute pollutants to the storm drain because poorly maintained vehicles may leak fluids containing hydrocarbons, metals, and other pollutants. In addition, heavily soiled automobiles may drop clods of dirt onto the parking surface, contributing to the sediment load when runoff is present. During rain events, or wash-down activities, the pollutants may be carried into the storm drain system. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	
Bacteria	
Foaming Agents	
Metals	X
Hydrocarbons	X
Hazardous Materials	x
Pesticides and Herbicides	
Other	

Think before parking your car. Remember - The ocean starts at your front door.

Required Activities

- If required, vehicles have to be removed from the street during designated street sweeping/cleaning times.
- If the automobile is leaking, place a pan or similar collection device under the automobile, until such time as the leak may be repaired.
- Use dry cleaning methods to remove any materials deposited by vehicles (e.g. adsorbents for fluid leaks, sweeping for soil clod deposits).

Recommended Activities

- Park automobiles over permeable surfaces (e.g. gravel, or porous cement).
- Limit vehicle parking to covered areas.
- Perform routine maintenance to minimize fluid leaks, and maximize fuel efficiency.

For additional information contact:
County of Orange, OC **Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com

R-4
HOME AND GARDEN CARE ACTIVITIES

HOME CARE

Many hazardous materials may be used in and around residences during routine maintenance activities (such as: oils, paints, cleaners, bleaches, pesticides, glues, solvents, and other products). Improper or excessive use of these products can increase the potential for pollutants to be transported to the storm drain by runoff. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

Think before conducting home care activities. Remember - The ocean starts at your front door.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	
Bacteria	x
Foaming Agents	x
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	
Other	x

Required Activities

- Clean out painting equipment in an area where the waste can be contained and properly disposed of (latex - sewer, oil based - household hazardous waste center).
- Rinse off cement mixers and cement laden tools in a contained washout area. Dispose of dried concrete waste in household trash.
- If safe, contain, clean up, and properly dispose all household hazardous waste spills. If an unsafe condition exists, call 911 to activate the proper response team.
- Household hazardous materials must be stored indoors or under cover, and in closed and labeled containers. Dispose of them at a household hazardous waste center.
- Household wash waters (e.g. washer machine effluent, mop water, etc.) must be disposed of in the sanitary sewer.
- Pool and spa water may be discharged to the storm drain if residual chlorine is less than 0.1 mg/L, the pH is between 6.5 and 8.5, and the water is free from any unusual coloration. (Call 714-834-6107 to obtain information on a pool drain permit). Pool filter media must be contained and disposed of properly.

Recommended Activities

- Only purchase the types and amounts of materials needed.
- Share unused portions of products with neighbors or community programs (latex paint)

For additional information contact:
County of Orange, OC **Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com

GARDEN CARE

Garden activities may contribute pollutants via soil erosion, green waste, fertilizer and pesticide use. Plant and garden care activities such as landscape maintenance, fertilization, and pesticide application have the potential to discharge significant quantities of pollutants to the storm drain system. Nonvegetated surfaces may allow for significant erosion leading to high sediment loads. Other pollutants such as pesticides may adsorb onto the soil particles and be transported off site. Excess fertilizer and pesticide pollutants from over application may be carried to the storm drain by dissolving in irrigation runoff or rainwater. Green wastes may also contain organic matter and may have adsorbed fertilizers and pesticides.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	x
Bacteria	x
Foaming Agents	
Metals	
Hydrocarbons	
Hazardous Materials	
Pesticides and Herbicides	x
Other	x

Excessive irrigation is often the most significant factor in home and garden care activities. Pollutants may dissolve in irrigation water and then be transported to the storm drain, or particles and materials coated with fertilizers and pesticides may be suspended in the irrigation flow and carried to the storm drain. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

Think before conducting garden care activities. Remember - The ocean starts at your front door.

Required Activities

- Irrigation systems must be properly adjusted to reflect seasonal water needs.
- Minimize the use of pesticides and fertilizers. Read the labels and follow directions to avoid improper use. Do not apply chemicals if it is windy or about to rain.
- Properly clean up and dispose of spills of gardening chemicals, fertilizes, or soils. If possible, return the spilled material to the container for future use.
- Lawn and garden care products must be stored in closed labeled containers, in covered areas, or off-ground and under protective tarps.
- Household hazardous waste must be properly disposed at a household hazardous waste center.
- Cover nonvegetated surfaces to prevent erosion.

Recommended Activities

- Utilize xeroscaping and use of drought and insect resistant landscaping.
- Cultivate garden often to control weeds
- Use integrated pest management (IPM). Planting pest repelling plants (e.g. Marigolds) or using pest eating insects (e.g. ladybugs) may reduce the need for pesticides.
- Do not leave food (human or pet) outside overnight
- Remove fruit and garden waste

For additional information contact:
County of Orange, OC **Watershed**
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or visit our website at: www.ocwatersheds.com

R-5
DISPOSAL OF PET WASTES

Pet wastes left in the environment may introduce solids, bacteria, and nutrients to the storm drain. The type and quantity of waste will dictate the proper disposal method. Small quantities of waste are best disposed with regular trash or flushed down a toilet. Large quantities of wastes from herbivore animals may be composted for subsequent use or disposal to landfill.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	x
Bacteria	x
Foaming Agents	
Metals	
Hydrocarbons	
Hazardous Materials	
Pesticides and Herbicides	
Other	

Pick up after your pet! It's as easy as 1-2-3. 1) Bring a bag. 2) Clean it up. 3) Dispose of it properly (toilet or trash). The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

Think before you dispose of any pet wastes. Remember - The ocean starts at your front door.

Required Activities

- All pet wastes must be picked up and properly disposed of. Pet waste should be disposed of in the regular trash, flushed down a toilet, or composted as type and quantities dictate.
- Properly dispose of unused flea control products (shampoo, sprays, or collars).
- Manure produced by livestock in uncovered areas should be removed at least daily for composting, or storage in water-tight container prior to disposal. Never hose down to stream or storm drain. Composting or storage areas should be configured and maintained so as not to allow contact with runoff. Compost may be donated to greenhouses, nurseries, and botanical parks. Topsoil companies and composting centers may also accept composted manure.
- Line waste pits or trenches with an impermeable layer, such as thick plastic sheeting.
- When possible, allow wash water to infiltrate into the ground, or collect in an area that is routed to the sanitary sewer.
- Confine livestock in fenced in areas except during exercise and grazing times. Restrict animal access to creeks and streams, preferably by fencing.

For additional information contact:
County of Orange, OC **Watershed**
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- Install gutters that will divert roof runoff away from livestock areas.

Recommended Activities

- In order to properly dispose of pet waste, carry bags, pooper-scooper, or equivalent to safely pick up pet wastes while walking with pets.
- Bathe pets indoors and use less toxic shampoos. When possible, have pets professionally groomed.
- Properly inoculate your pet in order to maintain their health and reduce the possibility of pathogens in pet wastes.
- Maintain healthy and vigorous pastures with at least three inches of leafy material.
- Consider indoor feeding of livestock during heavy rainfall, to minimize manure exposed to potential runoff.
- Locate barns, corrals, and other high use areas on portions of property that either drain away from or are located distant form nearby creeks or storm drains.

For additional information contact:
County of Orange, OC **Watershed**
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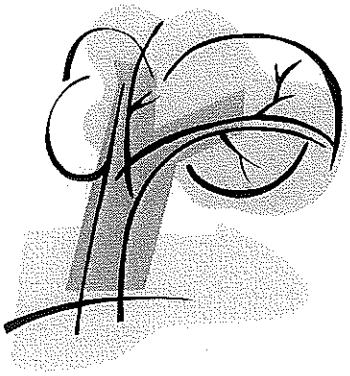

R-6
DISPOSAL OF GREEN WASTES

Green wastes entering the storm drain may clog the system creating flooding problems. Green wastes washed into receiving waters create an oxygen demand as they are decomposed, reducing the available oxygen for aquatic life. Pesticide and nutrient residues may be carried to the receiving water with the green wastes. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	x
Bacteria	x
Foaming Agents	
Metals	
Hydrocarbons	
Hazardous Materials	x
Pesticides and Herbicides	x
Other	

Think before disposing of any green wastes – Remember - The ocean starts at your front door.

Required Activities

- Green wastes can not be disposed of in the street, gutter, public right-of-way, storm drain, or receiving water. Dispose of green wastes as a part of the household trash. If the quantities are too large, arrange a pick up with the local waste hauler.

- After conducting yard or garden activities sweep the area and properly dispose of the clippings and waste. Do not sweep or blow out into the street or gutter.

Recommended Activities

- Utilize a commercial landscape company to conduct the landscape activities and waste disposal.

- Utilize native plants and drought tolerant species to reduce the water use and green waste produced.

- Use a lawn mower that has a mulcher so that the grass clippings remain on the lawn and do not have to be collected and disposed of.

- Compost materials in a designated area within the yard.

- Recycle lawn clippings and greenery waste through local programs if available.

For additional information contact:
County of Orange, OC **Watershed**
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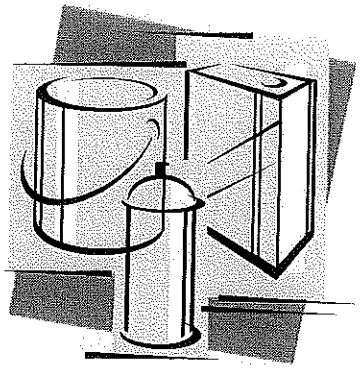
or visit our website at: www.ocwatersheds.com



R-7
HOUSEHOLD HAZARDOUS WASTE

Household hazardous wastes (HHW) are defined as waste materials which are typically found in homes or similar sources, which exhibit characteristics such as: corrosivity, ignitability, reactivity, and/or toxicity, or are listed as hazardous materials by EPA.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	
Nutrients	
Bacteria	
Foaming Agents	x
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	x
Other	x

List of most common HHW products:

- Drain openers
- Oven cleaners
- Wood and metal cleaners and polishes
- Automotive oil and fuel additives
- Grease and rust solvents
- Carburetor and fuel injection cleaners
- Starter fluids
- Batteries
- Paint Thinners
- Paint strippers and removers
- Adhesives
- Herbicides
- Pesticides
- Fungicides/wood preservatives

Many types of waste can be recycled, however options for each waste type are limited. Recycling is always preferable to disposal of unwanted materials. All gasoline, antifreeze, waste oil, and lead-acid batteries can be recycled. Latex and oil-based paint can be reused, as well as recycled. Materials that cannot be reused or recycled should be disposed of at a properly permitted landfill.

Think before disposing of any household hazardous waste. Remember - The ocean starts at your front door.

RECYCLE USED OIL

Required Activities

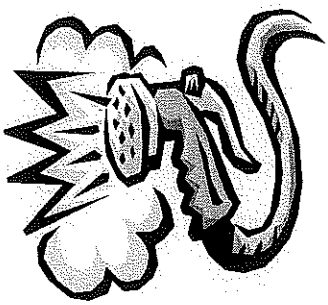
- Dispose of HHW at a local collection facility. Call (714) 834-6752 for the household hazardous waste center closest to your area.
- Household hazardous materials must be stored indoors or under cover, and in closed and labeled containers.
- If safe, contain, clean up, and properly dispose all household hazardous waste spills. If an unsafe condition exists, call 911 to activate the proper response team.

Recommended Activities

- Use non-hazardous or less-hazardous products.
- Participate in HHW reuse and recycling. Call (714) 834-6752 for the participating household hazardous waste centers.

The California Integrated Waste Management Board has a Recycling Hotline (800) 553-2962, that provides information and recycling locations for used oil.

For additional information contact:
County of Orange, OC **Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com



R-8
WATER CONSERVATION

Excessive irrigation and/or the overuse of water is often the most significant factor in transporting pollutants to the storm drain system. Pollutants from a wide variety of sources including automobile repair and maintenance, automobile washing, automobile parking, home and garden care activities and pet care may dissolve in the water and be transported to the storm drain. In addition, particles and materials coated with fertilizers and pesticides may be suspended in the flow and be transported to the storm drain.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	x
Bacteria	x
Foaming Agents	x
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	x
Other	x

Hosing off outside areas to wash them down not only consumes large quantities of water, but also transports any pollutants, sediments, and waste to the storm drain system. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

Think before using water. Remember - The ocean starts at your front door.

Required Activities

- Irrigation systems must be properly adjusted to reflect seasonal water needs.
- Do not hose off outside surfaces to clean, sweep with a broom instead.

Recommended Activities

- Fix any leaking faucets and eliminate unnecessary water sources.
- Use xeroscaping and drought tolerant landscaping to reduce the watering needs.
- Do not over watering lawns or gardens. Over watering wastes water and promotes diseases.
- Use a bucket to re-soak sponges/rags while washing automobiles and other items outdoors. Use hose only for rinsing.
- Wash automobiles at a commercial car wash employing water recycling.

For additional information contact:
County of Orange, OC **Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com

IC2. ANIMAL HANDLING AREAS

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	x
Metals	
Bacteria	x
Oil & Grease	
Organics & Toxicants	
Pesticides	
Oxygen Demanding	x

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Use dry cleaning methods to clean animal handling areas regularly.
- Properly collect and dispose of water when water is used for cleaning.
- Prevent animals from moving away from controlled areas where BMPs are in use (e.g. fencing, leashing, etc.)
- Clean storm drain inlet(s) on a regular schedule and after large storms.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. **Use dry cleaning methods to clean animal handling areas regularly.**
   - Sweeping animal handling areas is encouraged over other methods.
   - Properly dispose of droppings, uneaten food, and other potential contaminants.
2. **If water is used for cleaning:**
   - Do not discharge wash water to storm drains or other receiving waters.
   - Wash water should be collected and pumped to the sanitary sewer, do not allow wash water to enter storm drains. Refer to fact sheet ***IC24 Wastewater Disposal*** for guidance on appropriate methods for disposal of wash water to the sanitary sewer.
3. **Keep animals in paved and covered areas, if feasible.**
4. **If keeping animals in covered areas is not feasible, cover the ground with vegetation or some other type of ground cover such as mulch.**
5. **Prevent animals from moving away from controlled areas where BMPs are in use (e.g. fencing, leashing, etc.).**

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

Training

1. **Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.**
2. **Train employees on proper spill containment and cleanup.**
   - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
   - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
   - Fact sheet IC17 discusses Spill Prevention and Control in detail.
3. **Establish a regular training schedule, train all new employees, and conduct annual refresher training.**
4. **Use a training log or similar method to document training.**

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. King County Surface Water Management. July 1995. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Stormwater Management Manual for Western Washington. Volume IV Source Control BMPs. Prepared by Washington State Department of Ecology Water Quality Program. Publication No. 99-14. August 2001.

For additional information contact:

County of Orange/ OC Watersheds
Main: (714) 955-0600
24 hr Water Pollution Hotline: 1-877-89-SPILL
or visit our website at www.ocwatersheds.com

IC3. BUILDING MAINTENANCE

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	
Metals	x
Bacteria	x
Oil & Grease	
Organics & Toxicants	
Pesticides	
Oxygen Demanding	

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Properly collect and dispose of water when pressure washing buildings, rooftops, and other large objects.
- Properly prepare work area before conducting building maintenance.
- Properly clean and dispose of equipment and wastes used and generated during building maintenance.
- Store toxic material under cover when not in use and during precipitation events.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. **Properly collect and dispose of water when pressure washing buildings, rooftops, and other large objects.**
   - If pressure washing where the surrounding area is paved, use a water collection device that enables collection of wash water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect the runoff and loose materials. Dispose of the collected runoff and solids properly. Refer to fact sheet ***IC24 Wastewater Disposal*** for guidance on appropriate methods for disposal of wash water to the sanitary sewer.
   - If pressure washing on a landscaped area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the landscaping and not drain to pavement.
2. **Properly prepare work area before conducting building maintenance.**
   - Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
   - Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

3. **Properly clean and dispose of equipment and wastes used and generated during building maintenance.**
    - Clean paint brushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
    - Properly dispose of wash water, sweepings, and sediments.
    - Properly store equipment, chemicals, and wastes.
    - Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.

    OPTIONAL:
    - Recycle residual paints, solvents, lumber, and other materials to the maximum extent practicable
4. **Employ soil erosion and stabilization techniques when exposing large areas of soil.**
    - Confine excavated materials to pervious surfaces away from storm drain inlets, sidewalks, pavement, and ditches. Material must be covered if rain is expected.
    - Use chemical stabilization or geosynthetics to stabilize bare ground surfaces.
5. **Store toxic material under cover when not in use and during precipitation events.**
6. **Properly dispose of fluids from air conditioning, cooling tower, and condensate drains.**
7. **Regularly inspect air emission control equipment under AQMD permit.**
8. **Switch to non-toxic chemicals for maintenance when possible.**
    - If cleaning agents are used, select biodegradable products whenever feasible
    - Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds).
9. **Use chemicals that can be recycled.**
    - Buy recycled products to the maximum extent practicable

Training

1. **Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.**
2. **Train employees on proper spill containment and cleanup.**
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
3. **Establish a regular training schedule, train all new employees, and conduct annual refresher training.**
4. **Use a training log or similar method to document training.**

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

California Storm Water Best Management Practice Handbooks. Industrial/Commercial Best Management Practice Handbook. Prepared by Camp Dresser& McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. King County Surface Water Management. July 1995. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Stormwater Management Manual for Western Washington. Volume IV Source Control BMPs. Prepared by Washington State Department of Ecology Water Quality Program. Publication No. 99-14. August 2001.

For additional information contact:

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24 hr Water Pollution Hotline: 1-877-89-SPILL
or visit our website at www.ocwatersheds.com

IC4. CARPET CLEANING

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Discharge wash water to sink, toilet, or other drain connected to the sanitary sewer system (Refer to fact sheet ***IC24 Wastewater Disposal*** for appropriate disposal methods to the sanitary sewer).

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	
Floatable Materials	
Metals	
Bacteria	
Oil & Grease	
Organics & Toxicants	x
Pesticides	
Oxygen Demanding	

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

Discharge wash water to sink, toilet, or other drain connected to the sanitary sewer system.

- Never discharge wash water to a street, gutter, parking lot, or storm drain. Either:
  - empty the spent cleaning fluid tank into a utility sink or other indoor sewer connection at the service provider's home base

  or
  - arrange with the customer to discharge into a toilet or utility sink on their premises.
- Refer to fact sheet ***IC24 Wastewater Disposal*** for guidance on appropriate methods for disposal of wash water to the sanitary sewer..
- These guidelines apply even to cleaning products labeled "nontoxic" and "biodegradable."

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

Training

1. **Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.**
2. **Train employees on proper spill containment and cleanup.**
   - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
   - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
   - BMP IC17 discusses Spill Prevention and Control in detail.
3. **Establish a regular training schedule, train all new employees, and conduct annual refresher training.**
4. **Use a training log or similar method to document training.**

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

Water Quality Guidelines for Carpet Cleaning Activities. Orange County Stormwater Program. Prepared by Watershed & Coastal Resources Division. January 2002. On-line: http://www.ocwatersheds.com/PublicEducation/pe_brochures_carpet.asp

Orange County Stormwater Program. 2002. Water Quality Guidelines for Carpet Cleaning Activities. March.

For additional information contact:

County of Orange/ OC Watersheds
Main: (714) 955-0600
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or visit our website at www.ocwatersheds.com

IC5. CONCRETE AND ASPHALT PRODUCTION, APPLICATION, AND CUTTING

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Properly collect and dispose of process water.
- Protect production, pouring, and cutting areas from stormwater runoff and runon.
- Sweep the production, pouring, and cutting areas regularly to collect loose materials.
- Pre-heat, transfer or load hot bituminous material away from storm drain inlets.
- Use drip pans or absorbent material to catch drips from paving equipment, including equipment that is not in use.
- Cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc.
- To avoid runoff, use only as much water as necessary for dust control.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	
Floatable Materials	
Metals	
Bacteria	
Oil & Grease	
Organics & Toxicants	
Pesticides	
Oxygen Demanding	

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. **Properly collect and dispose of process water.**
   Discharge process water from production, pouring, equipment cleaning, and cutting activities to a sump, process water treatment or recycling system, or sanitary sewer system if allowed. Refer to fact sheet ***IC24 Wastewater Disposal*** for guidance on appropriate methods for disposal of process water to the sanitary sewer.
2. **Protect production, pouring, and cutting areas from stormwater runoff and runon.** Construct a berm around the perimeter of the area to prevent the runon of uncontaminated stormwater from adjacent areas as well as runoff of stormwater.
3. **Sweep the production, pouring, and cutting areas regularly to collect loose materials.**
   - **DO NOT** hose down area to a storm drain or conveyance ditch.
   - Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.
4. **Pre-heat, transfer or load hot bituminous material away from storm drain inlets.**
5. **Use drip pans or absorbent material to catch drips from paving equipment, including equipment that is not in use. Dispose of collected material and absorbents properly.**
6. **Cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc.**

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

- Clean covers regularly.
- Leave covers in place until job is complete and clean any debris for proper disposal.

7. **Conduct surface repair work during dry weather to prevent contamination from contacting stormwater runoff.**
8. **To avoid runoff, use only as much water as necessary for dust control.**
9. **Do not allow concrete and concrete pumping vehicles to discharge concrete, slurry, or rinse water into gutters, storm drains, or drainage ditches.**

Training

1. **Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.**
2. **Train employees on proper spill containment and cleanup.**
   - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
   - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
   - BMP IC17 discusses Spill Prevention and Control in detail.
3. **Establish a regular training schedule, train all new employees, and conduct annual refresher training.**
4. **Use a training log or similar method to document training.**

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

Los Angeles County Stormwater Quality. Public Agency Activities Model Program. On-line: http://ladpw.org/wmd/npdes/public_TC.cfm

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. King County Surface Water Management. July 1995. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July 1998. (Revised February 2002 by the California Coastal Commission)

Santa Clara Valley Urban Runoff Pollution Prevention Program. Maintenance Best Management Practices for the Construction Industry. Brochures: Landscaping, Gardening, and Pool; Roadwork and Paving; and Fresh Concrete and Mortar Application. June 2001.

For additional information contact:

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Main: (714) 955-0600
24 hr Water Pollution Hotline: 1-877-89-SPILL
or visit our website at www.ocwatersheds.com

IC6. CONTAMINATED OR ERODIBLE SURFACES AREAS

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Protect contaminated or erodible surface areas from rainfall and wind dispersal.
- Protect materials from stormwater runoff and runon.
- Conduct routine maintenance.

Stencil storm drains

Training

1. Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
2. Provide on-going employee training in pollution prevention.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	
Metals	x
Bacteria	x
Oil & Grease	x
Organics & Toxicants	x
Pesticides	x
Oxygen Demanding	

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. **Protect contaminated or erodible surface areas from rainfall and wind dispersal though one or more of the following:**
   - Preserve natural vegetation.
   - Re-plant or landscaping bare ground surfaces.
   - Use chemical stabilization or geosynthetics to stabilize bare ground surfaces.
   - Remove contaminated soils.
   - Cover materials with a fixed roof or a temporary waterproof covering made of polyethylene, polypropylene or hypalon. Keep covers in place at all times when work is not occurring. If areas are so large that they cannot feasibly be covered and contained, implement erosion control practices at the perimeter of the area and at any catch basins to prevent dispersion of the stockpiled material.
2. **Protect materials from stormwater runoff and runon.** Construct a berm around the perimeter of the area to prevent the runon of uncontaminated stormwater from adjacent areas as well as runoff of stormwater from the material.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

3. **Minimize pooling of water.** Paved areas should be sloped in a manner that minimizes the pooling of water in the area. A minimum slope of 1.5 percent is recommended.
4. **Conduct routine maintenance.** Sweep paved areas regularly to collect loose materials.
    - **DO NOT** hose down area to a storm drain or conveyance ditch.
    - Properly dispose of waste materials.

Training

1. **Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.**
2. **Train employees on proper spill containment and cleanup.**
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
3. **Establish a regular training schedule, train all new employees, and conduct annual refresher training.**
4. **Use a training log or similar method to document training.**

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

California Storm Water Best Management Practice Handbooks. Industrial/Commercial Best Management Practice Handbook. Prepared by Camp Dresser& McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. King County Surface Water Management. July 1995. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Stormwater Management Manual for Western Washington. Volume IV Source Control BMPs. Prepared by Washington State Department of Ecology Water Quality Program. Publication No. 99-14. August 2001.

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IC7. LANDSCAPE MAINTENANCE

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	x
Metals	
Bacteria	x
Oil & Grease	
Organics & Toxicants	
Pesticides	x
Oxygen Demanding	x

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Properly store and dispose of gardening wastes.
- Use mulch or other erosion control measures on exposed soils.
- Properly manage irrigation and runoff.
- Properly store and dispose of chemicals.
- Properly manage pesticide and herbicide use.
- Properly manage fertilizer use.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. **Take steps to reduce landscape maintenance requirements.**
   - Where feasible, retain and/or plant native vegetation with features that are determined to be beneficial. Native vegetation usually requires less maintenance than planting new vegetation.
   - When planting or replanting consider using low water use flowers, trees, shrubs, and groundcovers.
   - Consider alternative landscaping techniques such as naturescaping and xeriscaping.
2. **Properly store and dispose of gardening wastes.**
   - Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage at a permitted landfill or by composting.
   - Do not dispose of gardening wastes in streets, waterways, or storm drainage systems.
   - Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm and/or cover.
3. **Use mulch or other erosion control measures on exposed soils.**

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

4. **Properly manage irrigation and runoff.**
    - Irrigate slowly or pulse irrigate so the infiltration rate of the soil is not exceeded.
    - Inspect irrigation system regularly for leaks and to ensure that excessive runoff is not occurring.
    - If re-claimed water is used for irrigation, ensure that there is no runoff from the landscaped area(s).
    - If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.
    - Use automatic timers to minimize runoff.
    - Use popup sprinkler heads in areas with a lot of activity or where pipes may be broken. Consider the use of mechanisms that reduce water flow to broken sprinkler heads.
5. **Properly store and dispose of chemicals.**
    - Implement storage requirements for pesticide products with guidance from the local fire department and/or County Agricultural Commissioner.
    - Provide secondary containment for chemical storage.
    - Dispose of empty containers according to the instructions on the container label.
    - Triple rinse containers and use rinse water as product.
6. **Properly manage pesticide and herbicide use.**
    - Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of pesticides and herbicides and training of applicators and pest control advisors.
    - Follow manufacturers' recommendations and label directions.
    - Use pesticides only if there is an actual pest problem (not on a regular preventative schedule). When applicable use less toxic pesticides that will do the job. Avoid use of copper-based pesticides if possible. Use the minimum amount of chemicals needed for the job.
    - Do not apply pesticides if rain is expected or if wind speeds are above 5 mph.
    - Do not mix or prepare pesticides for application near storm drains. Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the targeted pest.
    - Whenever possible, use mechanical methods of vegetation removal rather than applying herbicides. Use hand weeding where practical.
    - Do not apply any chemicals directly to surface waters, unless the application is approved and permitted by the state. Do not spray pesticides within 100 feet of open waters.
    - Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
    - When conducting mechanical or manual weed control, avoid loosening the soil, which could lead to erosion.
    - Purchase only the amount of pesticide that you can reasonably use in a given time period.
    - Careful soil mixing and layering techniques using a topsoil mix or composted organic material can be used as an effective measure to reduce herbicide use and watering.
7. **Properly manage fertilizer use.**
    - Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers.
    - Follow manufacturers' recommendations and label directions.
    - Employ techniques to minimize off-target application (e.g. spray drift) of fertilizer, including consideration of alternative application techniques. Calibrate fertilizer distributors to avoid excessive application.
    - Periodically test soils for determining proper fertilizer use.
    - Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
    - Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
    - Use slow release fertilizers whenever possible to minimize leaching

8. **Incorporate the following integrated pest management techniques where appropriate:**
    - Mulching can be used to prevent weeds where turf is absent.
    - Remove insects by hand and place in soapy water or vegetable oil. Alternatively, remove insects with water or vacuum them off the plants.
    - Use species-specific traps (e.g. pheromone-based traps or colored sticky cards).
    - Sprinkle the ground surface with abrasive diatomaceous earth to prevent infestations by soft-bodied insects and slugs. Slugs also can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.
    - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).
    - Small mammals and birds can be excluded using fences, netting, and tree trunk guards.
    - Promote beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seedhead weevils, and spiders that prey on detrimental pest species.

Training

1. **Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.**
2. **Educate and train employees on the use of pesticides and pesticide application techniques. Only employees properly trained to use pesticides can apply them.**
3. **Train and encourage employees to use integrated pest management techniques.**
4. **Train employees on proper spill containment and cleanup.**
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
5. **Establish a regular training schedule, train all new employees, and conduct annual refresher training.**
6. **Use a training log or similar method to document training.**

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

California Storm Water Best Management Practice Handbooks. Industrial/Commercial Best Management Practice Handbook. Prepared by Camp Dresser& McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. King County Surface Water Management. July 1995. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

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Water Quality Handbook for Nurseries. Oklahoma Cooperative Extension Service. Division of Agricultural Sciences and Natural Resources. Oklahoma State University. E-951. September 1999.

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IC10. OUTDOOR LOADING/UNLOADING OF MATERIALS

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	
Metals	x
Bacteria	
Oil & Grease	x
Organics & Toxicants	x
Pesticides	x
Oxygen Demanding	

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Park vehicles and conduct loading/unloading only in designated loading/unloading areas so that spills or leaks can be contained.
- Clean loading/unloading areas regularly to remove potential sources of pollutants.
- Reduce exposure of materials to rain.
- Use drip pans underneath hose and pipe connections and other leak-prone spots during liquid transfer operations, and when making and breaking connections.
- Inspect equipment regularly.
- If possible, conduct loading and unloading in dry weather.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. **Properly design loading/unloading areas to prevent storm water runon, runoff of spills, etc.**
   - Grade and/or berm the area to prevent runon.
   - Position roof downspouts to direct stormwater away from the area.
   - Grade and/or berm the loading/unloading area to a drain that is connected to a dead-end.
   - The area where truck transfers take place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.
   - Avoid placing loading/unloading areas near storm drains.
2. **Park vehicles and conduct loading/unloading only in designated loading/unloading areas so that spills or leaks can be contained.**
3. **Clean loading/unloading areas regularly to remove potential sources of pollutants.** This includes outside areas that are regularly covered by containers or other materials.
4. **Reduce exposure of materials to rain.**
   - Cover the loading/unloading areas.
   - If a cover is unfeasible, use overhangs, or seals or door skirts to enclose areas.
5. **Use drip pans underneath hose and pipe connections and other leak-prone spots during liquid transfer operations, and when making and breaking connections.**

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices*"

6. **Inspect equipment regularly**
    - Designate a responsible party to check under delivery vehicles for leaking fluids, spilled materials, debris, or other foreign materials.
    - Check loading/unloading equipment regularly for leaks.
7. **If possible, conduct loading and unloading in dry weather.**

Training

1. **Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.**
2. **Train employees on proper spill containment and cleanup.**
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
3. **Train employees on the proper techniques used during liquid transfers to avoid leaks and spills.**
4. **Train forklift operators on the proper loading and unloading procedures.**
5. **Establish a regular training schedule, train all new employees, and conduct annual refresher training.**
6. **Use a training log or similar method to document training.**

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

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California Storm Water Best Management Practice Handbooks. Industrial/Commercial Best Management Practice Handbook. Prepared by Camp Dresser& McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

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IC11. OUTDOOR PROCESS EQUIPMENT OPERATIONS AND MAINTENANCE

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Conduct activities indoors and/or under covered areas
- Inspect equipment regularly.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	
Floatable Materials	
Metals	x
Bacteria	
Oil & Grease	x
Organics & Toxicants	x
Pesticides	
Oxygen Demanding	

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. **Alter activities to prevent exposure of pollutants to stormwater.**
   - Perform activities during dry periods.
   - Move activities indoors.
   - Replace toxic materials with benign materials.
2. **Cover process equipment/area with a permanent roof.**
3. **Design process area to prevent stormwater runon.**
   - Grade and/or berm the area to prevent runon.
   - Position roof downspouts to direct stormwater away from the area.
4. **Design process area to contain spills.**
   - Place equipment on an impervious surface, or install a drip pan under potential leak points.
   - Construct a berm around the process equipment to contain spills.
   - Install drains connected to the public sewer or the facility's process wastewater system within these contained areas. **DO NOT** discharge to a public sewer until contacting the local sewer authority to find out if pretreatment is required. If discharge to the sanitary sewer is not allowed, pump water to a tank and dispose of properly.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

5. **Inspect equipment regularly.**
    - Conduct regular and frequent inspection of equipment for leaks, malfunctions, staining on and around equipment, and other evidence of leaks.
    - Develop a standard methodology for reporting inspection results.
    - Develop a procedure for taking action on items in the report, responding to leaks, cleaning up spills, and completing repairs to prevent future leaks.
6. **If possible, eliminate or reduce the amount of hazardous materials and waste** by substituting non-hazardous or less hazardous material:
    - Use non-caustic detergents instead of caustic cleaning for parts cleaning.
    - Use a water-based cleaning service and have tank cleaned. Use detergent-based or water-based cleaning systems in place of organic solvent degreasers.
    - Replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check list of active ingredients to see whether it contains chlorinated solvents.
    - Choose cleaning agents that can be recycled.
7. **Recycled wastes whenever possible**
    - Recycling is always preferable to disposal of unwanted materials.
    - Separate wastes for easier recycling. Keep hazardous and non-hazardous wastes separate, do not mix used oil and solvents, and keep chlorinated solvents separate from non-chlorinated solvents.
    - Label and track the recycling of waste material (e.g. used oil, spent solvents, batteries). Purchase recycled products to support the market for recycled materials.

Training

1. **Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.**
2. **Train employees on proper spill containment and cleanup.**
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
3. **Establish a regular training schedule, train all new employees, and conduct annual refresher training.**
4. **Use a training log or similar method to document training.**

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

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IC12. OUTDOOR STORAGE OF RAW MATERIALS, PRODUCTS, AND CONTAINERS

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	
Metals	x
Bacteria	
Oil & Grease	x
Organics & Toxicants	x
Pesticides	
Oxygen Demanding	

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Store materials indoors, if feasible.
- Store materials on paved or impervious surfaces.
- Protect materials stored outside from rainfall and wind dispersal.
- Protect materials stored outside from stormwater runon.
- Properly store and handle chemical materials.
- Keep outdoor storage containers in good condition.
- Conduct regular inspections of storage areas.
- If drums are stored in an area where unauthorized persons may gain access secure them in such a manner as to prevent accidental spillage, pilferage, or any unauthorized use.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. **Store materials indoors, if feasible.**
2. **Store materials on paved or impervious surfaces.**
3. **Protect materials stored outside from rainfall and wind dispersal.**
   - Cover materials with a fixed roof or a temporary waterproof covering made of polyethylene, polypropylene, or hypalon.
   - Keep covers in place at all times when work is not occurring.
   - If areas are so large that they cannot feasibly be covered and contained, implement erosion control practices at the perimeter of the area and at any catch basins to prevent dispersion of the stockpiled material.
4. **Protect materials stored outside from stormwater runon.** Construct a berm around the perimeter of the material storage area to prevent the runon of uncontaminated stormwater from adjacent areas as well as runoff of stormwater from the material.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

5. **Minimize pooling of water.** Slope paved areas to minimize the pooling of water on the site, particularly with materials that may leach pollutants into stormwater and/or groundwater, such as compost, logs, and wood chips. A minimum slope of 1.5 percent is recommended.
6. **All materials stored outside should have a secondary containment system.**
    - Surround storage tanks with a berm or other secondary containment system.
    - Slope the area inside the berm to a drain.
    - Drain liquids to the sanitary sewer if available.
    - **DO NOT** discharge wash water to sanitary sewer until contacting the local sewer authority to find out if pretreatment is required. If discharge to the sanitary sewer is not allowed, pump water to a tank and dispose of properly.
    - Pass accumulated stormwater in petroleum storage areas through an oil/water separator.
7. **Properly store and handle chemical materials.**
    - Designate a secure material storage area that is paved with Portland cement concrete, free of cracks and gaps, and impervious in order to contain leaks and spills.
    - Do not store chemicals, drums, or bagged materials directly on the ground. Place these items in secondary containers.
    - Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all the containers or 110 percent of the volume of the largest container, whichever is greater.
    - Keep chemicals in their original containers, if feasible, and keep them well labeled.
8. **Keep outdoor storage containers in good condition.**
    - Keep storage areas clean and dry.
    - Sweep and maintain routes to and from storage areas.
9. **Conduct regular inspections of storage areas.**
    - Check for external corrosion of material containers, structural failures, spills and overfills due to operator error, failure of piping system, etc.
    - Inspect tank foundations, connections, coatings, tank walls, and piping system.
    - Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken tanks or container systems.
10. **If drums are stored in an area where unauthorized persons may gain access secure them in such a manner as to prevent accidental spillage, pilferage, or any unauthorized use.**

Training

1. **Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.**
2. **Train employees on proper spill containment and cleanup.**
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
3. **Train forklift operators on the proper loading and unloading procedures.**
4. **Establish a regular training schedule, train all new employees, and conduct annual refresher training.**
5. **Use a training log or similar method to document training.**

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

California Storm Water Best Management Practice Handbooks. Industrial/Commercial Best Management Practice Handbook. Prepared by Camp Dresser& McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

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IC14. PAINTING, FINISHING, AND COATINGS OF VEHICLES, BOATS, BUILDINGS, AND EQUIPMENT

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Use drop/ground cloths.
- Shelter any blasting and spray painting activities.
- Maintain a clean working environment.
- Cover and seal nearby storm drain inlets.
- Properly clean, store, and dispose of painting, finishing, and coating materials.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	
Nutrients	
Floatable Materials	
Metals	x
Bacteria	
Oil & Grease	x
Organics & Toxicants	x
Pesticides	
Oxygen Demanding	

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. **Use drop/ground cloths.**
   - Underneath outdoor painting, scraping, and sandblasting work.
   - Underneath outdoor mixing of paints, solvents, and tool cleaning.
2. **Shelter any blasting and spray painting activities.**
   - Hang wind-blocking tarps to prevent sand blasting dust and overspray from escaping.
   - Do not conduct these activities when wind conditions are such that containment is ineffective.
   - Do not conduct these activities over open water.
3. **Maintain a clean working environment.**
   - Utilize dry cleaning methods (e.g. sweeping). If washing is unavoidable, collect wash water for treatment and/or proper disposal.
   - Vacuum loose paint chips and paint dust to prevent discharges
   - Properly dispose of surface chips, used blasting sand, residual paints, and other materials. Use temporary storage containment that is not exposed to rain.
4. **Cover and seal nearby storm drain inlets.**
   - Cover and seal nearby storm drain inlets with waterproof material, mesh, or other runoff control device.
   - Leave covers in place until job is complete.
   - Clean covers daily and remove any debris for proper disposal.
5. **Properly clean, store, and dispose of painting, finishing, and coating materials.**
   - Do not dispose of toxic substances or liquid wastes on the pavement, ground, or storm drain.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

- Cover materials with a temporary waterproof covering made of polyethylene, polypropylene or hypalon.
- Clean paint brushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be poured into a sanitary sewer drain. Refer to fact sheet ***IC24 Wastewater Disposal*** for guidance on appropriate methods for disposal of wash water to the sanitary sewer.
- Clean paint brushes and tools covered with non-water-based paints, finishes, or other materials such that used solvents (e.g., paint thinner, turpentine, etc.) can be collected for recycling or proper disposal.
- Recycle paint, paint thinner, solvents, and other recyclable materials whenever possible.

Training

1. **Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.**
2. **Train employees on proper spill containment and cleanup.**
   - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
   - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
   - Fact Sheet IC17 discusses Spill Prevention and Control in detail.
3. **Establish a regular training schedule, train all new employees, and conduct annual refresher training.**
4. **Use a training log or similar method to document training.**

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

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California Storm Water Best Management Practice Handbooks. Industrial/Commercial Best Management Practice Handbook. Prepared by Camp Dresser& McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

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Stormwater Management Manual for Western Washington. Volume IV Source Control BMPs. Prepared by Washington State Department of Ecology Water Quality Program. Publication No. 99-14. August 2001.

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IC15. PARKING AND STORAGE AREA MAINTENANCE

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Conduct regular cleaning.
- Properly collect and dispose of wash water.
- Keep the parking and storage areas clean and orderly.
- Use absorbent materials and properly dispose of them when cleaning heavy oily deposits.
- When conducting surface repair work cover materials and clean paintbrushes and tools appropriately.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	x
Metals	x
Bacteria	x
Oil & Grease	x
Organics & Toxicants	x
Pesticides	x
Oxygen Demanding	x

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. **Conduct regular cleaning.**
   - Sweeping or vacuuming the parking facility is encouraged over other methods.
   - Sweep all parking lots at least once before the onset of the wet season.
   - Establish frequency of sweeping based on usage and field observations of waste accumulation.
2. **Properly collect and dispose of wash water.**
   - Block the storm drain or contain runoff.
   - Wash water should be collected and pumped to the sanitary sewer or discharged to a pervious surface, do not allow wash water to enter storm drains. Refer to fact sheet ***IC24 Wastewater Disposal*** for guidance on appropriate methods for disposal of wash water to the sanitary sewer.
   - Dispose of parking lot sweeping debris and dirt at a landfill.
3. **Consider use of source treatment BMPs to treat runoff.**
   - Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
   - Utilize sand filters or oleophilic collectors for oily waste in low quantities.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

4. **Keep the parking and storage areas clean and orderly.**
    - Clean out and cover litter receptacles frequently to prevent spillage.
    - Remove debris in a timely fashion.

    OPTIONAL:
    - Post "No Littering" signs.
5. **When cleaning heavy oily deposits:**
    - If possible, clean oily spots with absorbent materials.
    - Do not allow discharges to the storm drain.
    - Appropriately dispose of spilled materials and absorbents.
6. **When conducting surface repair work:**
    - Pre-heat, transfer or load hot bituminous material away from storm drain inlets.
    - Conduct surface repair work during dry weather to prevent contamination from contacting stormwater runoff.
    - Cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and clean any debris for proper disposal.
    - To avoid runoff, use only as much water as necessary for dust control.
    - Use drip pans or absorbent material to catch drips from paving equipment that is not in use. Dispose of collected material and absorbents properly.
7. **Conduct inspections on a regular basis.**
    - Designate personnel to conduct inspections of the parking facilities and stormwater conveyance systems associated with them.
    - Inspect cleaning equipment/sweepers for leaks on a regular basis.
8. **Keep accurate maintenance logs to evaluate materials removed/stored and improvements made.**
9. **Arrange rooftop drains to prevent drainage directly onto paved surfaces.**

Training

1. **Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.**
2. **Train employees on proper spill containment and cleanup.**
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
3. **Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.**
4. **Establish a regular training schedule, train all new employees, and conduct annual refresher training.**
5. **Use a training log or similar method to document training.**

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

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California Storm Water Best Management Practice Handbooks. Industrial/Commercial Best Management Practice Handbook. Prepared by Camp Dresser& McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

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IC16. POOL AND FOUNTAIN CLEANING

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Prevent algae problems with regular cleaning, consistent adequate chlorine levels, and well-maintained water filtration and circulation systems.
- Discharge pool and fountain water properly.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	x
Metals	
Bacteria	x
Oil & Grease	
Organics & Toxicants	x
Pesticides	x
Oxygen Demanding	x

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. **Prevent algae problems with regular cleaning, consistent adequate chlorine levels, and well-maintained water filtration and circulation systems.**
   - Do not use copper-based algaecides.
   - Control algae with chlorine or other alternatives, such as sodium bromide.
2. **Manage pH and water hardness to minimize corrosion of copper pipes.**
3. **Discharge pool and fountain water properly.** Consider hiring a professional pool-draining service to collect all pool water for off-site disposal. If this is not feasible, adhere to the following:
   - When draining pools or fountains never discharge water to a street or storm drain, discharge to the sanitary sewer if permitted to do so. Refer to fact sheet ***IC24 Wastewater Disposal*** for guidance on appropriate methods for disposal of wash water to the sanitary sewer.
   - If draining a pool to the sanitary sewer, prevent backflow by maintaining an "air gap" between the discharge line and the sewer line (do not seal the connection between the hose and sewer line). Be sure to call the local sewer authority for guidance on flow rate restrictions, backflow prevention, and handling special cleaning waste (such as acid wash). Keep discharge flows to the low levels. Higher flow rates may be prohibited by local ordinance.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

- If water is dechlorinated with a neutralizing chemical or by allowing chlorine to dissipate for a few days (do not use the facility during this time), the water may be recycled/reused by draining it gradually onto a landscaped area. Water must be tested prior to discharge to ensure that chlorine is not present.
- Provide drip pans or buckets beneath drain pipe connections to catch leaks. This will be especially pertinent if pool or spa water that has not been dechlorinated is pumped through piping to a discharge location.

4. **Properly clean and/or dispose of filters.**
    - Never clean a filter in the street or near a storm drain.
    - Rinse cartridge filters onto a dirt area, and work filter residue into soil.
    - Backwash diatomaceous earth filters onto dirt. Dispose of spent diatomaceous earth in the garbage. Diatomaceous earth cannot be discharged to surface waters, storm drainage systems, septic systems, or on the ground.
    - If there is not a suitable dirt area, discharge filter backwash or rinsewater to the sanitary sewer if permitted to do so by the local sewering agency.

Training

1. **Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.**
2. **Train employees on proper spill containment and cleanup.**
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
3. **Train maintenance personnel on the proper techniques for testing chlorine levels and applying neutralizing chemicals.**
4. **Establish a regular training schedule, train all new employees, and conduct annual refresher training.**
5. **Use a training log or similar method to document training.**

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Los Angeles County Stormwater Quality. Public Agency Activities Model Program. On-line: http://ladpw.org/wmd/npdes/public_TC.cfm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July 1998 (Revised February 2002 by the California Coastal Commission).

Santa Clara Valley Urban Runoff Pollution Prevention Program. Maintenance Best Management Practices for the Construction Industry. Brochures: Landscaping, Gardening, and Pool; Roadwork and Paving; and Fresh Concrete and Mortar Application. June 2001.

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IC17. SPILL PREVENTION AND CLEANUP

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	x
Metals	x
Bacteria	x
Oil & Grease	x
Organics & Toxicants	x
Pesticides	x
Oxygen Demanding	x

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Develop procedures to prevent/mitigate spills to storm drain systems.
- Post "No Dumping" signs with a phone number for reporting illegal dumping and disposal.
- Conduct routine cleaning, inspections, and maintenance.
- Properly store and handle chemical materials.
- Protect materials stored outside from stormwater runon.
- Secure drums stored in an area where unauthorized persons may gain access to prevent accidental spillage, pilferage, or any unauthorized use.
- Identify key spill response personnel.
- Clean up leaks and spills immediately.
- Report and track spills.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

Spill Prevention

1. **Develop procedures to prevent/mitigate spills to storm drain systems.**
   Standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
2. **Post "No Dumping" signs with a phone number for reporting illegal dumping and disposal.**
3. **Conduct routine cleaning, inspections, and maintenance**
   - Sweep and clean storage areas consistently at a designated frequency (e.g. weekly, monthly). **DO NOT** hose down areas to storm drains.
   - Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Reuse, recycle, or properly dispose of any collected liquids or soiled absorbent materials.
   - Check tanks (and any containment sumps) frequently for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

- Check for external corrosion of material containers, structural failures, spills and overfills due to operator error, failure of piping system, etc.
- Inspect tank foundations, connections, coatings, and tank walls and piping system.

4. **Properly store and handle chemical materials.**
   - Designate a secure material storage area that is paved with Portland cement concrete, free of cracks and gaps, and impervious in order to contain leaks and spills.
   - Do not store chemicals, drums, or bagged materials directly on the ground. Place these items in secondary containers.
   - Keep chemicals in their original containers, if feasible.
   - Keep containers well labeled according to their contents (e.g., solvent, gasoline).
   - Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).
   - Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).
5. **Utilize secondary containment systems for liquid materials.**
   - Surround storage tanks with a berm or other secondary containment system.
   - Slope the area inside the berm to a drain.
   - Drain liquids to the sanitary sewer if available. **DO NOT** discharge wash water to sanitary sewer until contacting the local sewer authority to find out if pretreatment is required
   - Pass accumulated stormwater in petroleum storage areas through an oil/water separator.
   - Use catch basin filtration inserts.
6. **Protect materials stored outside from stormwater runon.** Construct a berm around the perimeter of the material storage area to prevent the runon of uncontaminated stormwater from adjacent areas as well as runoff of stormwater from the material.
7. **Secure drums stored in an area where unauthorized persons may gain access to prevent accidental spillage, pilferage, or any unauthorized use.**

Spill Control and Cleanup Activities

8. **Identify key spill response personnel.**
9. **Adopt the Orange County Hazardous Materials Area Plan or an equivalent plan, which includes a set of planned responses to hazardous materials emergencies. The plan should include:**
   - Description of the facility, owner and address, activities and chemicals present
   - Facility map
   - Notification and evacuation procedures
   - Cleanup instructions
   - Identification of responsible departments
10. **Clean up leaks and spills immediately.**
    - Place a stockpile of spill cleanup materials where they will be readily accessible (e.g. near storage and maintenance areas).
    - Utilize dry cleaning methods to clean up spills to minimize the use of water. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste. Physical methods for the cleanup of dry chemicals include the use brooms, shovels, sweepers, or plows.
    - Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
    - Clean up chemical materials with absorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
    - For larger spills, a private spill cleanup company or Hazmat team may be necessary.

11. Reporting
    1. **Report spills that pose an immediate threat to human health or the environment to local agencies, such as the fire department, and the Regional Water Quality Control Board.**
    2. **Establish a system for tracking incidents. The system should be designed to identify the following:**
        - Types and quantities (in some cases) of wastes
        - Patterns in time of occurrence (time of day/night, month, or year)
        - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
        - Responsible parties
    3. **Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).**

Training
    1. **Educate employees about spill prevention and cleanup.**
        - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
        - Educate employees on aboveground storage tank requirements.
        - Train all employees upon hiring and conduct annual refresher training.
    2. **Train employees responsible for aboveground storage tanks and liquid transfers on the Spill Prevention Control and Countermeasure Plan.**

Stencil storm drains

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References

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IC19. VEHICLE AND EQUIPMENT MAINTENANCE AND REPAIR

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Utilize dry cleanup methods such as sweeping try to avoid washing down work areas.
- Use drip pans and/or containers where needed.
- Inspect vehicles and equipment for leaks.
- Dispose of all waste products properly and recycle whenever possible.
- Clean storm drain inlet(s) on a regular schedule and after large storms.
- Store idle equipment under cover.
- Keep equipment clean and free of excess oil and grease.
- Remove all fluids from retired, wrecked, or salvaged vehicles.
- Dispose of solvents per instructions on the container.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	
Nutrients	
Floatable Materials	
Metals	x
Bacteria	
Oil & Grease	x
Organics & Toxicants	x
Pesticides	
Oxygen Demanding	

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. **Only conduct maintenance or repair work in designated areas.**
   - Conduct maintenance and repair work in a designated area with spill containment.
   - Construct a berm or intercept trench at doorways to prevent the runon of uncontaminated stormwater from adjacent areas as well as stormwater runoff.
2. **Utilize dry cleanup methods such as sweeping, try to avoid washing down work areas.**
   - If work areas are washed and if discharge to the sanitary sewer is allowed, treat water with an appropriate treatment device (e.g. clarifier) before discharging. **DO NOT** discharge wash water to sanitary sewer until contacting the local sewer authority to find out if pretreatment is required.
   - If discharge to the sanitary sewer is not permitted, pump water to a tank and dispose of properly.
3. **Use drip pans and/or containers where needed.** Keep a drip pan or container under equipment or vehicles when unclipping hoses, unscrewing filters, or conducting other maintenance and repair work that may result in fluids dripping or splattering onto the shop floor or ground.
4. **Inspect vehicles and equipment for leaks.**
   - Inspect incoming vehicles and equipment for leaks.
   - Inspect vehicles and equipment during regular maintenance; keep records.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

5. **Dispose of all waste products properly and recycle whenever possible.**
    - Promptly transfer waste materials to the proper waste or recycling drums.
    - Store waste and/or recycling drums in designated areas with spill containment.
    - Separate hazardous and non-hazardous wastes, do not mix used oil and solvents and keep chlorinated solvents separate from non-chlorinated solvents.
    - Store cracked batteries in a non-leaking secondary container and dispose of properly at recycling or household hazardous waste facilities.
    - Recycle greases, used oils, oil filters, antifreeze, cleaning solutions, batteries, and hydraulic and transmission fluids whenever possible.
    - Label and track the recycling of waste material (e.g. used oil, spent solvents, batteries). Purchase recycled products to support the market for recycled materials.
    - Separate wastes for easier recycling. Keep hazardous and non-hazardous wastes separate, do not mix used oil and solvents, and keep chlorinated solvents separate from non-chlorinated solvents.
6. **Paint signs near outdoor drains and post signs at sinks to remind employees and others not to pour wastes down drains.**
7. **Clean storm drain inlet(s) on a regular schedule and after large storms.**
8. **Store idle equipment under cover.**
9. **Keep equipment clean and free of excess oil and grease.**
10. **Completely drain oil filters before recycling/disposal.**
11. **Remove all fluids from retired, wrecked, or salvaged vehicles.**
12. **Dispose of solvents per instructions on the container.**
13. **Use non-toxic chemicals for maintenance when possible.**
    - Use non-caustic detergents instead of caustic cleaning for parts cleaning.
    - Use a water-based cleaning service and have tank cleaned. Use detergent-based or water-based cleaning systems in place of organic solvent degreasers.
    - Replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check list of active ingredients to see whether it contains chlorinated solvents.
    - Choose cleaning agents that can be recycled.
14. **Reduce or eliminate use of solvents when feasible**

Training

1. **Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.**
2. **Train employees on proper spill containment and cleanup.**
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
3. **Establish a regular training schedule, train all new employees, and conduct annual refresher training.**
4. **Use a training log or similar method to document training.**

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

California Storm Water Best Management Practice Handbooks. Industrial/Commercial Best Management Practice Handbook. Prepared by Camp Dresser& McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. King County Surface Water Management. July 1995. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July 1998 (Revised February 2002 by the California Coastal Commission).

Stormwater Management Manual for Western Washington. Volume IV Source Control BMPs. Prepared by Washington State Department of Ecology Water Quality Program. Publication No. 99-14. August 2001.

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IC20. VEHICLE AND EQUIPMENT WASHING AND STEAM CLEANING

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	
Metals	x
Bacteria	
Oil & Grease	x
Organics & Toxicants	
Pesticides	
Oxygen Demanding	x

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Consider using off-site commercial washing and/or steam cleaning businesses, if feasible.
- Use commercial washing and/or steam cleaning businesses capable of properly disposing of wastewater (Refer to fact sheet ***IC24 Wastewater Disposal*** for guidance on appropriate methods for disposal of wash water to the sanitary sewer).
- Designate an impervious indoor or outdoor area to be used solely for vehicle and equipment washing/steam cleaning.
- Clearly mark the vehicle and equipment washing/steam cleaning area.
- If the area is outdoors, cover the wash area when not in use to prevent contact with rainwater.
- Provide trash containers in wash area and empty on a regular basis.
- Use hoses with nozzles that automatically turn off when left unattended.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. **Use off-site commercial washing and/or steam cleaning businesses.** These businesses are better equipped to handle and properly dispose of the wash waters.
2. **Use commercial washing and/or steam cleaning businesses capable of disposing of wastewater.**
   - Mobile cleaning businesses should use a leak proof cover device that will catch and contain all contaminated (i.e. chemical additives such as soaps, solvents, or degreasers are used) wastewater runoff for later disposal in a manner that complies with all city, county, state, and federal codes.
   - Refer to fact sheet ***IC24 Wastewater Disposal*** for guidance on appropriate methods for disposal of wastewater to the sanitary sewer.
3. **Designate an impervious indoor or outdoor area to be used solely for vehicle and equipment washing/steam cleaning.** Do not conduct oil changes and other engine maintenance in the designated washing area.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

4. **Clearly mark the vehicle and equipment washing/steam cleaning area. Design wash area to properly collect and dispose of wash water and/or effluent generated.**
    - Install sumps or drain lines to collect wash water.
    - Construct a berm around the designated area and grade to collect wash water as well as to prevent storm water runon.
    - Use portable containment (such as ground cover devices) and vacuum collection of wastewater.
    - Inspect and maintain equipment (such as ground cover devices) regularly to ensure proper and effective functioning.
5. **If the area is outdoors, cover the wash area when not in use to prevent contact with rainwater.**
6. **Provide trash containers in wash area and empty on a regular basis.**
7. **Use hoses with nozzles that automatically turn off when left unattended.**
8. **Use biodegradable, phosphate-free detergents if possible.**
9. **Recycle waste materials, whenever possible**
    - Recycling is always preferable to disposal of unwanted materials.
    - Separate wastes for easier recycling. Keep hazardous and non-hazardous wastes separate, do not mix used oil and solvents, and keep chlorinated solvents separate from non-chlorinated solvents.
    - Label and track the recycling of waste material (e.g. used oil, spent solvents, batteries).
    - Purchase recycled products to support the market for recycled materials.
12. **If possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous material:**
    - Use non-caustic detergents instead of caustic cleaning for parts cleaning.
    - Use a water-based cleaning service and have tank cleaned. Use detergent-based or water-based cleaning systems in place of organic solvent degreasers.
    - Replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check list of active ingredients to see whether it contains chlorinated solvents.
    - Choose cleaning agents that can be recycled.

Training

1. **Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.**
2. **Train staff on the proper maintenance of the wash area.**
3. **Train employees on proper spill containment and cleanup.**
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
4. **Establish a regular training schedule, train all new employees, and conduct annual refresher training.**
5. **Use a training log or similar method to document training.**

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

California Storm Water Best Management Practice Handbooks. Industrial/Commercial Best Management Practice Handbook. Prepared by Camp Dresser& McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. King County Surface Water Management. July 1995. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July 1998 (Revised February 2002 by the California Coastal Commission).

Stormwater Management Manual for Western Washington. Volume IV Source Control BMPs. Prepared by Washington State Department of Ecology Water Quality Program. Publication No. 99-14. August 2001.

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IC21. WASTE HANDLING AND DISPOSAL

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	x
Metals	x
Bacteria	x
Oil & Grease	x
Organics & Toxicants	x
Pesticides	x
Oxygen Demanding	x

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Prevent waste materials from coming in direct contact with wind or rain. .
- Keep waste collection areas clean.
- Secure solid waste containers when not in use.
- Regularly inspect, repair, and/or replace waste containers.
- Use all of a product before disposing of the container.
- Label and store hazardous wastes according to hazardous waste regulations.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. **Prevent waste materials from coming in direct contact with wind or rain.**
   - Cover the waste management area with a permanent roof.
   - If this is not feasible, cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene, or hypalon.
   - Cover dumpsters to prevent rain from washing out waste materials.
2. **Design waste handling and disposal area to prevent stormwater runon.**
   - Enclose the waste handling and disposal area or build a berm around it.
   - Position roof downspouts to direct stormwater away from waste handling and disposal area.
3. **Design waste handling and disposal area to contain spills.**
   - Place dumpsters or other waste receptacles on an impervious surface.
   - Construct a berm around the area to contain spills.
   - Install drains connected to the public sewer or the facility's process wastewater system within these contained areas. **DO NOT** discharge to a public sewer until contacting the local sewer authority to find out if pretreatment is required.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

4. **Keep waste collection areas clean.**
    - When cleaning around waste handling and disposal areas use dry methods when possible (e.g. sweeping, use of absorbents).
    - If water must be used, collect water and discharge to the sewer if permitted to do so. **DO NOT** discharge to a public sewer until contacting the local sewer authority to find out if pretreatment is required. If discharge to the sanitary sewer is not allowed, pump water to a tank and dispose of properly.
    - Post "No Littering" signs.
5. **Secure solid waste containers when not in use.**
6. **Regularly inspect, repair, and/or replace waste containers.**
7. **Do not fill waste containers with washout water or any other liquid.**
8. **Use all of a product before disposing of the container.**
9. **Segregate wastes by type and label and date wastes.**
    - Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal.
    - Ensure that only appropriate solid wastes are added to solid waste containers.
    - Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc. may not be disposed of in solid waste containers.
10. **Label and store hazardous wastes according to hazardous waste regulations.**
    - Consult your local hazardous waste agency or Fire Department for details.
    - Obtain a hazardous waste generator license or permit if necessary.
12. **Minimize waste.**
    - Recycle materials whenever possible.
    - Modify processes or equipment to increase efficiency.
    - Identify and promote use of non-hazardous alternatives.
    - Reduction in the amount of waste generated can be accomplished using many different types of source controls such as:
        - Production planning and sequencing
        - Process or equipment modification
        - Raw material substitution or elimination
        - Loss prevention and housekeeping
        - Waste segregation and separation
        - Close loop recycling
    - Establish a material tracking system to increase awareness about material usage. This may reduce spills and minimize contamination, thus reducing the amount of waste produced.

Training

1. **Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.**
2. **Train employees in proper waste handling and disposal.**
3. **Train employees on proper spill containment and cleanup.**
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.

4. **Establish a regular training schedule, train all new employees, and conduct annual refresher training.**
5. **Use a training log or similar method to document training.**

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

California Storm Water Best Management Practice Handbooks. Industrial/Commercial Best Management Practice Handbook. Prepared by Camp Dresser& McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

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IC22. EATING AND DRINKING ESTABLISHMENTS

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Use dry cleaning methods instead of water
- Clean equipment (floor mats, grease filters, grills, garbage cans, etc.) indoors or in a covered outdoor wash area that is plumbed to the sanitary sewer or in an area that will contain the wash water (Refer to fact sheet ***IC24 Wastewater Disposal*** for guidance on appropriate methods for disposal of wash water to the sanitary sewer).
- Recycle and/or properly dispose of grease and oil.
- Block the storm drain when hosing or steam/pressure washing outside dumpster areas, sidewalks, and common areas.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	
Nutrients	x
Floatable Materials	x
Metals	
Bacteria	x
Oil & Grease	x
Organics & Toxicants	x
Pesticides	x
Oxygen Demanding	x

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. **Practice good housekeeping.**
   - Conduct regular sweeping or vacuuming of outdoor areas: Dry sweep pavement areas including "drive-thru" areas, parking lots, sidewalks, outdoor eating areas and dumpster storage areas frequently.
   - Keep outside areas free of trash & debris.
   - Do not hose out dumpsters or fill them with liquid waste.
   - Regularly inspect, repair, and/or replace dumpsters.
2. **Clean equipment (floor mats, grease filters, grills, garbage cans, etc.) indoors or in a covered outdoor wash area that is plumbed to the sanitary sewer.**
   - Clean equipment in a mop sink if possible (never in a food preparation sink). If there is no mop sink, dedicate an indoor cleaning area where a drain is plumbed to the sanitary sewer.
   - Dispose mop water from cleaning floors in a mop sink, toilet or other drain that is plumbed to the sanitary sewer. Refer to fact sheet ***IC24 Wastewater Disposal*** for guidance on appropriate methods for disposal of wash water to the sanitary sewer.
   - Do not pour wash water outside or into a street, gutter, or storm drain.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

- Dispose of all wastewater containing oil and grease in a grease trap or interceptor.

3. **Recycle and/or properly dispose of grease and oil.** Collect and dispose of concentrated waste oil and grease and disposed of by a certified waste grease hauler. NEVER pour grease or oil into a sink, floor drain, storm drain or dumpster.
4. **Block storm drain(s) when cleaning (hosing or steam/pressure washing) outside dumpster areas, sidewalks, and common areas with hot water, soap, or other cleaning agent.** Collect water/waste and discharge to the sanitary sewer (with approval of the local sanitation district).

Training

1. **Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.**
2. **Train employees on proper spill containment and cleanup.**
   - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
   - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
   - Fact sheet IC17 discusses Spill Prevention and Control in detail.
3. **Establish a regular training schedule, train all new employees, and conduct annual refresher training.**
4. **Use a training log or similar method to document training.**

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

Carlsbad Jurisdictional Urban Runoff Management Plan. Best Management Practices for Restaurants. City of Carlsbad. February 2002. On-line: http://www.ci.carlsbad.ca.us/cserv/jurmp.html

Orange County Stormwater Program. 2001. Water Quality Guidelines for Exterior Restaurant Cleaning Operations. Brochure. June.

Orange County Stormwater Program. Good Cleaning Practices Food & Restaurant Industry. Poster. Courtesy of the City and County of LA.

For additional information contact:

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IC23. FIRE SPRINKLER TESTING/MAINTENANCE

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

Provided below are specific procedures associated with this activity. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Conduct activity on non-rainy days and for the shortest duration possible to minimize discharge volume.
- Inspect flow path and remove all debris and materials prior to testing or maintenance.

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	
Nutrients	
Floatable Materials	
Metals	x
Bacteria	
Oil & Grease	x
Organics & Toxicants	
Pesticides	
Oxygen Demanding	

Best Management Practices

1. **Contain flows onsite** and/or direct the water flows to landscaped or green areas whenever possible and safe to do so without causing damage or erosion.
2. **Divert sprinkler system flows to the sewer**, when practicable and with the permission of the local sewer agency. Refer to fact sheet ***IC24 Wastewater Disposal*** for guidance on appropriate methods for disposal of wash water to the sanitary sewer.
3. **Training**
   a. Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
   b. Establish a regular training schedule, train all new employees, and conduct annual refresher training.
   c. Use a training log or similar method to document training.

References

California Storm Water Best Management Practice Handbooks. Industrial/Commercial Best Management Practice Handbook. Prepared by Camp Dresser& McKee, Larry Walker Associates for California Stormwater Quality Association. January 2003.

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[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

IC24. DISPOSAL OF WASTEWATER GENERATED BY MOBILE BUSINESSES & OUTDOOR ACTIVITIES

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner.[1] The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Dispose of wastewater according to the instructions below. No wastewater shall be disposed of into the storm drain system.

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	x
Metals	x
Bacteria	x
Oil & Grease	x
Toxic Organic	x
Pesticides	x
Oxygen Demanding	x

Purpose of this BMP:

Orange County cities and the County of Orange are mandated under NPDES Permits issued by the California Regional Water Quality Control Boards to prohibit the discharge of pollutants and non-storm water runoff into the storm drain system. Therefore, untreated wastewater (including wastewater from mobile detailing, pressure washing, steam cleaning, carpet cleaning, or similar activities) shall **not** be discharged to the storm drain system.

In an effort to help businesses comply with the NPDES Permit, the cities of Orange County, County of Orange, South Orange County Wastewater Authority, Orange County Sanitation District, and Irvine Ranch Water District have developed the following best management practices (BMPs) for the proper disposal of wastewater generated by mobile business operations and outdoor activities.

If you have specific questions regarding any of the BMPs herein, please call your local sewering agency or your City's NPDES Coordinator.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

1. General Best Management Practices (BMPs) and Preparation of Work Area

What should I do prior to conducting a job?

The BMPs presented below are intended to help you comply with local and state regulations that prohibit wasteater from entering the storm drain system. The following BMPs must be followed by all mobile businesses or outdoor activities of a fixed business that generate wastewater, regardless of the type of surface to be cleaned or cleaning operation to be performed:

- Evaluate the chemicals and compounds used for cleaning and reduce or eliminate the use of those that contain solvents, heavy metals, high levels of phosphates, or very high/very low pH that exceeds the local sewering agency requirements.
- Walk through the area where the cleaning will occur prior to the start of the job and identify all area drains, yard drains, and catch basins where wastewater could potentially enter the storm drain system.
- Block/seal off identified drains or catch basins using sand bags, plugs, rubber mats, or temporary berms.
- Collect all trash and debris from the project area and place them in a trash bin for disposal.
- Sweep all surface areas prior to cleaning to minimize the amount of suspended solids, soil, and grit in wastewater.
- Identify the wastewater disposal option that will be used. Whether you are discharging to landscaping or the sanitary sewer, it is necessary that you meet all the requirements identified below.
- Conduct mobile washing in accordance with all operating instructions provided by the equipment supplier. Maintain equipment in good working order and routinely check and test all safety features.

What methods can be used to collect wastewater at a site?

There is no specific containment method that must be used for wastewater collection/diversion. However, the system must be adequately designed so that the wastewater does not flow into an on-site or off-site storm drain inlet. All mobile and existing businesses should use one of the following methods, regardless of the surface to be cleaned or the type of cleaning operation to be performed:

- Portable containment areas can be made from waterproof tarps, heavy-duty plastic, or rubber matting equipped with berms to prevent wastewater from running into storm drain inlets or discharge off-site. Materials that can be used for berms include sand bags or water-filled tubing. Whatever containment material is used, it must seal tightly to the ground so that no wastewater can pass under or over the berms.
- When power washing smaller pieces of equipment, containment devices to use may include portable vinyl swimming pools, plastic 55-gallon drums on casters, and flat metal or plastic containment pads.
- Depending on the volume of wastewater generated, it may be necessary to use a pump system, which may range in size from a wet-dry vacuum to a sump pump. A natural basin from which to pump can also be set up by establishing a slightly sloped containment area.

- Stationary or more permanent containment areas can be constructed with cement. Berms and pump systems may be used to contain wastewater and divert it to a holding tank.

- Commercial wastewater collection systems are also available for power washing. These systems can range from portable wash pits to self-contained water recycling systems. A list of companies selling this type of equipment can usually be found in the telephone book under "Pressure Washing Services and Equipment".

- Storm drain inlet covers can be made of an impermeable barrier such as a heavy-duty vinyl or plastic secured in place with materials such as concrete blocks, gravel bags, or sand bags. Storm drain inlet covers may also be available though commercial vendors.

Note: Blocking storm drain catch basin inlets in the public right-of-way (i.e. public street, or other publicly owned facility) is prohibited as a method of containment, unless expressly permitted by the municipality typically through an encroachment permit process. Wastewater should be contained on-site prior to entering the public right-of-way. Contact the local municipality for more information.

2. Wastewater Disposal Options

How can I dispose of my wastewater?

Wastewater is not allowed in the storm drain or street. However, the wastewater may be discharged to landscaping or the sanitary sewer, or it may be picked up and disposed of by a waste hauler. Please note that if you are unsure of the types of pollutants in the wastewater, laboratory analysis may be required to establish the proper disposal method.

Choose one of the three wastewater disposal options listed below based upon the following conditions:

Option 1: Discharge Wastewater to a Landscaped Area

The wastewater must meet the following requirements if discharging to landscaping:

- The pH must be between 6.5 and 8.5. This can be checked quickly and easily through the use of pH paper test strips.

- The wastewater should not contain large volumes or concentrations of:

    - Toxic materials.
    - Degreasers.
    - Pollutants that may create a fire or explosion hazard (e.g., gasoline, diesel).
    - Solid or viscous pollutants in amounts sufficient to cause obstruction or blockage of flow.
    - Petroleum oil, or other products of mineral oil origin.
    - Paint.

  Prior to surface washing, you must exercise any reasonable means to eliminate large volumes or concentrations of the above listed pollutants. Common methods to eliminate standing pools of pollutants include the placement of absorbent to adsorb the pollutant, dry-sweeping the absorbent, and disposing of the absorbent properly.

- In addition, wastewater from cleaning food-related vehicles or areas, vehicle exteriors or engines, and buildings with lead- or mercury-based paint should **not** be discharged to landscaping.

- Filter the wastewater if it contains debris, fibers, or other suspended solids.

- Ensure that the wastewater is fully contained within the landscaped area and will fully infiltrate into the ground prior to leaving the job site.

Option 2: Discharge Wastewater to the Sanitary Sewer

The wastewater must comply with the following conditions if disposed of into the sanitary sewer system:

- The wastewater temperature must be less than 140°F (60°C).

- The pH must be between 6.0 and 12.0. This can be checked quickly and easily through the use of pH paper test strips. Adjust the wastewater to a pH that is between 6.0 and 12.0. Dilution is not an effective or acceptable pretreatment.

- The wastewater quality must comply with the local sanitary sewer district's discharge limits and requirements. The wastewater should not contain large volumes or concentrations of:

    - Pollutants that may create a fire or explosion hazard (e.g., gasoline, diesel).
    - Solid or viscous pollutants in amounts sufficient to cause obstruction or blockage of flow.
    - Petroleum oil, non-biodegradable cutting oil, or other products of mineral oil origin.
    - Oil based paint.

  Prior to surface washing, you must exercise any reasonable means to eliminate large volumes or concentrations of the above listed pollutants. Common methods to eliminate standing pools of pollutants include the placement of absorbent to adsorb the pollutant, dry-sweeping the absorbent, and disposing of the absorbent properly.

- No wastewater shall be discharged into any publicly owned sewer manholes without the sewer agency's written authorization.

- Filter the wastewater if it contains debris, fibers, or other suspended solids.

- If chemicals (e.g., solvents or acids) are used during the cleaning process, additional precautions may be needed. Contact your local sanitation district to learn if wastewater containing these chemicals requires pretreatment before discharge to the sanitary sewer or if it needs to be treated as hazardous waste.

- Ensure that the wastewater is released at a flow rate and/or concentration, which will not cause problems, pass through, or interference with the sewerage facilities. Generally, if you are using a privately owned cleanout, sink, toilet, or floor drain at a client's property, and the flow does not backup, the flow amount will not cause problems, pass through, or interference with the sewerage facilities.

- Utilize an approved discharge point such as:

    - Privately owned cleanout (or sink, toilet or floor drain), oil/water separator, or below ground clarifier at the client's property where the wash water is generated;
    - Privately owned industrial sewer connection at the client's property where the wash water is generated;
    - Waste hauler station at sanitary sewer facility; and

- Any other disposal points approved by the sanitary sewer facility.

- Maintain a logbook of all discharges.

Option 3: Dispose of Wastewater Using a Professional Hazardous Waste Hauler

Wastewater that can be characterized in any of the following ways must be disposed of using a hazardous waste hauler:

- Is corrosive (as indicated by a pH value of less than 5.5) or caustic (as indicated by a pH value of greater than 10.0).
- Contains a pollutant that may create a fire or explosion hazard (e.g., gasoline, diesel fuel).
- Contains solid or viscous pollutants in amounts sufficient to cause obstruction or blockage of flow.
- Contains petroleum oil, non-biodegradable cutting oil, or other products of mineral oil origin.
- Contains other potential hazardous wastes. Examples of other potential hazardous wastes include:
  - Wastewater generated from power washing old paint off a building. Paint chips need to be collected, evaluated, and disposed of properly. Paint chips cannot be left on the ground at the job site. Old paint stripped off commercial buildings may contain metals (e.g., lead, chromium, cadmium, and mercury), causing it to be a regulated hazardous waste.
  - Wastewater used in conjunction with certain solvents and degreasing agents, which may cause the wastewater to be classified as a listed or characteristic hazardous waste.

You must comply with the following conditions if a hazardous waste hauler is used:

- Ensure that the waste hauler is certified by the appropriate sanitary sewering agency and the Orange County Health Care Agency, is Hazardous Waste DOT certified, and is complying with applicable discharge regulations, which may include obtaining necessary permits and conducting water quality monitoring requirements. Please contact the Orange County Health Care Agency and/or your local fire department for specific requirements.
- Identify the wastes involved and determine if a hazardous waste has been generated.
- Maintain a logbook of all discharges and hazardous waste manifests, if applicable.

For additional information contact:

County of Orange/ OC Watersheds
Main: (714) 955-0600
24 hr Water Pollution Hotline: 1-877-89-SPILL
or visit our website at www.ocwatersheds.com

FP-2

LANDSCAPE MAINTENANCE

The model procedures described below focus on minimizing the discharge of pesticides and fertilizers, landscape waste, trash, debris, and other pollutants to the storm drain system and receiving waters. Landscape maintenance practices may involve one or more of the following activities:

1. **Mowing, Trimming/Weeding, and Planting**
2. **Irrigation**
3. **Fertilizer and Pesticide Management**
4. **Managing Landscape Waste**
5. **Erosion Control**

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for landscape maintenance include:

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools. Refer to Appendix D, Fertilizer and Pesticide Management Guidance for further details.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) will preserve the landscapes water efficiency.
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

1. Mowing, Trimming/Weeding, and Planting

Mowing, Trimming/Weeding

✓ Whenever possible, use mechanical methods of vegetation removal rather than applying herbicides. Use hand weeding where practical.

- ✓ When conducting mechanical or manual weed control, avoid loosening the soil, which could erode into streams or storm drains.
- ✓ Use coarse textured mulches or geotextiles to suppress weed growth and reduce the use of herbicides.
- ✓ Do not blow or rake leaves, etc. into the street or place yard waste in gutters or on dirt shoulders. Sweep up any leaves, litter or residue in gutters or on street.
- ✓ Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this procedure sheet).
- ✓ Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- ✓ Where feasible, retain and/or plant selected native vegetation whose features are determined to be beneficial. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting ornamental vegetation.
- ✓ When planting or replanting consider using low water use groundcovers.

OPTIONAL:

- Careful soil mixing and layering techniques using a topsoil mix or composted organic material can be used as an effective measure to reduce herbicide use and watering.

2. Irrigation

- ✓ Utilize water delivery rates that do not exceed the infiltration rate of the soil.
- ✓ Use timers appropriately or a drip system to prevent runoff and then only irrigate as much as is needed.
- ✓ Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.
- ✓ Where practical, use automatic timers to minimize runoff.
- ✓ Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.
- ✓ If re-claimed water is used for irrigation, ensure that there is no runoff from the landscaped area(s).
- ✓ If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.

3. Fertilizer and Pesticide Management

Usage

- ✓ Utilize a comprehensive management system that incorporates integrated pest management techniques.
- ✓ Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- ✓ Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution.
- ✓ Pesticide application must be under the supervision of a California qualified pesticide applicator.
- ✓ When applicable use the least toxic pesticides that will do the job. Avoid use of copper-based pesticides if possible.
- ✓ Do not mix or prepare pesticides or fertilizers for application near storm drains.
- ✓ Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- ✓ Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- ✓ Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- ✓ Periodically test soils for determining proper fertilizer use.
- ✓ Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- ✓ Inspect pesticide/fertilizer equipment and transportation vehicles daily.
- ✓ Refer to Appendix D for further guidance on Fertilizer and Pesticide management

OPTIONAL:

- Work fertilizers into the soil rather than dumping or broadcasting them onto the surface.
- Use beneficial insects where possible to control pests (green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seedhead weevils, and spiders prey on detrimental pest species).
- Use slow release fertilizers whenever possible to minimize leaching.

Scheduling

- ✓ Do not use pesticides if rain is expected within 24 hours.
- ✓ Apply pesticides only when wind speeds are low (less than 5 mph).

Disposal

- ✓ Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- ✓ Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- ✓ Dispose of empty pesticide containers according to the instructions on the container label.

4. Managing Landscape Waste

Also see Waste Handling and Disposal procedure sheet

- ✓ Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- ✓ Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- ✓ Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.
- ✓ Inspection of drainage facilities should be conducted to detect illegal dumping of clippings/cuttings in or near these facilities. Materials found should be picked up and properly disposed of.
- ✓ Landscape wastes in and around storm drain inlets should be avoided by either using bagging equipment or by manually picking up the material.

5. Erosion Control

Also see Waste Handling and Disposal procedure sheet

- ✓ Maintain vegetative cover on medians and embankments to prevent soil erosion. Apply mulch or leave clippings to serve as additional cover for soil stabilization and to reduce the velocity of storm water runoff.
- ✓ Minimize the use of disking as a means of vegetation management because the practice may result in erodable barren soil.
- ✓ Confine excavated materials to pervious surfaces away from storm drain inlets, sidewalks, pavement, and ditches. Material must be covered if rain is expected.

LIMITATIONS:

Alternative pest/weed controls may not be available, suitable, or effective in every case.

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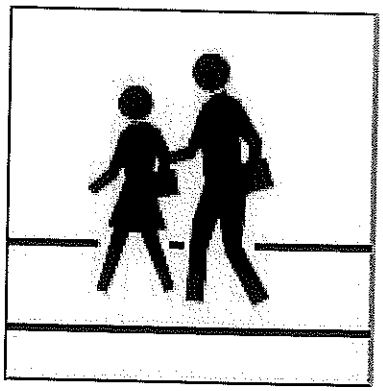

FP-4

SIDEWALK, PLAZA, AND FOUNTAIN MAINTENANCE AND CLEANING

Pollutants on sidewalks and other pedestrian traffic areas and plazas are typically due to littering and vehicle use. Fountain water containing chlorine and copper-based algaecides is toxic to aquatic life. Proper inspection, cleaning, and repair of pedestrian areas and city surfaces and structures can reduce pollutant runoff from these areas. Maintaining these areas may involve one or more of the following activities:

1. **Surface Cleaning**
2. **Graffiti Cleaning**
3. **Sidewalk Repair**
4. **Controlling Litter**
5. **Fountain Maintenance**

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for sidewalk, plaza, and fountain maintenance and cleaning include:

- Use dry cleaning methods whenever practical for surface cleaning activities.
- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal).
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

1. Surface Cleaning

Discharges of wash water to the sto rm water drainage system from cleaning or hosing of impervious surfaces is prohibited.

Sidewalks, Plazas

- ✓ Use dry methods (e.g. sweeping, backpack blowers, vacuuming) whenever practical to clean sidewalks and plazas rather than hosing, pressure washing, or steam cleaning. DO NOT sweep or blow material into curb; use devices that contain the materials.
- ✓ If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.

Parking Areas, Driveways, Drive-thru

- ✓ Parking facilities should be swept/vacuumed on a regular basis. Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- ✓ If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.
- ✓ Sweep all parking lots at least once before the onset of the wet season.
- ✓ Use absorbents to pick up oil; then dry sweep.
- ✓ Appropriately dispose of spilled materials and absorbents.

OPTIONAL:

- Consider increasing sweeping frequency based on factors such as traffic volume, land use, field observations of sediment and trash accumulation, proximity to water courses, etc.

Building Surfaces, Decks, etc., without loose paint

- ✓ Use high-pressure water, no soap.
- ✓ If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.

Unpainted Building Surfaces, Wood Decks, etc.

- ✓ If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.
- ✓ Use a biodegradable cleaning agent or acid wash to remove deposits, wood restorer, or other chemicals. Screen wash water using an appropriate filtering device (e.g. filter fabric), if needed, to catch debris.
- ✓ Make sure pH is between 6.5 and 8.5 THEN discharge to landscaping (if cold water without a cleaning agent) otherwise dispose of properly.

2. Graffiti Cleaning

Graffiti Removal

See Roads, Streets, and Highways Operation and Maintenance procedure sheet.

- ✓ Avoid graffiti abatement activities during rain events.
- ✓ When graffiti is removed by painting over, implement the procedures under Painting and Paint Removal in the Roads, Streets, and Highway Operation and Maintenance procedure sheet.

- ✓ Protect nearby storm drain inlets prior to removing graffiti from walls, signs, sidewalks, or other structures needing graffiti abatement. Clean up afterwards by sweeping or vacuuming thoroughly, and/or by using absorbent and properly disposing of the absorbent.
- ✓ Note that care should be taken when disposing of waste since it may need to be disposed of as hazardous waste.

OPTIONAL:

- Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds).

3. Sidewalk Repair

Surface Removal and Repair

- ✓ Schedule surface removal activities for dry weather if possible.
- ✓ Avoid creating excess dust when breaking asphalt or concrete.
- ✓ Take measures to protect nearby storm drain inlets prior to breaking up asphalt or concrete (e.g. place hay bales or sand bags around inlets). Clean afterwards by sweeping up material.
- ✓ Designate an area for clean up and proper disposal of excess materials.
- ✓ Remove and recycle as much of the broken pavement as possible.
- ✓ When making saw cuts in pavement, use as little water as possible. Cover each storm drain inlet with filter fabric during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains shovel or vacuum the slurry, remove from site and dispose of properly.

Also see the street sweeping section of the Roads, Streets, and Highways Operation and Maintenance procedure sheet.

- ✓ Always dry sweep first to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains. Once dry sweeping is complete, the area may be hosed down if needed. Discharge wash water to landscaping, pump to the sanitary sewer if permitted to do so or contain and dispose of properly.

Concrete Installation and Repair

- ✓ Avoid mixing excess amounts of fresh concrete or cement mortar on-site. Only mix what is needed for the job.
- ✓ Wash concrete trucks off-site or in designated areas on-site, such that there is no discharge of concrete wash water into storm drain inlets, open ditches, streets, or other storm water conveyance structures.

See Roads, Streets, and Highways Operation and Maintenance procedure sheet.

- ✓ Store dry and wet concrete materials under cover, protected from rainfall and runoff and away from drainage areas. After job is complete remove temporary stockpiles (asphalt materials, sand, etc.) and other materials as soon as possible.
- ✓ Return leftover materials to the transit mixer. Dispose of small amounts of

excess concrete, grout, and mortar in the trash.

- ✓ When washing concrete to remove fine particles and expose the aggregate, contain the wash water for proper disposal.
- ✓ Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stock pile, or dispose in the trash.
- ✓ Protect applications of fresh concrete from rainfall and runoff until the material has hardened.

4. Litter Control

- ✓ Enforce anti-litter laws.
- ✓ Provide litter receptacles in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events.
- ✓ Cover litter receptacles and clean out frequently to prevent leaking/spillage or overflow.

OPTIONAL:

- Post "No Littering" signs.

5. Fountain Maintenance

- ✓ Do not use copper-based algaecides. Control algae with chlorine or other alternatives, such as sodium bromide.
- ✓ When draining fountains, never discharge water to a street or storm drain; discharge to the sanitary sewer
- ✓ Allow chlorine to dissipate for a few days and then recycle/reuse water by draining it gradually onto a landscaped area. Water must be tested prior to discharge to ensure that chlorine is not present (concentration must be less than 0.1 ppm).

LIMITATIONS:

Surface cleaning activities that require discharges to the local sanitation agency will require coordination with the agency.

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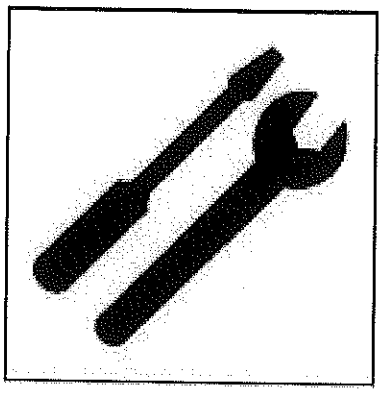

FF-3

EQUIPMENT MAINTENANCE AND REPAIR

Vehicle or equipment maintenance has the potential to be a significant source of stormwater pollution. Engine repair and service (parts cleaning, spilled fuel, oil, etc.), replacement of fluids, and outdoor equipment storage and parking (dripping engines) can all contaminate stormwater. Conducting the following activities in a controlled manner will reduce the potential for stormwater contamination:

1. **General Maintenance and Repair**
2. **Vehicle and Machine Repair**
3. **Waste Handling/Disposal**

Related vehicle maintenance activities are covered under the following program headings in this manual: "Vehicle and Equipment Cleaning", "Vehicle and Equipment Storage", and "Vehicle Fueling".

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for equipment maintenance and repair include:

- Review maintenance activities to verify that they minimize the amount of pollutants discharged to receiving waters. Keep accurate maintenance logs to evaluate materials removed and improvements made.
- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Minimize use of solvents. Clean parts without using solvents whenever possible. Recycle used motor oil, diesel oil, and other vehicle fluids and parts whenever possible.
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

1. General Maintenance and Repair

General Guidelines

➔ Note: Permission must be obtained for any discharge of wash water to the sanitary sewer from the local sewering agency.

- ✓ Review maintenance activities to verify that they minimize the amount of pollutants discharged to receiving waters. Keep accurate maintenance logs to evaluate materials removed and improvements made.
- ✓ Regularly inspect vehicles and equipment for leaks.
- ✓ Move activity indoors or cover repair area with a permanent roof if feasible.
- ✓ Minimize contact of stormwater with outside operations through berming and drainage routing.
- ✓ Place curbs around the immediate boundaries of the process equipment.
- ✓ Clean yard storm drain inlets regularly and stencil them.

Good Housekeeping

➔ Note: Permission must be obtained for any discharge of wash water to the sanitary sewer from the local sewering agency.

- ✓ Avoid hosing down work areas. If work areas are washed and if discharge to the sanitary sewer is allowed, treat water with an appropriate treatment device (e.g. clarifier) before discharging. If discharge to the sanitary sewer is not permitted, pump water to a tank and dispose of properly.
- ✓ Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle or dispose of properly if kept separate.
- ✓ Keep a drip pan under the vehicle while you unclip hoses, unscrew filters, or remove other parts. Place a drip pan under any vehicle that might leak while you work on it to keep splatters or drips off the shop floor.
- ✓ Educate employees on proper handling and disposal of engine fluids.
- ✓ Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- ✓ Do not pour liquid waste to floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections.
- ✓ Post signs at sinks and stencil outdoor storm drain inlets.

2. Vehicle Repair

General Guidelines

Also see Waste Handling procedure sheet

- ✓ Perform vehicle fluid removal or changing inside or under cover where feasible to prevent the run-on of stormwater and the runoff of spills.
- ✓ Regularly inspect vehicles and equipment for leaks, and repair as needed.
- ✓ Use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- ✓ Immediately drain all fluids from wrecked vehicles. Ensure that the drain pan or drip pan is large enough to contain drained fluids (e.g. larger pans are needed to contain antifreeze, which may gush from some vehicles).

- ✓ Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- ✓ Recycle used motor oil, diesel oil, and other vehicle fluids and parts whenever possible.
- ✓ Oil filters disposed of in trash cans or dumpsters can leak oil. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.
- ✓ Store cracked batteries in a non-leaking secondary container and dispose of properly at recycling or household hazardous waste facilities.

Vehicle Leak and Spill Control

- ✓ Use absorbent materials on small spills. Remove the absorbent materials promptly and dispose of properly.
- ✓ Place a stockpile of spill cleanup materials where it will be readily accessible.
- ✓ Sweep floor using dry absorbent material.

3. Machine Repair

Also see the Spill Prevention and Control procedure sheet

- ✓ Keep equipment clean; don't allow excessive build-up of oil or grease.
- ✓ Minimize use of solvents.
- ✓ Use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- ✓ Perform major equipment repairs at the corporation yard, when practical.
- ✓ Following good housekeeping measures in Vehicle Repair section.

4. Waste Handling/Disposal

Waste Reduction

- ✓ Prevent spills and drips of solvents and cleansers to the shop floor.
- ✓ Do liquid cleaning at a centralized station so the solvents and residues stay in one area. Recycle liquid cleaners when feasible.
- ✓ Locate drip pans, drain boards, and drying racks to direct drips back into a solvent sink or fluid holding tank for reuse.

Safer Alternatives

OPTIONAL:

- If possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous material:
  - Use non-caustic detergents instead of caustic cleaning for parts cleaning.

- Use a water-based cleaning service and have tank cleaned. Use detergent-based or water-based cleaning systems in place of organic solvent degreasers.
- Replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check list of active ingredients to see whether it contains chlorinated solvents.
- Choose cleaning agents that can be recycled.

Recycling

Also see Waste Handling procedure sheet

OPTIONAL:

- Separate wastes for easier recycling. Keep hazardous and non-hazardous wastes separate, do not mix used oil and solvents, and keep chlorinated solvents separate from non-chlorinated solvents.
- Label and track the recycling of waste material (e.g. used oil, spent solvents, batteries).
- Purchase recycled products to support the market for recycled materials.

LIMITATIONS:

Space and time limitations may preclude all work being conducted indoors. It may not be possible to contain and clean up spills from vehicles/equipment brought on-site after working hours. Dry floor cleaning methods may not be sufficient for some spills – see spill prevention and control procedures sheet. Identification of engine leaks may require some use of solvents.

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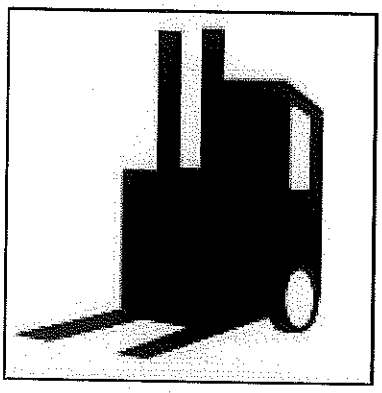


FF-6

MATERIAL LOADING AND UNLOADING

The loading/unloading of materials usually takes place outside; therefore, materials spilled, leaked, or lost during loading/unloading have the potential to collect in the soil or on other surfaces and be carried away by runoff or when the area is cleaned. Additionally, rainfall may wash pollutants from machinery used to unload or move materials. Material loading and unloading involves the following activities:

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for material loading and unloading include:

- Check loading and unloading equipment regularly for leaks.
- Cover loading docks.
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

General Guidelines

✓ Regularly clean work areas to remove materials such as debris, sandblasting material, etc.

✓ Design loading/unloading area to prevent stormwater runon that would include grading or berming the area, and positioning roof downspouts so they direct stormwater away from loading/unloading areas.

✓ Use overhangs or door skirts that enclose the trailer.

✓ Park tank trucks or delivery vehicles so that spills or leaks can be contained.

✓ Avoid loading and exposing materials during rain events unless the loading dock is covered and protected from rain. A seal or door skirt between the trailer and the building may also prevent exposure to rain.

✓ Shipboard cooling and process water discharges should be directed to minimize contact with spent abrasives, paint, and other debris.

Tank truck transfers

- ✓ The area where the transfer takes place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.
- ✓ Transfer area should be designed to prevent runon of stormwater from adjacent areas. Sloping the pad and using a berm around the uphill side of the transfer area should reduce runon.
- ✓ Transfer area should be designed to prevent runoff of spilled liquids from the area. Sloping the area to a drain should prevent runoff. The drain should be connected to a dead-end sump. A positive control valve should be installed on the drain.

Spill Control

Also see Spill Prevention and Control procedures sheet

- ✓ Contain leaks during transfer.
- ✓ Use drip pans under hoses.
- ✓ Have an emergency spill cleanup plan readily available.
- ✓ Place spill kits and materials next to or near each loading/unloading area.
- ✓ Use drip pans or comparable devices when transferring oils, solvents, and paints.

Training

- ✓ Make sure forklift operators are properly trained.
- ✓ Train employees regarding spill containment and cleanup.
- ✓ Employees trained in spill containment and cleanup should be present during the loading/unloading.
- ✓ Use a written operations plan that describes procedures for loading and/or unloading.

Inspection

Also see Spill Prevention and Control procedures sheet

- ✓ Check loading and unloading equipment regularly for leaks, including valves, pumps, flanges and connections.
- ✓ Inspect regularly for leaking valves, pipes, hoses, or soil chutes carrying either water or wastewater.
- ✓ Look for dust or fumes during loading or unloading operations.

LIMITATIONS:

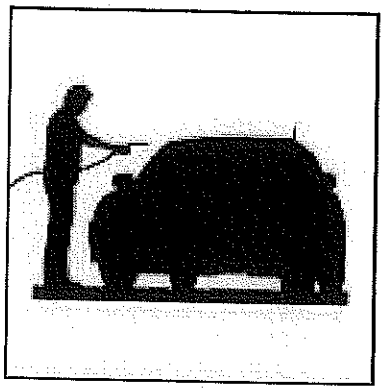
Space and time limitations may preclude all transfers from being performed indoors or under cover. It may not be possible to conduct transfers only during dry weather.

REFERENCES:

California Storm Water Best Management Practice Handbooks. Municipal Best Management Practice Handbook.

Prepared by Camp Dresser & McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.



FF-11

VEHICLE AND EQUIPMENT CLEANING

Vehicle and equipment cleaning activities can contribute toxic hydrocarbons and other organic compounds, oils and greases, nutrients, heavy metals, and suspended solids to stormwater runoff. Use of the procedures outlined below can prevent or reduce the discharge of pollutants to stormwater during vehicle and equipment cleaning.

1. **Inspection and Cleaning of Stormwater Conveyance Structures**
2. **Controlling Illicit Connections and Discharges**
3. **Controlling Illegal Dumping**

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for vehicle and equipment cleaning include:

- Use outside service agencies to clean vehicles and equipment.
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

If your facility washes or steam cleans a large number of vehicles or pieces of equipment, consider contracting out this work to a commercial business. These businesses are better equipped to handle and dispose of the wash waters properly. Contracting out this work can also be economical by eliminating the need for a separate washing/cleaning operation at your facility.

If washing/cleaning must occur on-site follow these procedures:

- ✓ Use designated, covered, wash areas to prevent contact with stormwater and bermed to contain wash water.
- ✓ Designated wash areas must be well marked with signs indicating where and how washing must be done.
- ✓ Water may be discharged to the sanitary sewer after flowing through a clarifier. If the above conditions are not met, other pre-treatment may be

→ Note: Permission must be obtained for any discharge of wash water to the sanitary sewer from the local sewering agency.

required.

✓ Do not permit steam cleaning or engine degreasing at the wash out area.

✓ Washing operations should be conducted in a designated wash area having the following characteristics:

- Paved with Portland cement concrete
- Covered or bermed to prevent contact with storm water
- Sloped for wash water collection
- Connected to the sanitary sewer – upon approval.
- Clearly designated

OPTIONAL:

- Consider filtering and recycling wash water.
- Equip wash areas with oil/water separators.

LIMITATIONS

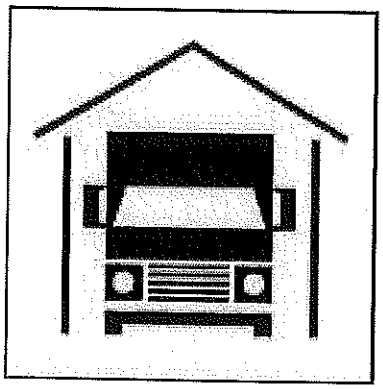
Steam cleaning can generate significant pollutant concentrations requiring permitting, monitoring, pretreatment, and inspections. The measures outlined in this procedure sheet are insufficient to address all the environmental impacts and compliance issues related to steam cleaning.

REFERENCES:

California Storm Water Best Management Practice Handbooks. Municipal Best Management Practice Handbook. Prepared by Camp Dresser & McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

The Stormwater Mangers Resource Center (http://www.stormwatercenter.net/)

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.



FF-12

VEHICLE AND EQUIPMENT STORAGE

Stormwater runoff from vehicle and equipment storage areas can be contaminated with toxic hydrocarbons and other organic compounds, oils and greases, heavy metals, nutrients, and suspended solids. Activities associated with vehicle and equipment storage may involve one or more of the following:

1. **Storing Vehicles and Equipment**
2. **Wrecked Vehicle Storage**
3. **Cleaning Storage Areas**

Related vehicle maintenance activities are covered under the following program headings in this manual: "Vehicle and Equipment Cleaning", "Equipment Maintenance and Repair", and "Vehicle Fueling".

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for vehicle and equipment storage include:

- Use outside service agencies to clean vehicle storage areas and collect water for off-site disposal.
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

1. Storing Vehicles and Equipment

General Guidelines

✓ Place drip pans or absorbent materials under vehicles and heavy equipment when not in use.

✓ Inspect the storage yard for filling drip pans and other problems (leaking equipment) regularly.

✓ Train employees on procedures for storage and inspection items.

Batteries

- ✓ Store batteries that have been dropped or are cracked in a secondary container even if it appears that the acid has already drained.

2. Wrecked Vehicle Storage

- ✓ As the vehicles arrive, place drip pans under them immediately, even if the fluids have leaked out before the car arrives.
- ✓ Drain all fluids from wrecked vehicles and "part" cars. Also drain engines, transmission, and other used parts.
- ✓ Promptly transfer used fluids to the proper container; do not leave full drip pans or other open containers lying around.
- ✓ Do not store vehicles near storm drain inlets.
- ✓ Comply with all applicable State and Federal regulations regarding storage, handling, and transport of petroleum products.

3. Cleaning Vehicle Storage Areas

- ✓ Dry sweep parking lots, storage areas, and driveways at least once per month to collect dirt, waste, and debris, do not hose down the area to a storm drain.
- ✓ Considering using an outside service to clean vehicle storage areas and collect water for off-site disposal.

LIMITATIONS:

It may not be possible to contain and clean up spills from vehicles/equipment brought on-site after working hours.

REFERENCES:

California Storm Water Best Management Practice Handbooks. Municipal Best Management Practice Handbook. Prepared by Camp Dresser & McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Los Angeles County Stormwater Quality Model Programs. Public Agency Activities http://ladpw.org/wmd/npdes/model_links.cfm

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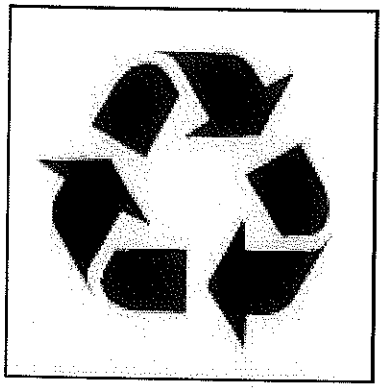

FF-13

WASTE HANDLING AND DISPOSAL

Improper storage of solid wastes can allow toxic compounds, oils and greases, heavy metals, nutrients, suspended solids, and other pollutants to enter stormwater runoff. The discharge of pollutants to stormwater from waste handling and disposal can be prevented and reduced by tracking waste generation, storage, and disposal; reducing waste generation and disposal through source reduction and recycling; and preventing run-on and runoff. Proper waste handling and disposal activities include the following:

1. **Litter Control**
2. **Waste Collection**
3. **Spill/Leak Control**
4. **Run-on/Runoff Prevention**

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for waste handling and disposal include:

- Reuse products when possible.
- Recycle leftover products that are recyclable.
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

1. Litter Control

General Guidelines

✓ Enforce anti-litter laws.

✓ Provide a sufficient number of litter receptacles at each fixed facility.

✓ Clean out and cover litter receptacles frequently to prevent spillage.

OPTIONAL:

- Post "No Littering" signs.
- Place trash receptacles at transit stops and maintain as necessary

2. Waste Collection

General Guidelines

✓ Keep waste collection areas clean.

✓ Regularly inspect solid waste containers for structural damage. Repair or replace damaged containers as necessary.

✓ Secure solid waste containers; containers should be closed tightly when not in use.

✓ Do not fill waste containers with washout water or any other liquid.

✓ Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc. may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).

✓ Do not mix liquid wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal.

Good Housekeeping

➔ Note: Permission must be obtained for any discharge of wash water to the sanitary sewer from the local sewering agency.

✓ Use the entire product before disposing of the container.

✓ The waste management area should be kept clean by sweeping and cleaning up spills immediately.

✓ When cleaning around dumpster areas use dry methods when possible (e.g. sweeping, use of absorbents). If water must be used after sweeping/using absorbents, collect water and discharge to landscaped area or discharge through grease interceptor to the sewer if permitted to do so.

Chemical/Hazardous Waste Management

✓ All hazardous waste must be labeled according to hazardous waste regulations. Consult your Fire Department or your local hazardous waste agency for details.

✓ Educate/train employees and subcontractors in proper hazardous waste handling management practices.

✓ Handle hazardous materials as infrequently as possible. Only properly trained personnel should handle hazardous waste.

✓ Select designated hazardous waste collection areas on-site and make sure that hazardous waste is collected, removed, and disposed of only at these authorized disposal areas.

✓ Hazardous wastes may only be stored for 90 days or less, unless the facility obtains a permit.

✓ Hazardous materials and wastes should be stored in covered containers and protected from vandalism.

✓ Place hazardous waste containers in secondary containment.

✓ Stencil storm drains on the facility's property

Waste Reduction/ Recycling

✓ Recycle materials whenever possible.

OPTIONAL:

- Reduce the amount of waste generated by using source controls such as:
  - Production planning and sequencing
  - Process or equipment modification
  - Raw material substitution or elimination
  - Loss prevention and housekeeping
  - Waste segregation and separation
  - Close loop recycling
- Establish a material tracking system to increase awareness about material usage. This may reduce spills and minimize contamination, thus reducing the amount of waste produced.

3. Spill/Leak Control:

Also see Spill Prevention and Control procedure sheet

✓ Clean up spills immediately.

✓ Spill cleanup materials should be placed where they are easily accessible.

✓ Minimize spillage/leaking from solid waste containers. For larger solid waste containers (especially compactors) that utilize a hydraulic fluid pump system, regularly inspect and replace faulty pumps or hoses to minimize the potential of releases and spills.

✓ Check waste management areas for leaking containers or spills.

✓ Leaking equipment including valves, lines, seals, or pumps should be repaired promptly.

✓ Transfer waste from damaged containers into safe containers.

✓ Vehicles transporting waste should have spill prevention equipment that can prevent spills during transport. The spill prevention equipment includes:

- Vehicles equipped with baffles for liquid waste
- Trucks with sealed gates and spill guards for solid waste

✓ Special care should be taken when loading or unloading wastes See Loading and Unloading procedure sheet.

4. Run-on/Runoff Prevention

- ✓ Prevent stormwater run-on from entering waste management areas by enclosing the area or building a berm around the area.
- ✓ Prevent the waste materials from directly contacting rain.
- ✓ Cover waste areas with a permanent roof if feasible. If not feasible, cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.
- ✓ If possible, move the activity indoors; ensuring first that all safety concerns such as fire hazard and ventilation are addressed.
- ✓ Dumpsters should be covered to prevent rain from washing waste out of holes or cracks in the bottom of the dumpster.

OPTIONAL:

- Minimize the runoff of stormwater for land application by:
  - Choosing a site where slopes are under 6%, the soil is permeable, there is a low water table, it is located away from wetlands or marshes, there is a closed drainage system.
  - Avoiding application of waste to the site when it is raining or when the ground is saturated with water.
  - Growing vegetation on land disposal areas to stabilize soils and reduce the volume of surface water runoff from the site.
  - Maintaining adequate barriers between the land application site and the receiving waters. Planted strips are particularly good.
  - Using erosion control techniques such as mulching and matting, filter fences, straw bales, diversion terracing, and sediment basins.
  - Performing routine maintenance to ensure the erosion control or site stabilization measures are working.

LIMITATIONS:

Hazardous waste cannot be re-used or recycled; it must be disposed of by a licensed hazardous waste hauler.

REFERENCES:

Bay Area Stormwater Management Agencies Association. 1996. Pollution From Surface Cleaning.

California Storm Water Best Management Practice Handbooks. Municipal Best Management Practice Handbook. Prepared by Camp Dresser & McKee, Larry Walker Associates, Uribe and Associates, Resources Planning

Associates for Stormwater Quality Task Force. March 1993.

Harvard University. 2002. Solid Waste Container Best Management Practices – Fact Sheet On-Line Resources – Environmental Health and Safety.

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FP-3

ROADS, STREETS, AND HIGHWAYS OPERATION AND MAINTENANCE

Streets, roads, and highways are significant sources of pollutants in storm water discharges, and operation and maintenance (O&M) practices, if not conducted properly, can contribute to the problem. O&M practices may involve one or more of the following activities:

1. **Sweeping & Cleaning**
2. **Street Repair & Maintenance**
3. **Bridge and Structure Maintenance**

Streets, roads, and highways are significant sources of pollutants in storm water discharges, and operation and maintenance (O&M) practices, if not conducted properly, can contribute to the problem. O&M practices may involve one or more of the following activities:

Pollution prevention measures that should be consider and the minimum required and optional model procedures for each performance standard are provided below.

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measure for roads, streets, and highways operation and maintenance include:

- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal)
- Recycle paint and other materials whenever possible.
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

1. Sweeping & Cleaning

Sweeping Frequency and Timing

- ✓ Maintain a consistent sweeping schedule. Provide minimum monthly sweeping of streets.
- ✓ Perform street cleaning during dry weather if possible.
- ✓ Avoid wet cleaning or flushing of streets, and utilize dry methods where possible.
- ✓ If flushing of a street is absolutely necessary, sweep and remove debris before flushing. Do not let wash water enter storm drain inlets. Collect wash water and direct to a dirt or vegetated area, pump into a vacuum truck and dispose of properly.

OPTIONAL:

- Consider increasing sweeping frequency based on factors such as traffic volume, land use, field observations of sediment and trash accumulation, proximity to water courses, etc.

Equipment Operation and Selection

- ✓ Maintain cleaning equipment in good working condition and purchase replacement equipment as needed. Old sweepers should be replaced as needed with new technologically advanced sweepers (preferably regenerative air sweepers) that maximize pollutant removal.
- ✓ Operate sweepers at manufacturer requested optimal speed levels to increase effectiveness.
- ✓ Clean sweepers at a wash rack that drains to the sanitary sewer. The wash rack area should be covered and bermed and wash water should drain to a clarifier prior to entering the sanitary sewer.
- ✓ Regularly inspect vehicles and equipment for leaks, and repair immediately.

➔ Note: Permission must be obtained for any discharge of wash water to the sanitary sewer from the local sewering agency.

OPTIONAL:

- If available use vacuum or regenerative air sweepers in the high sediment and trash areas (typically industrial/commercial).

Management of Material Removed by Sweeping

- ✓ Dispose of street sweeping debris and dirt at a landfill.
- ✓ Do not store swept material along the side of the street or near a storm drain inlet.
- ✓ If dewatering of saturated materials is necessary it should be conducted in a designated area away from storm drain inlets and the water contained for proper disposal.

➔ Note: Permission must be obtained for any discharge of wash water to the sanitary sewer from the local sewering agency.

- ✓ If authorized by the local sanitation agency, water may be discharged to the sanitary sewer only after passing through a clarifier. As an alternative, dewatering can be conducted in a containment area in which saturated materials are placed on a tarp and allowed to dry. Dry debris is then disposed of properly.
- ✓ Keep debris storage to a minimum during the wet season or make sure debris piles are contained (e.g. by berming the area) or covered (e.g. with tarps or permanent covers).

Maximize Access for Sweepers

- ✓ Keep accurate operation logs to track program.
- ✓ Properly maintain and operate equipment; which will increase efficiency.
- ✓ Sweeping should be conducted as close to the curb line as possible.

OPTIONAL:

- Institute a parking policy to restrict parking in problematic areas during periods of street sweeping.
- Post permanent street sweeping signs in problematic areas; use temporary signs if installation of permanent signs is not possible.
- Develop and distribute flyers notifying residents of street sweeping schedules.

2. Repair and Maintenance

Pavement Marking

- ✓ Develop paint handling procedures for proper use, storage, and disposal of paints.
- ✓ Transfer and load paint and hot thermoplastic away from storm drain inlets.
- ✓ Street or hand sweep thermoplastic grindings. Yellow thermoplastic grindings may require special handling as they may contain lead.
- ✓ Replace paints containing lead and tributyltin with less toxic alternatives.
- ✓ Use water based paints. Clean application equipment in a sink that is connected to the sanitary sewer.
- ✓ Properly store leftover paints if they are to be kept for the next job, or dispose of properly.
- ✓ See Spill Control procedure sheet for guidance on the proper cleanup of paint spills.

Concrete Installation and Repair

- ✓ Avoid mixing excess amounts of fresh concrete or cement mortar on-site. Only mix what is needed for the job.
- ✓ Wash concrete trucks off site or in designated areas on site, such that there is no discharge of concrete wash water into storm drain inlets, open ditches, streets, or other stormwater conveyance structures.

- ✓ Store concrete materials under cover, away from drainage areas.
- ✓ Return leftover materials to the transit mixer. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- ✓ Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.
- ✓ When washing poured concrete areas to remove fine particles and expose the aggregate, contain the wash water for proper disposal; do not discharge water to the storm drain system.
- ✓ Do not allow excess concrete to be dumped on-site, except in designated areas.
- ✓ Apply concrete, asphalt, and seal coat during dry weather to allow the material to adequately dry prior to a rain event.
- ✓ When making saw cuts in pavement, use as little water as possible and perform during dry weather. Cover each nearby or appropriate storm drain inlet completely with filter fabric or plastic during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site. Alternatively, a small on-site vacuum may be used to pick up the slurry as this will prohibit slurry from reaching storm drain inlets.

Patching, Resurfacing, and Surface Sealing

- ✓ Pre-heat, transfer or load hot bituminous material away from storm drain inlets.
- ✓ Apply concrete, asphalt, and seal coat during dry weather to allow the material to adequately dry prior to a rain event.
- ✓ Where applicable, cover and seal each nearby or appropriate storm drain inlet (with waterproof material, plastic or mesh) and maintenance holes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from covered man holes and storm drain inlets when the job is complete.
- ✓ Use only as much water as necessary for dust control, to avoid runoff.
- ✓ Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.
- ✓ Prior to a rain event or at the completion of a project, sweep the project area by hand or with a street sweeper.

Equipment Cleaning, Maintenance, and Storage

Also see Equipment Repair & Maintenance procedure sheet.

- ✓ Clean equipment including sprayers, sprayer paint supply lines, patch and paving equipment, and mudjacking equipment at the end of each day. If equipment can be cleaned and materials reapplied at the job site, do so in compliance with the laws and regulations. Clean in a sink or other area (e.g. vehicle wash area) that is connected to the sanitary sewer.

✓ If refueling or repairing vehicles and equipment must be done on-site, conduct the activity away from storm drain inlets and watercourses.

➔ Note: Permission must be obtained for any discharge of wash water to the sanitary sewer from the local sewering agency.

✓ Place drip pans or absorbent materials under heavy equipment when not in use.

✓ Clean paint brushes and tools covered with water-based paints in sinks connected to sanitary sewers. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.

OPTIONAL:

- Conduct cleaning at a corporation or maintenance yard if possible.
- When practical, perform major equipment repairs at the corporation yard.

➔ In addition to the procedures above, review and apply general procedures outlined for Minor Construction activities when conducting street, road, and highway repair and maintenance activities.

3. Bridge and Structure Maintenance

Painting and Paint Removal

✓ Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.

✓ Do not transfer or load paint near storm drain inlets or watercourses.

✓ Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint container.

✓ If sand blasting is used to remove paint, cover nearby storm drain inlets prior to starting work.

✓ If the bridge crosses a watercourse, perform work on a maintenance traveler or platform, or use suspended netting or tarps to capture paint, rust, paint removing agents, or other materials, to prevent discharge of materials to surface waters. If sanding, use a sander with a vacuum filter bag.

✓ Recycle paint when possible (e.g. paint may be used for graffiti removal activities). Dispose of paint at an appropriate household hazardous waste facility.

✓ See Spill Control procedure sheet for guidance on the proper cleanup of paint spills.

Graffiti Removal

✓ Avoid graffiti abatement activities during rain events.

✓ Protect nearby storm drain inlets prior to removing graffiti from walls, signs, sidewalks, or other structures needing graffiti abatement. Clean up

afterwards by sweeping or vacuuming thoroughly, and/or by using absorbent and properly disposing of the absorbent.

- ✓ Note that care should be taken when disposing of waste since it may need to be disposed of as hazardous waste.
- ✓ When graffiti is removed by painting over, implement the procedures under Painting and Paint Removal above.
- ✓ Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a landscaped or dirt area.
- ✓ If a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound), plug nearby storm drains and collect wash water and dispose of properly.

OPTIONAL:

- Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds).

Guardrail and Fence Repair

- ✓ When cleaning guardrails or fences follow the appropriate surface cleaning methods (depending on the type of surface) outlined in the Sidewalk, Plaza, and Fountain Maintenance and Cleaning procedure sheet.
- ✓ If painting is conducted, follow the Painting and Paint Removal procedures above.
- ✓ If graffiti removal is conducted, follow the Graffiti Removal procedures above.
- ✓ If construction takes place, see the procedure sheet for Minor Construction.
- ✓ Recycle materials whenever possible.

LIMITATIONS:

Limitations related to street sweeping may inc lude high equipment costs, the potential inability to restrict parking in urban areas, the need for sweeper operator training, the inability of current sweeper technology to remove oil and grease, and the lack of scientific evidence regarding the expected levels of pollutant removal.

REFERENCES:

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

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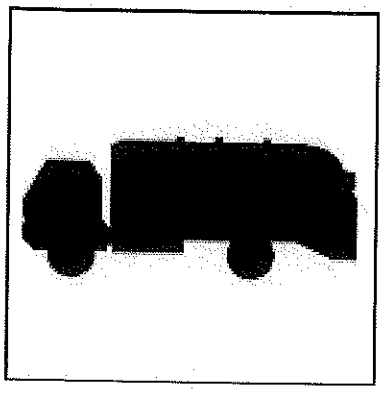


FP-5

SOLID WASTE HANDLING

It is important to control litter to eliminate trash and other materials in storm water runoff. Waste reduction is a major component of waste management and should be encouraged through training and public outreach. Management of waste once it is collected may involve reuse, recycling, or proper disposal. Specific solid waste handling activities may include one or more of the following:

1. **Solid Waste Collection**
2. **Waste Reduction and Recycling**
3. **Hazardous Waste Collection**
4. **Litter Control**

Reduce by purchasing only the amount needed.
Reuse products when possible.
Recycle leftover products that are recyclable, and dispose of other wastes safely.

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for solid waste handling include:

- Reuse products when possible.
- Recycle leftover products that are recyclable.
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

1. Solid Waste Collection

✓ Implement procedures, where applicable, to collect, transport, and dispose of solid waste at appropriate disposal facilities in accordance with applicable federal, state, and local laws and regulations. Optional disposal options include the reuse and recycling of appropriate materials (see following sections).

- ✓ Include properly designed trash storage areas.
- ✓ Regularly inspect solid waste containers for structural damage. Repair or replace damaged containers as necessary.
- ✓ Secure solid waste containers; containers must be closed tightly when not in use.
- ✓ Do not fill waste containers with washout water or any other liquid.
- ✓ Remove all debris from containers prior to cleaning with water. Only clean out containers in a designated area that drains to a washrack that is connected to a sanitary sewer.
- ✓ Minimize spillage/leaking from solid waste containers. For larger solid waste containers (especially compactors) that utilize a hydraulic fluid pump system, regularly inspect and replace faulty pumps or hoses to minimize the potential of releases and spills.

Also see Emergency Spill Response procedure sheet.

- ✓ Ensure that only appropriate solid wastes are disposed of. Certain wastes such as hazardous wastes, appliances, fluorescent bulbs, pesticides, etc. may not be disposed of in solid waste containers.

2. Waste Reduction and Recycling

Although many types of waste can be recycled, recycling options for each waste type may be limited. All gasoline, antifreeze, waste oil, and lead-acid batteries can be recycled. Latex and oil-based paint can be reused, as well as recycled. Materials that cannot be reused or recycled should be disposed of properly.

- ✓ Provide containers for the collection and storage of recyclable materials.
- ✓ Do not mix liquid wastes, this can cause chemical reactions or make recycling impossible and complicate disposal.
- ✓ Recycle used motor oil. Municipalities are required to have a used oil recycling element within their integrated waste management plan.

> *CalRecycle has a Recycling Hotline, (800) RECYCLE, that provides information and recycling locations for used oil.*

3. Hazardous Waste Collection

Household hazardous wastes (HHW) are defined as waste materials which are typically found in homes or similar sources, which exhibit characteristics such as: corrosivity, ignitability, reactivity, and/or toxicity, or are listed as hazardous materials by EPA.

List of most common HHW products:
Drain opener
Oven cleaners
Wood and metal cleaners and polishes
Paint Thinners
Automotive oil and fuel additives
Adhesives
Grease and rust solvents Batteries
Herbicides
Paint strippers and removers Pesticides
Fungicides/wood preservatives
Starter fluids
Carburetor and fuel injection cleaners

✓ Follow proper storage and disposal measures for hazardous waste materials as identified on packaging or Material Safety Data Sheets.

✓ Emergencies related to hazardous waste should be reported to 911

OPTIONAL:

- Identify and promote use of non-hazardous alternatives.
- Promote household hazardous waste (HHW) reuse and recycling.

4. Litter Control

✓ Enforce anti-litter laws.

✓ Provide litter receptacles in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events.

✓ Clean out and cover litter receptacles frequently to prevent overflow.

✓ Increase litter control for events generating substantial quantities of litter.

OPTIONAL:

- Post "No Littering" signs
- Place trash receptacles at transit stops and maintain as necessary.
- Participate in and/or organize additional clean-up programs (e.g., "Coastal Clean Up Day", "Pride Days", "Volunteer Connection Days").

REFERENCES:

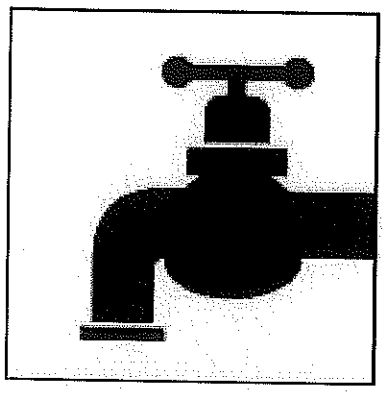
Bay Area Stormwater Management Agencies Association. 1996. *Pollution From Surface Cleaning.*

California Storm Water Best Management Practice Handbooks. Municipal Best Management Practice Handbook. Prepared by Camp Dresser & McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

Environmental Protection Agency (EPA). *Pollution Prevention and Good Housekeeping for Municipal Operations Storm Water. Pet Waste Collection.* Office of Wastewater Management. Online:

http://www.epa.gov/npdes/menuofbmps/poll_3.htm

Harvard University. 2002. Solid Waste Container Best Management Practices – Fact Sheet On-Line Resources – Environmental Health and Safety.



FP-6

WATER AND SEWER UTILITY OPERATION AND MAINTENANCE

Although the operation and maintenance of public utilities are not considered themselves a chronic source of stormwater pollution, some activities and accidents can result in the discharge of pollutants that can pose a threat to both human health and the quality of receiving waters if they enter the storm drain system. Activities associated with the operation and maintenance of water and sewer utilities to prevent and handle such incidents include the following:

1. **Water Line Maintenance**
2. **Sanitary Sewer Maintenance**
3. **Spill/Leak/Overflow Control, Response, and Containment**

Cities that do not provide maintenance of water and sewer utilities should coordinate with the contracting agency responsible for these activities and ensure that these model procedures are followed.

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for water and sewer utility operation and maintenance include:

- Inspect potential non-storm water discharge flow paths and clear/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

1. Water Line Maintenance

Procedures can be employed to reduce pollutants from discharges associated with water utility operation and maintenance activities. Planned discharges may include fire hydrant testing, flushing water supply mains after new construction, flushing lines due to complaints of taste and odor, dewatering mains for maintenance work. Unplanned discharges from treated, recycled water, raw water, and groundwater systems operation and maintenance activities can occur from water main breaks, sheared fire hydrants, equipment malfunction, and operator error.

Planned Discharges

✓ For planned discharges use one of the following options:

- Reuse water for dust suppression, irrigation, or construction compaction
- Discharge to the sanitary sewer system with approval
- Discharge to the storm drain system or to a creek using applicable pollution control measures listed below (this option is ONLY applicable to uncontaminated pumped ground water, water line flushing, fire hydrant testing and flushing, discharges from potable water sources other than water main breaks) and may require a permit from the Regional Water Quality Control Board.

✓ If water is discharged to a storm drain inlet (catch basin), control measures must be put in place to control potential pollutants (i.e. sediment, chlorine, etc.). Examples of some storm drain inlet protection options include:

- Silt fence – appropriate where the inlet drains a relatively flat area.
- Gravel and wire mesh sediment filter – Appropriate where concentrated flows are expected.
- Wooden weir and fabric – use at curb inlets where a compact installation is desired.

✓ Prior to discharge, inspect discharge flow path and clear/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).

✓ Select appropriate pollution control measure(s) considering the receiving system (i.e. curb inlet, drop inlet, culvert, creek, etc.) and ensure that the control device(s) fit properly.

✓ General design considerations for inlet protection devices include the following:

- The device should be constructed such that cleaning and disposal of trapped sediment is made easy, while minimizing interference with discharge activities.
- Devices should be constructed so that any standing water resulting from the discharge will not cause excessive inconvenience or flooding/damage to adjacent land or structures.

✓ The effectiveness of control devices must be monitored during the discharge period and any necessary repairs or modifications made as needed.

OPTIONAL:

- Sediment removal may be enhanced by placing filter fabric, gravel bags, etc. at storm drain inlets.

Unplanned Discharges

✓ Stop the discharge as quickly as possible by turning off water source.

✓ Inspect flow path of the discharged water:

- Control erosion along the flow path.
- Identify areas that may produce significant sediment or gullies, use sandbags to redirect the flow.
- Identify erodible areas which may need to be repaired or protected during subsequent repairs or corrective actions

✓ If repairs or corrective action will cause additional discharges of water, select the appropriate procedures for erosion control, chlorine residual, turbidity, and chemical additives. Prevent potential pollutants from entering the flow path and ensure that no additional discharged water enters storm drain inlets.

2. Sanitary Sewer Maintenance

Applicable to municipalities who own and operated a sewage collection system. Facilities that are covered under this program include sanitary sewer pipes and pump stations owned and operated by the Permittee. The owner of the sanitary sewer facilities is the entity responsible for carrying out this prevention and response program.

Sewer System Cleaning

- ✓ Sewer lines should be cleaned on a regular basis to remove grease, grit, and other debris that may lead to sewer backups.
- ✓ Establish routine maintenance program. Cleaning should be conducted at an established minimum frequency and more frequently for problem areas such as restaurants that are identified
- ✓ Cleaning activities may require removal of tree roots and other identified obstructions.

Preventative and Corrective Maintenance

- ✓ During routine maintenance and inspection note the condition of sanitary sewer structures and identify areas that need repair or maintenance. Items to note may include the following:
  - cracked/deteriorating pipes
  - leaking joints/seals at manhole
  - frequent line plugs
  - line generally flows at or near capacity
  - suspected infiltration or exfiltration
- ✓ Document suggestions and requests for repair and report the information to the appropriate manager or supervisor.
- ✓ Prioritize repairs based on the nature and severity of the problem. Immediate clearing of blockage or repair is required where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, sewer line blockages). These repairs may be temporary until scheduled or capital improvements can be completed.
- ✓ Review previous sewer maintenance records to help identify "hot spots" or areas with frequent maintenance problems and locations of potential system failure.

3. Spill/Leak/Overflow Control, Response, and Containment

Control

Also see Drainage System procedures sheet

- ✓ Refer to countywide Illicit Discharge Detection and Elimination Program. Components of this program include:
  - Investigation/inspection and follow-up
  - Elimination of illicit discharges and connections
  - Enforcement of ordinances
  - Respond to sewage spills

- Facilitate public reporting of illicit discharges and connections. A citizen's hotline for reporting observed overflow conditions should be established to supplement the field screening efforts being conducted by the Principal Permittee.

Response and Containment

✓ Establish lead department/agency responsible for spill response and containment. Provide coordination within departments.

✓ When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system to the maximum extent practicable by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.).

✓ If a spill reaches the storm drain notify County of Orange Health Care Agency through Control One at (714) 628-7208.

✓ Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.

✓ Record required information at the spill site.

✓ Perform field tests as necessary to determine the source of the spill.

✓ Develop additional notification procedures regarding spill reporting as needed.

LIMITATIONS:

Private property access rights needed to perform testing along storm drain right-of-ways. Requirements of municipal ordinance authority for suspected source verification testing necessary for guaranteed rights of entry.

REFERENCES:

California Storm Water Best Management Practice Handbooks. Municipal Best Management Practice Handbook. Prepared by Camp Dresser & McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

Los Angeles County Stormwater Quality. Public Agency Activities Model Program. On-line: http://ladpw.org/wmd/npdes/public_TC.cfm

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

Santa Clara Valley Urban Runoff Pollution Prevention Program. Water Utility Pollution Prevention Plan.

DF-1
DRAINAGE FACILITY OPERATION AND MAINTENANCE

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and storm water that may contain certain pollutants. Consequently these pollutants may accumulate in the system and must be removed periodically. In addition, the systems must also be maintained to function properly hydraulically to avoid flooding. Maintaining the system may involve the following activities:

1. Inspection and Cleaning of Stormwater Conveyance Structures
2. Controlling Illicit Connections and Discharges
3. Controlling Illegal Dumping

This list of Model Maintenance Procedures can be utilized as an inspection checklist to determine where better compliance with Designated Minimum Best Management Practices (notated with checkmarks and capital letters) is needed, and to recommend Additional Best Management Practices (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. BMPs applicable to certain constituents are notated as:

Bacteria (BACT) Sediment (SED) Nutrients (NUT) Oil and Grease (O&G) Pesticides (PEST)
OtherToxic Compounds (TOX) Trash (TRASH) Hydrological Impacts (HYD) Any/All or General (ANY)

Program/Facility Being Inspected: _____

Date: _____ Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

MAINTENANCE PROCEDURES:

1. Inspection and Cleaning of Drainage Facilities

Unsatisfactory	OK	General Guidelines
☐ _____	☐	T 1A. Annually inspect and clean drainage structures as needed.
☐ _____	☐	T 1B. Maintain appropriate records of cleaning and inspections.
☐ _____	☐	T 1C. Properly dispose of removed materials at a landfill or recycling facility.
☐ _____	☐	T 1D. Conduct intermittent supplemental visual inspections during the wet season to determine if there are problem inlets where sediment/trash or other pollutants accumulate, and provide for additional cleanouts as appropriate.
☐ _____	☐	T 1E. Prevent or clean up any discharges that may occur during the course of maintenance and cleaning procedures.
☐ _____	☐	T 1F. Verify that appropriate employees or subcontractors are trained in proper conductance of maintenance activities, including record keeping and disposal.
☐ _____	☐	T 1G. Annually inspect and clean v-ditches as needed, prior to the wet season. On shrub-covered slopes, vegetative debris may be placed on the downhill side of the ditch. Trash should be bagged and disposed at a landfill.

Unsatisfactory	OK
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐

General Guidelines (cont.)

- 1a. Remove trash or debris as needed from open channels. It should be noted that major vegetative debris removal may require other regulatory permits prior to completing the work. (TRASH)
- 1b. Consider retrofitting energy dissipaters (e.g. riprap) below culvert outfalls to minimize potential for erosion. (SED)
- 1c. Repair any v-ditches that have cracked or displaced in a manner that accelerates erosion. (SED)
- 1d. If suspicious conditions appear to exist, test selected samples of the removed wastes for compliance with hazardous waste regulations prior to disposal. (TOX)
- 1e. Consider more frequent regular cleaning of selected drainage structures to help address ongoing specific impairments. (SED, BACT, NUT, TRASH)
- 1f. Consider structural retrofits to the MS4 to help address ongoing specific impairments (SED, BACT, NUT, TRASH, O&G)
- 1g. Consider cleaning out pipes at gradient breaks or other in-pipe debris accumulation points as identified/needed. (ANY, BACT, NUT, TRASH)

Storm Drain Flushing

- 1h. Flushing of storm drains or storm drain inlets should only be done when critically necessary and no other solution is practical. (SED, BACT, TRASH).
- 1i. If flushed, to the extent practical the material should be collected (vacuumed), treated with an appropriate filtering device to remove sand and debris and disposed of properly. (SED)

Waste Management

T 1H. Store wastes collected from cleaning activities of the drainage facilities in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.

- 1j. Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device to remove the sand and debris prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not permitted, water should be pumped or vacuumed to a tank and properly disposed of. Do not dewater near a storm drain or stream. (SED, TRASH)
- 1k. Provide for laboratory analysis of at least one randomly collected sediment (less the debris) sample per year from the storm drain inlet leaning program to ensure that it does not meet the EPA criteria for hazardous waste. If the sample is determined to be hazardous, the sediment must be disposed of as hazardous waste and the source should be investigated. (TOX).

2. Controlling Illicit Connections and Discharges

Unsatisfactory	OK	General Guidelines
☐ _____	☐	T 2A. Report prohibited discharges such as dumping, paint spills, abandoned oil containers, etc. observed during the course of normal daily activities so they can be investigated, contained, and cleaned up.
☐ _____	☐	T 2B. Where field observations and/or monitoring data indicate significant problems, conduct field investigations to detect and eliminate existing illicit connections and improper disposal of pollutants into the storm drain (i.e. identify problem areas where discharges or illegal connections may occur and follow up stream to determine the source(s)). (Refer to Appendices A-10 and A-11.)
☐ _____	☐	T 2C. Report all observed illicit connections and discharges to the 24-hour water pollution problem reporting hotline (714) 567-6363.
☐ _____	☐	T 2D. Encourage public reporting of improper waste disposal by distributing public education materials and advertising the 24-hour water pollution problem reporting hotline.
		Storm Drain Stenciling ("No Dumping—Drains to Ocean")
☐ _____	☐	T 2E. Implement and maintain a storm drain stenciling program.
☐ _____	☐	• 2a. Consider adding the hotline number to the storm drain stencils (BACT, TOX, TRASH).

3. Controlling Illegal Dumping

		Field Investigation
☐ _____	☐	T 3A. Report prohibited discharges such as dumpings observed during the course of normal daily activities so they can be investigated, contained and cleaned up.
☐ _____	☐	T 3B. Conduct field investigations to detect and eliminate improper disposal of pollutants into the storm drain (i.e. identify problem areas where discharges or illegal connections may occur and follow up stream to determine the source(s)).
☐ _____	☐	T 3C. Report all observed illegal dumping to the 24-hour water pollution problem reporting hotline (714) 567-6363.
☐ _____	☐	T 3D. Encourage public reporting of improper waste disposal by distributing public education materials and advertising the 24-hour water pollution problem reporting hotline.
☐ _____	☐	T 3E. If perpetrator can be identified, take appropriate enforcement action.
☐ _____	☐	• 3a. Consider posting "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs could also indicate fines and penalties for illegal dumping. (ANY)

Unsatisfactory	OK	Training/Education/Outreach
☐ _____	☐	T 3F. Verify that appropriate employees and subcontractors are trained to recognize and report illegal dumping.
☐ _____	☐	T 3G. Encourage public reporting of illegal dumping by advertising the 24-hour water pollution problem reporting hotline (714) 567-6363.
☐ _____	☐	• 3b. Take extra steps to educate the public in neighborhoods where illegal dumping has occurred to inform them why illegal dumping is a problem, and that illegal dumping carries a significant financial penalty. (ANY)

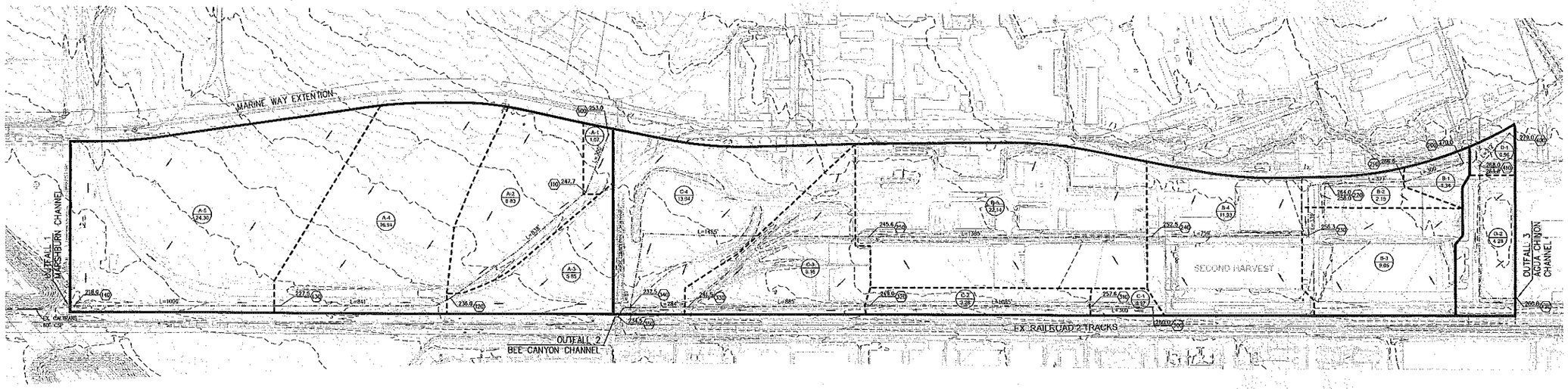
LIMITATIONS:

Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.

B

Attachment B

Hydrology Maps, HCOC Backup Calculations (2-year, 24-hour AES files), and Bio-filtration basin Calculations



OUTFALL	RECEIVING WATER	TRIBUTARY AREA (AC)		Q25 (CFS)		Q100 (CFS)	
		EXISTING	PROPOSED	EXISTING	PROPOSED	EXISTING	PROPOSED
1	MARSHBURN CHANNEL	56.99	49.58	75.25	102.53	101.75	133.63
2	BEE CANYON CHANNEL	73.98	83.30	130.87	153.80	171.84	199.96
3	AGUA CHINON CHANNEL	5.24	3.33	14.83	10.82	19.36	13.92
TOTAL		136.21	136.21	220.95	267.15	292.95	347.51

N

0 200 300 400

(IN FEET)
1 INCH = 200 FEET

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	REVISIONS			

PRELIMINARY HYDROLOGY MAP
EXISTING CONDITION

EL TORO DEVELOPMENT - ORANGE COUNTY
LOWE ENTERPRISES REAL ESTATE GROUP
WINCHESTER TRIANGLE, COUNTY OF ORANGE
IRVINE, CALIFORNIA

DRAWN: RH
DATE: 2015.11.16
CHECKED: -
DATE: -
REVISION # -
DATE: -
JOB NO: SP7531

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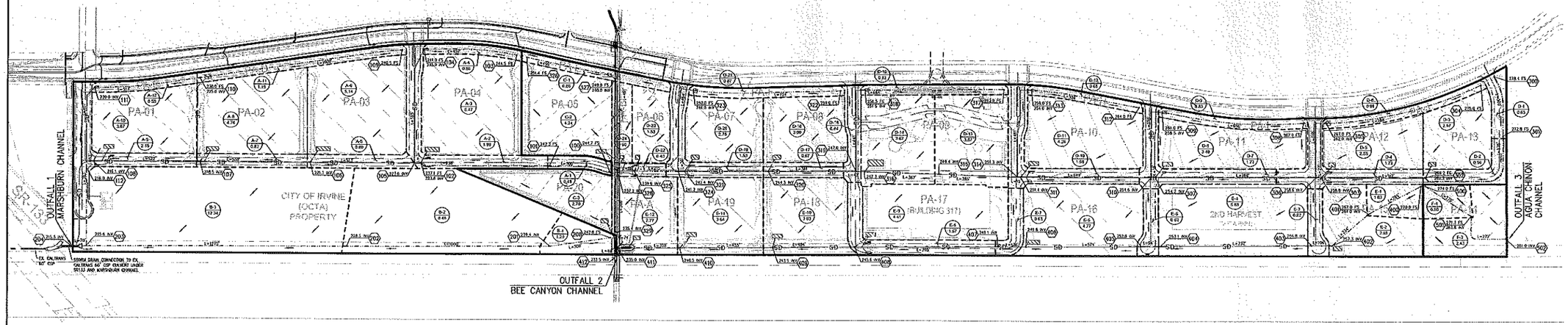

OUTFALL	RECEIVING WATER	TRIBUTARY AREA (AC)		Q25 (CFS)		Q100 (CFS)	
		EXISTING	PROPOSED	EXISTING	PROPOSED	EXISTING	PROPOSED
1	MARSHBURN CHANNEL	56.99	49.58	75.25	102.53	101.75	133.63
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3	AGUA CHINON CHANNEL	5.24	3.33	14.83	10.82	19.36	13.92
TOTAL		136.21	136.21	220.95	267.15	292.95	347.51

N

0 200 300 400
(IN FEET)
1 INCH = 200 FEET

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NO.	DESCRIPTION	BY	DATE	CHK
	REVISIONS			

PRELIMINARY HYDROLOGY MAP
PROPOSED CONDITION

EL TORO DEVELOPMENT - ORANGE COUNTY
LOWE ENTERPRISES REAL ESTATE GROUP
UNINCORPORATED TERRITORY OF THE COUNTY OF ORANGE
IRVINE, CALIFORNIA

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DATE: 2015.11.18
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DATE: -
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DATE: -
JOB NO: SP7331

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****************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
        (C) Copyright 1989-2014 Advanced Engineering Software (aes)
            Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                        Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  EL TORO DEVELOPMENT
  2 YEAR STORM - PROPOSED CONDITION
  STREAM C - AGUA CHINON CHANNEL
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =     3.33
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.030
    LOW LOSS FRACTION = 0.932
    TIME OF CONCENTRATION(MIN.) =  8.47
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      0.33
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.24

****************************************************************************
  TIME      VOLUME        Q    0.        2.5       5.0       7.5      10.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.05      0.0000      0.01  Q          .         .         .         .
  0.19      0.0001      0.01  Q          .         .         .         .
  0.33      0.0002      0.01  Q          .         .         .         .
  0.47      0.0002      0.01  Q          .         .         .         .
```

0.61	0.0003	0.01	Q	.	.	.	.
0.75	0.0004	0.01	Q	.	.	.	.
0.90	0.0005	0.01	Q	.	.	.	.
1.04	0.0006	0.01	Q	.	.	.	.
1.18	0.0008	0.01	Q	.	.	.	.
1.32	0.0009	0.01	Q	.	.	.	.
1.46	0.0010	0.01	Q	.	.	.	.
1.60	0.0011	0.01	Q	.	.	.	.
1.74	0.0013	0.01	Q	.	.	.	.
1.88	0.0014	0.01	Q	.	.	.	.
2.02	0.0016	0.01	Q	.	.	.	.
2.17	0.0018	0.01	Q	.	.	.	.
2.31	0.0019	0.02	Q	.	.	.	.
2.45	0.0021	0.02	Q	.	.	.	.
2.59	0.0023	0.02	Q	.	.	.	.
2.73	0.0025	0.02	Q	.	.	.	.
2.87	0.0027	0.02	Q	.	.	.	.
3.01	0.0029	0.02	Q	.	.	.	.
3.15	0.0031	0.02	Q	.	.	.	.
3.29	0.0034	0.02	Q	.	.	.	.
3.44	0.0036	0.02	Q	.	.	.	.
3.58	0.0039	0.02	Q	.	.	.	.
3.72	0.0041	0.02	Q	.	.	.	.
3.86	0.0044	0.02	Q	.	.	.	.
4.00	0.0047	0.02	Q	.	.	.	.
4.14	0.0049	0.02	Q	.	.	.	.
4.28	0.0052	0.03	Q	.	.	.	.
4.42	0.0055	0.03	Q	.	.	.	.
4.57	0.0059	0.03	Q	.	.	.	.
4.71	0.0062	0.03	Q	.	.	.	.
4.85	0.0065	0.03	Q	.	.	.	.
4.99	0.0069	0.03	Q	.	.	.	.
5.13	0.0072	0.03	Q	.	.	.	.
5.27	0.0076	0.03	Q	.	.	.	.
5.41	0.0080	0.03	Q	.	.	.	.
5.55	0.0084	0.03	Q	.	.	.	.
5.69	0.0088	0.04	Q	.	.	.	.
5.84	0.0092	0.04	Q	.	.	.	.
5.98	0.0096	0.04	Q	.	.	.	.
6.12	0.0101	0.04	Q	.	.	.	.
6.26	0.0105	0.04	Q	.	.	.	.
6.40	0.0110	0.04	Q	.	.	.	.
6.54	0.0115	0.04	Q	.	.	.	.
6.68	0.0120	0.04	Q	.	.	.	.
6.82	0.0125	0.04	Q	.	.	.	.
6.97	0.0130	0.05	Q	.	.	.	.
7.11	0.0136	0.05	Q	.	.	.	.
7.25	0.0142	0.05	Q	.	.	.	.
7.39	0.0147	0.05	Q	.	.	.	.
7.53	0.0153	0.05	Q	.	.	.	.
7.67	0.0159	0.05	Q	.	.	.	.
7.81	0.0166	0.05	Q	.	.	.	.

7.95	0.0172	0.06	Q	.	.	.	.
8.09	0.0179	0.06	Q	.	.	.	.
8.24	0.0186	0.06	Q	.	.	.	.
8.38	0.0193	0.06	Q	.	.	.	.
8.52	0.0200	0.06	Q	.	.	.	.
8.66	0.0207	0.06	Q	.	.	.	.
8.80	0.0215	0.07	Q	.	.	.	.
8.94	0.0223	0.07	Q	.	.	.	.
9.08	0.0231	0.07	Q	.	.	.	.
9.22	0.0239	0.07	Q	.	.	.	.
9.37	0.0248	0.07	Q	.	.	.	.
9.51	0.0257	0.08	Q	.	.	.	.
9.65	0.0266	0.08	Q	.	.	.	.
9.79	0.0275	0.08	Q	.	.	.	.
9.93	0.0285	0.08	Q	.	.	.	.
10.07	0.0294	0.09	Q	.	.	.	.
10.21	0.0305	0.09	Q	.	.	.	.
10.35	0.0315	0.09	Q	.	.	.	.
10.49	0.0326	0.09	Q	.	.	.	.
10.64	0.0337	0.10	Q	.	.	.	.
10.78	0.0349	0.10	Q	.	.	.	.
10.92	0.0361	0.10	Q	.	.	.	.
11.06	0.0373	0.11	Q	.	.	.	.
11.20	0.0386	0.11	Q	.	.	.	.
11.34	0.0399	0.11	Q	.	.	.	.
11.48	0.0412	0.12	Q	.	.	.	.
11.62	0.0426	0.12	Q	.	.	.	.
11.76	0.0441	0.13	Q	.	.	.	.
11.91	0.0456	0.13	Q	.	.	.	.
12.05	0.0472	0.13	Q	.	.	.	.
12.19	0.0491	0.19	Q	.	.	.	.
12.33	0.0513	0.19	Q	.	.	.	.
12.47	0.0536	0.20	Q	.	.	.	.
12.61	0.0560	0.21	Q	.	.	.	.
12.75	0.0585	0.22	Q	.	.	.	.
12.89	0.0610	0.22	Q	.	.	.	.
13.04	0.0637	0.23	Q	.	.	.	.
13.18	0.0664	0.24	Q	.	.	.	.
13.32	0.0692	0.25	Q	.	.	.	.
13.46	0.0722	0.25	.Q	.	.	.	.
13.60	0.0752	0.27	.Q	.	.	.	.
13.74	0.0784	0.28	.Q	.	.	.	.
13.88	0.0817	0.29	.Q	.	.	.	.
14.02	0.0852	0.30	.Q	.	.	.	.
14.16	0.0889	0.34	.Q	.	.	.	.
14.31	0.0929	0.35	.Q	.	.	.	.
14.45	0.0971	0.37	.Q	.	.	.	.
14.59	0.1016	0.39	.Q	.	.	.	.
14.73	0.1064	0.42	.Q	.	.	.	.
14.87	0.1114	0.44	.Q	.	.	.	.
15.01	0.1169	0.49	.Q	.	.	.	.
15.15	0.1227	0.52	. Q	.	.	.	.

15.29	0.1292	0.59	. Q . . . .
15.44	0.1363	0.63	. Q . . . .
15.58	0.1439	0.66	. Q . . . .
15.72	0.1521	0.76	. Q . . . .
15.86	0.1632	1.14	. Q . . . .
16.00	0.1791	1.59	. Q . . . .
16.14	0.2171	4.93	. . Q. . .
16.28	0.2511	0.91	. Q . . . .
16.42	0.2599	0.59	. Q . . . .
16.56	0.2665	0.55	. Q . . . .
16.71	0.2725	0.47	.Q . . . .
16.85	0.2775	0.41	.Q . . . .
16.99	0.2820	0.36	.Q . . . .
17.13	0.2860	0.32	.Q . . . .
17.27	0.2895	0.28	.Q . . . .
17.41	0.2927	0.26	.Q . . . .
17.55	0.2956	0.24	Q . . . .
17.69	0.2983	0.23	Q . . . .
17.84	0.3009	0.21	Q . . . .
17.98	0.3033	0.20	Q . . . .
18.12	0.3054	0.16	Q . . . .
18.26	0.3071	0.13	Q . . . .
18.40	0.3085	0.12	Q . . . .
18.54	0.3099	0.11	Q . . . .
18.68	0.3112	0.11	Q . . . .
18.82	0.3123	0.10	Q . . . .
18.96	0.3135	0.09	Q . . . .
19.11	0.3145	0.09	Q . . . .
19.25	0.3155	0.08	Q . . . .
19.39	0.3164	0.08	Q . . . .
19.53	0.3173	0.07	Q . . . .
19.67	0.3182	0.07	Q . . . .
19.81	0.3190	0.07	Q . . . .
19.95	0.3197	0.06	Q . . . .
20.09	0.3204	0.06	Q . . . .
20.23	0.3211	0.06	Q . . . .
20.38	0.3217	0.05	Q . . . .
20.52	0.3223	0.05	Q . . . .
20.66	0.3228	0.05	Q . . . .
20.80	0.3234	0.04	Q . . . .
20.94	0.3239	0.04	Q . . . .
21.08	0.3243	0.04	Q . . . .
21.22	0.3248	0.04	Q . . . .
21.36	0.3252	0.03	Q . . . .
21.51	0.3256	0.03	Q . . . .
21.65	0.3260	0.03	Q . . . .
21.79	0.3263	0.03	Q . . . .
21.93	0.3266	0.03	Q . . . .
22.07	0.3270	0.03	Q . . . .
22.21	0.3272	0.02	Q . . . .
22.35	0.3275	0.02	Q . . . .
22.49	0.3278	0.02	Q . . . .

22.63	0.3280	0.02	Q	.	.	.	.
22.78	0.3282	0.02	Q	.	.	.	.
22.92	0.3284	0.02	Q	.	.	.	.
23.06	0.3286	0.01	Q	.	.	.	.
23.20	0.3287	0.01	Q	.	.	.	.
23.34	0.3289	0.01	Q	.	.	.	.
23.48	0.3290	0.01	Q	.	.	.	.
23.62	0.3292	0.01	Q	.	.	.	.
23.76	0.3293	0.01	Q	.	.	.	.
23.91	0.3294	0.01	Q	.	.	.	.
24.05	0.3294	0.01	Q	.	.	.	.
24.19	0.3295	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1448.4
10%	93.2
20%	25.4
30%	16.9
40%	8.5
50%	8.5
60%	8.5
70%	8.5
80%	8.5
90%	8.5

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                        Analysis prepared by:



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 Problem Descriptions:
  EL TORO DEVELOPMENT
  2 YEAR STORM - PROPOSED CONDITION
  STREAM B - BEE CANYON CHANNEL
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =   83.30
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.060
    LOW LOSS FRACTION = 0.932
    TIME OF CONCENTRATION(MIN.) = 18.37
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     5.74
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     8.49

****************************************************************************
  TIME      VOLUME       Q     0.       20.0      40.0      60.0      80.0
 (HOURS)     (AF)      (CFS)
----------------------------------------------------------------------------
  0.08      0.0000      0.00  Q          .         .         .         .
  0.39      0.0021      0.16  Q          .         .         .         .
  0.69      0.0062      0.17  Q          .         .         .         .
  1.00      0.0105      0.17  Q          .         .         .         .
```

1.30	0.0147	0.17	Q
1.61	0.0191	0.17	Q
1.92	0.0235	0.17	Q
2.22	0.0279	0.18	Q
2.53	0.0324	0.18	Q
2.83	0.0370	0.18	Q
3.14	0.0416	0.18	Q
3.45	0.0463	0.19	Q
3.75	0.0511	0.19	Q
4.06	0.0560	0.19	Q
4.37	0.0609	0.20	Q
4.67	0.0659	0.20	Q
4.98	0.0710	0.20	Q
5.28	0.0762	0.21	Q
5.59	0.0814	0.21	Q
5.90	0.0868	0.21	Q
6.20	0.0923	0.22	Q
6.51	0.0978	0.22	Q
6.81	0.1035	0.23	Q
7.12	0.1093	0.23	Q
7.43	0.1152	0.24	Q
7.73	0.1213	0.24	Q
8.04	0.1275	0.25	Q
8.35	0.1338	0.25	Q
8.65	0.1403	0.26	Q
8.96	0.1470	0.27	Q
9.26	0.1538	0.27	Q
9.57	0.1608	0.28	Q
9.88	0.1681	0.29	Q
10.18	0.1755	0.30	Q
10.49	0.1832	0.31	Q
10.80	0.1911	0.32	Q
11.10	0.1995	0.34	Q
11.41	0.2114	0.60	Q
11.71	0.2283	0.74	Q
12.02	0.2509	1.05	Q
12.33	0.2890	1.96	Q
12.63	0.3503	2.88	.Q
12.94	0.4262	3.12	.Q
13.24	0.5122	3.68	.Q
13.55	0.6093	4.00	. Q
13.86	0.7204	4.78	. Q
14.16	0.8473	5.25	. Q
14.47	1.0000	6.82	. Q
14.78	1.1823	7.59	. Q
15.08	1.4018	9.75	. Q
15.39	1.6689	11.36	. Q
15.69	1.9964	14.53	. Q
16.00	2.4581	21.96	. Q
16.31	3.6897	75.39	. Q
16.61	4.8071	12.93	. Q
16.92	5.0788	8.55	. Q

17.22	5.2640	6.10	. Q . . . .
17.53	5.3964	4.37	. Q . . . .
17.84	5.4944	3.38	.Q . . . .
18.14	5.5709	2.66	.Q . . . .
18.45	5.6158	0.89	Q . . . .
18.76	5.6329	0.47	Q . . . .
19.06	5.6428	0.31	Q . . . .
19.37	5.6505	0.29	Q . . . .
19.67	5.6577	0.28	Q . . . .
19.98	5.6645	0.26	Q . . . .
20.29	5.6710	0.25	Q . . . .
20.59	5.6772	0.24	Q . . . .
20.90	5.6831	0.23	Q . . . .
21.20	5.6888	0.22	Q . . . .
21.51	5.6943	0.21	Q . . . .
21.82	5.6996	0.20	Q . . . .
22.12	5.7047	0.20	Q . . . .
22.43	5.7096	0.19	Q . . . .
22.74	5.7144	0.19	Q . . . .
23.04	5.7190	0.18	Q . . . .
23.35	5.7235	0.18	Q . . . .
23.65	5.7279	0.17	Q . . . .
23.96	5.7322	0.17	Q . . . .
24.27	5.7364	0.16	Q . . . .
24.57	5.7384	0.00	Q . . . .

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1451.2
10%	147.0
20%	36.7
30%	18.4
40%	18.4
50%	18.4
60%	18.4
70%	18.4
80%	18.4
90%	18.4

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 Problem Descriptions:
  EL TORO DEVELOPMENT
  2 YEAR STORM - PROPOSED CONDITION
  STREAM A - MARSHBURN CHANNEL
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =   49.58
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.050
    LOW LOSS FRACTION = 0.932
    TIME OF CONCENTRATION(MIN.) = 14.28
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     3.75
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     4.72

****************************************************************************
  TIME      VOLUME        Q     0.        15.0       30.0       45.0       60.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.05      0.0000      0.00  Q          .          .          .          .
  0.29      0.0010      0.10  Q          .          .          .          .
  0.53      0.0029      0.10  Q          .          .          .          .
  0.77      0.0048      0.10  Q          .          .          .          .
```

1.01	0.0068	0.10	Q	.	.	.	.
1.24	0.0088	0.10	Q	.	.	.	.
1.48	0.0108	0.10	Q	.	.	.	.
1.72	0.0128	0.10	Q	.	.	.	.
1.96	0.0148	0.10	Q	.	.	.	.
2.20	0.0169	0.11	Q	.	.	.	.
2.43	0.0190	0.11	Q	.	.	.	.
2.67	0.0211	0.11	Q	.	.	.	.
2.91	0.0232	0.11	Q	.	.	.	.
3.15	0.0254	0.11	Q	.	.	.	.
3.39	0.0276	0.11	Q	.	.	.	.
3.62	0.0298	0.11	Q	.	.	.	.
3.86	0.0320	0.11	Q	.	.	.	.
4.10	0.0343	0.12	Q	.	.	.	.
4.34	0.0365	0.12	Q	.	.	.	.
4.58	0.0389	0.12	Q	.	.	.	.
4.81	0.0412	0.12	Q	.	.	.	.
5.05	0.0436	0.12	Q	.	.	.	.
5.29	0.0460	0.12	Q	.	.	.	.
5.53	0.0484	0.12	Q	.	.	.	.
5.77	0.0509	0.13	Q	.	.	.	.
6.00	0.0534	0.13	Q	.	.	.	.
6.24	0.0560	0.13	Q	.	.	.	.
6.48	0.0586	0.13	Q	.	.	.	.
6.72	0.0612	0.13	Q	.	.	.	.
6.96	0.0639	0.14	Q	.	.	.	.
7.19	0.0666	0.14	Q	.	.	.	.
7.43	0.0693	0.14	Q	.	.	.	.
7.67	0.0721	0.14	Q	.	.	.	.
7.91	0.0750	0.15	Q	.	.	.	.
8.15	0.0779	0.15	Q	.	.	.	.
8.38	0.0809	0.15	Q	.	.	.	.
8.62	0.0839	0.16	Q	.	.	.	.
8.86	0.0869	0.16	Q	.	.	.	.
9.10	0.0901	0.16	Q	.	.	.	.
9.34	0.0935	0.18	Q	.	.	.	.
9.57	0.0978	0.26	Q	.	.	.	.
9.81	0.1032	0.29	Q	.	.	.	.
10.05	0.1098	0.38	Q	.	.	.	.
10.29	0.1176	0.42	Q	.	.	.	.
10.53	0.1267	0.51	Q	.	.	.	.
10.76	0.1373	0.56	Q	.	.	.	.
11.00	0.1493	0.67	Q	.	.	.	.
11.24	0.1630	0.72	Q	.	.	.	.
11.48	0.1785	0.85	Q	.	.	.	.
11.72	0.1958	0.91	Q	.	.	.	.
11.95	0.2152	1.06	Q	.	.	.	.
12.19	0.2384	1.30	Q	.	.	.	.
12.43	0.2714	2.06	.Q	.	.	.	.
12.67	0.3129	2.16	.Q	.	.	.	.
12.91	0.3577	2.39	.Q	.	.	.	.
13.14	0.4059	2.52	.Q	.	.	.	.

13.38	0.4583	2.81	.Q
13.62	0.5151	2.97	.Q
13.86	0.5773	3.35	. Q
14.10	0.6454	3.57	. Q
14.33	0.7231	4.33	. Q
14.57	0.8113	4.65	. Q
14.81	0.9108	5.46	. Q
15.05	1.0234	5.99	. Q
15.29	1.1557	7.46	. Q
15.52	1.3100	8.23	. Q
15.76	1.4988	10.96	. Q
16.00	1.7654	16.16	. Q
16.24	2.4442	52.86	. Q
16.48	3.0477	8.51	. Q
16.71	3.1966	6.64	. Q
16.95	3.3113	5.02	. Q
17.19	3.3996	3.96	. Q
17.43	3.4695	3.15	. Q
17.67	3.5266	2.66	.Q
17.90	3.5751	2.27	.Q
18.14	3.6167	1.96	.Q
18.38	3.6457	0.99	Q
18.62	3.6631	0.78	Q
18.86	3.6769	0.61	Q
19.09	3.6875	0.46	Q
19.33	3.6953	0.33	Q
19.57	3.7007	0.22	Q
19.81	3.7045	0.16	Q
20.05	3.7075	0.15	Q
20.28	3.7105	0.15	Q
20.52	3.7134	0.14	Q
20.76	3.7161	0.14	Q
21.00	3.7188	0.13	Q
21.24	3.7214	0.13	Q
21.47	3.7239	0.13	Q
21.71	3.7263	0.12	Q
21.95	3.7287	0.12	Q
22.19	3.7310	0.12	Q
22.43	3.7333	0.11	Q
22.66	3.7355	0.11	Q
22.90	3.7376	0.11	Q
23.14	3.7397	0.11	Q
23.38	3.7418	0.10	Q
23.62	3.7438	0.10	Q
23.85	3.7458	0.10	Q
24.09	3.7478	0.10	Q
24.33	3.7487	0.00	Q

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have

an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1442.3
10%	128.5
20%	42.8
30%	28.6
40%	14.3
50%	14.3
60%	14.3
70%	14.3
80%	14.3
90%	14.3

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 Problem Descriptions:
  EL TORO DEVELOPMENT
  2 YEAR STORM - EXISTING CONDITION
  STREAM C - AGUA CHINON CHANNEL
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =     5.24
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.150
    LOW LOSS FRACTION = 0.932
    TIME OF CONCENTRATION(MIN.) = 10.70
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      0.21
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.69

****************************************************************************
  TIME      VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)     (AF)      (CFS)
----------------------------------------------------------------------------
  0.13      0.0001      0.01  Q         .         .         .         .
  0.31      0.0002      0.01  Q         .         .         .         .
  0.49      0.0004      0.01  Q         .         .         .         .
  0.66      0.0005      0.01  Q         .         .         .         .
```

0.84	0.0007	0.01	Q	.	.	.	.
1.02	0.0008	0.01	Q	.	.	.	.
1.20	0.0010	0.01	Q	.	.	.	.
1.38	0.0011	0.01	Q	.	.	.	.
1.56	0.0013	0.01	Q	.	.	.	.
1.73	0.0015	0.01	Q	.	.	.	.
1.91	0.0016	0.01	Q	.	.	.	.
2.09	0.0018	0.01	Q	.	.	.	.
2.27	0.0019	0.01	Q	.	.	.	.
2.45	0.0021	0.01	Q	.	.	.	.
2.63	0.0023	0.01	Q	.	.	.	.
2.80	0.0025	0.01	Q	.	.	.	.
2.98	0.0026	0.01	Q	.	.	.	.
3.16	0.0028	0.01	Q	.	.	.	.
3.34	0.0030	0.01	Q	.	.	.	.
3.52	0.0031	0.01	Q	.	.	.	.
3.70	0.0033	0.01	Q	.	.	.	.
3.87	0.0035	0.01	Q	.	.	.	.
4.05	0.0037	0.01	Q	.	.	.	.
4.23	0.0039	0.01	Q	.	.	.	.
4.41	0.0040	0.01	Q	.	.	.	.
4.59	0.0042	0.01	Q	.	.	.	.
4.77	0.0044	0.01	Q	.	.	.	.
4.94	0.0046	0.01	Q	.	.	.	.
5.12	0.0048	0.01	Q	.	.	.	.
5.30	0.0050	0.01	Q	.	.	.	.
5.48	0.0052	0.01	Q	.	.	.	.
5.66	0.0054	0.01	Q	.	.	.	.
5.84	0.0056	0.01	Q	.	.	.	.
6.01	0.0058	0.01	Q	.	.	.	.
6.19	0.0060	0.01	Q	.	.	.	.
6.37	0.0062	0.01	Q	.	.	.	.
6.55	0.0064	0.01	Q	.	.	.	.
6.73	0.0066	0.01	Q	.	.	.	.
6.91	0.0068	0.01	Q	.	.	.	.
7.08	0.0070	0.01	Q	.	.	.	.
7.26	0.0072	0.01	Q	.	.	.	.
7.44	0.0074	0.01	Q	.	.	.	.
7.62	0.0077	0.02	Q	.	.	.	.
7.80	0.0079	0.02	Q	.	.	.	.
7.97	0.0081	0.02	Q	.	.	.	.
8.15	0.0084	0.02	Q	.	.	.	.
8.33	0.0086	0.02	Q	.	.	.	.
8.51	0.0088	0.02	Q	.	.	.	.
8.69	0.0091	0.02	Q	.	.	.	.
8.87	0.0093	0.02	Q	.	.	.	.
9.05	0.0096	0.02	Q	.	.	.	.
9.22	0.0098	0.02	Q	.	.	.	.
9.40	0.0101	0.02	Q	.	.	.	.
9.58	0.0103	0.02	Q	.	.	.	.
9.76	0.0106	0.02	Q	.	.	.	.
9.94	0.0109	0.02	Q	.	.	.	.

10.12	0.0112	0.02	Q
10.29	0.0114	0.02	Q
10.47	0.0117	0.02	Q
10.65	0.0120	0.02	Q
10.83	0.0123	0.02	Q
11.01	0.0126	0.02	Q
11.18	0.0129	0.02	Q
11.36	0.0132	0.02	Q
11.54	0.0136	0.02	Q
11.72	0.0139	0.02	Q
11.90	0.0142	0.02	Q
12.08	0.0146	0.02	Q
12.26	0.0150	0.03	Q
12.43	0.0154	0.03	Q
12.61	0.0159	0.03	Q
12.79	0.0164	0.03	Q
12.97	0.0169	0.03	Q
13.15	0.0174	0.03	Q
13.32	0.0179	0.04	Q
13.50	0.0184	0.04	Q
13.68	0.0190	0.04	Q
13.86	0.0196	0.04	Q
14.04	0.0202	0.04	Q
14.22	0.0208	0.05	Q
14.40	0.0215	0.05	Q
14.57	0.0222	0.05	Q
14.75	0.0233	0.10	Q
14.93	0.0251	0.14	Q
15.11	0.0279	0.24	Q
15.29	0.0319	0.30	.Q
15.47	0.0370	0.38	.Q
15.64	0.0432	0.45	.Q
15.82	0.0536	0.97	. Q
16.00	0.0726	1.59	. Q
16.18	0.1299	6.19	. Q
16.36	0.1802	0.64	. Q
16.53	0.1877	0.38	.Q
16.71	0.1919	0.19	Q
16.89	0.1938	0.06	Q
17.07	0.1946	0.05	Q
17.25	0.1952	0.04	Q
17.43	0.1958	0.04	Q
17.61	0.1963	0.04	Q
17.78	0.1968	0.03	Q
17.96	0.1973	0.03	Q
18.14	0.1978	0.03	Q
18.32	0.1981	0.02	Q
18.50	0.1985	0.02	Q
18.67	0.1988	0.02	Q
18.85	0.1991	0.02	Q
19.03	0.1994	0.02	Q
19.21	0.1997	0.02	Q

19.39	0.1999	0.02	Q	.	.	.	.
19.57	0.2002	0.02	Q	.	.	.	.
19.74	0.2005	0.02	Q	.	.	.	.
19.92	0.2007	0.02	Q	.	.	.	.
20.10	0.2009	0.02	Q	.	.	.	.
20.28	0.2012	0.02	Q	.	.	.	.
20.46	0.2014	0.02	Q	.	.	.	.
20.64	0.2016	0.01	Q	.	.	.	.
20.82	0.2018	0.01	Q	.	.	.	.
20.99	0.2020	0.01	Q	.	.	.	.
21.17	0.2022	0.01	Q	.	.	.	.
21.35	0.2024	0.01	Q	.	.	.	.
21.53	0.2026	0.01	Q	.	.	.	.
21.71	0.2028	0.01	Q	.	.	.	.
21.89	0.2030	0.01	Q	.	.	.	.
22.06	0.2032	0.01	Q	.	.	.	.
22.24	0.2034	0.01	Q	.	.	.	.
22.42	0.2036	0.01	Q	.	.	.	.
22.60	0.2037	0.01	Q	.	.	.	.
22.78	0.2039	0.01	Q	.	.	.	.
22.95	0.2041	0.01	Q	.	.	.	.
23.13	0.2042	0.01	Q	.	.	.	.
23.31	0.2044	0.01	Q	.	.	.	.
23.49	0.2046	0.01	Q	.	.	.	.
23.67	0.2047	0.01	Q	.	.	.	.
23.85	0.2049	0.01	Q	.	.	.	.
24.02	0.2050	0.01	Q	.	.	.	.
24.20	0.2051	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1444.5
10%	42.8
20%	21.4
30%	10.7
40%	10.7
50%	10.7
60%	10.7
70%	10.7
80%	10.7
90%	10.7

```
****************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                         Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  EL TORO DEVELOPMENT
  2 YEAR STORM - EXISTING CONDITION
  STREAM B - BEE CANYON CHANNEL
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =   73.98
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.110
    LOW LOSS FRACTION = 0.932
    TIME OF CONCENTRATION(MIN.) = 25.16
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     3.55
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     9.08

****************************************************************************
  TIME      VOLUME       Q    0.       15.0      30.0      45.0      60.0
 (HOURS)     (AF)      (CFS)
----------------------------------------------------------------------------
  0.07      0.0000      0.00  Q         .         .         .         .
  0.48      0.0025      0.15  Q         .         .         .         .
  0.90      0.0076      0.15  Q         .         .         .         .
  1.32      0.0128      0.15  Q         .         .         .         .
```

1.74	0.0181	0.15	Q
2.16	0.0234	0.16	Q
2.58	0.0289	0.16	Q
3.00	0.0344	0.16	Q
3.42	0.0401	0.16	Q
3.84	0.0459	0.17	Q
4.26	0.0518	0.17	Q
4.68	0.0579	0.18	Q
5.10	0.0641	0.18	Q
5.52	0.0704	0.19	Q
5.94	0.0769	0.19	Q
6.36	0.0835	0.20	Q
6.77	0.0903	0.20	Q
7.19	0.0974	0.21	Q
7.61	0.1046	0.21	Q
8.03	0.1120	0.22	Q
8.45	0.1197	0.22	Q
8.87	0.1276	0.23	Q
9.29	0.1359	0.24	Q
9.71	0.1444	0.25	Q
10.13	0.1533	0.26	Q
10.55	0.1626	0.28	Q
10.97	0.1722	0.28	Q
11.39	0.1824	0.30	Q
11.81	0.1932	0.32	Q
12.23	0.2049	0.36	Q
12.65	0.2188	0.43	Q
13.06	0.2344	0.47	Q
13.48	0.2512	0.50	Q
13.90	0.2747	0.86	Q
14.32	0.3155	1.49	Q
14.74	0.4002	3.40	. Q
15.16	0.5388	4.60	. Q
15.58	0.7589	8.10	. Q
16.00	1.1071	11.99	. Q
16.42	2.2110	51.71	. Q
16.84	3.2164	6.31	. Q
17.26	3.3688	2.49	.Q
17.68	3.4210	0.52	Q
18.10	3.4379	0.45	Q
18.52	3.4514	0.33	Q
18.94	3.4621	0.29	Q
19.35	3.4718	0.27	Q
19.77	3.4807	0.25	Q
20.19	3.4890	0.23	Q
20.61	3.4967	0.21	Q
21.03	3.5039	0.20	Q
21.45	3.5107	0.19	Q
21.87	3.5172	0.18	Q
22.29	3.5234	0.17	Q
22.71	3.5293	0.17	Q
23.13	3.5350	0.16	Q

23.55	3.5405	0.15	Q	.	.	.	.
23.97	3.5457	0.15	Q	.	.	.	.
24.39	3.5508	0.14	Q	.	.	.	.
24.81	3.5533	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1459.3
10%	100.6
20%	50.3
30%	25.2
40%	25.2
50%	25.2
60%	25.2
70%	25.2
80%	25.2
90%	25.2

```
****************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                        Analysis prepared by:


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----------------------------------------------------------------------------

 Problem Descriptions:
  EL TORO DEVELOPMENT
  2 YEAR STORM - EXISTING CONDITION
  STREAM A - MARSHBURN CHANNEL
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =   56.99
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.260
    LOW LOSS FRACTION = 0.932
    TIME OF CONCENTRATION(MIN.) = 36.87
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.64
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     8.10

****************************************************************************
  TIME      VOLUME       Q    0.        7.5       15.0      22.5      30.0
 (HOURS)     (AF)      (CFS)
----------------------------------------------------------------------------
  0.02      0.0000      0.00  Q         .         .         .         .
  0.64      0.0029      0.11  Q         .         .         .         .
  1.25      0.0086      0.11  Q         .         .         .         .
  1.87      0.0145      0.12  Q         .         .         .         .
```

2.48	0.0206	0.12	Q	.	.	.	.
3.10	0.0268	0.13	Q	.	.	.	.
3.71	0.0333	0.13	Q	.	.	.	.
4.32	0.0399	0.13	Q	.	.	.	.
4.94	0.0467	0.14	Q	.	.	.	.
5.55	0.0538	0.14	Q	.	.	.	.
6.17	0.0611	0.15	Q	.	.	.	.
6.78	0.0687	0.15	Q	.	.	.	.
7.40	0.0765	0.16	Q	.	.	.	.
8.01	0.0848	0.17	Q	.	.	.	.
8.63	0.0934	0.17	Q	.	.	.	.
9.24	0.1024	0.18	Q	.	.	.	.
9.85	0.1120	0.19	Q	.	.	.	.
10.47	0.1221	0.21	Q	.	.	.	.
11.08	0.1329	0.22	Q	.	.	.	.
11.70	0.1445	0.24	Q	.	.	.	.
12.31	0.1570	0.25	Q	.	.	.	.
12.93	0.1723	0.35	Q	.	.	.	.
13.54	0.1906	0.37	Q	.	.	.	.
14.16	0.2113	0.44	Q	.	.	.	.
14.77	0.2354	0.51	Q	.	.	.	.
15.39	0.2661	0.70	Q	.	.	.	.
16.00	0.3053	0.85	.Q	.	.	.	.
16.61	0.9100	22.97	.	.	.	Q	.
17.23	1.5080	0.58	Q	.	.	.	.
17.84	1.5331	0.40	Q	.	.	.	.
18.46	1.5513	0.31	Q	.	.	.	.
19.07	1.5651	0.23	Q	.	.	.	.
19.69	1.5759	0.20	Q	.	.	.	.
20.30	1.5855	0.18	Q	.	.	.	.
20.92	1.5941	0.16	Q	.	.	.	.
21.53	1.6020	0.15	Q	.	.	.	.
22.14	1.6093	0.14	Q	.	.	.	.
22.76	1.6161	0.13	Q	.	.	.	.
23.37	1.6226	0.12	Q	.	.	.	.
23.99	1.6286	0.12	Q	.	.	.	.
24.60	1.6344	0.11	Q	.	.	.	.
25.22	1.6373	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1474.8
10%	36.9
20%	36.9
30%	36.9

40%	36.9
50%	36.9
60%	36.9
70%	36.9
80%	36.9
90%	36.9

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
2 YEAR STORM - PROPOSED CONDITION
STREAM C - AGUA CHINON CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 2Y100Q3.DAT
  TIME/DATE OF STUDY: 13:21 11/17/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                      --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)    (FT)     SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  =====  ======  =====  =======
  1   20.0    10.0    0.022/0.022/0.020   0.50    1.50 0.0312 0.125 0.0170

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
         DURATION     RAINFALL(INCH)
         5-MINUTES          0.19
```

```
        30-MINUTES          0.40
         1-HOUR             0.53
         3-HOUR             0.89
         6-HOUR             1.22
        24-HOUR             2.05
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR UNIT HYDROGRAPH METHOD*

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   270.00
  ELEVATION DATA: UPSTREAM(FEET) =    274.00  DOWNSTREAM(FEET) =    271.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.168
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.841
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        0.90     0.30     0.100    36    7.17
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =       1.47
  TOTAL AREA(ACRES) =       0.90   PEAK FLOW RATE(CFS) =      1.47

****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   262.80  DOWNSTREAM(FEET) =   261.00
  FLOW LENGTH(FEET) =   272.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.49
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.47
  PIPE TRAVEL TIME(MIN.) =   1.30    Tc(MIN.) =    8.47
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =     542.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.47
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.673
```

```
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B       2.43      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =     2.43      SUBAREA RUNOFF(CFS) =     3.59
EFFECTIVE AREA(ACRES) =       3.33   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =         3.3       PEAK FLOW RATE(CFS) =       4.92
==============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =        3.3  TC(MIN.) =       8.47
EFFECTIVE AREA(ACRES) =       3.33  AREA-AVERAGED Fm(INCH/HR)=  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.100
PEAK FLOW RATE(CFS)    =       4.92
==============================================================================
==============================================================================
END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
2 YEAR STORM - PROPOSED CONDITION
STREAM B - BEE CANYON CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 2Y100Q2.DAT
  TIME/DATE OF STUDY: 13:20 11/17/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  =====  ====  =====  =======
  1   18.0     10.0    0.022/0.022/0.020  0.50    1.50 0.0312 0.125 0.0170

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.19
```

```
        30-MINUTES          0.40
         1-HOUR             0.53
         3-HOUR             0.89
         6-HOUR             1.22
        24-HOUR             2.05
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR UNIT HYDROGRAPH METHOD*

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    278.40  DOWNSTREAM(FEET) =    272.80

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.599
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.930
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B       0.63     0.30      0.100    36    6.60
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =       1.08
  TOTAL AREA(ACRES) =       0.63   PEAK FLOW RATE(CFS) =      1.08

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  63
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  272.80  DOWNSTREAM ELEVATION(FEET) =  269.20
  STREET LENGTH(FEET) =   575.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.022
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.022

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0170
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0170
  MAXIMUM ALLOWABLE STREET FLOW DEPTH(FEET) =   0.50

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.62
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.27
```

```
  HALFSTREET FLOOD WIDTH(FEET) =     6.60
  AVERAGE FLOW VELOCITY(FEET/SEC.) =     1.36
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =     0.36
STREET FLOW TRAVEL TIME(MIN.) =    7.05    Tc(MIN.) =    13.65
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.272
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)   CN
COMMERCIAL                  B        0.96      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =     0.96      SUBAREA RUNOFF(CFS) =     1.07
EFFECTIVE AREA(ACRES) =       1.59    AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =         1.6        PEAK FLOW RATE(CFS) =       1.78

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.28   HALFSTREET FLOOD WIDTH(FEET) =    6.91
FLOW VELOCITY(FEET/SEC.) =  1.39   DEPTH*VELOCITY(FT*FT/SEC.) =    0.38
LONGEST FLOWPATH FROM NODE     300.00 TO NODE     302.00 =     875.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     302.00 TO NODE     302.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =    13.65
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.272
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)   CN
COMMERCIAL                  B        2.57      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =     2.57      SUBAREA RUNOFF(CFS) =     2.87
EFFECTIVE AREA(ACRES) =       4.16    AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =         4.2        PEAK FLOW RATE(CFS) =       4.65

****************************************************************************
FLOW PROCESS FROM NODE     302.00 TO NODE     303.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    261.30  DOWNSTREAM(FEET) =    258.80
FLOW LENGTH(FEET) =    512.00    MANNING'S N =  0.013
DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =    4.22
ESTIMATED PIPE DIAMETER(INCH) =  18.00     NUMBER OF PIPES =    1
PIPE-FLOW(CFS) =        4.65
PIPE TRAVEL TIME(MIN.) =    2.02     Tc(MIN.) =    15.67
```

```
 LONGEST FLOWPATH FROM NODE     300.00 TO NODE     303.00 =     1387.00 FEET.
****************************************************************************
 FLOW PROCESS FROM NODE     303.00 TO NODE     303.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =    15.67
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.175
 SUBAREA LOSS RATE DATA(AMC  I ):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  B        1.72      0.30      0.100    36
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =     1.72       SUBAREA RUNOFF(CFS) =     1.77
 EFFECTIVE AREA(ACRES) =       5.88   AREA-AVERAGED Fm(INCH/HR) =  0.03
 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =         5.9        PEAK FLOW RATE(CFS) =        6.06

****************************************************************************
 FLOW PROCESS FROM NODE     303.00 TO NODE     303.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =    15.67
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.175
 SUBAREA LOSS RATE DATA(AMC  I ):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  B        2.55      0.30      0.100    36
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =     2.55       SUBAREA RUNOFF(CFS) =     2.63
 EFFECTIVE AREA(ACRES) =       8.43   AREA-AVERAGED Fm(INCH/HR) =  0.03
 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =         8.4        PEAK FLOW RATE(CFS) =        8.69

****************************************************************************
 FLOW PROCESS FROM NODE     303.00 TO NODE     306.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    258.80  DOWNSTREAM(FEET) =    258.60
 FLOW LENGTH(FEET) =     27.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =    5.77
 ESTIMATED PIPE DIAMETER(INCH) =  21.00     NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =        8.69
 PIPE TRAVEL TIME(MIN.) =    0.08     Tc(MIN.) =    15.75
 LONGEST FLOWPATH FROM NODE     300.00 TO NODE     306.00 =     1414.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     306.00 TO NODE     306.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    15.75
  RAINFALL INTENSITY(INCH/HR) =    1.17
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =        8.43
  TOTAL STREAM AREA(ACRES) =        8.43
  PEAK FLOW RATE(CFS) AT CONFLUENCE =        8.69

****************************************************************************
  FLOW PROCESS FROM NODE     304.00 TO NODE     305.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    788.00
  ELEVATION DATA: UPSTREAM(FEET) =     275.00  DOWNSTREAM(FEET) =     267.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    17.428
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.105
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.94      0.30      0.850    36   17.43
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =       0.72
  TOTAL AREA(ACRES) =       0.94   PEAK FLOW RATE(CFS) =       0.72

****************************************************************************
  FLOW PROCESS FROM NODE     305.00 TO NODE     306.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    262.00  DOWNSTREAM(FEET) =    258.60
  FLOW LENGTH(FEET) =    318.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    3.36
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        0.72
  PIPE TRAVEL TIME(MIN.) =    1.58    Tc(MIN.) =    19.01
```

```
  LONGEST FLOWPATH FROM NODE     304.00 TO NODE     306.00 =     1106.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     306.00 TO NODE     306.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    19.01
  RAINFALL INTENSITY(INCH/HR) =    1.05
  AREA-AVERAGED Fm(INCH/HR) =  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.85
  EFFECTIVE STREAM AREA(ACRES) =        0.94
  TOTAL STREAM AREA(ACRES) =        0.94
  PEAK FLOW RATE(CFS) AT CONFLUENCE =        0.72

  ** CONFLUENCE DATA **
   STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)            (ACRES)    NODE
      1         8.69   15.75     1.172   0.30( 0.03) 0.10        8.4     300.00
      2         0.72   19.01     1.052   0.30( 0.26) 0.85        0.9     304.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)            (ACRES)    NODE
      1         9.37   15.75     1.172   0.30( 0.05) 0.16        9.2     300.00
      2         8.49   19.01     1.052   0.30( 0.05) 0.18        9.4     304.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =        9.37    Tc(MIN.) =     15.75
  EFFECTIVE AREA(ACRES) =        9.21   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =        9.4
  LONGEST FLOWPATH FROM NODE     300.00 TO NODE     306.00 =     1414.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     306.00 TO NODE     307.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    258.60  DOWNSTREAM(FEET) =    254.70
  FLOW LENGTH(FEET) =    786.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    4.97
  ESTIMATED PIPE DIAMETER(INCH) =  21.00     NUMBER OF PIPES =   1
```

```
PIPE-FLOW(CFS) =        9.37
PIPE TRAVEL TIME(MIN.) =   2.64    Tc(MIN.) =   18.39
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    307.00 =    2200.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    307.00 TO NODE    307.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   18.39
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.072
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        1.73      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    1.73      SUBAREA RUNOFF(CFS) =    1.62
EFFECTIVE AREA(ACRES) =     10.94   AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.15
TOTAL AREA(ACRES) =       11.1       PEAK FLOW RATE(CFS) =      10.10

****************************************************************************
FLOW PROCESS FROM NODE    307.00 TO NODE    307.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   18.39
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.072
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        3.48      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    3.48      SUBAREA RUNOFF(CFS) =    3.26
EFFECTIVE AREA(ACRES) =     14.42   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.14
TOTAL AREA(ACRES) =       14.6       PEAK FLOW RATE(CFS) =      13.36

****************************************************************************
FLOW PROCESS FROM NODE    307.00 TO NODE    310.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   254.70  DOWNSTREAM(FEET) =   254.60
FLOW LENGTH(FEET) =    18.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.70
ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       13.36
```

```
  PIPE TRAVEL TIME(MIN.) =    0.05     Tc(MIN.) =    18.44
  LONGEST FLOWPATH FROM NODE     300.00 TO NODE     310.00 =     2218.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     310.00 TO NODE     310.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    18.44
  RAINFALL INTENSITY(INCH/HR) =    1.07
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.14
  EFFECTIVE STREAM AREA(ACRES) =       14.42
  TOTAL STREAM AREA(ACRES) =       14.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       13.36

****************************************************************************
  FLOW PROCESS FROM NODE     308.00 TO NODE     309.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    696.00
  ELEVATION DATA: UPSTREAM(FEET) =     267.00  DOWNSTREAM(FEET) =     261.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    17.135
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.116
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.83      0.30      0.850    36   17.13
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =       0.64
  TOTAL AREA(ACRES) =       0.83   PEAK FLOW RATE(CFS) =       0.64

****************************************************************************
  FLOW PROCESS FROM NODE     309.00 TO NODE     310.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    256.50  DOWNSTREAM(FEET) =    254.60
  FLOW LENGTH(FEET) =    370.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS    3.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    2.51
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```

```
PIPE-FLOW(CFS) =        0.64
PIPE TRAVEL TIME(MIN.) =   2.45    Tc(MIN.) =    19.59
LONGEST FLOWPATH FROM NODE    308.00 TO NODE    310.00 =    1066.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    310.00 TO NODE    310.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   19.59
RAINFALL INTENSITY(INCH/HR) =   1.03
AREA-AVERAGED Fm(INCH/HR) =  0.26
AREA-AVERAGED Fp(INCH/HR) =  0.30
AREA-AVERAGED Ap =  0.85
EFFECTIVE STREAM AREA(ACRES) =       0.83
TOTAL STREAM AREA(ACRES) =       0.83
PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.64

** CONFLUENCE DATA **
 STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.) (INCH/HR)  (INCH/HR)           (ACRES)    NODE
    1        13.36   18.44    1.070   0.30( 0.04) 0.14      14.4     300.00
    1        12.21   21.74    0.974   0.30( 0.04) 0.15      14.6     304.00
    2         0.64   19.59    1.034   0.30( 0.26) 0.85       0.8     308.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
 STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.) (INCH/HR)  (INCH/HR)           (ACRES)    NODE
    1        14.00   18.44    1.070   0.30( 0.05) 0.18      15.2     300.00
    2        13.61   19.59    1.034   0.30( 0.05) 0.18      15.3     308.00
    3        12.81   21.74    0.974   0.30( 0.06) 0.19      15.4     304.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      14.00    Tc(MIN.) =    18.44
EFFECTIVE AREA(ACRES) =      15.20   AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.18
TOTAL AREA(ACRES) =       15.4
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    310.00 =    2218.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    310.00 TO NODE    311.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   254.60  DOWNSTREAM(FEET) =   251.40
```

```
FLOW LENGTH(FEET) =   649.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.45
ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      14.00
PIPE TRAVEL TIME(MIN.) =   1.99    Tc(MIN.) =   20.43
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    311.00 =    2867.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    311.00 TO NODE    311.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   20.43
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.009
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        1.98      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    1.98      SUBAREA RUNOFF(CFS) =    1.74
EFFECTIVE AREA(ACRES) =     17.18   AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
TOTAL AREA(ACRES) =       17.4       PEAK FLOW RATE(CFS) =      14.83

****************************************************************************
FLOW PROCESS FROM NODE    311.00 TO NODE    311.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   20.43
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.009
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        4.26      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    4.26      SUBAREA RUNOFF(CFS) =    3.75
EFFECTIVE AREA(ACRES) =     21.44   AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.15
TOTAL AREA(ACRES) =       21.6       PEAK FLOW RATE(CFS) =      18.58

****************************************************************************
FLOW PROCESS FROM NODE    311.00 TO NODE    314.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   251.40  DOWNSTREAM(FEET) =   251.30
FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.66
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       18.58
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =   20.46
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    314.00 =    2882.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    314.00 TO NODE    314.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   20.46
  RAINFALL INTENSITY(INCH/HR) =   1.01
  AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.15
  EFFECTIVE STREAM AREA(ACRES) =      21.44
  TOTAL STREAM AREA(ACRES) =      21.65
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      18.58

****************************************************************************
  FLOW PROCESS FROM NODE    312.00 TO NODE    313.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   539.00
  ELEVATION DATA: UPSTREAM(FEET) =    264.00  DOWNSTREAM(FEET) =    259.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.244
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.194
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B       0.66      0.30      0.850    36   15.24
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =      0.56
  TOTAL AREA(ACRES) =      0.66   PEAK FLOW RATE(CFS) =      0.56

****************************************************************************
  FLOW PROCESS FROM NODE    313.00 TO NODE    314.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   254.00  DOWNSTREAM(FEET) =   251.30
  FLOW LENGTH(FEET) =   481.00   MANNING'S N =  0.013
```

```
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   2.48
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       0.56
PIPE TRAVEL TIME(MIN.) =   3.23    Tc(MIN.) =   18.48
LONGEST FLOWPATH FROM NODE    312.00 TO NODE    314.00 =    1020.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    314.00 TO NODE    314.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   18.48
RAINFALL INTENSITY(INCH/HR) =   1.07
AREA-AVERAGED Fm(INCH/HR) =  0.26
AREA-AVERAGED Fp(INCH/HR) =  0.30
AREA-AVERAGED Ap =  0.85
EFFECTIVE STREAM AREA(ACRES) =       0.66
TOTAL STREAM AREA(ACRES) =       0.66
PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.56

** CONFLUENCE DATA **
 STREAM       Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER     (CFS)   (MIN.) (INCH/HR)  (INCH/HR)           (ACRES)    NODE
    1       18.58   20.46    1.008   0.30( 0.05) 0.15      21.4     300.00
    1       18.04   21.62    0.977   0.30( 0.05) 0.16      21.5     308.00
    1       17.09   23.79    0.925   0.30( 0.05) 0.16      21.6     304.00
    2        0.56   18.48    1.069   0.30( 0.26) 0.85       0.7     312.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
 STREAM       Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER     (CFS)   (MIN.) (INCH/HR)  (INCH/HR)           (ACRES)    NODE
    1       18.39   18.48    1.069   0.30( 0.05) 0.18      20.0     312.00
    2       19.10   20.46    1.008   0.30( 0.05) 0.18      22.1     300.00
    3       18.54   21.62    0.977   0.30( 0.05) 0.18      22.2     308.00
    4       17.55   23.79    0.925   0.30( 0.05) 0.18      22.3     304.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       19.10    Tc(MIN.) =    20.46
EFFECTIVE AREA(ACRES) =       22.10   AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.18
TOTAL AREA(ACRES) =       22.3
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    314.00 =    2882.00 FEET.

****************************************************************************
```

```
  FLOW PROCESS FROM NODE     314.00 TO NODE     315.00 IS CODE =  31
----------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
======================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   251.30  DOWNSTREAM(FEET) =   249.40
  FLOW LENGTH(FEET) =   385.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.89
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       19.10
  PIPE TRAVEL TIME(MIN.) =   1.09    Tc(MIN.) =   21.55
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    315.00 =    3267.00 FEET.

**********************************************************************
  FLOW PROCESS FROM NODE     315.00 TO NODE     315.00 IS CODE =  81
----------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
======================================================================
  MAINLINE Tc(MIN.) =   21.55
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.979
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        3.67      0.30      0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     3.67      SUBAREA RUNOFF(CFS) =     3.13
  EFFECTIVE AREA(ACRES) =      25.77   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =        26.0       PEAK FLOW RATE(CFS) =      21.55

**********************************************************************
  FLOW PROCESS FROM NODE     315.00 TO NODE     316.00 IS CODE =  31
----------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
======================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   249.40  DOWNSTREAM(FEET) =   247.30
  FLOW LENGTH(FEET) =   367.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  21.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.37
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       21.55
  PIPE TRAVEL TIME(MIN.) =   0.96    Tc(MIN.) =   22.51
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    316.00 =    3634.00 FEET.

**********************************************************************
  FLOW PROCESS FROM NODE     316.00 TO NODE     316.00 IS CODE =  81
----------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
======================================================================
```

```
MAINLINE Tc(MIN.) =   22.51
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.954
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        3.62      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =     3.62      SUBAREA RUNOFF(CFS) =     3.01
EFFECTIVE AREA(ACRES) =     29.39   AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
TOTAL AREA(ACRES) =       29.6       PEAK FLOW RATE(CFS) =      24.00

****************************************************************************
FLOW PROCESS FROM NODE    316.00 TO NODE    319.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   247.30  DOWNSTREAM(FEET) =   247.00
FLOW LENGTH(FEET) =    42.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  27.0 INCH PIPE IS  21.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   7.11
ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      24.00
PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =   22.61
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    319.00 =    3676.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    319.00 TO NODE    319.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   22.61
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.952
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        0.84      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =     0.84      SUBAREA RUNOFF(CFS) =     0.70
EFFECTIVE AREA(ACRES) =     30.23   AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
TOTAL AREA(ACRES) =       30.4       PEAK FLOW RATE(CFS) =      24.64

****************************************************************************
FLOW PROCESS FROM NODE    319.00 TO NODE    319.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
```

```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    22.61
  RAINFALL INTENSITY(INCH/HR) =    0.95
  AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.16
  EFFECTIVE STREAM AREA(ACRES) =       30.23
  TOTAL STREAM AREA(ACRES) =       30.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       24.64

****************************************************************************
  FLOW PROCESS FROM NODE    317.00 TO NODE    318.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    684.00
  ELEVATION DATA: UPSTREAM(FEET) =    263.00  DOWNSTREAM(FEET) =    256.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   16.688
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.133
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.82      0.30      0.850    36   16.69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =       0.65
  TOTAL AREA(ACRES) =       0.82   PEAK FLOW RATE(CFS) =       0.65

****************************************************************************
  FLOW PROCESS FROM NODE    318.00 TO NODE    319.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   251.50  DOWNSTREAM(FEET) =   247.00
  FLOW LENGTH(FEET) =   441.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.22
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.65
  PIPE TRAVEL TIME(MIN.) =   2.28    Tc(MIN.) =   18.97
  LONGEST FLOWPATH FROM NODE    317.00 TO NODE    319.00 =    1125.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    319.00 TO NODE    319.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
```

```
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   18.97
  RAINFALL INTENSITY(INCH/HR) =   1.05
  AREA-AVERAGED Fm(INCH/HR) =  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.85
  EFFECTIVE STREAM AREA(ACRES) =        0.82
  TOTAL STREAM AREA(ACRES) =        0.82
  PEAK FLOW RATE(CFS) AT CONFLUENCE =        0.65

  ** CONFLUENCE DATA **
   STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)            (ACRES)    NODE
      1        24.24   20.63     1.003   0.30( 0.05) 0.16       28.1     312.00
      1        24.64   22.61     0.952   0.30( 0.05) 0.16       30.2     300.00
      1        23.97   23.77     0.925   0.30( 0.05) 0.16       30.3     308.00
      1        22.78   25.95     0.880   0.30( 0.05) 0.16       30.4     304.00
      2         0.65   18.97     1.053   0.30( 0.26) 0.85        0.8     317.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)            (ACRES)    NODE
      1        24.09   18.97     1.053   0.30( 0.05) 0.18       26.7     317.00
      2        24.85   20.63     1.003   0.30( 0.05) 0.17       29.0     312.00
      3        25.20   22.61     0.952   0.30( 0.05) 0.17       31.1     300.00
      4        24.51   23.77     0.925   0.30( 0.05) 0.18       31.2     308.00
      5        23.29   25.95     0.880   0.30( 0.05) 0.18       31.3     304.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       25.20    Tc(MIN.) =    22.61
  EFFECTIVE AREA(ACRES) =       31.05   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =        31.3
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    319.00 =    3676.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    319.00 TO NODE    320.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   247.00  DOWNSTREAM(FEET) =   244.30
  FLOW LENGTH(FEET) =   381.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  19.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.36
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       25.20
```

```
  PIPE TRAVEL TIME(MIN.) =    0.86     Tc(MIN.) =    23.47
  LONGEST FLOWPATH FROM NODE     300.00 TO NODE     320.00 =     4057.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     320.00 TO NODE     320.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    23.47
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.932
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.67      0.30      0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     0.67      SUBAREA RUNOFF(CFS) =     0.54
  EFFECTIVE AREA(ACRES) =      31.72   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =        31.9       PEAK FLOW RATE(CFS) =       25.20
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE     320.00 TO NODE     320.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    23.47
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.932
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        3.00      0.30      0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     3.00      SUBAREA RUNOFF(CFS) =     2.43
  EFFECTIVE AREA(ACRES) =      34.72   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =        34.9       PEAK FLOW RATE(CFS) =       27.56

****************************************************************************
  FLOW PROCESS FROM NODE     320.00 TO NODE     321.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    244.30  DOWNSTREAM(FEET) =    242.40
  FLOW LENGTH(FEET) =    410.00    MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    6.40
  ESTIMATED PIPE DIAMETER(INCH) =  33.00     NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       27.56
```

```
  PIPE TRAVEL TIME(MIN.) =    1.07     Tc(MIN.) =    24.54
  LONGEST FLOWPATH FROM NODE     300.00 TO NODE     321.00 =     4467.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     321.00 TO NODE     321.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    24.54
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.908
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.53      0.30      0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     1.53      SUBAREA RUNOFF(CFS) =     1.21
  EFFECTIVE AREA(ACRES) =      36.25   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =        36.5       PEAK FLOW RATE(CFS) =      28.04

****************************************************************************
  FLOW PROCESS FROM NODE     321.00 TO NODE     321.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    24.54
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.908
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        2.76      0.30      0.200    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =     2.76      SUBAREA RUNOFF(CFS) =     2.11
  EFFECTIVE AREA(ACRES) =      39.01   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =        39.2       PEAK FLOW RATE(CFS) =      30.15

****************************************************************************
  FLOW PROCESS FROM NODE     321.00 TO NODE     324.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    242.40  DOWNSTREAM(FEET) =    241.20
  FLOW LENGTH(FEET) =     30.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  14.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.79
  ESTIMATED PIPE DIAMETER(INCH) =  24.00     NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       30.15
```

```
  PIPE TRAVEL TIME(MIN.) =    0.03     Tc(MIN.) =    24.57
  LONGEST FLOWPATH FROM NODE     300.00 TO NODE     324.00 =     4497.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     324.00 TO NODE     324.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    24.57
  RAINFALL INTENSITY(INCH/HR) =    0.91
  AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.17
  EFFECTIVE STREAM AREA(ACRES) =       39.01
  TOTAL STREAM AREA(ACRES) =       39.22
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       30.15

****************************************************************************
  FLOW PROCESS FROM NODE     322.00 TO NODE     323.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    724.00
  ELEVATION DATA: UPSTREAM(FEET) =     259.00  DOWNSTREAM(FEET) =     252.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    17.013
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.121
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.87      0.30     0.850    36   17.01
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =       0.68
  TOTAL AREA(ACRES) =       0.87   PEAK FLOW RATE(CFS) =       0.68

****************************************************************************
  FLOW PROCESS FROM NODE     323.00 TO NODE     324.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    246.00  DOWNSTREAM(FEET) =    241.20
  FLOW LENGTH(FEET) =    464.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    3.27
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```

```
PIPE-FLOW(CFS) =        0.68
PIPE TRAVEL TIME(MIN.) =   2.36     Tc(MIN.) =    19.38
LONGEST FLOWPATH FROM NODE     322.00 TO NODE     324.00 =     1188.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     324.00 TO NODE     324.00 IS CODE =    1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =    19.38
RAINFALL INTENSITY(INCH/HR) =    1.04
AREA-AVERAGED Fm(INCH/HR) =  0.26
AREA-AVERAGED Fp(INCH/HR) =  0.30
AREA-AVERAGED Ap =  0.85
EFFECTIVE STREAM AREA(ACRES) =        0.87
TOTAL STREAM AREA(ACRES) =        0.87
PEAK FLOW RATE(CFS) AT CONFLUENCE =        0.68

** CONFLUENCE DATA **
 STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)            (ACRES)    NODE
    1        29.48   20.98     0.994   0.30( 0.05) 0.17       34.7     317.00
    1        30.02   22.60     0.952   0.30( 0.05) 0.17       36.9     312.00
    1        30.15   24.57     0.908   0.30( 0.05) 0.17       39.0     300.00
    1        29.35   25.77     0.883   0.30( 0.05) 0.17       39.1     308.00
    1        27.95   28.00     0.842   0.30( 0.05) 0.17       39.2     304.00
    2         0.68   19.38     1.040   0.30( 0.26) 0.85        0.9     322.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
 STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)            (ACRES)    NODE
    1        29.24   19.38     1.040   0.30( 0.06) 0.18       32.9     322.00
    2        30.12   20.98     0.994   0.30( 0.06) 0.18       35.5     317.00
    3        30.62   22.60     0.952   0.30( 0.05) 0.18       37.8     312.00
    4        30.71   24.57     0.908   0.30( 0.05) 0.18       39.9     300.00
    5        29.89   25.77     0.883   0.30( 0.05) 0.18       40.0     308.00
    6        28.46   28.00     0.842   0.30( 0.06) 0.18       40.1     304.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       30.71     Tc(MIN.) =     24.57
EFFECTIVE AREA(ACRES) =       39.88    AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.18
TOTAL AREA(ACRES) =       40.1
LONGEST FLOWPATH FROM NODE     300.00 TO NODE     324.00 =     4497.00 FEET.

****************************************************************************
```

```
  FLOW PROCESS FROM NODE     324.00 TO NODE     325.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   241.20  DOWNSTREAM(FEET) =   239.60
  FLOW LENGTH(FEET) =   215.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.75
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       30.71
  PIPE TRAVEL TIME(MIN.) =   0.46    Tc(MIN.) =   25.04
  LONGEST FLOWPATH FROM NODE     300.00 TO NODE     325.00 =    4712.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     325.00 TO NODE     325.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   25.04
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.898
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        1.53      0.30      0.200    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =     1.53      SUBAREA RUNOFF(CFS) =     1.15
  EFFECTIVE AREA(ACRES) =      41.41   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.18
  TOTAL AREA(ACRES) =        41.6       PEAK FLOW RATE(CFS) =       31.44

****************************************************************************
  FLOW PROCESS FROM NODE     325.00 TO NODE     328.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   239.60  DOWNSTREAM(FEET) =   237.20
  FLOW LENGTH(FEET) =    86.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.87
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       31.44
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =   25.15
  LONGEST FLOWPATH FROM NODE     300.00 TO NODE     328.00 =    4798.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     328.00 TO NODE     328.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

```
==========================================================================
  MAINLINE Tc(MIN.) =   25.15
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.896
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.40      0.30      0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     0.40      SUBAREA RUNOFF(CFS) =     0.31
  EFFECTIVE AREA(ACRES) =     41.81   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.18
  TOTAL AREA(ACRES) =        42.0       PEAK FLOW RATE(CFS) =      31.67

**************************************************************************
  FLOW PROCESS FROM NODE    328.00 TO NODE    328.00 IS CODE =  81
--------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
  MAINLINE Tc(MIN.) =   25.15
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.896
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                 B        0.90      0.30      0.850    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA AREA(ACRES) =     0.90      SUBAREA RUNOFF(CFS) =     0.52
  EFFECTIVE AREA(ACRES) =     42.71   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.19
  TOTAL AREA(ACRES) =        42.9       PEAK FLOW RATE(CFS) =      32.18

**************************************************************************
  FLOW PROCESS FROM NODE    328.00 TO NODE    328.00 IS CODE =   1
--------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   25.15
  RAINFALL INTENSITY(INCH/HR) =   0.90
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.19
  EFFECTIVE STREAM AREA(ACRES) =      42.71
  TOTAL STREAM AREA(ACRES) =      42.92
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      32.18

**************************************************************************
  FLOW PROCESS FROM NODE    326.00 TO NODE    327.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    455.00
  ELEVATION DATA: UPSTREAM(FEET) =     251.40  DOWNSTREAM(FEET) =     249.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.948
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.163
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.86      0.30      0.850    36   15.95
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =       0.70
  TOTAL AREA(ACRES) =       0.86   PEAK FLOW RATE(CFS) =       0.70

******************************************************************************
  FLOW PROCESS FROM NODE    327.00 TO NODE    328.00 IS CODE =  31
------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   240.00  DOWNSTREAM(FEET) =   237.20
  FLOW LENGTH(FEET) =   461.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.73
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.70
  PIPE TRAVEL TIME(MIN.) =   2.81    Tc(MIN.) =   18.76
  LONGEST FLOWPATH FROM NODE    326.00 TO NODE    328.00 =     916.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    328.00 TO NODE    328.00 IS CODE =   1
------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   18.76
  RAINFALL INTENSITY(INCH/HR) =   1.06
  AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.85
  EFFECTIVE STREAM AREA(ACRES) =       0.86
  TOTAL STREAM AREA(ACRES) =       0.86
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.70

  ** CONFLUENCE DATA **
   STREAM        Q       Tc    Intensity   Fp(Fm)     Ap      Ae      HEADWATER
```

NUMBER	(CFS)	(MIN.)	(INCH/HR)	(INCH/HR)		(ACRES)	NODE
1	30.94	19.95	1.023	0.30(0.06)	0.20	35.7	322.00
1	31.73	21.55	0.979	0.30(0.06)	0.20	38.4	317.00
1	32.17	23.17	0.939	0.30(0.06)	0.20	40.6	312.00
1	32.18	25.15	0.896	0.30(0.06)	0.19	42.7	300.00
1	31.33	26.35	0.872	0.30(0.06)	0.20	42.8	308.00
1	29.86	28.58	0.832	0.30(0.06)	0.20	42.9	304.00
2	0.70	18.76	1.060	0.30(0.25)	0.85	0.9	326.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	30.91	18.76	1.060	0.30(0.07)	0.22	34.4	326.00
2	31.61	19.95	1.023	0.30(0.06)	0.22	36.6	322.00
3	32.36	21.55	0.979	0.30(0.06)	0.21	39.2	317.00
4	32.76	23.17	0.939	0.30(0.06)	0.21	41.5	312.00
5	32.74	25.15	0.896	0.30(0.06)	0.21	43.6	300.00
6	31.87	26.35	0.872	0.30(0.06)	0.21	43.7	308.00
7	30.36	28.58	0.832	0.30(0.06)	0.21	43.8	304.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 32.76 Tc(MIN.) = 23.17
EFFECTIVE AREA(ACRES) = 41.49 AREA-AVERAGED Fm(INCH/HR) = 0.06
AREA-AVERAGED Fp(INCH/HR) = 0.30 AREA-AVERAGED Ap = 0.21
TOTAL AREA(ACRES) = 43.8
LONGEST FLOWPATH FROM NODE 300.00 TO NODE 328.00 = 4798.00 FEET.

```
****************************************************************************
  FLOW PROCESS FROM NODE    328.00 TO NODE    328.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   23.17
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.939
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        4.24      0.30      0.200    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    4.24      SUBAREA RUNOFF(CFS) =    3.35
  EFFECTIVE AREA(ACRES) =     45.73   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.21
  TOTAL AREA(ACRES) =       48.0       PEAK FLOW RATE(CFS) =      36.05

****************************************************************************
  FLOW PROCESS FROM NODE    328.00 TO NODE    329.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   237.20  DOWNSTREAM(FEET) =   235.40
FLOW LENGTH(FEET) =   300.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  33.0 INCH PIPE IS  25.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   7.43
ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      36.05
PIPE TRAVEL TIME(MIN.) =   0.67    Tc(MIN.) =   23.85
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    329.00 =    5098.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    329.00 TO NODE    329.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
MAINLINE Tc(MIN.) =   23.85
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.923
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
RESIDENTIAL
"11+ DWELLINGS/ACRE"        B        2.70      0.30      0.200    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
SUBAREA AREA(ACRES) =    2.70      SUBAREA RUNOFF(CFS) =    2.10
EFFECTIVE AREA(ACRES) =     48.43   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.21
TOTAL AREA(ACRES) =       50.7       PEAK FLOW RATE(CFS) =      37.52

****************************************************************************
FLOW PROCESS FROM NODE    329.00 TO NODE    411.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   235.40  DOWNSTREAM(FEET) =   235.00
FLOW LENGTH(FEET) =    74.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  36.0 INCH PIPE IS  24.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   7.32
ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      37.52
PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =   24.02
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    411.00 =    5172.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    411.00 TO NODE    411.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
TOTAL NUMBER OF STREAMS =  2
```

```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    24.02
  RAINFALL INTENSITY(INCH/HR) =    0.92
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.21
  EFFECTIVE STREAM AREA(ACRES) =       48.43
  TOTAL STREAM AREA(ACRES) =       50.72
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       37.52

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    295.00
  ELEVATION DATA: UPSTREAM(FEET) =    270.00  DOWNSTREAM(FEET) =    267.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.402
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.807
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        1.03      0.30      0.100    36    7.40
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =       1.65
  TOTAL AREA(ACRES) =       1.03   PEAK FLOW RATE(CFS) =       1.65

****************************************************************************
  FLOW PROCESS FROM NODE    401.00 TO NODE    402.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   261.00  DOWNSTREAM(FEET) =   257.30
  FLOW LENGTH(FEET) =   234.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.92
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.65
  PIPE TRAVEL TIME(MIN.) =   0.79    Tc(MIN.) =    8.20
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    402.00 =     529.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
MAINLINE Tc(MIN.) =     8.20
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.705
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        2.89      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =     2.89      SUBAREA RUNOFF(CFS) =     4.36
EFFECTIVE AREA(ACRES) =       3.92   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =         3.9       PEAK FLOW RATE(CFS) =       5.91

****************************************************************************
FLOW PROCESS FROM NODE    402.00 TO NODE    403.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   257.30  DOWNSTREAM(FEET) =   256.80
FLOW LENGTH(FEET) =   104.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.39
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =        5.91
PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =    8.59
LONGEST FLOWPATH FROM NODE    400.00 TO NODE    403.00 =     633.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    403.00 TO NODE    403.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =     8.59
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.659
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        0.62      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =     0.62      SUBAREA RUNOFF(CFS) =     0.91
EFFECTIVE AREA(ACRES) =       4.54   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =         4.5       PEAK FLOW RATE(CFS) =       6.66

****************************************************************************
FLOW PROCESS FROM NODE    403.00 TO NODE    404.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
```

```
ELEVATION DATA: UPSTREAM(FEET) =   256.80  DOWNSTREAM(FEET) =   253.10
FLOW LENGTH(FEET) =   737.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.54
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =        6.66
PIPE TRAVEL TIME(MIN.) =   2.70    Tc(MIN.) =   11.29
LONGEST FLOWPATH FROM NODE    400.00 TO NODE    404.00 =    1370.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    404.00 TO NODE    404.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   11.29
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.418
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        5.89      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =     5.89      SUBAREA RUNOFF(CFS) =     7.36
EFFECTIVE AREA(ACRES) =      10.43   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =        10.4       PEAK FLOW RATE(CFS) =      13.03

****************************************************************************
FLOW PROCESS FROM NODE    404.00 TO NODE    405.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   253.10  DOWNSTREAM(FEET) =   252.60
FLOW LENGTH(FEET) =    94.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.57
ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       13.03
PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =   11.57
LONGEST FLOWPATH FROM NODE    400.00 TO NODE    405.00 =    1464.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    405.00 TO NODE    405.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   11.57
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.398
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
```

```
COMMERCIAL                    B        0.62      0.30      0.100     36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =     0.62       SUBAREA RUNOFF(CFS) =     0.76
EFFECTIVE AREA(ACRES) =      11.05   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =        11.1       PEAK FLOW RATE(CFS) =      13.61

****************************************************************************
FLOW PROCESS FROM NODE    405.00 TO NODE    406.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   252.60  DOWNSTREAM(FEET) =   249.80
FLOW LENGTH(FEET) =   574.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.41
ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      13.61
PIPE TRAVEL TIME(MIN.) =   1.77    Tc(MIN.) =   13.34
LONGEST FLOWPATH FROM NODE    400.00 TO NODE    406.00 =    2038.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    406.00 TO NODE    406.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   13.34
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.289
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                    B        4.77      0.30      0.100     36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =     4.77       SUBAREA RUNOFF(CFS) =     5.40
EFFECTIVE AREA(ACRES) =      15.82   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =        15.8       PEAK FLOW RATE(CFS) =      17.92

****************************************************************************
FLOW PROCESS FROM NODE    406.00 TO NODE    407.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   249.80  DOWNSTREAM(FEET) =   249.10
FLOW LENGTH(FEET) =   136.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  27.0 INCH PIPE IS  19.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.95
ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
```

```
PIPE-FLOW(CFS) =        17.92
PIPE TRAVEL TIME(MIN.) =    0.38     Tc(MIN.) =    13.72
LONGEST FLOWPATH FROM NODE     400.00 TO NODE     407.00 =     2174.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     407.00 TO NODE     407.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =    13.72
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.268
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        0.63      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =     0.63      SUBAREA RUNOFF(CFS) =     0.70
EFFECTIVE AREA(ACRES) =      16.45   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =        16.4       PEAK FLOW RATE(CFS) =       18.33

****************************************************************************
FLOW PROCESS FROM NODE     407.00 TO NODE     408.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    249.10  DOWNSTREAM(FEET) =    245.60
FLOW LENGTH(FEET) =    705.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  27.0 INCH PIPE IS  19.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =    5.88
ESTIMATED PIPE DIAMETER(INCH) =  27.00     NUMBER OF PIPES =    1
PIPE-FLOW(CFS) =        18.33
PIPE TRAVEL TIME(MIN.) =    2.00     Tc(MIN.) =    15.72
LONGEST FLOWPATH FROM NODE     400.00 TO NODE     408.00 =     2879.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     408.00 TO NODE     408.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =    15.72
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.173
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        1.67      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =     1.67      SUBAREA RUNOFF(CFS) =     1.72
EFFECTIVE AREA(ACRES) =      18.12   AREA-AVERAGED Fm(INCH/HR) =  0.03
```

```
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        18.1        PEAK FLOW RATE(CFS) =       18.64

****************************************************************************
  FLOW PROCESS FROM NODE    408.00 TO NODE    408.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   15.72
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.173
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        4.41      0.30      0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    4.41       SUBAREA RUNOFF(CFS) =     4.54
  EFFECTIVE AREA(ACRES) =     22.53   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        22.5        PEAK FLOW RATE(CFS) =       23.17

****************************************************************************
  FLOW PROCESS FROM NODE    408.00 TO NODE    409.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   245.60  DOWNSTREAM(FEET) =   243.50
  FLOW LENGTH(FEET) =   404.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.38
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       23.17
  PIPE TRAVEL TIME(MIN.) =   1.05    Tc(MIN.) =   16.78
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    409.00 =    3283.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    409.00 TO NODE    409.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   16.78
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.130
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        3.63      0.30      0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    3.63       SUBAREA RUNOFF(CFS) =     3.59
  EFFECTIVE AREA(ACRES) =     26.16   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
```

```
  TOTAL AREA(ACRES) =        26.2        PEAK FLOW RATE(CFS) =       25.90

****************************************************************************
  FLOW PROCESS FROM NODE     409.00 TO NODE     410.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   243.50  DOWNSTREAM(FEET) =   240.50
  FLOW LENGTH(FEET) =   455.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.18
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       25.90
  PIPE TRAVEL TIME(MIN.) =   1.06    Tc(MIN.) =   17.83
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    410.00 =    3738.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     410.00 TO NODE     410.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.83
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.091
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        3.64      0.30      0.200    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =     3.64      SUBAREA RUNOFF(CFS) =     3.38
  EFFECTIVE AREA(ACRES) =     29.80   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.11
  TOTAL AREA(ACRES) =        29.8       PEAK FLOW RATE(CFS) =       28.36

****************************************************************************
  FLOW PROCESS FROM NODE     410.00 TO NODE     411.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   240.50  DOWNSTREAM(FEET) =   235.00
  FLOW LENGTH(FEET) =   308.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  19.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.41
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       28.36
  PIPE TRAVEL TIME(MIN.) =   0.49    Tc(MIN.) =   18.33
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    411.00 =    4046.00 FEET.

****************************************************************************
```

```
 FLOW PROCESS FROM NODE     411.00 TO NODE     411.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =    18.33
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.074
 SUBAREA LOSS RATE DATA(AMC  I ):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)   CN
 PUBLIC PARK                 B        2.77      0.30      0.850    36
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
 SUBAREA AREA(ACRES) =     2.77       SUBAREA RUNOFF(CFS) =     2.04
 EFFECTIVE AREA(ACRES) =      32.57    AREA-AVERAGED Fm(INCH/HR) =  0.05
 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
 TOTAL AREA(ACRES) =        32.6        PEAK FLOW RATE(CFS) =       29.94

****************************************************************************
 FLOW PROCESS FROM NODE     411.00 TO NODE     411.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    18.33
 RAINFALL INTENSITY(INCH/HR) =    1.07
 AREA-AVERAGED Fm(INCH/HR) =  0.05
 AREA-AVERAGED Fp(INCH/HR) =  0.30
 AREA-AVERAGED Ap =  0.17
 EFFECTIVE STREAM AREA(ACRES) =       32.57
 TOTAL STREAM AREA(ACRES) =       32.57
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       29.94

 ** CONFLUENCE DATA **
  STREAM        Q       Tc    Intensity   Fp(Fm)      Ap      Ae      HEADWATER
  NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)    NODE
     1        36.28   19.61     1.033   0.30( 0.06) 0.21      41.4     326.00
     1        36.79   20.80     0.999   0.30( 0.06) 0.21      43.5     322.00
     1        37.31   22.39     0.957   0.30( 0.06) 0.21      46.2     317.00
     1        37.52   24.02     0.920   0.30( 0.06) 0.21      48.4     312.00
     1        37.29   25.99     0.879   0.30( 0.06) 0.21      50.5     300.00
     1        36.31   27.20     0.856   0.30( 0.06) 0.21      50.6     308.00
     1        34.62   29.43     0.818   0.30( 0.06) 0.21      50.7     304.00
     2        29.94   18.33     1.074   0.30( 0.05) 0.17      32.6     400.00

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
  STREAM        Q       Tc    Intensity   Fp(Fm)      Ap      Ae      HEADWATER
  NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)    NODE
```

1	65.28	18.33	1.074	0.30(0.06)	0.20	71.2	400.00
2	65.02	19.61	1.033	0.30(0.06)	0.20	74.0	326.00
3	64.53	20.80	0.999	0.30(0.06)	0.20	76.1	322.00
4	63.84	22.39	0.957	0.30(0.06)	0.20	78.7	317.00
5	62.94	24.02	0.920	0.30(0.06)	0.20	81.0	312.00
6	61.51	25.99	0.879	0.30(0.06)	0.19	83.1	300.00
7	59.87	27.20	0.856	0.30(0.06)	0.19	83.2	308.00
8	57.07	29.43	0.818	0.30(0.06)	0.20	83.3	304.00

```
COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       65.28    Tc(MIN.) =     18.33
EFFECTIVE AREA(ACRES) =       71.24   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
TOTAL AREA(ACRES) =        83.3
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    411.00 =    5172.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    411.00 TO NODE    412.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   235.00  DOWNSTREAM(FEET) =   233.50
FLOW LENGTH(FEET) =    40.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  17.28
ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       65.28
PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =   18.37
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    412.00 =    5212.00 FEET.
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =        83.3  TC(MIN.) =      18.37
EFFECTIVE AREA(ACRES) =      71.24  AREA-AVERAGED Fm(INCH/HR)=  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.196
PEAK FLOW RATE(CFS)    =       65.28

** PEAK FLOW RATE TABLE **
```

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	65.28	18.37	1.073	0.30(0.06)	0.20	71.2	400.00
2	65.02	19.65	1.032	0.30(0.06)	0.20	74.0	326.00
3	64.53	20.84	0.998	0.30(0.06)	0.20	76.1	322.00
4	63.84	22.43	0.956	0.30(0.06)	0.20	78.7	317.00
5	62.94	24.05	0.919	0.30(0.06)	0.20	81.0	312.00
6	61.51	26.03	0.878	0.30(0.06)	0.19	83.1	300.00
7	59.87	27.24	0.856	0.30(0.06)	0.19	83.2	308.00
8	57.07	29.47	0.818	0.30(0.06)	0.20	83.3	304.00

```
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
2 YEAR STORM - PROPOSED CONDITION
STREAM A - MARSHBURN CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 2Y100Q1.DAT
  TIME/DATE OF STUDY: 13:19 11/17/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                      --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =     2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)    (FT)     SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  =====  ======  =====  =======
  1   18.0     10.0   0.022/0.022/0.020   0.50    1.50 0.0312 0.125 0.0170
  2   18.0     10.0   0.022/0.022/0.020   0.50    1.50 0.0312 0.125 0.0170

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                          AREA-AVERAGED
         DURATION       RAINFALL(INCH)
```

```
        5-MINUTES          0.19
       30-MINUTES          0.40
        1-HOUR             0.53
        3-HOUR             0.89
        6-HOUR             1.22
       24-HOUR             2.05
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR UNIT HYDROGRAPH METHOD*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    244.70  DOWNSTREAM(FEET) =    242.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.818
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.751
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B       0.48      0.30      0.100    36    7.82
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =       0.74
  TOTAL AREA(ACRES) =       0.48   PEAK FLOW RATE(CFS) =       0.74

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  63
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  242.30  DOWNSTREAM ELEVATION(FEET) =  237.10
  STREET LENGTH(FEET) =   638.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.022
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.022

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0170
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0170
  MAXIMUM ALLOWABLE STREET FLOW DEPTH(FEET) =   0.50

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.80
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
```

```
    STREET FLOW DEPTH(FEET) =  0.27
    HALFSTREET FLOOD WIDTH(FEET) =    6.55
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.53
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.41
  STREET FLOW TRAVEL TIME(MIN.) =   6.94   Tc(MIN.) =   14.75
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.216
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.96      0.30      0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.96      SUBAREA RUNOFF(CFS) =    2.09
  EFFECTIVE AREA(ACRES) =      2.44    AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        2.4        PEAK FLOW RATE(CFS) =       2.61

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   7.77
  FLOW VELOCITY(FEET/SEC.) =  1.67   DEPTH*VELOCITY(FT*FT/SEC.) =   0.49
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     938.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   14.75
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.216
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        5.47      0.30      0.200    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    5.47      SUBAREA RUNOFF(CFS) =    5.69
  EFFECTIVE AREA(ACRES) =      7.91   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =        7.9        PEAK FLOW RATE(CFS) =       8.30

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    105.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   223.80  DOWNSTREAM(FEET) =   223.60
  FLOW LENGTH(FEET) =    31.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.41
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =        8.30
  PIPE TRAVEL TIME(MIN.) =   0.10     Tc(MIN.) =    14.85
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =     969.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.85
  RAINFALL INTENSITY(INCH/HR) =   1.21
  AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.17
  EFFECTIVE STREAM AREA(ACRES) =        7.91
  TOTAL STREAM AREA(ACRES) =        7.91
  PEAK FLOW RATE(CFS) AT CONFLUENCE =        8.30

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   457.00
  ELEVATION DATA: UPSTREAM(FEET) =    244.50  DOWNSTREAM(FEET) =    241.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.828
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.213
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.56      0.30      0.850    36   14.83
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =       0.48
  TOTAL AREA(ACRES) =       0.56   PEAK FLOW RATE(CFS) =       0.48

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   235.00  DOWNSTREAM(FEET) =   223.60
  FLOW LENGTH(FEET) =   565.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.75
```

```
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =        0.48
PIPE TRAVEL TIME(MIN.) =   2.51    Tc(MIN.) =   17.34
LONGEST FLOWPATH FROM NODE    103.00 TO NODE    105.00 =    1022.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   17.34
RAINFALL INTENSITY(INCH/HR) =   1.11
AREA-AVERAGED Fm(INCH/HR) =  0.25
AREA-AVERAGED Fp(INCH/HR) =  0.30
AREA-AVERAGED Ap =  0.85
EFFECTIVE STREAM AREA(ACRES) =        0.56
TOTAL STREAM AREA(ACRES) =        0.56
PEAK FLOW RATE(CFS) AT CONFLUENCE =        0.48

** CONFLUENCE DATA **
 STREAM       Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER     (CFS)   (MIN.) (INCH/HR) (INCH/HR)           (ACRES)     NODE
    1        8.30   14.85    1.212  0.30( 0.05) 0.17        7.9     100.00
    2        0.48   17.34    1.109  0.30( 0.25) 0.85        0.6     103.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
 STREAM       Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER     (CFS)   (MIN.) (INCH/HR) (INCH/HR)           (ACRES)     NODE
    1        8.76   14.85    1.212  0.30( 0.06) 0.21        8.4     100.00
    2        8.04   17.34    1.109  0.30( 0.06) 0.21        8.5     103.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =        8.76    Tc(MIN.) =    14.85
EFFECTIVE AREA(ACRES) =        8.39   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.21
TOTAL AREA(ACRES) =        8.5
LONGEST FLOWPATH FROM NODE    103.00 TO NODE    105.00 =    1022.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   223.60  DOWNSTREAM(FEET) =   221.10
FLOW LENGTH(FEET) =   513.00   MANNING'S N =  0.013
```

```
DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.88
ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =        8.76
PIPE TRAVEL TIME(MIN.) =   1.75    Tc(MIN.) =   16.60
LONGEST FLOWPATH FROM NODE    103.00 TO NODE    106.00 =    1535.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   16.60
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.137
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        0.80      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    0.80      SUBAREA RUNOFF(CFS) =    0.80
EFFECTIVE AREA(ACRES) =      9.19   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
TOTAL AREA(ACRES) =        9.3       PEAK FLOW RATE(CFS) =       8.91

****************************************************************************
FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   16.60
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.137
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
RESIDENTIAL
"11+ DWELLINGS/ACRE"        B        5.14      0.30      0.200    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
SUBAREA AREA(ACRES) =    5.14      SUBAREA RUNOFF(CFS) =    4.98
EFFECTIVE AREA(ACRES) =     14.33   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
TOTAL AREA(ACRES) =       14.4       PEAK FLOW RATE(CFS) =      13.89

****************************************************************************
FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   221.10  DOWNSTREAM(FEET) =   218.50
FLOW LENGTH(FEET) =   538.00   MANNING'S N =  0.013
```

```
DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.40
ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       13.89
PIPE TRAVEL TIME(MIN.) =   1.66    Tc(MIN.) =   18.26
LONGEST FLOWPATH FROM NODE    103.00 TO NODE    107.00 =    2073.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   18.26
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.076
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        0.82      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    0.82      SUBAREA RUNOFF(CFS) =    0.77
EFFECTIVE AREA(ACRES) =     15.15   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.19
TOTAL AREA(ACRES) =       15.2       PEAK FLOW RATE(CFS) =      13.89
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   18.26
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.076
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
RESIDENTIAL
"11+ DWELLINGS/ACRE"        B        4.76      0.30      0.200    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
SUBAREA AREA(ACRES) =    4.76      SUBAREA RUNOFF(CFS) =    4.35
EFFECTIVE AREA(ACRES) =     19.91   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
TOTAL AREA(ACRES) =       20.0       PEAK FLOW RATE(CFS) =      18.23

****************************************************************************
FLOW PROCESS FROM NODE    107.00 TO NODE    108.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   218.50  DOWNSTREAM(FEET) =   216.10
```

```
FLOW LENGTH(FEET) =   522.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.68
ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      18.23
PIPE TRAVEL TIME(MIN.) =   1.53    Tc(MIN.) =   19.79
LONGEST FLOWPATH FROM NODE    103.00 TO NODE    108.00 =    2595.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   19.79
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.028
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        2.15      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    2.15      SUBAREA RUNOFF(CFS) =    1.93
EFFECTIVE AREA(ACRES) =     22.06   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.19
TOTAL AREA(ACRES) =       22.1       PEAK FLOW RATE(CFS) =      19.29

****************************************************************************
FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   19.79
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.028
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
RESIDENTIAL
"11+ DWELLINGS/ACRE"        B        3.67      0.30      0.200    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
SUBAREA AREA(ACRES) =    3.67      SUBAREA RUNOFF(CFS) =    3.20
EFFECTIVE AREA(ACRES) =     25.73   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.19
TOTAL AREA(ACRES) =       25.8       PEAK FLOW RATE(CFS) =      22.49

****************************************************************************
FLOW PROCESS FROM NODE    108.00 TO NODE    112.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   216.10  DOWNSTREAM(FEET) =   216.00
```

```
  FLOW LENGTH(FEET) =    53.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  24.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.34
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       22.49
  PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =   20.00
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    112.00 =    2648.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   20.00
  RAINFALL INTENSITY(INCH/HR) =   1.02
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.19
  EFFECTIVE STREAM AREA(ACRES) =      25.73
  TOTAL STREAM AREA(ACRES) =      25.81
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      22.49

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =    240.50  DOWNSTREAM(FEET) =    230.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   19.042
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.051
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B       1.19      0.30      0.850    36   19.04
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =      0.85
  TOTAL AREA(ACRES) =      1.19   PEAK FLOW RATE(CFS) =      0.85

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   225.00  DOWNSTREAM(FEET) =   220.00
```

```
FLOW LENGTH(FEET) =   517.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   3.42
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       0.85
PIPE TRAVEL TIME(MIN.) =   2.52    Tc(MIN.) =   21.56
LONGEST FLOWPATH FROM NODE    109.00 TO NODE    111.00 =    1517.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    111.00 TO NODE    111.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   21.56
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.978
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
PUBLIC PARK                 B        0.59      0.30      0.850    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
SUBAREA AREA(ACRES) =    0.59      SUBAREA RUNOFF(CFS) =    0.38
EFFECTIVE AREA(ACRES) =      1.78   AREA-AVERAGED Fm(INCH/HR) =  0.26
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.85
TOTAL AREA(ACRES) =        1.8       PEAK FLOW RATE(CFS) =       1.16

****************************************************************************
FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   220.00  DOWNSTREAM(FEET) =   216.00
FLOW LENGTH(FEET) =   407.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   3.74
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       1.16
PIPE TRAVEL TIME(MIN.) =   1.81    Tc(MIN.) =   23.38
LONGEST FLOWPATH FROM NODE    109.00 TO NODE    112.00 =    1924.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   23.38
```

```
RAINFALL INTENSITY(INCH/HR) =   0.93
AREA-AVERAGED Fm(INCH/HR) =  0.26
AREA-AVERAGED Fp(INCH/HR) =  0.30
AREA-AVERAGED Ap =  0.85
EFFECTIVE STREAM AREA(ACRES) =        1.78
TOTAL STREAM AREA(ACRES) =        1.78
PEAK FLOW RATE(CFS) AT CONFLUENCE =        1.16

** CONFLUENCE DATA **
 STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)            (ACRES)    NODE
    1        22.49   20.00     1.022   0.30( 0.06) 0.19      25.7     100.00
    1        20.94   22.56     0.953   0.30( 0.06) 0.19      25.8     103.00
    2         1.16   23.38     0.934   0.30( 0.26) 0.85       1.8     109.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
 STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)            (ACRES)    NODE
    1        23.61   20.00     1.022   0.30( 0.07) 0.22      27.3     100.00
    2        22.09   22.56     0.953   0.30( 0.07) 0.23      27.5     103.00
    3        21.65   23.38     0.934   0.30( 0.07) 0.23      27.6     109.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       23.61    Tc(MIN.) =    20.00
EFFECTIVE AREA(ACRES) =       27.25   AREA-AVERAGED Fm(INCH/HR) =  0.07
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.22
TOTAL AREA(ACRES) =        27.6
LONGEST FLOWPATH FROM NODE    103.00 TO NODE    112.00 =    2648.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    203.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   216.00  DOWNSTREAM(FEET) =   215.60
 FLOW LENGTH(FEET) =   383.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  39.0 INCH PIPE IS  29.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.47
 ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       23.61
 PIPE TRAVEL TIME(MIN.) =   1.84    Tc(MIN.) =   21.84
 LONGEST FLOWPATH FROM NODE    103.00 TO NODE    203.00 =    3031.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
```

```
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   21.84
  RAINFALL INTENSITY(INCH/HR) =   0.97
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.22
  EFFECTIVE STREAM AREA(ACRES) =       27.25
  TOTAL STREAM AREA(ACRES) =       27.59
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       23.61

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    242.80  DOWNSTREAM(FEET) =    239.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.292
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.823
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        1.20      0.30     0.100    36    7.29
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =       1.94
  TOTAL AREA(ACRES) =       1.20   PEAK FLOW RATE(CFS) =       1.94

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   239.40  DOWNSTREAM(FEET) =   228.50
  FLOW LENGTH(FEET) =  1000.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.51
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.94
  PIPE TRAVEL TIME(MIN.) =   3.70    Tc(MIN.) =   10.99
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =    1300.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

```
==============================================================================
  MAINLINE Tc(MIN.) =   10.99
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.440
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        8.46      0.30      0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    8.46       SUBAREA RUNOFF(CFS) =   10.74
  EFFECTIVE AREA(ACRES) =      9.66   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        9.7       PEAK FLOW RATE(CFS) =      12.26

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   228.50  DOWNSTREAM(FEET) =   215.60
  FLOW LENGTH(FEET) =  1275.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.00
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.26
  PIPE TRAVEL TIME(MIN.) =   3.03    Tc(MIN.) =   14.03
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    2575.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
  MAINLINE Tc(MIN.) =   14.03
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.252
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B       12.34      0.30      0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =   12.34      SUBAREA RUNOFF(CFS) =   13.57
  EFFECTIVE AREA(ACRES) =     22.00   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       22.0       PEAK FLOW RATE(CFS) =      24.20

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
```

```
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.03
  RAINFALL INTENSITY(INCH/HR) =   1.25
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       22.00
  TOTAL STREAM AREA(ACRES) =       22.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       24.20

  ** CONFLUENCE DATA **
   STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)            (ACRES)    NODE
      1        23.61   21.84    0.971  0.30( 0.07) 0.22      27.3     100.00
      1        22.09   24.41    0.911  0.30( 0.07) 0.23      27.5     103.00
      1        21.65   25.24    0.894  0.30( 0.07) 0.23      27.6     109.00
      2        24.20   14.03    1.252  0.30( 0.03) 0.10      22.0     200.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)            (ACRES)    NODE
      1        44.08   14.03    1.252  0.30( 0.05) 0.16      39.5     200.00
      2        42.24   21.84    0.971  0.30( 0.05) 0.17      49.3     100.00
      3        39.54   24.41    0.911  0.30( 0.05) 0.17      49.5     103.00
      4        38.75   25.24    0.894  0.30( 0.05) 0.17      49.6     109.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       44.08    Tc(MIN.) =    14.03
  EFFECTIVE AREA(ACRES) =       39.50   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =       49.6
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    203.00 =    3031.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   215.60  DOWNSTREAM(FEET) =   215.50
  FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  34.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.61
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       44.08
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =   14.28
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    204.00 =    3101.00 FEET.
```

```
==========================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)        =        49.6  TC(MIN.) =      14.28
  EFFECTIVE AREA(ACRES) =        39.50  AREA-AVERAGED Fm(INCH/HR)=  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.155
  PEAK FLOW RATE(CFS)      =        44.08

  ** PEAK FLOW RATE TABLE **
   STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)            (ACRES)    NODE
      1        44.08   14.28     1.239   0.30( 0.05) 0.16       39.5     200.00
      2        42.24   22.10     0.965   0.30( 0.05) 0.17       49.3     100.00
      3        39.54   24.67     0.905   0.30( 0.05) 0.17       49.5     103.00
      4        38.75   25.50     0.888   0.30( 0.05) 0.17       49.6     109.00
==========================================================================
==========================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
2 YEAR STORM - EXISTING CONDITION
STREAM C - AGUA CHINON CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 2Y100X3.DAT
  TIME/DATE OF STUDY: 13:17 11/17/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  =====  ====  ====  =======
  1   20.0     10.0    0.018/0.018/0.018  0.50    1.50 0.0312 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
         DURATION     RAINFALL(INCH)
         5-MINUTES          0.19
```

```
        30-MINUTES          0.40
         1-HOUR             0.53
         3-HOUR             0.89
         6-HOUR             1.22
        24-HOUR             2.05
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR UNIT HYDROGRAPH METHOD*

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    410.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   212.00
  ELEVATION DATA: UPSTREAM(FEET) =    279.00  DOWNSTREAM(FEET) =    268.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.991
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.041
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"        B        0.96      0.30      0.500    36    5.99
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA RUNOFF(CFS) =       1.63
  TOTAL AREA(ACRES) =       0.96   PEAK FLOW RATE(CFS) =       1.63

****************************************************************************
  FLOW PROCESS FROM NODE    410.00 TO NODE    420.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   263.80  DOWNSTREAM(FEET) =   260.80
  FLOW LENGTH(FEET) =   819.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.90
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.63
  PIPE TRAVEL TIME(MIN.) =   4.71    Tc(MIN.) =   10.70
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    420.00 =    1031.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    420.00 TO NODE    420.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   10.70
```

```
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.463
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
RESIDENTIAL
"5-7 DWELLINGS/ACRE"        B        4.28      0.30      0.500    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
SUBAREA AREA(ACRES) =    4.28      SUBAREA RUNOFF(CFS) =    5.06
EFFECTIVE AREA(ACRES) =      5.24   AREA-AVERAGED Fm(INCH/HR) =  0.15
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.50
TOTAL AREA(ACRES) =        5.2       PEAK FLOW RATE(CFS) =       6.19
=============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =        5.2  TC(MIN.) =      10.70
EFFECTIVE AREA(ACRES) =      5.24  AREA-AVERAGED Fm(INCH/HR)=  0.15
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.500
PEAK FLOW RATE(CFS)    =       6.19
=============================================================================
=============================================================================
END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
2 YEAR STORM - EXISTING CONDITION
STREAM B - BEE CANYON CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 2Y100X2.DAT
  TIME/DATE OF STUDY: 13:16 11/17/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                      --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)    (FT)     SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  =====  ======  =====  =======
  1   20.0    10.0    0.018/0.018/0.018   0.50    1.50 0.0312 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
         DURATION     RAINFALL(INCH)
         5-MINUTES          0.19
```

```
        30-MINUTES          0.40
         1-HOUR             0.53
         3-HOUR             0.89
         6-HOUR             1.22
        24-HOUR             2.05
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR UNIT HYDROGRAPH METHOD*

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    270.00  DOWNSTREAM(FEET) =    266.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.277
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.588
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"        B        1.34      0.30      0.500    36    9.28
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA RUNOFF(CFS) =       1.73
  TOTAL AREA(ACRES) =       1.34   PEAK FLOW RATE(CFS) =      1.73

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    220.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    266.50  DOWNSTREAM(FEET) =    264.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   377.00   CHANNEL SLOPE =  0.0066
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   8.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   2.00
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.241
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        2.19      0.30      0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.93
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.26
  AVERAGE FLOW DEPTH(FEET) =   0.54   TRAVEL TIME(MIN.) =   4.98
  Tc(MIN.) =   14.26
  SUBAREA AREA(ACRES) =     2.19       SUBAREA RUNOFF(CFS) =    2.39
```

```
EFFECTIVE AREA(ACRES) =        3.53      AREA-AVERAGED Fm(INCH/HR) =    0.08
AREA-AVERAGED Fp(INCH/HR) =    0.30  AREA-AVERAGED Ap =    0.25
TOTAL AREA(ACRES) =          3.5          PEAK FLOW RATE(CFS) =        3.70

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) =  0.59   FLOW VELOCITY(FEET/SEC.) =   1.33
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    220.00 =     677.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    220.00 TO NODE    230.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   258.00  DOWNSTREAM(FEET) =   256.30
FLOW LENGTH(FEET) =   339.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.04
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =        3.70
PIPE TRAVEL TIME(MIN.) =   1.40    Tc(MIN.) =   15.65
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    230.00 =    1016.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   15.65
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.176
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        9.05      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    9.05      SUBAREA RUNOFF(CFS) =    9.33
EFFECTIVE AREA(ACRES) =     12.58   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.14
TOTAL AREA(ACRES) =       12.6       PEAK FLOW RATE(CFS) =      12.83

****************************************************************************
FLOW PROCESS FROM NODE    230.00 TO NODE    240.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   256.30  DOWNSTREAM(FEET) =   252.50
FLOW LENGTH(FEET) =   759.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.42
```

```
ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       12.83
PIPE TRAVEL TIME(MIN.) =   2.33    Tc(MIN.) =   17.99
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    240.00 =    1775.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    240.00 TO NODE    240.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   17.99
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.086
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B       11.93      0.30      0.100    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =   11.93      SUBAREA RUNOFF(CFS) =   11.33
EFFECTIVE AREA(ACRES) =     24.51   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.12
TOTAL AREA(ACRES) =       24.5       PEAK FLOW RATE(CFS) =      23.14

****************************************************************************
FLOW PROCESS FROM NODE    240.00 TO NODE    250.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   252.50  DOWNSTREAM(FEET) =   245.60
FLOW LENGTH(FEET) =  1385.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.27
ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       23.14
PIPE TRAVEL TIME(MIN.) =   3.68    Tc(MIN.) =   21.67
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    250.00 =    3160.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    250.00 TO NODE    250.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   21.67
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.976
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
RESIDENTIAL
"5-7 DWELLINGS/ACRE"        B       22.14      0.30      0.500    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
```

```
  SUBAREA AREA(ACRES) =    22.14        SUBAREA RUNOFF(CFS) =    16.45
  EFFECTIVE AREA(ACRES) =      46.65    AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.30   AREA-AVERAGED Ap =  0.30
  TOTAL AREA(ACRES) =        46.7        PEAK FLOW RATE(CFS) =       37.17

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    340.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   245.60  DOWNSTREAM(FEET) =   237.50
  FLOW LENGTH(FEET) =  1465.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  26.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.16
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       37.17
  PIPE TRAVEL TIME(MIN.) =   3.41    Tc(MIN.) =   25.08
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    340.00 =    4625.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    340.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   25.08
  RAINFALL INTENSITY(INCH/HR) =   0.90
  AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.30
  EFFECTIVE STREAM AREA(ACRES) =       46.65
  TOTAL STREAM AREA(ACRES) =       46.65
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       37.17

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    310.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    260.00  DOWNSTREAM(FEET) =    257.60

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.004
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.520
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
```

```
"5-7 DWELLINGS/ACRE"        B        0.97      0.30      0.500     36    10.00
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
SUBAREA RUNOFF(CFS) =       1.20
TOTAL AREA(ACRES) =       0.97   PEAK FLOW RATE(CFS) =       1.20

****************************************************************************
FLOW PROCESS FROM NODE    310.00 TO NODE    320.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    257.60  DOWNSTREAM(FEET) =    249.00
CHANNEL LENGTH THRU SUBAREA(FEET) =  1085.00   CHANNEL SLOPE =  0.0079
CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   8.000
MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.983
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
RESIDENTIAL
"5-7 DWELLINGS/ACRE"        B        3.28      0.30      0.500     36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.46
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.59
AVERAGE FLOW DEPTH(FEET) =   0.44   TRAVEL TIME(MIN.) =  11.38
Tc(MIN.) =   21.38
SUBAREA AREA(ACRES) =     3.28       SUBAREA RUNOFF(CFS) =    2.46
EFFECTIVE AREA(ACRES) =      4.25     AREA-AVERAGED Fm(INCH/HR) =   0.15
AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.50
TOTAL AREA(ACRES) =        4.2         PEAK FLOW RATE(CFS) =       3.19

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) =  0.48   FLOW VELOCITY(FEET/SEC.) =   1.70
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    320.00 =    1385.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    320.00 TO NODE    330.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    249.00  DOWNSTREAM(FEET) =    241.50
CHANNEL LENGTH THRU SUBAREA(FEET) =   885.00   CHANNEL SLOPE =  0.0085
CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   8.000
MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.832
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
RESIDENTIAL
```

```
"5-7 DWELLINGS/ACRE"        B        9.16      0.30      0.500     36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =        6.01
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.05
AVERAGE FLOW DEPTH(FEET) =   0.61   TRAVEL TIME(MIN.) =   7.20
Tc(MIN.) =   28.58
SUBAREA AREA(ACRES) =      9.16        SUBAREA RUNOFF(CFS) =     5.62
EFFECTIVE AREA(ACRES) =      13.41      AREA-AVERAGED Fm(INCH/HR) =   0.15
AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.50
TOTAL AREA(ACRES) =        13.4          PEAK FLOW RATE(CFS) =       8.23

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) =  0.68   FLOW VELOCITY(FEET/SEC.) =   2.21
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    330.00 =    2270.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    330.00 TO NODE    340.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    241.50  DOWNSTREAM(FEET) =    237.50
CHANNEL LENGTH THRU SUBAREA(FEET) =   284.00   CHANNEL SLOPE =  0.0141
CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   6.00
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.812
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
RESIDENTIAL
"5-7 DWELLINGS/ACRE"        B       13.94      0.30      0.500     36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       12.39
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.81
AVERAGE FLOW DEPTH(FEET) =   0.73   TRAVEL TIME(MIN.) =   1.24
Tc(MIN.) =   29.83
SUBAREA AREA(ACRES) =    13.94        SUBAREA RUNOFF(CFS) =     8.31
EFFECTIVE AREA(ACRES) =      27.35      AREA-AVERAGED Fm(INCH/HR) =   0.15
AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.50
TOTAL AREA(ACRES) =        27.3          PEAK FLOW RATE(CFS) =      16.30

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) =  0.84   FLOW VELOCITY(FEET/SEC.) =   4.12
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    340.00 =    2554.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    340.00 TO NODE    340.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
```

```
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   29.83
  RAINFALL INTENSITY(INCH/HR) =   0.81
  AREA-AVERAGED Fm(INCH/HR) =  0.15
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.50
  EFFECTIVE STREAM AREA(ACRES) =       27.35
  TOTAL STREAM AREA(ACRES) =       27.35
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       16.30

  ** CONFLUENCE DATA **
   STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)            (ACRES)    NODE
      1        37.17   25.08     0.897   0.30( 0.09) 0.30       46.7     200.00
      2        16.30   29.83     0.812   0.30( 0.15) 0.50       27.3     300.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)            (ACRES)    NODE
      1        52.63   25.08     0.897   0.30( 0.11) 0.37       69.6     200.00
      2        49.55   29.83     0.812   0.30( 0.11) 0.37       74.0     300.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       52.63    Tc(MIN.) =     25.08
  EFFECTIVE AREA(ACRES) =       69.65   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.37
  TOTAL AREA(ACRES) =       74.0
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    340.00 =    4625.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    350.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   237.50  DOWNSTREAM(FEET) =   234.50
  FLOW LENGTH(FEET) =    81.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.15
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       52.63
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =   25.16
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    350.00 =    4706.00 FEET.
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =       74.0  TC(MIN.) =     25.16
  EFFECTIVE AREA(ACRES) =     69.65  AREA-AVERAGED Fm(INCH/HR)=  0.11
```

AREA-AVERAGED Fp(INCH/HR) = 0.30 AREA-AVERAGED Ap = 0.367
PEAK FLOW RATE(CFS) = 52.63

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	52.63	25.16	0.895	0.30(0.11)	0.37	69.6	200.00
2	49.55	29.91	0.811	0.30(0.11)	0.37	74.0	300.00

END OF RATIONAL METHOD ANALYSIS

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
2 YEAR STORM - EXISTING CONDITION
STREAM A - MARSHBURN CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 2Y100X1.DAT
  TIME/DATE OF STUDY: 13:15 11/17/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                      --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)    (FT)     SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  =====  ====  ====  =======
  1   20.0     10.0    0.018/0.018/0.018  0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
         DURATION     RAINFALL(INCH)
         5-MINUTES          0.19
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        30-MINUTES          0.40
         1-HOUR             0.53
         3-HOUR             0.89
         6-HOUR             1.22
        24-HOUR             2.05
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR UNIT HYDROGRAPH METHOD*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    253.00  DOWNSTREAM(FEET) =    247.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.601
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.471
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        1.07      0.30     0.850    36   10.60
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =       1.17
  TOTAL AREA(ACRES) =      1.07   PEAK FLOW RATE(CFS) =      1.17

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    120.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    247.70  DOWNSTREAM(FEET) =    236.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   838.00   CHANNEL SLOPE =  0.0140
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   2.00
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.014
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                 B        8.83      0.30     0.850    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.27
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.45
  AVERAGE FLOW DEPTH(FEET) =   0.38   TRAVEL TIME(MIN.) =   9.66
  Tc(MIN.) =   20.26
  SUBAREA AREA(ACRES) =     8.83       SUBAREA RUNOFF(CFS) =    6.03
  EFFECTIVE AREA(ACRES) =      9.90     AREA-AVERAGED Fm(INCH/HR) =   0.26
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AREA-AVERAGED Fp(INCH/HR) =    0.30  AREA-AVERAGED Ap =    0.85
TOTAL AREA(ACRES) =          9.9          PEAK FLOW RATE(CFS) =        6.76

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) =  0.45   FLOW VELOCITY(FEET/SEC.) =   1.63
LONGEST FLOWPATH FROM NODE     100.00 TO NODE     120.00 =     1138.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     120.00 TO NODE     120.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =    20.26
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.014
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
PUBLIC PARK                 B        5.85      0.30      0.850    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
SUBAREA AREA(ACRES) =     5.85      SUBAREA RUNOFF(CFS) =     4.00
EFFECTIVE AREA(ACRES) =      15.75   AREA-AVERAGED Fm(INCH/HR) =  0.25
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.85
TOTAL AREA(ACRES) =        15.8       PEAK FLOW RATE(CFS) =       10.76

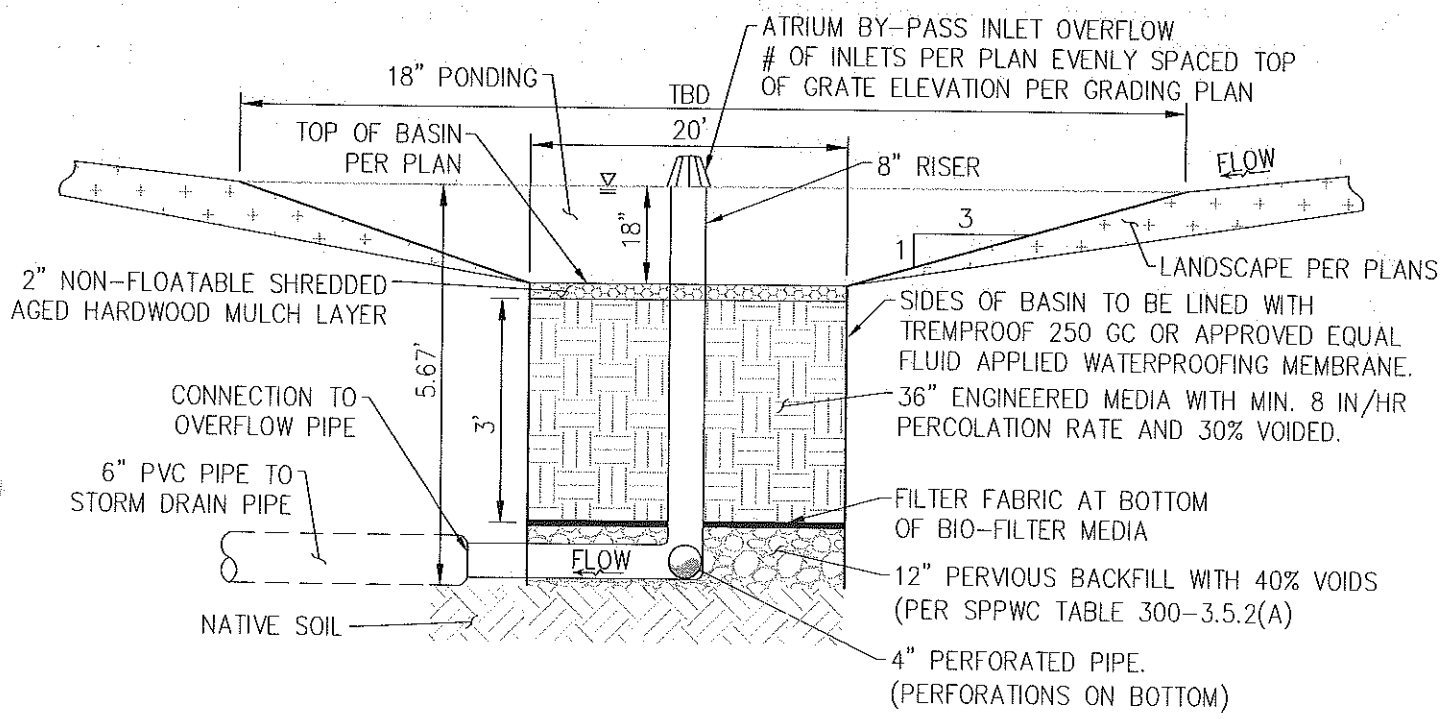
****************************************************************************
FLOW PROCESS FROM NODE     120.00 TO NODE     130.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =     236.00  DOWNSTREAM(FEET) =     227.50
CHANNEL LENGTH THRU SUBAREA(FEET) =    841.00   CHANNEL SLOPE =  0.0101
CHANNEL BASE(FEET) =     0.00    "Z" FACTOR =  20.000
MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =    2.00
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.840
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
PUBLIC PARK                 B       16.94      0.30      0.850    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       15.23
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.78
AVERAGE FLOW DEPTH(FEET) =    0.65   TRAVEL TIME(MIN.) =    7.85
Tc(MIN.) =    28.11
SUBAREA AREA(ACRES) =     16.94       SUBAREA RUNOFF(CFS) =     8.92
EFFECTIVE AREA(ACRES) =      32.69     AREA-AVERAGED Fm(INCH/HR) =    0.25
AREA-AVERAGED Fp(INCH/HR) =    0.30  AREA-AVERAGED Ap =    0.85
TOTAL AREA(ACRES) =        32.7          PEAK FLOW RATE(CFS) =      17.22

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
```

```
DEPTH(FEET) =  0.68   FLOW VELOCITY(FEET/SEC.) =   1.84
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    130.00 =    1979.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    130.00 TO NODE    140.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    227.50  DOWNSTREAM(FEET) =    218.00
CHANNEL LENGTH THRU SUBAREA(FEET) =  1000.00   CHANNEL SLOPE =  0.0095
CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  20.000
MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   3.00
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.719
SUBAREA LOSS RATE DATA(AMC  I ):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
PUBLIC PARK                 B       24.30      0.30      0.850    36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      22.31
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.90
AVERAGE FLOW DEPTH(FEET) =   0.77   TRAVEL TIME(MIN.) =   8.76
Tc(MIN.) =   36.87
SUBAREA AREA(ACRES) =    24.30       SUBAREA RUNOFF(CFS) =   10.15
EFFECTIVE AREA(ACRES) =     56.99     AREA-AVERAGED Fm(INCH/HR) =   0.25
AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.85
TOTAL AREA(ACRES) =       57.0         PEAK FLOW RATE(CFS) =      23.80

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) =  0.78   FLOW VELOCITY(FEET/SEC.) =   1.94
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    140.00 =    2979.00 FEET.
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =       57.0  TC(MIN.) =     36.87
EFFECTIVE AREA(ACRES) =     56.99  AREA-AVERAGED Fm(INCH/HR)=  0.25
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.850
PEAK FLOW RATE(CFS)    =      23.80
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```



ONSITE BIO-FILTRATION CONCEPT FOR PLANNING AREAS

NTS (PROVIDED FOR CAPACITY SIZING ONLY)

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 1	3.67	7993.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	7,993	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**3,761**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	4.5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	190	ft
Total Length of Planter 1 + Slopes	**199**	ft
Total Treatment Area =	**3,800**	**sq-ft**
Total Planter Area =	**5,771**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 2	4.76	10367.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	10,367	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered} = Min[((K_{media} \times T_{Routing})/12),d_p]$	0.63	ft
Facility Surface Area= $A=(DCV/(d_p+d_{Filtered})$	**4,879**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	245	ft
Total Length of Planter 1 + Slopes	**254**	ft
Total Treatment Area =	**4,900**	**sq-ft**
Total Planter Area =	**7,366**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 3	5.14	11195.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	11,195	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**5,268**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	265	ft
Total Length of Planter 1 + Slopes	**274**	ft
Total Treatment Area =	**5,300**	**sq-ft**
Total Planter Area =	**7,946**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 4	5.47	11914.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	11,914	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[(((K_{media} x $T_{Routing}$)/12},d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**5,607**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	285	ft
Total Length of Planter 1 + Slopes	**294**	ft
Total Treatment Area =	**5,700**	**sq-ft**
Total Planter Area =	**8,526**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 5	4.24	9235.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	9,235	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**4,346**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	220	ft
Total Length of Planter 1 + Slopes	**229**	ft
Total Treatment Area =	**4,400**	**sq-ft**
Total Planter Area =	**6,641**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 6	1.53	3332.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	3,332	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**1,568**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	80	ft
Total Length of Planter 1 + Slopes	**89**	ft
Total Treatment Area =	**1,600**	**sq-ft**
Total Planter Area =	**2,581**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 7	2.76	6011.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	6,011	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**2,829**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	145	ft
Total Length of Planter 1 + Slopes	**154**	ft
Total Treatment Area =	**2,900**	**sq-ft**
Total Planter Area =	**4,466**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 8	3.00	7231.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	7,231	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**3,403**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	175	ft
Total Length of Planter 1 + Slopes	**184**	ft
Total Treatment Area =	**3,500**	**sq-ft**
Total Planter Area =	**5,336**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 9	1.36	3278.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	3,278	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**1,543**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	80	ft
Total Length of Planter 1 + Slopes	**89**	ft
Total Treatment Area =	**1,600**	**sq-ft**
Total Planter Area =	**2,581**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 10	5.93	14293.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	14,293	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**6,726**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	340	ft
Total Length of Planter 1 + Slopes	**349**	ft
Total Treatment Area =	**6,800**	**sq-ft**
Total Planter Area =	**10,121**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 11	4.26	10268.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	10,268	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**4,832**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	245	ft
Total Length of Planter 1 + Slopes	**254**	ft
Total Treatment Area =	**4,900**	**sq-ft**
Total Planter Area =	**7,366**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 12	3.48	8388.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	8,388	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**3,947**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	200	ft
Total Length of Planter 1 + Slopes	**209**	ft
Total Treatment Area =	**4,000**	**sq-ft**
Total Planter Area =	**6,061**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 13	2.55	6146.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	6,146	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered} = Min[((K_{media} \times T_{Routing})/12),d_p]$	0.63	ft
Facility Surface Area= $A=(DCV/(d_p+d_{Filtered})$	**2,892**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	145	ft
Total Length of Planter 1 + Slopes	**154**	ft
Total Treatment Area =	**2,900**	**sq-ft**
Total Planter Area =	**4,466**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 14	2.58	6219.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	6,219	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**2,927**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	150	ft
Total Length of Planter 1 + Slopes	**159**	ft
Total Treatment Area =	**3,000**	**sq-ft**
Total Planter Area =	**4,611**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 15	3.33	8026.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	8,026	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**3,777**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	190	ft
Total Length of Planter 1 + Slopes	**199**	ft
Total Treatment Area =	**3,800**	**sq-ft**
Total Planter Area =	**5,771**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 16	3.92	9448.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	9,448	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**4,446**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	225	ft
Total Length of Planter 1 + Slopes	**234**	ft
Total Treatment Area =	**4,500**	**sq-ft**
Total Planter Area =	**6,786**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 17	4.77	11497.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	11,497	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**5,410**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	275	ft
Total Length of Planter 1 + Slopes	**284**	ft
Total Treatment Area =	**5,500**	**sq-ft**
Total Planter Area =	**8,236**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 18	4.41	10630.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	10,630	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**5,002**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	255	ft
Total Length of Planter 1 + Slopes	**264**	ft
Total Treatment Area =	**5,100**	**sq-ft**
Total Planter Area =	**7,656**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 19	3.63	8749.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	8,749	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**4,117**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	210	ft
Total Length of Planter 1 + Slopes	**219**	ft
Total Treatment Area =	**4,200**	**sq-ft**
Total Planter Area =	**6,351**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 20	3.64	7928.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	7,928	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**3,731**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	190	ft
Total Length of Planter 1 + Slopes	**199**	ft
Total Treatment Area =	**3,800**	**sq-ft**
Total Planter Area =	**5,771**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA 21	2.70	5881.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	5,881	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**2,768**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	140	ft
Total Length of Planter 1 + Slopes	**149**	ft
Total Treatment Area =	**2,800**	**sq-ft**
Total Planter Area =	**4,321**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA-A	2.77	2091.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	2,091	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**984**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	50	ft
Total Length of Planter 1 + Slopes	**59**	ft
Total Treatment Area =	**1,000**	**sq-ft**
Total Planter Area =	**1,711**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA-B	0.90	680.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	680	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered} = Min[((K_{media} \times T_{Routing})/12),d_p]$	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**320**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	20	ft
Total Length of Planter 1 + Slopes	**29**	ft
Total Treatment Area =	**400**	**sq-ft**
Total Planter Area =	**841**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA-C	0.59	445.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	445	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered} = Min[((K_{media} \times T_{Routing})/12),d_p]$	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**209**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	15	ft
Total Length of Planter 1 + Slopes	**24**	ft
Total Treatment Area =	**300**	**sq-ft**
Total Planter Area =	**696**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA-D	1.19	898.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	898	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**423**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	25	ft
Total Length of Planter 1 + Slopes	**34**	ft
Total Treatment Area =	**500**	**sq-ft**
Total Planter Area =	**986**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA-E1	0.56	423.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	423	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12},d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**199**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	10	ft
Total Length of Planter 1 + Slopes	**19**	ft
Total Treatment Area =	**200**	**sq-ft**
Total Planter Area =	**551**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA-E2	0.86	649.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	649	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[(((K_{media} x $T_{Routing}$)/12},d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**305**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	20	ft
Total Length of Planter 1 + Slopes	**29**	ft
Total Treatment Area =	**400**	**sq-ft**
Total Planter Area =	**841**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA-F	0.87	657.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	657	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered} = Min[((K_{media} \times T_{Routing})/12),d_p]$	0.63	ft
Facility Surface Area= $A=(DCV/(d_p+d_{Filtered})$	**309**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	20	ft
Total Length of Planter 1 + Slopes	**29**	ft
Total Treatment Area =	**400**	**sq-ft**
Total Planter Area =	**841**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA-G	0.82	619.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	619	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**291**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	15	ft
Total Length of Planter 1 + Slopes	**24**	ft
Total Treatment Area =	**300**	**sq-ft**
Total Planter Area =	**696**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA-H	0.66	498.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	498	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[((K_{media} x $T_{Routing}$)/12),d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**234**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	15	ft
Total Length of Planter 1 + Slopes	**24**	ft
Total Treatment Area =	**300**	**sq-ft**
Total Planter Area =	**696**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA-I	0.83	627.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	627	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered} = Min[((K_{media} \times T_{Routing})/12),d_p]$	0.63	ft
Facility Surface Area= $A=(DCV/(d_p+d_{Filtered})$	**295**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	15	ft
Total Length of Planter 1 + Slopes	**24**	ft
Total Treatment Area =	**300**	**sq-ft**
Total Planter Area =	**696**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

Design Capture Volume (DCV)		
Drainage Area	*Area* (acres)	*DCV* (cf)
DMA-J	0.94	710.0

Simple Sizing Method for Bioretention with Underdrain

Planter Box System A		
DCV =	710	cu-ft
d_p (ponding depth) = 18" =>	1.50	ft
K_{media} =	2.50	in/hr
$DD_p=(d_p/K_{media})$ x 12 in/ft	7.20	hours
$d_{Filtered}$ = Min[{(K_{media} x $T_{Routing}$)/12},d_p]	0.63	ft
Facility Surface Area= A=(DCV/(d_p+$d_{Filtered}$)	**334**	**sq-ft**
Width of Planter Base	20	ft
Width of Planter Slopes (3:1)	5	ft
Total Width of Planter 1 + Slopes	**29**	ft
Length of Planter 1	20	ft
Total Length of Planter 1 + Slopes	**29**	ft
Total Treatment Area =	**400**	**sq-ft**
Total Planter Area =	**841**	**sq-ft**

*Equations per Page XIV-52 in the Technical Guidance Document, Appendix XIV.5

C

Attachment C

Supporting Maps and Exhibits

-Watershed Map for Newport Bay

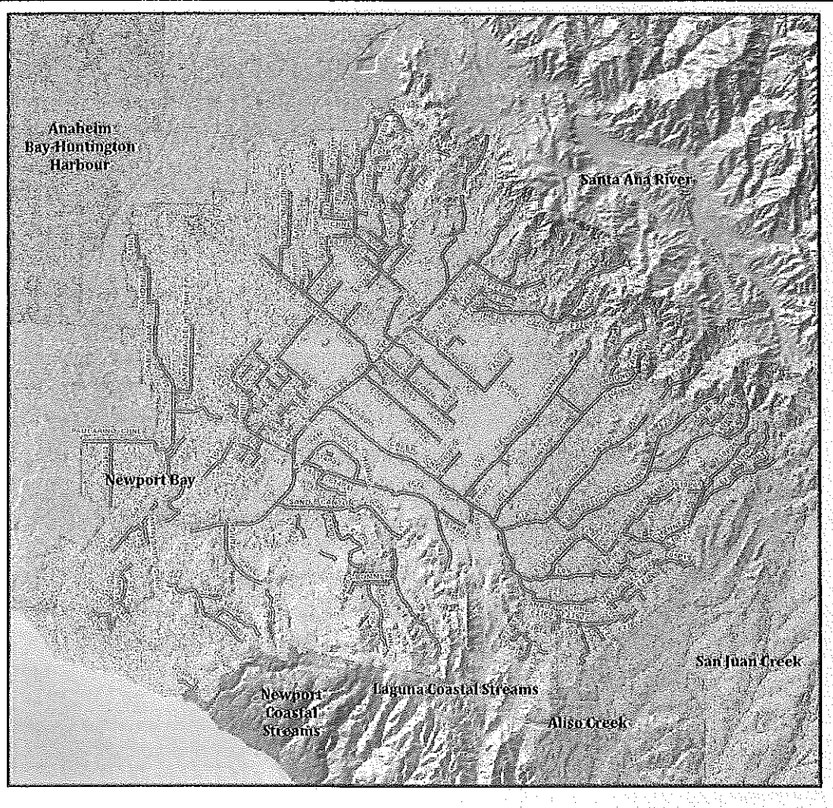
-Base Map of Drainage Facilities in Orange County

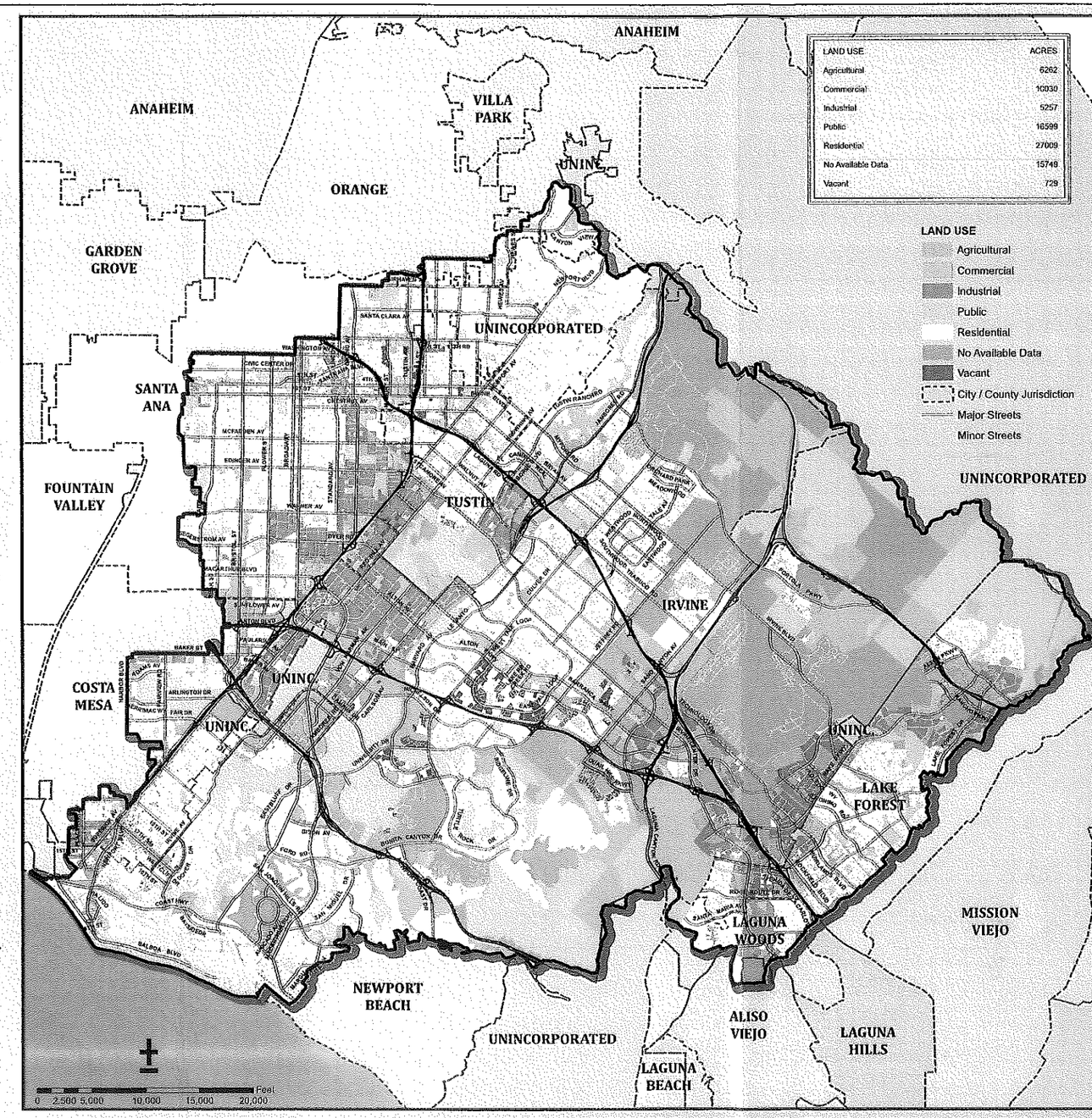
-Rainfall zones (Figure XVI-1)

-Susceptibility Analysis Newport Bay – Newport Coastal Streams

-North OC Ground Water Protection Areas

-2010 CA 303(d) List of Water Quality Limited Segments





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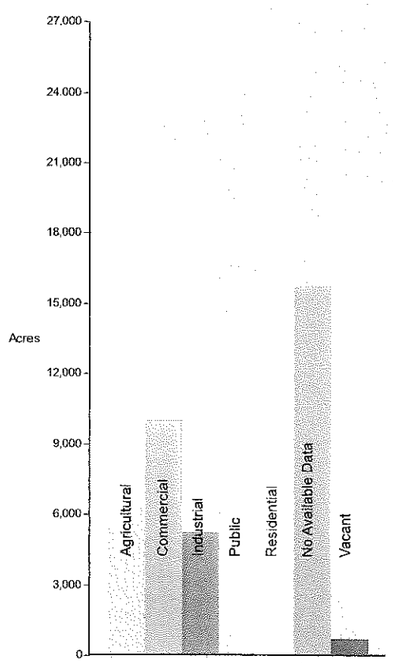
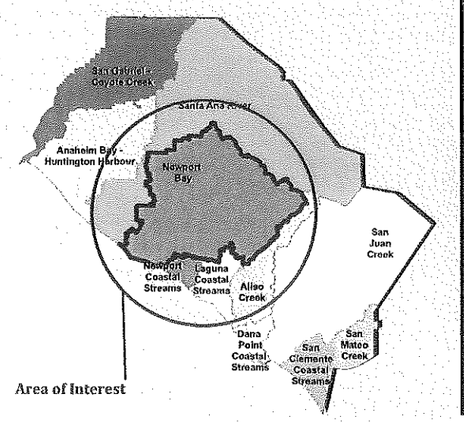
Commercial	10030
Industrial	5257
Public	16599
Residential	27009
No Available Data	15749
Vacant	729





97294 Acres

WATERSHED: NEWPORT BAY

COUNTY OF ORANGE, CALIFORNIA

DESIGNED AND PRODUCED BY:
OC Public Works
GIS Mapping Unit
Map Pages

DATA SOURCES:
- Geomatics Land Information Systems Division

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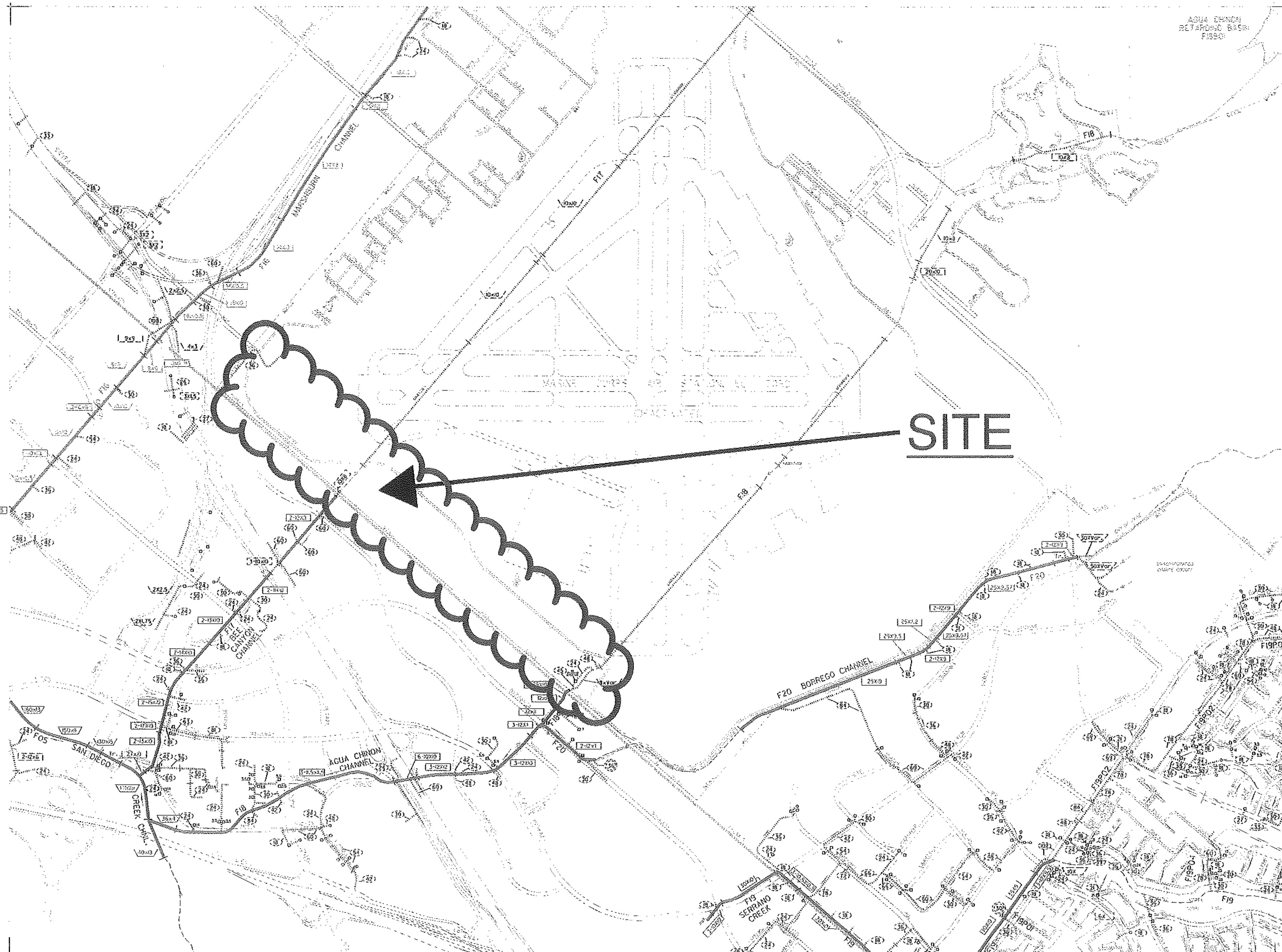
DATE: November 18, 2009

40

48



50

57

49

NOTICE

The drainage information has been prepared for information purposes only. The location, ownership, facility information and limits have been determined from available information provided by public agencies, but may not be exact, accurate, or up-to-date. The user of this information is responsible for verifying exact location, ownership, accuracy, and the regional versus local character of drainage facilities.

Additional information may be obtained from public plans and recorded deeds. Facility designations included with this information are for convenience only and are not controlling or intended to imply ownership by the County or the Orange County Flood Control District (OCFCD). The information is being provided as a courtesy and neither the County of Orange nor OCFCD assume any liabilities for inaccuracy of the information.

To notify OC Public Works Flood Control Section of additions or corrections, please contact Sal Gutierrez at (714) 834-5396 or by email at sal.gutierrez@ocpw.ocgov.com

ORANGE COUNTY FLOOD CONTROL DISTRICT

BASE MAP
OF DRAINAGE FACILITIES
IN ORANGE COUNTY

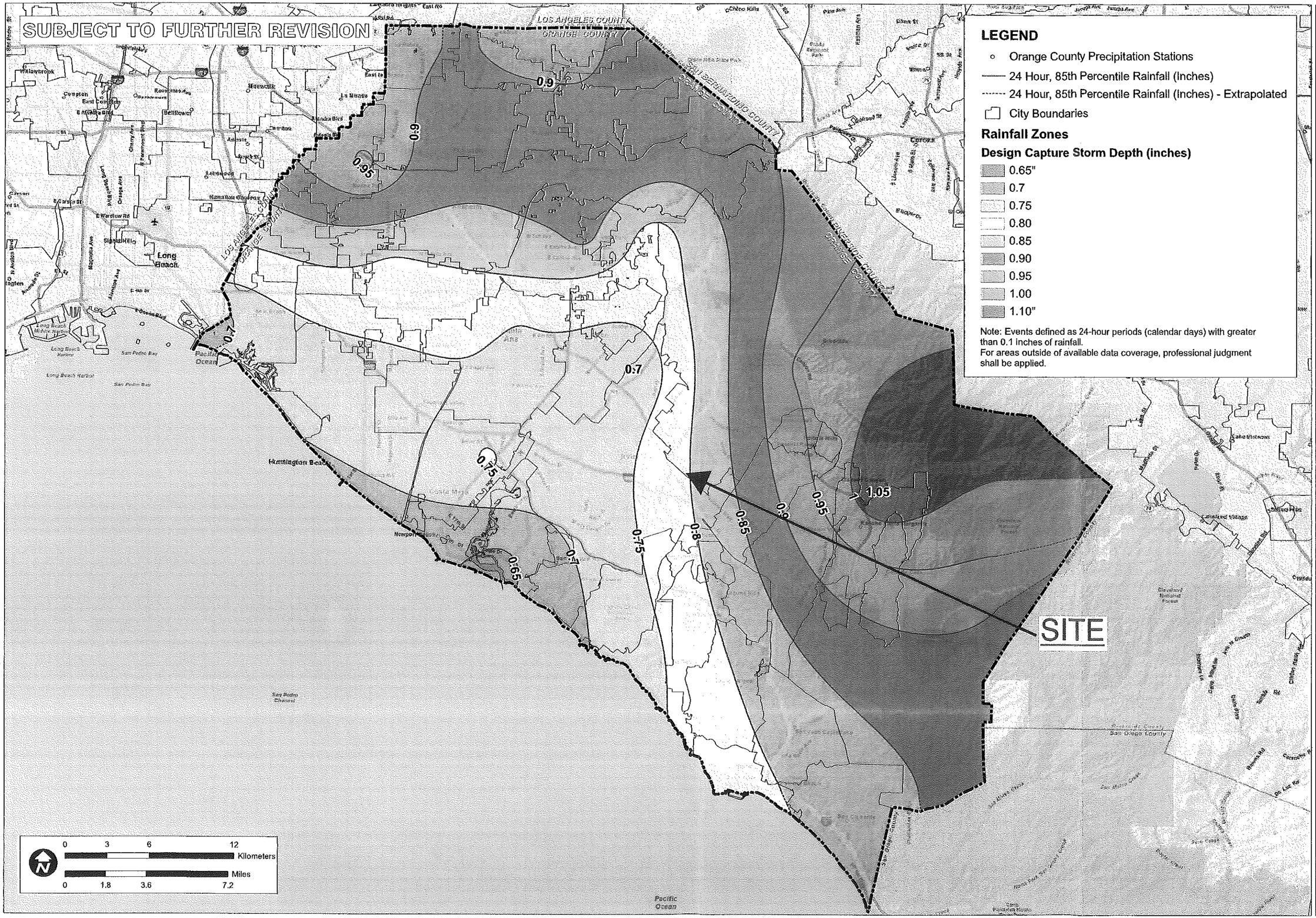
REVISION	DATE	SHEET NO.	DWG NO.
S. GUTIERREZ	OCT 1, 2008	49	MAPS 113-3

Channel Drainage Area Boundary
Major Sub-Area Drainage Boundary
Minor Sub-Area Drainage Boundary
Existing O.C.F.C.D. Facility
Existing Local Facility
Existing Retarding Basin or Reservoir
Natural Watercourse
City Limits
Groundsill
G P.S. — Pump Station
Catch Basin (length in feet)
Drop Inlet or Other Entry
OCFCD Basins or Reservoirs

EXISTING FACILITIES

O.C.F.C.D. / LOCAL
Earth Trapezoidal Channel (base width by height in feet)
Reinforced Concrete Trapezoidal Channel (base width by height in feet)
Reinforced Concrete Rectangular Channel (base width by height in feet)
Reinforced Concrete Box (RCB) (number of barrels-span by height in feet)
Reinforced Concrete Pipe (RCP) (diameter in inches)
Metal Sheet Channel (MSC) (base width by pile height in feet Sheet pile total length)
Corrugated Metal Pipe (CMP) (diameter in inches)
Concrete Pipe (diameter in inches)
Concrete Oval Pipe (width by height in inches)
Steel Pipe (diameter in inches)
Reinforced Concrete Arch (base span by height in inches)
Corrugated Metal Arch (base span by height in inches)

49


SUBJECT TO FURTHER REVISION
LEGEND
Orange County Precipitation Stations
24 Hour, 85th Percentile Rainfall (Inches)
24 Hour, 85th Percentile Rainfall (Inches) - Extrapolated
City Boundaries
Rainfall Zones
Design Capture Storm Depth (inches)
0.65"
0.7
0.75
0.80
0.85
0.90
0.95
1.00
1.10"
Note: Events defined as 24-hour periods (calendar days) with greater than 0.1 inches of rainfall.
For areas outside of available data coverage, professional judgment shall be applied.
LOS ANGELES COUNTY
ORANGE COUNTY
SAN BERNARDINO COUNTY
RIVERSIDE COUNTY
San Diego County
Long Beach
Huntington Beach
Newport Beach
Pacific Ocean
1.05
0.95
0.9
0.85
0.8
0.75
0.7
0.65
SITE
0 3 6 12 Kilometers
0 1.8 3.6 7.2 Miles
TITLE
RAINFALL ZONES
JOB
ORANGE COUNTY
TECHNICAL GUIDANCE
DOCUMENT
ORANGE CO.
CA
SCALE 1" = 1.8 miles
DESIGNED TH
DRAWING TH
CHECKED BMP
DATE 04/22/10
JOB NO. 9526-E
PACE
Advanced Water Engineering
FIGURE
XVI-1
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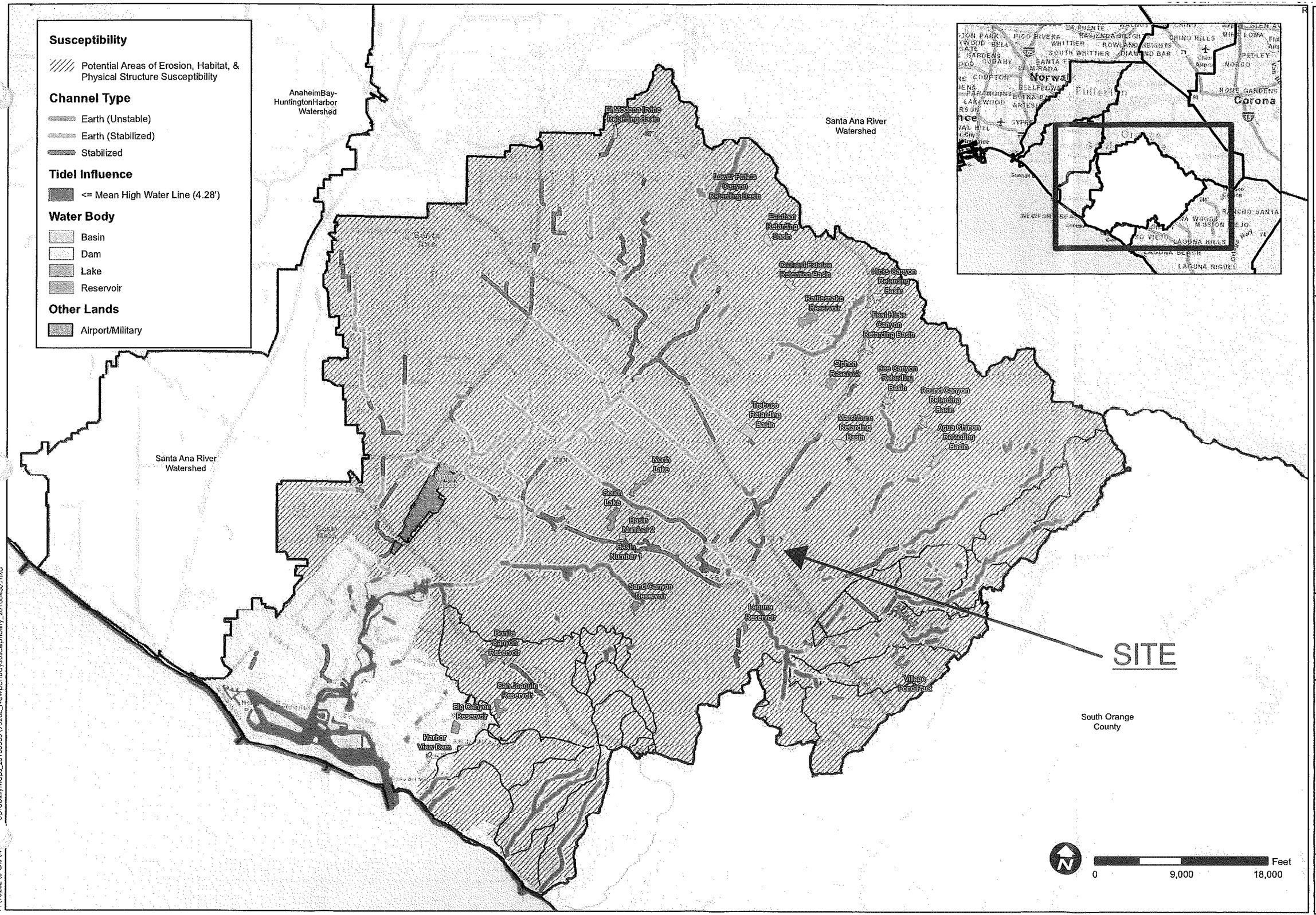


TITLE
SUSCEPTIBILITY ANALYIS
NEWPORT BAY-
NEWPORT COASTAL STREAMS

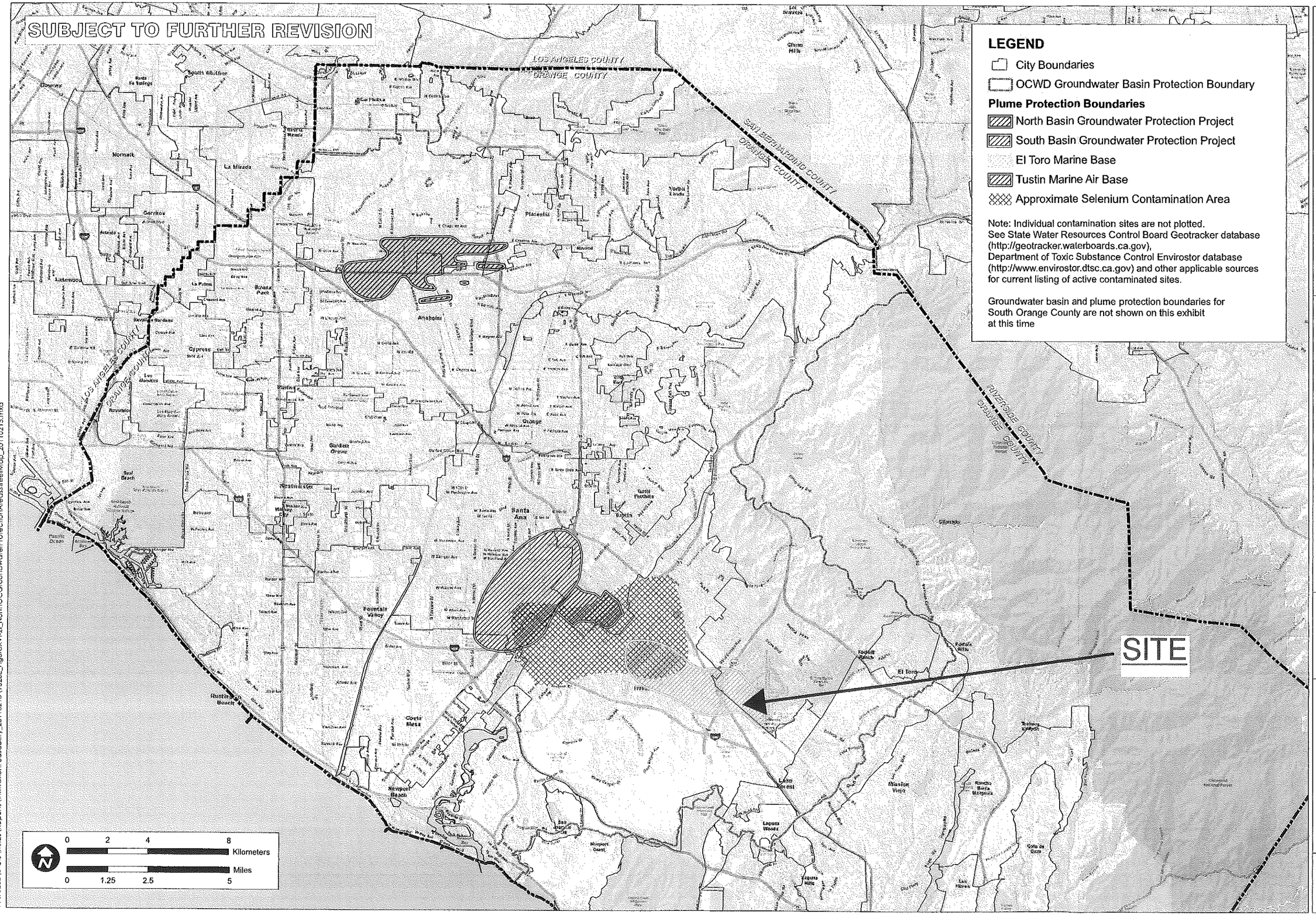
JOB
ORANGE COUNTY
WATERSHED
MASTER PLANNING
ORANGE CO. CA

SCALE	1" = ±2000'
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/30/10
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
4

P:\9526E\6-GIS\Vulnerability Maps_20100305\9526E_NewportBaySusceptibility_20100430.mxd



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TITLE
NORTH ORANGE COUNTY
GROUNDWATER PROTECTION
AREAS

JOB
ORANGE COUNTY
INFILTRATION STUDY
ORANGE CO. CA

SCALE	1" = 1.25 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/22/10
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-2f

8	San Diego Creek Reach 1	River & Stream	80111000 / 18070201	▪ Fecal Coliform ◦ Other Urban Runoff ◦ Urban Runoff/Storm Sewers	7.8 Miles	2002	5A	2019
				▪ Nutrients ◦ Source Unknown	7.8 Miles	1996	5B	1999
				▪ Pesticides ◦ Unknown Nonpoint Source	7.8 Miles	1990	5B	2004
				▪ Sedimentation/Siltation ◦ Source Unknown	7.8 Miles	1996	5B	1999
				▪ Selenium ◦ Source Unknown	7.8 Miles	2006	5A	2007
				▪ Toxaphene ◦ Source Unknown	7.8 Miles	2006	5A	2019
8	San Diego Creek Reach 2	River & Stream	80111000 / 18070201	▪ Indicator Bacteria ◦ Source Unknown	6.3 Miles	2010	5A	2021
				▪ Nutrients ◦ Agriculture ◦ Groundwater Loadings ◦ Urban Runoff/Storm Sewers	6.3 Miles	1996	5B	1999
				▪ Sedimentation/Siltation ◦ Agriculture ◦ Channel Erosion ◦ Construction/Land Development ◦ Erosion/Siltation	6.3 Miles	1996	5B	1999
				▪ Unknown Toxicity ◦ Unknown Nonpoint Source	6.3 Miles	1996	5B	2004

8	Newport Bay, Upper (Ecological Reserve)	Estuary	80111000 / 18070201	• Chlordane ◦ Source Unknown	653 Acres	2006	5A	2019
				• Copper ◦ Source Unknown	653 Acres	2006	5A	2007
				• DDT (Dichlorodiphenyltrichloroethane) ◦ Source Unknown	653 Acres	2006	5A	2019
				• Indicator Bacteria ◦ Source Unknown	653 Acres		5B	2000
				• Metals ◦ Urban Runoff/Storm Sewers	653 Acres	1992	5A	2019
				• Nutrients ◦ Source Unknown	653 Acres	2006	5B	1999
				• PCBs (Polychlorinated biphenyls) ◦ Source Unknown	653 Acres	2006	5A	2019
				• Pesticides ◦ Agriculture ◦ Unknown Nonpoint Source	653 Acres	1992	5B	2004
				• Sediment Toxicity ◦ Source Unknown	653 Acres	2006	5A	2019
				• Sedimentation/Siltation ◦ Agriculture ◦ Channel Erosion ◦ Construction/Land Development ◦ Erosion/Siltation	653 Acres	2006	5B	1999

8	Newport Bay, Lower (entire lower bay, including Rhine Channel, Turning Basin and South Lido Channel to east end of H-J Moorings)	Bay & Harbor	80114000 / 18070201	• Chlordane ◦ Source Unknown	767 Acres	2006	5A	2019
				• Copper ◦ Source Unknown	767 Acres	2006	5A	2007
				• DDT (Dichlorodiphenyltrichloroethane) ◦ Source Unknown	767 Acres	1990	5A	2019
				• Indicator Bacteria ◦ Source Unknown	767 Acres		5B	2000
				• Nutrients ◦ Source Unknown	767 Acres	1992	5B	1999
				• PCBs (Polychlorinated biphenyls) ◦ Source Unknown	767 Acres	1990	5A	2019
				• Pesticides ◦ Agriculture ◦ Contaminated Sediments	767 Acres	1990	5B	2004
				• Sediment Toxicity ◦ Source Unknown	767 Acres	2006	5A	2019

D

Attachment D

OC- Specific Design Criteria and Considerations & BMP Information and Details

XIV.5. Biotreatment BMP Fact Sheets (BIO)

Conceptual criteria for biotreatment BMP selection, design, and maintenance are contained in Appendix XII. These criteria are generally applicable to the design of biotreatment BMPs in Orange County and BMP-specific guidance is provided in the following fact sheets. [24]

*Note: Biotreatment BMPs shall be designed to provide the maximum feasible infiltration and ET based on criteria contained in **Appendix** XI.2.*

BIO-1: Bioretention with Underdrains

Also known as:

- *Rain gardens with underdrains*
- *Vegetated media filter*
- *Downspout planter boxes*

Bioretention
Source: Geosyntec Consultants

Bioretention stormwater treatment facilities are landscaped shallow depressions that capture and filter stormwater runoff. These facilities function as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. The facilities normally consist of a ponding area, mulch layer, planting soils, and plants. As stormwater passes down through the planting soil, pollutants are filtered, adsorbed, biodegraded, and sequestered by the soil and plants. Bioretention with an underdrain are utilized for areas with low permeability native soils or steep slopes where the underdrain system that routes the treated runoff to the storm drain system rather than depending entirely on infiltration. Bioretention must be designed without an underdrain in areas of high soil permeability.

Feasibility Screening Considerations

- If there are no hazards associated with infiltration (such as groundwater concerns, contaminant plumes or geotechnical concerns), bioinfiltration facilities, which achieve partial infiltration, should be used to maximize infiltration.

[24] Not all BMPs presented in this section are considered "biofiltration BMPs" under the South Orange County Permit Area. Biofiltration BMPs are vegetated treat-and-release BMPs that filter stormwater through amended soil media that is biologically active, support plant growth, and also promote infiltration and/or evapotranspiration. For projects in South Orange County, the total volume of storage in surface ponding and pores spaces is required to be at least 75% of the remaining DCV that the biofiltration BMP is designed to address. This prevents significant down-sizing of BMPs which otherwise may be possible via routing calculations. Biotreatment BMPs that do not meet this definition are not considered to be LID BMPs, but may be used as treatment control or pre-treatment BMPs. See Section III.7 and Worksheet SOC-1 for guidance.

- Bioretention with underdrain facilities should be lined if contaminant plumes or geotechnical concerns exist. If high groundwater is the reason for infiltration infeasibility, bioretention facilities with underdrains do not need to be lined.

Opportunity Criteria

- Land use may include commercial, residential, mixed use, institutional, and subdivisions. Bioretention may also be applied in parking lot islands, cul-de-sacs, traffic circles, road shoulders, road medians, and next to buildings in planter boxes.
- Drainage area is ≤ 5 acres.
- Area is available for infiltration.
- Site must have adequate relief between land surface and the stormwater conveyance system to permit vertical percolation through the soil media and collection and conveyance in underdrain to stormwater conveyance system.

OC-Specific Design Criteria and Considerations

- ☐ Ponding depth should not exceed 18 inches; fencing may be required if ponding depth is greater than 6 inches to mitigate drowning.
- ☐ The minimum soil depth is 2 feet (3 feet is preferred).
- ☐ The maximum drawdown time of the bioretention ponding area is 48 hours. The maximum drawdown time of the planting media and gravel drainage layer is 96 hours, if applicable.
- ☐ Infiltration pathways may need to be restricted due to the close proximity of roads, foundations, or other infrastructure. A geomembrane liner, or other equivalent water proofing, may be placed along the vertical walls to reduce lateral flows. This liner should have a minimum thickness of 30 mils.
- ☐ If infiltration in bioretention location is hazardous due to groundwater or geotechnical concerns, a geomembrane liner must be installed at the base of the bioretention facility. This liner should have a minimum thickness of 30 mils.
- ☐ The planting media placed in the cell shall be designed per the recommendations contained in MISC-1: Planting/Storage Media
- ☐ Plant materials should be tolerant of summer drought, ponding fluctuations, and saturated soil conditions for 48 hours; native place species and/or hardy cultivars that are not invasive and do not require chemical inputs should be used to the maximum extent feasible
- ☐ The bioretention area should be covered with 2-4 inches (average 3 inches) or mulch at the start and an additional placement of 1-2 inches of mulch should be added annually.
- ☐ Underdrain should be sized with a 6 inch minimum diameter and have a 0.5% minimum slope. Underdrain should be slotted polyvinyl chloride (PVC) pipe; underdrain pipe should be more than 5 feet from tree locations (if space allows).
- ☐ A gravel blanket or bedding is required for the underdrain pipe(s). At least 0.5 feet of washed aggregate must be placed below, to the top, and to the sides of the underdrain pipe(s).
- ☐ An overflow device is required at the top of the bioretention area ponding depth.
- ☐ Dispersed flow or energy dissipation (i.e. splash rocks) for piped inlets should be provided at basin inlet to prevent erosion.
- ☐ Ponding area side slopes shall be no steeper than 3:1 (H:V) unless designed as a planter box BMP with appropriate consideration for trip and fall hazards.

Simple Sizing Method for Bioretention with Underdrain

If the Simple Design Capture Volume Sizing Method described in **Appendix** III.3.1 is used to size a bioretention with underdrain facility, the user selects the basin depth and then determines the appropriate surface area to capture the DCV. The sizing steps are as follows:

Step 1: Determine DCV

Calculate the DCV using the Simple Design Capture Volume Sizing Method described in **Appendix** III.3.1.

Step 2: Verify that the Ponding Depth will Draw Down within 48 Hours

The ponding area drawdown time can be calculated using the following equation:

$DD_P = (d_P / K_{MEDIA}) \times 12$ in/ft

Where:

DD_P = time to drain ponded water, hours

d_P = depth of ponding above bioretention area, ft (not to exceed 1.5 ft)

K_{MEDIA} = media design infiltration rate, in/hr (equivalent to the media hydraulic conductivity with a factor of safety of 2; K_{MEDIA} of 2.5 in/hr should be used unless other information is available)

If the drawdown time exceeds 48 hours, adjust ponding depth and/or media infiltration rate until 48 hour drawdown time is achieved.

Step 3: Determine the Depth of Water Filtered During Design Capture Storm

The depth of water filtered during the design capture storm can be estimated as the amount routed through the media during the storm, or the ponding depth, whichever is smaller.

$d_{FILTERED}$ = Minimum [$((K_{MEDIA} \times T_{ROUTING})/12)$, d_P]

Where:

$d_{FILTERED}$ = depth of water that may be considered to be filtered during the design storm event, ft

K_{MEDIA} = media design infiltration rate, in/hr (equivalent to the media hydraulic conductivity with a factor of safety of 2; K_{MEDIA} of 2.5 in/hr should be used unless other information is available)

$T_{ROUTING}$ = storm duration that may be assumed for routing calculations; this should be assumed to be no greater than 3 hours. If the designer desires to account for further routing effects, the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs (See **Appendix** III.3.2) should be used.

d_P = depth of ponding above bioretention area, ft (not to exceed 1.5 ft)

Step 4: Determine the Facility Surface Area

$A = DCV / (d_P + d_{FILTERED})$

Where:

A = required area of bioretention facility, sq-ft

DCV = design capture volume, cu-ft

$d_{FILTERED}$ = depth of water that may be considered to be filtered during the design storm event, ft

d_P = depth of ponding above bioretention area, ft (not to exceed 1.5 ft)

In South Orange County, the provided ponding plus pore volume must be checked to demonstrate that it is greater than 0.75 of the remaining DCV that this BMP is designed to address. See Section III.7 and Worksheet SOC-1.

Capture Efficiency Method for Bioretention with Underdrains

If the bioretention geometry has already been defined and the user wishes to account more explicitly for routing, the user can determine the required footprint area using the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs (See Appendix III.3.2) to determine the fraction of the DCV that must be provided to manage 80 percent of average annual runoff volume, This method accounts for drawdown time different than 48 hours.

Step 1: Determine the drawdown time associated with the selected basin geometry

$DD = (d_p / K_{DESIGN}) \times 12$ in/ft

Where:

DD = time to completely drain infiltration basin ponding depth, hours

d_P = bioretention ponding depth, ft (should be less than or equal to 1.5 ft)

K_{DESIGN} = design media infiltration rate, in/hr (assume 2.5 inches per hour unless otherwise proposed)

If drawdown is less than 3 hours, the drawdown time should be rounded to 3 hours or the Capture Efficiency Method for Flow-based BMPs (See Appendix III.3.3) shall be used.

Step 2: Determine the Required Adjusted DCV for this Drawdown Time

Use the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs (See Appendix III.3.2) to calculate the fraction of the DCV the basin must hold to achieve 80 percent capture of average annual stormwater runoff volume based on the basin drawdown time calculated above.

Step 3: Determine the Basin Infiltrating Area Needed

The required infiltrating area (i.e. the surface area of the top of the media layer) can be calculated using the following equation:

$A = \text{Design Volume} / d_p$

Where:

A = required infiltrating area, sq-ft (measured at the media surface)

Design Volume = fraction of DCV, adjusted for drawdown, cu-ft (see Step 2)

d_p = ponding depth of water stored in bioretention area, ft (from Step 1)

This does not include the side slopes, access roads, etc. which would increase bioretention footprint. If the area required is greater than the selected basin area, adjust surface area or adjust ponding depth and recalculate required area until the required area is achieved.

In South Orange County, the provided ponding plus pore volume must be checked to demonstrate that it is greater than 0.75 of the remaining DCV that this BMP is designed to address. See Section III.7 and Worksheet SOC-1.

Configuration for Use in a Treatment Train

- Bioretention areas may be preceeded in a treatment train by HSCs in the drainage area, which would reduce the required design volume of the bioretention cell. For example, bioretention could be used to manage overflow from a cistern.
- Bioretention areas can be used to provide pretreatment for underground infiltration systems.

Additional References for Design Guidance

- CASQA BMP Handbook for New and Redevelopment: http://www.cabmphandbooks.com/Documents/Development/TC-32.pdf

- SMC LID Manual (pp 68): http://www.lowimpactdevelopment.org/guest75/pub/All_Projects/SoCal_LID_Manual/SoCalLID_Manual_FINAL_040910.pdf
- Los Angeles County Stormwater BMP Design and Maintenance Manual, Chapter 5: http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf
- San Diego County LID Handbook Appendix 4 (Factsheet 7): http://www.sdcounty.ca.gov/dplu/docs/LID-Appendices.pdf

  Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 4: http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850
- County of Los Angeles Low Impact Development Standards Manual, Chapter 5: http://dpw.lacounty.gov/wmd/LA_County_LID_Manual.pdf

BIO-7: Proprietary Biotreatment

Proprietary biotreatment devices are devices that are manufactured to mimic natural systems such as bioretention areas by incorporating plants, soil, and microbes engineered to provide treatment at higher flow rates or volumes and with smaller footprints than their natural counterparts. Incoming flows are typically filtered through a planting media (mulch, compost, soil, plants, microbes, etc.) and either infiltrated or collected by an underdrain and delivered to the storm water conveyance system. Tree box filters are an increasingly common type of proprietary biotreatment device that are installed at curb level and filled with a bioretention type soil. For low to moderate flows they operate similarly to bioretention systems and are bypassed during high flows. Tree box filters are highly adaptable solutions that can be used in all types of development and in all types of soils but are especially applicable to dense urban parking lots, street, and roadways.

Also known as:

- *Catch basin planter box*
- *Bioretention vault*
- *Tree box filter*

Proprietary biotreatment
Source: http://www.americastusa.com /index.php/filterra/

Feasibility Screening Considerations

- Proprietary biotreatment devices that are unlined may cause incidental infiltration. Therefore, an evaluation of site conditions should be conducted to evaluate whether the BMP should include an impermeable liner to avoid infiltration into the subsurface.

Opportunity Criteria

- Drainage areas of 0.25 to 1.0 acres.
- Land use may include commercial, residential, mixed use, institutional, and subdivisions. Proprietary biotreatment facilities may also be applied in parking lot islands, traffic circles, road shoulders, and road medians.
- Must not adversely affect the level of flood protection provided by the drainage system.

OC-Specific Design Criteria and Considerations

- ☐ Frequent maintenance and the use of screens and grates to keep trash out may decrease the likelihood of clogging and prevent obstruction and bypass of incoming flows.
- ☐ Consult proprietors for specific criteria concerning the design and performance.
- ☐ Proprietary biotreatment may include specific media to address pollutants of concern. However, for proprietary device to be considered a biotreatment device the media must be capable of supporting rigorous growth of vegetation.
- ☐ Proprietary systems must be acceptable to the reviewing agency. Reviewing agencies shall have the discretion to request performance information. Reviewing agencies shall have the discretion to deny the use of a proprietary BMP on the grounds of performance, maintenance considerations, or other relevant factors.

- ☐ In right of way areas, plant selection should not impair traffic lines of site. Local jurisdictions may also limit plant selection in keeping with landscaping themes.

Computing Sizing Criteria for Proprietary Biotreatment Device

- Proprietary biotreatment devices can be volume based or flow-based BMPs.
- Volume-based proprietary devices should be sized using the Simple Design Capture Volume Sizing Method described in Appendix III.3.1 or the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs described in Appendix III.3.2.
- The required design flowrate for flow-based proprietary devices should be computed using the Capture Efficiency Method for Flow-based BMPs described in Appendix III.3.3).

In South Orange County, the provided ponding plus pore volume must be checked to demonstrate that it is greater than 0.75 of the remaining DCV that this BMP is designed to address. Many propretary biotreatment BMPs will not be able to meet the definition of "biofiltration" that applies in South Orange County. See Section III.7 and Worksheet SOC-1.

Additional References for Design Guidance

- Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 4: http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850
- Los Angeles County Stormwater BMP Design and Maintenance Manual, Chapter 9: http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf
- Santa Barbara BMP Guidance Manual, Chapter 6: http://www.santabarbaraca.gov/NR/rdonlyres/91D1FA75-C185-491E-A882-49EE17789DF8/0/Manual_071008_Final.pdf

HSC-3: Street Trees

By intercepting rainfall, trees can provide several aesthetic and stormwater benefits including peak flow control, increased infiltration and ET, and runoff temperature reduction. The volume of precipitation intercepted by the canopy reduces the treatment volume required for downstream treatment BMPs. Shading reduces the heat island effect as well as the temperature of adjacent impervious surfaces, over which stormwater flows, and thus reduces the heat transferred to downstream receiving waters. Tree roots also strengthen the soil structure and provide infiltrative pathways, simultaneously reducing erosion potential and enhancing infiltration.

Also known as:

- *Canopy interception*

Street trees
Source: Geosyntec Consultants

Feasibility Screening Considerations

- Not applicable

Opportunity Criteria

- Street trees can be incorporated in green streets designs along sidewalks, streets, parking lots, or driveways.
- Street trees can be used in combination with bioretention systems along medians or in traffic calming bays.
- There must be sufficient space available to accommodate both the tree canopy and root system.

OC-Specific Design Criteria and Considerations

- ☐ Mature tree canopy, height, and root system should not interfere with subsurface utilities, suspended powerlines, buildings and foundations, or other existing or planned structures. Required setbacks should be adhered to.
- ☐ Depending on space constarints, a 20 to 30 foot diameter canopy (at maturity) is recommended for stormwater mitigation.
- ☐ Native, drought-tolerant species should be selected in order to minimize irrigation requirements and improve the long-term viability of trees.
- ☐ Trees should not impede pedstrian or vehicle sight lines.
- ☐ Planting locations should receive adequate sunlight and wind protection; other environmental factors should be considered prior to planting.
- ☐ Frequency and degree of vegetation management and maintenance should be considered with respect to owner capabilities (e.g., staffing, funding, etc.).
- ☐ Soils should be preserved in their natural condition (if appropriate for planting) or restored via soil amendments to meet minimum criteria described in MISC-2: Amended Soils. If necessary, a landscape architect or plant biologist should be consulted.
- ☐ A street tree selection guide, such as that specific to the City of Los Angeles, may need to be consulted to select species appropriate for the site design constraints (e.g., parkway size, tree height, canopy spread, etc.)
- ☐ Infiltration should not cause geotechnical hazards related to adjacent structures (buildings,

roadways, sidewalks, utilities, etc.)

Calculating HSC Retention Volume

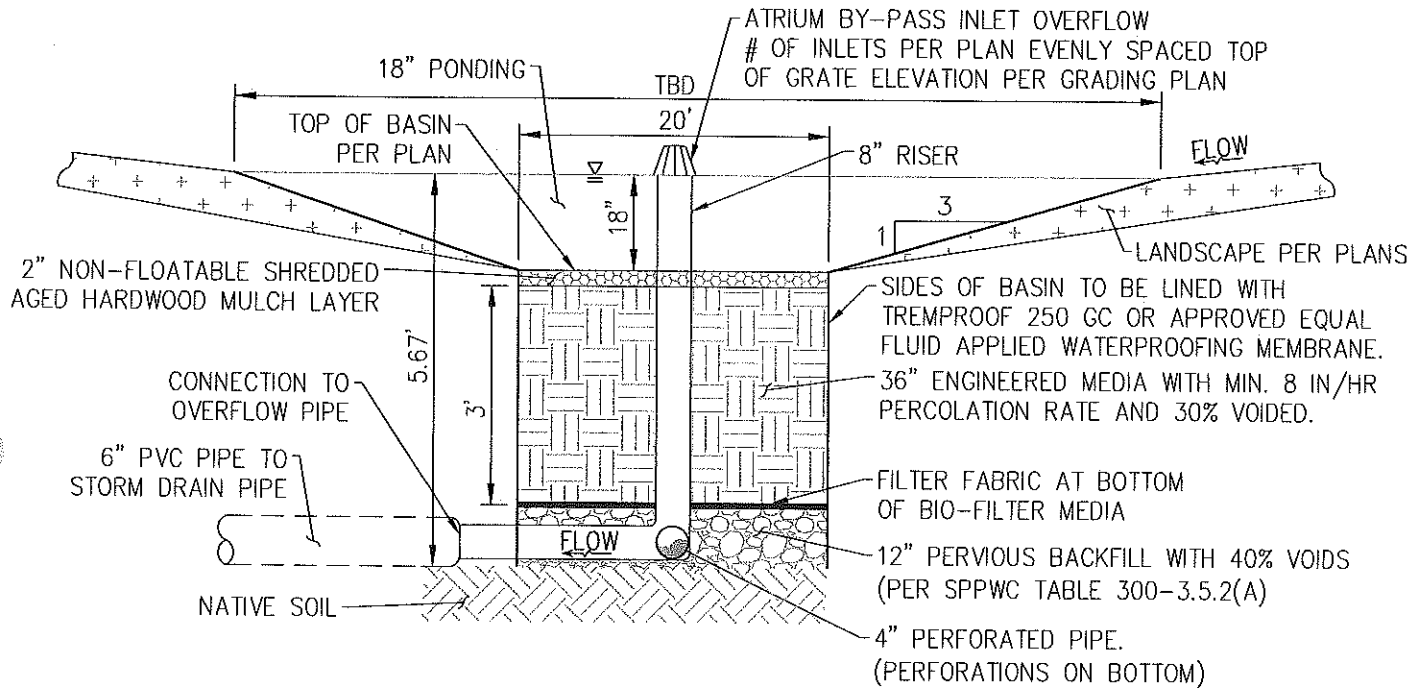
- The retention volume provided by streets trees via canopy interception is dependent on the tree species, time of the year, and maturity.
- To compute the retention depth, the expected impervious area covered by the full tree canopy after 4 years of growth must be computed (IA_{HSC}). The maximum retention depth credit for canopy interception (d_{HSC}) is 0.05 inches over the area covered by the canopy at 4 years of growth.

Configuration for Use in a Treatment Train

- As a HSC, street trees would serve as the first step in a treatment train by reducing the treatment volume and flow rate of a downstream treatment BMP.

Additional References for Design Guidance

- California Stormwater BMP Handbook.
  http://www.cabmphandbooks.com/Documents/Development/Section_3.pdf
- City of Los Angeles, Street Tree Division - Street Tree Selection Guide.
  http://bss.lacity.org/UrbanForestryDivision/StreetTreeSelectionGuide.htm
- Portland Stormwater Management Manual.
  http://www.portlandonline.com/bes/index.cfm?c=35122&a=55791
- San Diego County – Low Impact Development Fact Sheets.
  http://www.sdcounty.ca.gov/dplu/docs/LID-Appendices.pdf

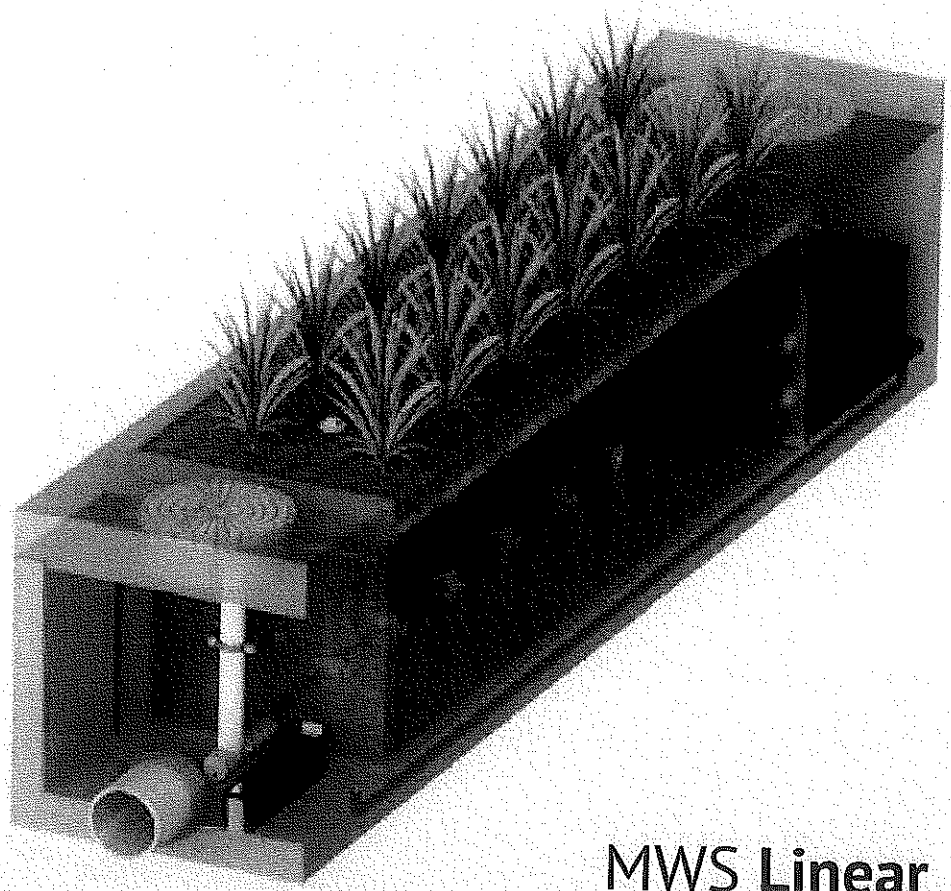


ONSITE BIO-FILTRATION CONCEPT FOR PLANNING AREAS

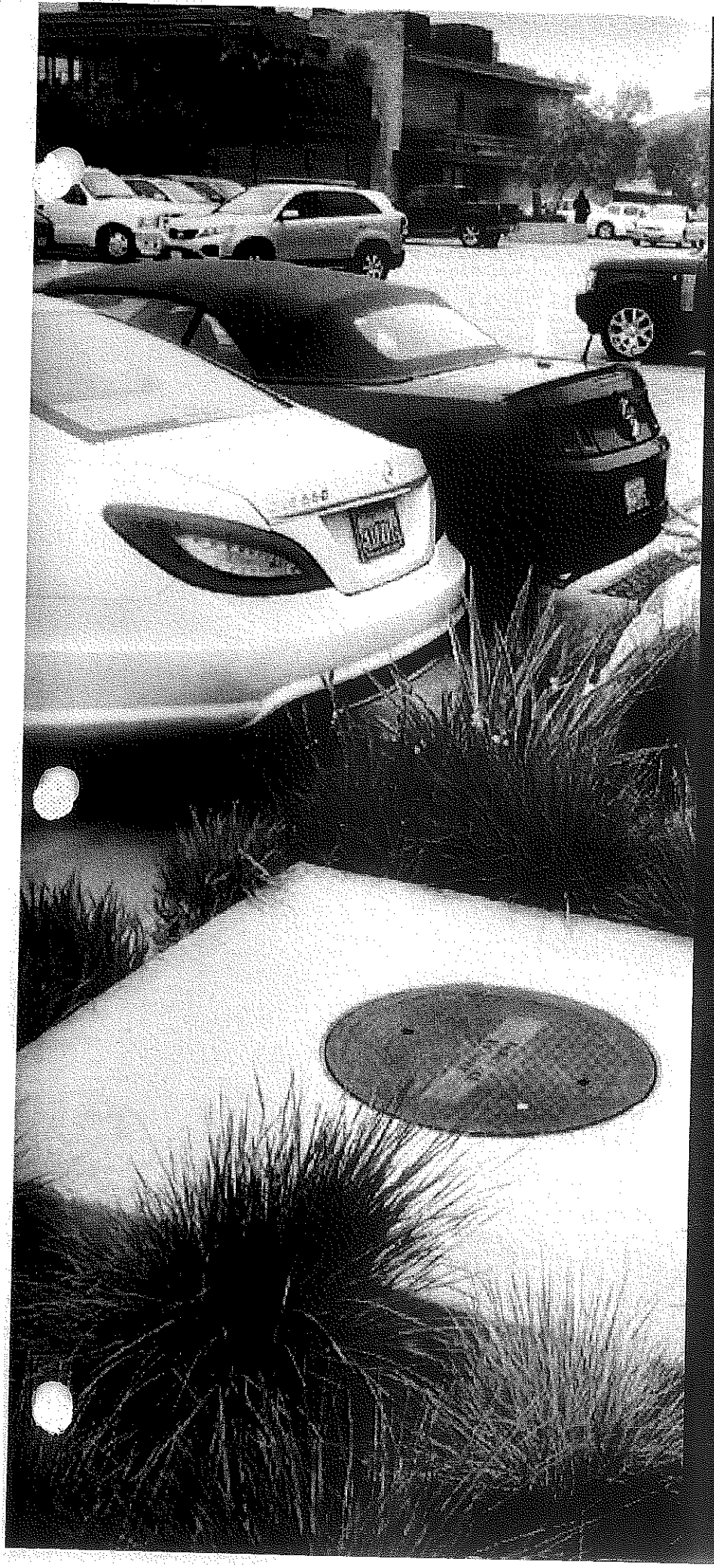
NTS (PROVIDED FOR CAPACITY SIZING ONLY)

MODULAR WETLANDS™

*Advanced **Stormwater** Biofiltration*



MWS **Linear**



Contents

1 Introduction

2 Applications

3 Configurations

4 Advantages

5 Operation

6 Orientations | Bypass

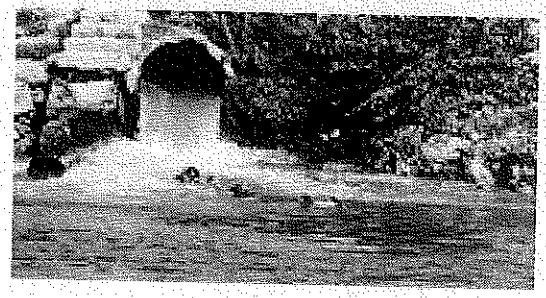
7 Performance | Approvals

8 Sizing

9 Installation | Maintenance | Plants

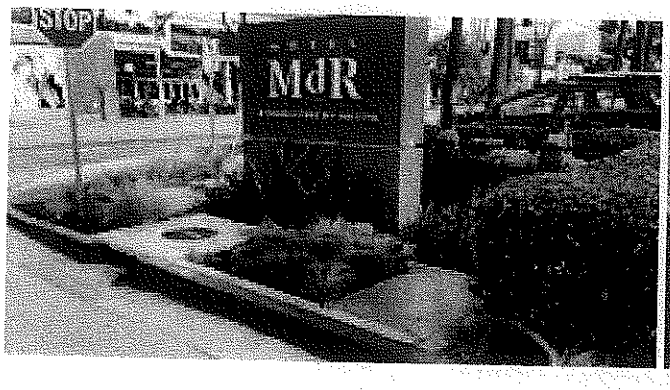
The Urban Impact

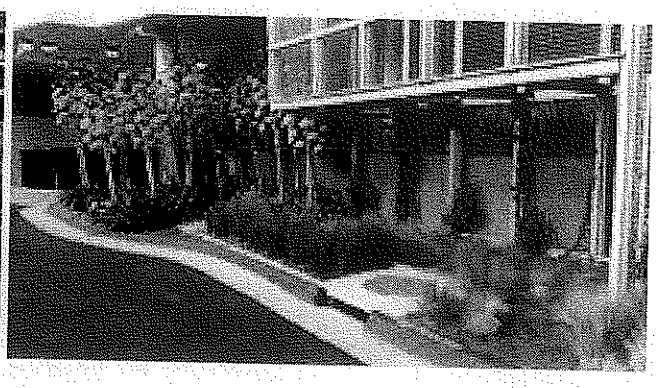
For hundreds of years natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as our cities grow and develop, these natural wetlands have perished under countless roads, rooftops, and parking lots.



Plant A Wetland

Without natural wetlands our cities are deprived of water purification, flood control, and land stability. Modular Wetlands and the MWS Linear re-establish nature's presence and rejuvenate water ways in urban areas.





MWS Linear

The Modular Wetland System Linear represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint and higher treatment capacity. While most biofilters use little or no pre-treatment, the MWS Linear incorporates an advanced pre-treatment chamber that includes separation and pre-filter cartridges. In this chamber sediment and hydrocarbons are removed from runoff before it enters the biofiltration chamber, in turn reducing maintenance costs and improving performance.

Applications

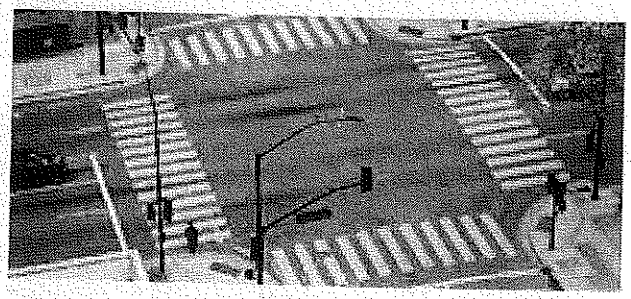
The MWS Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater and waste water applications - treating rooftops, streetscapes, parking lots, and industrial sites.

Industrial

Many states enforce strict regulations for discharges from industrial sites. The MWS Linear has helped various sites meet difficult EPA mandated effluent limits for dissolved metals and other pollutants.

Residential

Low to high density developments can benefit from the versatile design of the MWS Linear. The system can be used in both decentralized LID design and cost-effective end-of-the-line configurations.

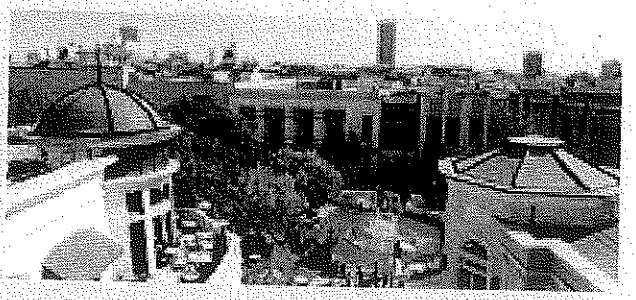


Streets

Street applications can be challenging due to limited space. The MWS Linear is very adaptable, and offers the smallest footprint to work around the constraints of existing utilities on retrofit projects.

Parking Lots

Parking lots are designed to maximize space and the MWS Linear's 4 ft. standard planter width allows for easy integration into parking lot islands and other landscape medians.



Commercial

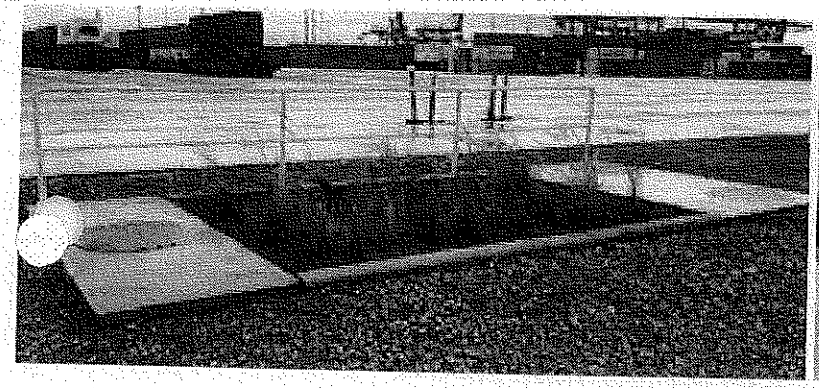
Compared to bioretention systems, the MWS Linear can treat far more area in less space - meeting treatment and volume control requirements.

Mixed Use

The MWS Linear can be installed as a raised planter to treat runoff from rooftops or patios, making it perfect for sustainable "live-work" spaces.

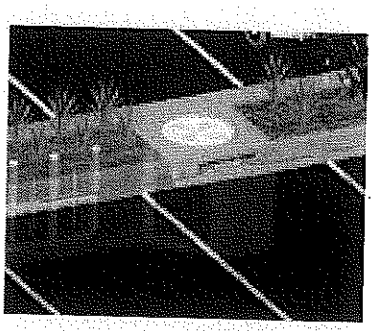
More applications are available on our website: www.ModularWetlands.com/Applications

- Agriculture
- Reuse
- Low Impact Development
- Waste Water



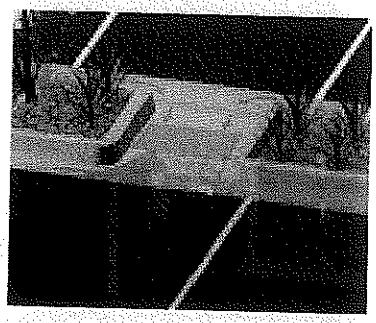
Configurations

The MWS Linear is the preferred biofiltration system of Civil Engineers across the country due to its versatile design. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your stormdrain design.



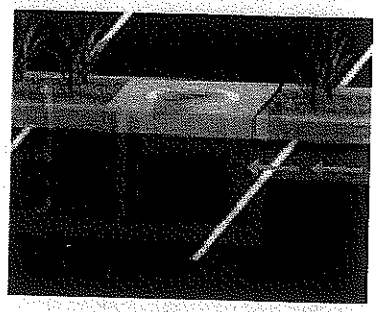
Curb Type

The *Curb Type* configuration accepts sheet flow through a curb opening and is commonly used along road ways and parking lots. It can be used in sump or flow by conditions. Length of curb opening varies based on model and size.



Grate Type

The *Grate Type* configuration offers the same features and benefits as the *Curb Type* but with a grated/drop inlet above the systems pre-treatment chamber. It has the added benefit of allowing for pedestrian access over the inlet. ADA compliant grates are available to assure easy and safe access. The *Grate Type* can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.



Vault Type

The system's patented horizontal flow biofilter is able to accept inflow pipes directly into the pre-treatment chamber, meaning the MWS Linear can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/bioretention systems. Another benefit of the "pipe in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.

Downspout Type

The *Downspout Type* is a variation of the *Vault Type* and is designed to accept a vertical downspout pipe from roof top and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

Advantages & Operation

The MWS Linear is the most efficient and versatile biofiltration system on the market, and the only system with horizontal flow which improves performance, reduces footprint, and minimizes maintenance. Figure-1 and Figure-2 illustrate the invaluable benefits of horizontal flow and the multiple treatment stages.

Featured Advantages

- Horizontal Flow Biofiltration
- Greater Filter Surface Area
- Pre-Treatment Chamber
- Patented Perimeter Void Area
- Flow Control
- No Depressed Planter Area

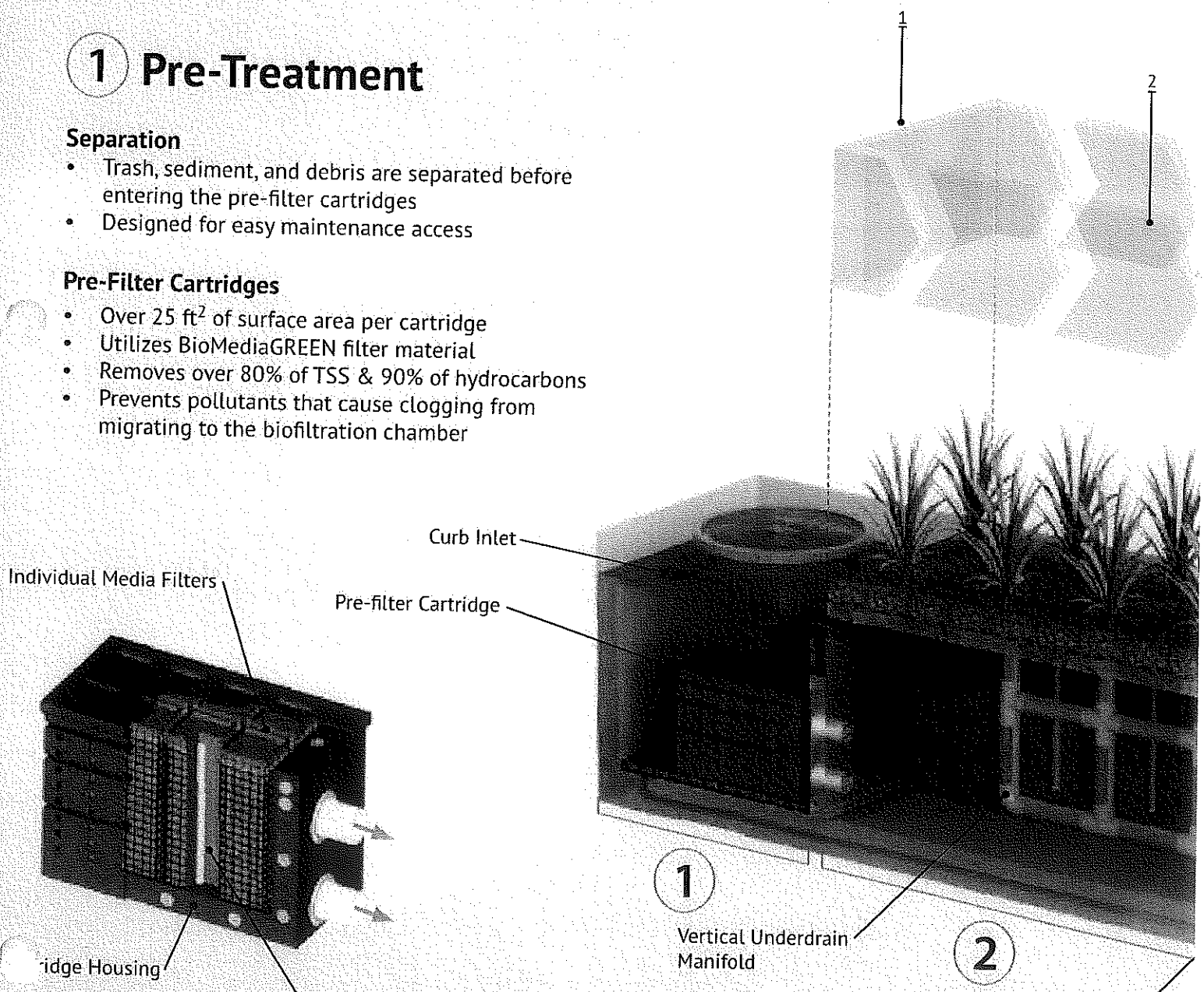
1 Pre-Treatment

Separation

- Trash, sediment, and debris are separated before entering the pre-filter cartridges
- Designed for easy maintenance access

Pre-Filter Cartridges

- Over 25 ft^2 of surface area per cartridge
- Utilizes BioMediaGREEN filter material
- Removes over 80% of TSS & 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber



BioMediaGREEN

Wetland MEDIA™

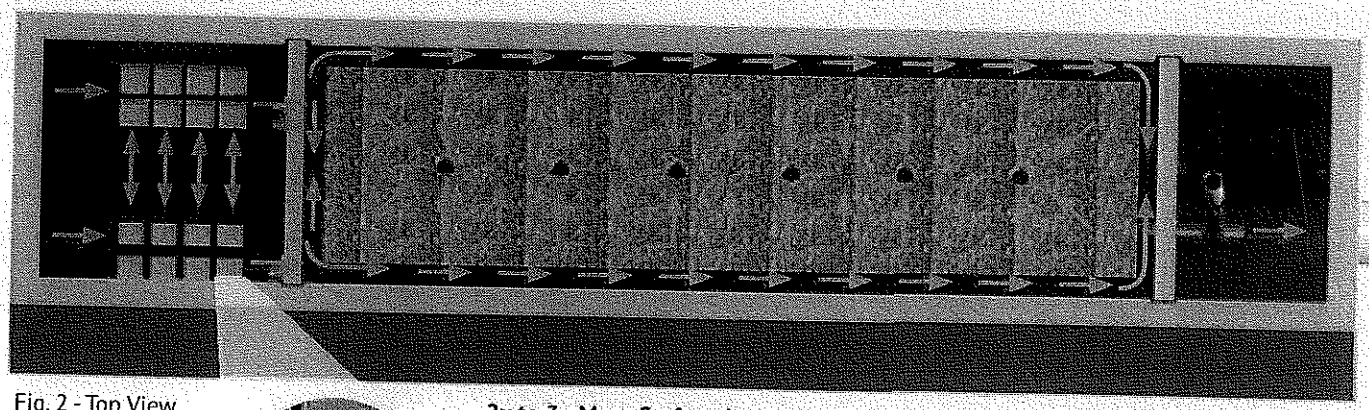
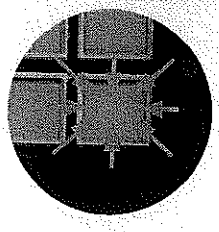


Fig. 2 - Top View

2x to 3x More Surface Area Than Traditional Downward Flow Bioretention Systems.



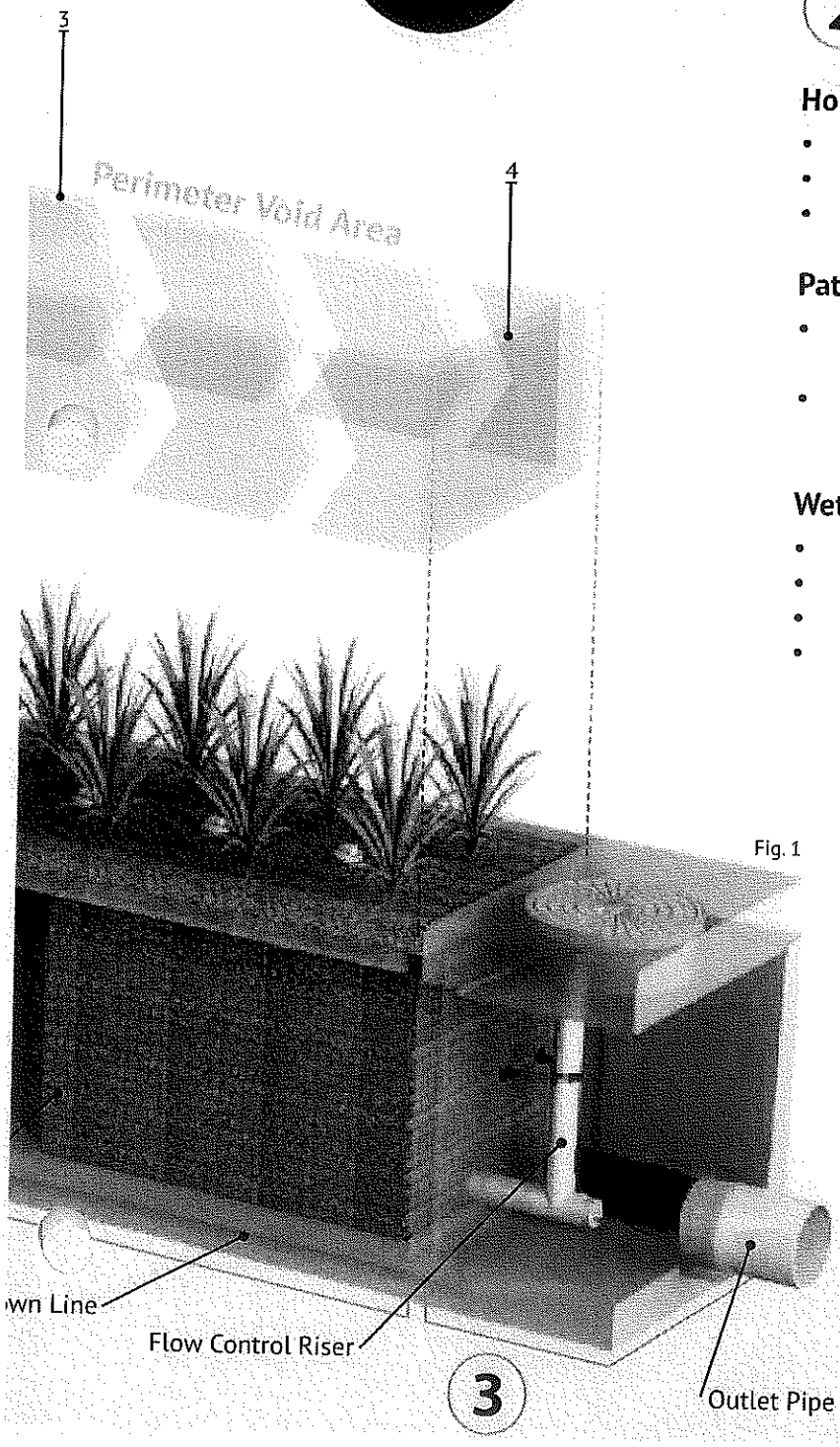


Fig. 1

2 Biofiltration

Horizontal Flow

- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

Patented Perimeter Void Area

- Vertically extends void area between the walls and the WetlandMEDIA on all four sides.
- Maximizes surface area of the media for higher treatment capacity

WetlandMEDIA

- Contains no organics and removes phosphorus
- Greater surface area and 48% void space
- Maximum evapotranspiration
- High ion exchange capacity and light weight

3 Discharge

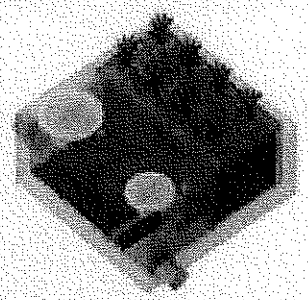
Flow Control

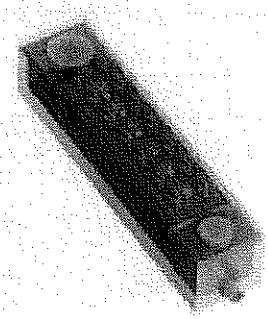
- Orifice plate controls flow of water through WetlandMEDIA to a level lower than the media's capacity.
- Extends the life of the media and improves performance

Drain-Down Filter

- The Drain-Down is an optional feature that completely drains the pre-treatment chamber
- Water that drains from the pre-treatment chamber between storm events will be treated

Orientations





Side-By-Side

The *Side-By-Side* orientation places the pre-treatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side. This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk. This orientation also offers internal bypass options as discussed below.

End-To-End

The *End-To-End* orientation places the pre-treatment and discharge chambers on opposite ends of the biofiltration chamber therefore minimizing the width of the system to 5 ft (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation. One limitation of this orientation is bypass must be external.

Bypass

Internal Bypass Weir (Side-by-Side Only)

The *Side-By-Side* orientation places the pre-treatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system's treatment capacity, thus allowing bypass from the pre-treatment chamber directly to the discharge chamber.

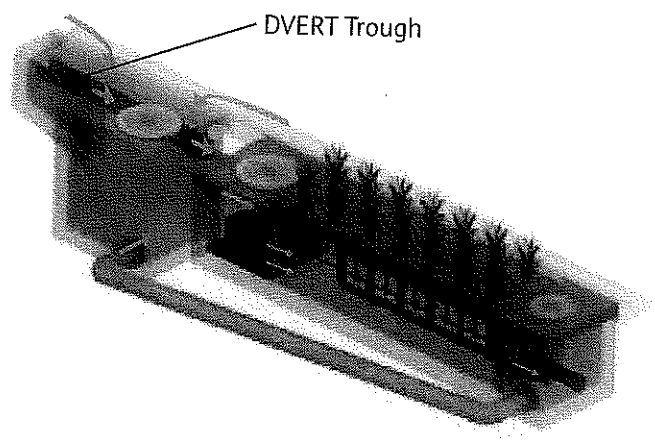
External Diversion Weir Structure

This traditional offline diversion method can be used with the MWS Linear in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir - to divert low flows over to the MWS Linear for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

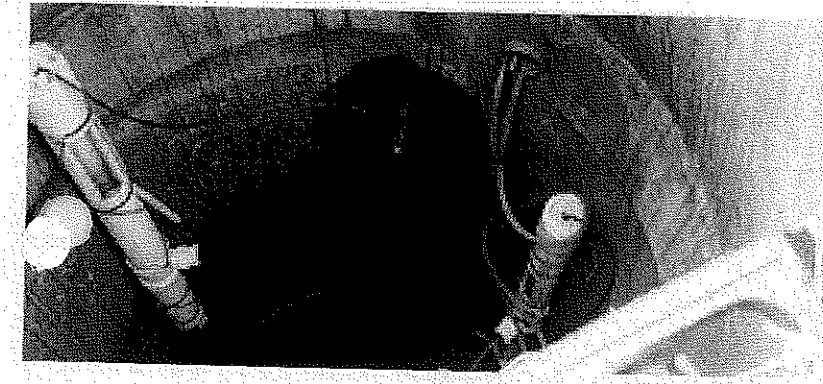
Flow By Design

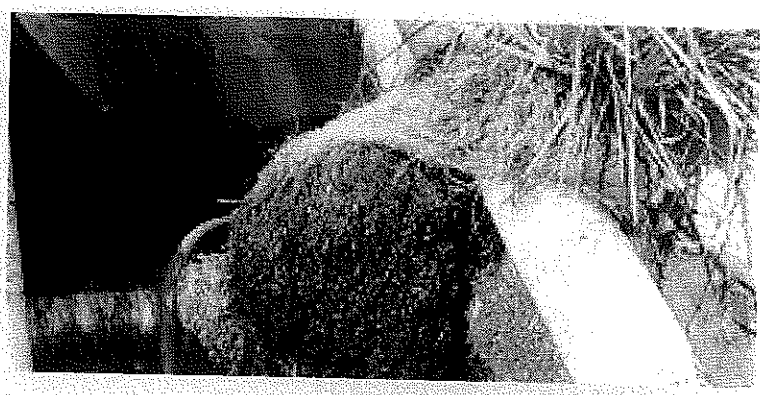
This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the MWS Linear and into the standard inlet downstream.

DVERT Low Flow Diversion



This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the MWS Linear via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels them over to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications that allows the MWS Linear to be installed anywhere space is available.





Performance

The MWS Linear continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons and bacteria. Since 2007 the MWS Linear has been field tested on numerous sites across the country. With it's advanced pre-treatment chamber and innovative horizontal flow biofilter, the system is able to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. With the same biological processes found in natural wetlands, the MWS Linear harnesses natures ability to process, transform, and remove even the most harmful pollutants.

Approvals

The MWS Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation, and perhaps the world.

Washington State TAPE Approved

The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft^2 loading rate. The highest performing BMP on the market for all main pollutant categories.

TSS	Total Phosphorus	Ortho Phosphorus	Nitrogen	Dissolved Zinc	Dissolved Copper	Total Zinc	Total Copper	Motor Oil
85%	64%	67%	45%	66%	38%	69%	50%	95%

DEQ Assignment

The Virginia Department of Environmental Quality assigned the MWS Linear, the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) Technical Criteria.

MASTEP Evaluation

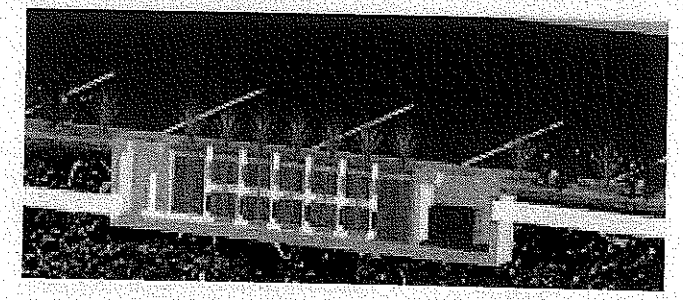
The University of Massachusetts at Amherst – Water Resources Research Center, issued a technical evaluation report noting removal rates up to 84% TSS, 70% Total Phosphorus, 68.5% Total Zinc, and more.

Rhode Island DEM Approved

Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% Pathogens, 30% Total Phosphorus for discharges to freshwater systems, and 30% Total Nitrogen for discharges to saltwater or tidal systems.

Flow Based Sizing

The MWS Linear can be used in stand alone applications to meet treatment flow requirements. Since the MWS Linear is the only biofiltration system that can accept inflow pipes several feet below the surface it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

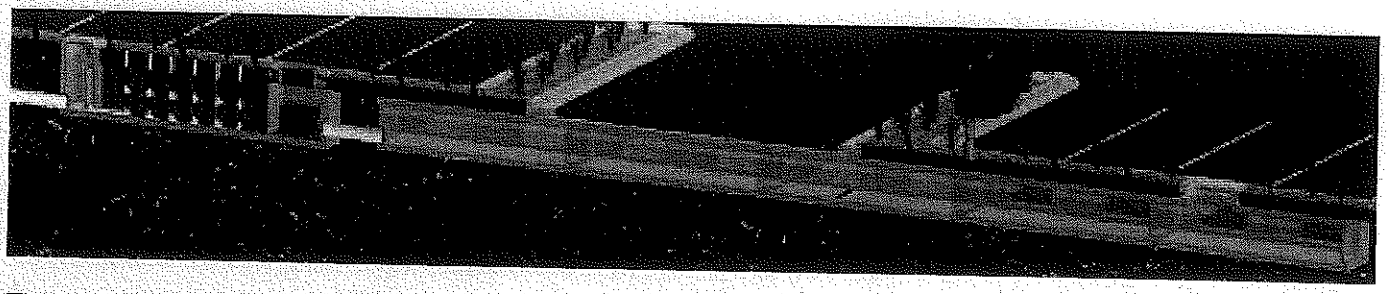


Treatment Flow Sizing Table

Model #	Dimensions	WetlandMedia Surface Area	Treatment Flow Rate (cfs)
MWS-L-4-4	4' x 4'	23 ft^2	0.052
MWS-L-4-6	4' x 6'	32 ft^2	0.073
MWS-L-4-8	4' x 8'	50 ft^2	0.115
MWS-L-4-13	4' x 13'	63 ft^2	0.144
MWS-L-4-15	4' x 15'	76 ft^2	0.175
MWS-L-4-17	4' x 17'	90 ft^2	0.206
MWS-L-4-19	4' x 19'	103 ft^2	0.237
MWS-L-4-21	4' x 21'	117 ft^2	0.268
MWS-L-8-8	8' x 8'	100 ft^2	0.230
MWS-L-8-12	8' x 12'	151 ft^2	0.346
MWS-L-8-16	8' x 16'	201 ft^2	0.462

Volume Based Sizing

Many states require treatment of a water quality volume and do not offer the option of flow based design. The MWS Linear and its unique horizontal flow makes it the only biofilter that can be used in volume based design installed downstream of ponds, detention basins, and underground storage systems.



Treatment Volume Sizing Table

Model #	Treatment Capacity (cu. ft.) @ 24-Hour Drain Down	Treatment Capacity (cu. ft.) @ 48-Hour Drain Down
MWS-L-4-4	1140	2280
MWS-L-4-6	1600	3200
MWS-L-4-8	2518	5036
MWS-L-4-13	3131	6261
MWS-L-4-15	3811	7623
MWS-L-4-17	4492	8984
MWS-L-4-19	5172	10345
MWS-L-4-21	5853	11706
MWS-L-8-8	5036	10072
MWS-L-8-12	7554	15109
MWS-L-8-16	10073	20145

Installation

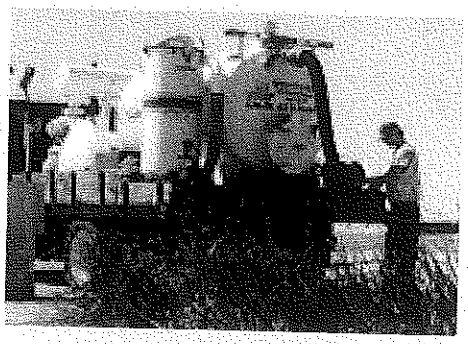
The MWS Linear is simple, easy to install, and has a space efficient design that offers lower excavation and installation costs compared to traditional tree-box type systems. The structure of the system resembles pre-cast catch basin or utility vaults and is installed in a similar fashion.

The system is delivered fully assembled for quick installation. Generally, the structure can be unloaded and set in place in 15 minutes. Our experienced team of field technicians are available to supervise installations and provide technical support.

Maintenance

Reduce your maintenance costs, man hours, and materials with the MWS Linear. Unlike other biofiltration systems that provide no pre-treatment, the MWS Linear is a self-contained treatment train which incorporates simple and effective pre-treatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pre-treatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pre-treatment chamber that can be cleaned by hand or with a standard vac truck. Only periodic replacement of low-cost media in the pre-filter cartridges is required for long term operation and there is absolutely no need to replace expensive biofiltration media.

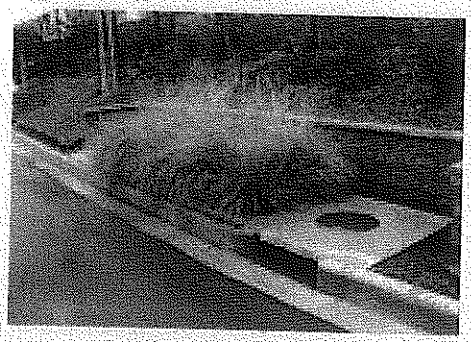


Plant Selection

Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the MWS Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade the stormwater runoff/flow is being subjected to nature's secret weapon: a dynamic physical, chemical, and biological process working to break down and remove non-point source pollutants. The flow rate is controlled in the MWS Linear, giving the plants more "contact time" so that pollutants are more successfully decomposed, volatilized and incorporated into the biomass of The MWS Linear's micro/macro flora and fauna.

A wide range of plants are suitable for use in the MWS Linear, but selections vary by location and climate. View suitable plants by selecting the list relative to your project location's hardy zone.

Please visit www.ModularWetlands.com/Plants for more information and various plant lists.



Section [_____]
Modular Subsurface Flow Wetland System

PART 1 – GENERAL

01.01.00 Purpose
The purpose of this specification is to establish generally acceptable criteria for Modular Subsurface Flow Wetland Systems used for biofiltration of stormwater runoff including dry weather flows and other contaminated water sources. It is intended to serve as a guide to producers, distributors, architects, engineers, contractors, plumbers, installers, inspectors, agencies and users; to promote understanding regarding materials, manufacture and installation; and to provide for identification of devices complying with this specification.

01.02.00 Description
Modular Subsurface Flow Wetland Systems (MSFWS) are used for filtration of stormwater runoff including dry weather flows. The MSFWS is a pre-engineered biofiltration system composed of a pretreatment chamber containing filtration cartridges, a horizontal flow biofiltration chamber with a peripheral void area and a centralized and vertically extending underdrain, the biofiltration chamber containing a sorptive media mix which does not contain any organic material and a layer of plant establishment media, and a discharge chamber containing an orifice control structure . Treated water flows horizontally in series through the pretreatment chamber cartridges, biofiltration chamber and orifice control structure.

01.03.00 Manufacturer
The manufacturer of the MSFWS shall be one that is regularly engaged in the engineering design and production of systems developed for the treatment of stormwater runoff for at least (10) years, and which have a history of successful production, acceptable to the engineer of work. In accordance with the drawings, the MSFWS(s) shall be a filter device Manufactured by Bio Clean Environmental Services, Inc., or Modular Wetland Systems, Inc., or assigned distributors or licensees. Bio Clean Environmental Services Inc., and Modular Wetland Systems, Inc., can be reached at:

Corporate Headquarters:
Bio Clean Environmental Service, Inc.
2972 San Luis Rey Road
Oceanside, CA 92058
Phone: (760) 433-7640
Fax: (760) 433-3176
www.biocleanenvironmental.net

Corporate Headquarters:
Modular Wetland Systems, Inc.
P.O. Box 869
Oceanside, CA 92049
Phone: (760) 433-7650
www.modularwetlands.net

01.04.00 Submittals

01.04.01 Shop drawings are to be submitted with each order to the contractor and consulting engineer.

01.04.02 Shop drawings are to detail the MSFWS and all components required and the sequence for installation, including:

- System configuration with primary dimensions
- Interior components
- Any accessory equipment called out on shop drawings

01.04.03 Inspection and maintenance documentation submitted upon request.

01.05.00 Work Included

01.05.01 Specification requirements for installation of MSFWS.

01.05.02 Manufacturer to supply components of the MSFWS(s):

- Pretreatment chamber components (pre-assembled)
- Concrete Structure(s)
- Biofiltration chamber components (pre-assembled)
- Flow control discharge structure (pre-assembled)

01.06.00 Reference Standards

ASTM C 29	Standard Test Method for Unit Weight and Voids in Aggregate
ASTM C 88	C 88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C131	C 131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregates by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 330	C 330 Standard Specification for Lightweight Aggregate for Structural Concrete
ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft.-lbf/ft3 (600 kN-m/m3)
ASTM D 1621	10 Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
ASTM D 1777	ASTM D1777 - 96(2007) Standard Test Method for Thickness of Textile Materials
ASTM D 4716	Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
AASHTO T 99-01	Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in) Drop
AASHTO T 104	Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
AASHTO T 260	Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials.
AASHTO T 288	Standard Method of Test for Determining Minimum Laboratory Soil Resistivity
AASHTO T 289	Standard Method of Test for Determining ph of Soil for Use in Corrosion Testing
AASHTO T 291	Standard Method of Test for Determining Water Soluble Chloride Ion Content in Soil
AASHTO T 290	T 290 Standard Method of Test for Determining Water Soluble Sulfate Ion Content in Soil

BIO CLEAN
ENVIRONMENTAL SERVICES, INC.

PART 2 – COMPONENTS

The Modular Subsurface Flow Wetland Systems (MSFWS) and all of its components shall be self-contained within a concrete structure constructed of concrete with a minimum 28 day compressive strength of 5,000 psi, with reinforcing per ASTM A 615, Grade 60, and supports and H20 loading as indicated by AASHTO. Each Chamber shall have appropriate access hatches for easy maintenance and sized to allow removal of all internal components without disassembly. All water transfer system components shall conform with the following;

- Filter netting shall be 100% Polyester with a number 16 sieve size, and strength tested per ASTM D 3787.
- Drainage cells shall be manufactured of lightweight injection-molded plastic and have a minimum compressive strength test of 6,000 psi and a void area along the surface making contact with the filter media of 75% or greater. The cells shall be at least 2" in thickness and allow water to freely flow in all four directions.

02.01.00 Pretreatment Chamber Components

02.01.01 Filter Cartridges shall operate at a loading rate not to exceed 3 gallons per minute per square foot surface area.

02.01.02 Drain Down System shall include a pervious floor that allows water to drain into the underdrain pipe that is connected to the discharge chamber.

02.02.00 Biofiltration Chamber Components

02.02.01 Media shall consist of ceramic material produced by expanding and vitrifying select material in a rotary kiln. Media must be produced to meet the requirements of ASTM C330, ASTM C331, and AASHTO M195. Aggregates must have a minimum 24-hour water absorption of 10.5% mass. Media shall not contain any organic material. Flow through media shall be horizontal from the outer perimeter of the chamber toward the centralized and vertically extending underdrain. The retention time in the media shall be at least 3 minutes. Downward flow filters are not acceptable alternatives. The thickness of the media shall be at least 19" from influent end to effluent end. The loading rate on the media shall not exceed 1.1 gallons per minute per square foot surface area. Media must be contained within structure that spaces the surface of the media at least 2" from all vertically extending walls of the concrete structure.

02.02.02 Planting shall be native, drought tolerant species recommend by manufacturer and/or landscape architect.

02.02.03 Plant Support Media shall be made of a 3" thick moisture retention cell that is inert and contains no chemicals or fertilizers, is not made of organic material and has an internal void percentage of 80%.

02.03.00 Discharge Chamber

The discharge device shall house a flow control orifice plate that restricts flows greater than designed treatment flow rate. All piping components shall be made of a high-density polyethylene. The discharge chamber shall also contain a drain down filter if specified on the drawing.

PART 3 – PERFORMANCE

03.01.00 General

03.01.01 Function - The MSFWS has no moving internal components and functions based on gravity flow, unless otherwise specified. The MSFWS is composed of a pretreatment chamber, a biofiltration chamber and a discharge chamber. The pretreatment device houses cartridge media filters, which consist of filter media housed in a perforated enclosure. The untreated runoff flows into the system via subsurface piping and or surface inlet. Water entering the system is forced through the filter cartridge enclosures by gravity flow. Then the flow contacts the filter media. The flow through the media is horizontal toward the center of each individual media filter. In the center of the media shall be a round slotted PVC pipe of no greater than 1.5" in diameter. The slotted PVC pipe shall extend downward into the water transfer cavity of the cartridge. The slotted PVC pipe shall be threaded on the bottom to connect to the water transfer cavity. After pollutants have been removed by the filter media the water discharges the pretreatment chamber and flows into the water transfer system and is conveyed to the biofiltration chamber. Once runoff has been filtered by the biofiltration chamber it is collected by the vertical underdrain and conveyed to a discharge chamber equipped with a flow control orifice plate. Finally the treated flow exits the system.

03.01.02 Pollutants - The MSFWS will remove and retain debris, sediments, TSS, dissolved and particulate metals and nutrients including nitrogen and phosphorus species, bacteria, BOD, oxygen demanding substances, organic compounds and hydrocarbons entering the filter during frequent storm events and continuous dry weather flows.

03.01.03 Treatment Flow Rate and Bypass - The MSFWS operates in-line. The MSFWS will treat 100% of the required water quality treatment flow based on a minimum filtration capacities listed in section 03.02.00. The size of the system must match those provided on the drawing to ensure proper performance and hydraulic residence time.

Minimum Treatment Capabilities

• System must be capable of treating flows to the specified treatment flow rate on the drawings. The flow rate shall be controlled by an orifice plate.

PART 4 - EXECUTION

04.01.00 General

The installation of the MSFWS shall conform to all applicable national, state, state highway, municipal and local specifications.

04.02.00 Installation

The Contractor shall furnish all labor, equipment, materials and incidentals required to install the (MSFWS) device(s) and appurtenances in accordance with the drawings and these specifications.

04.02.01 Grading and Excavation site shall be properly surveyed by a registered professional surveyor, and clearly marked with excavation limits and elevations. After site is marked it is the responsibility of the contractor to contact local utility companies and/or DigAlert to check for underground utilities. All grading permits shall be approved by governing agencies before commencement of grading and excavation. Soil conditions shall be tested in accordance with the governing agencies requirements. All earth removed shall be transported, disposed, stored, and handled per governing agencies standards. It is the responsibility of the contractor to install and maintain proper erosion control measures during grading and excavation operations.

04.02.02 Compaction – All soil shall be compacted per registered professional soils engineer's recommendations prior to installation of MSFWS components.

04.02.03 Backfill shall be placed according to a registered professional soils engineer's recommendations, and with a minimum of 6" of gravel under all concrete structures.

04.02.04 Concrete Structures – After backfill has been inspected by the governing agency and approved the concrete structures shall be lifted and placed in proper position per plans.

04.02.05 Subsurface Flow Wetland Media shall be carefully loaded into area so not to damage the Wetland Liner or Water Transfer Systems. The entire wetland area shall be filled to a level 9 inches below finished surface.

04.02.06 Planting layer shall be installed per manufacturer's drawings and consist of a minimum 3" grow enhancement media that ensures greater than 95% plant survival rate, and 6" of wetland media. Planting shall consist of native plants recommended by manufacturer and/or landscape architect. Planting shall be drip irrigated for at least the first 3 months to insure long term plant growth. No chemical herbicides, pesticides, or fertilizers shall be used in the planting or care and maintenance of the planted area.

04.03.00 Shipping, Storage and Handling

04.03.01 Shipping – MSFWS shall be shipped to the contractor's address or job site, and is the responsibility of the contractor to offload the unit(s) and place in the exact site of installation.

04.03.02 Storage and Handling– The contractor shall exercise care in the storage and handling of the MSFWS and all components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be born by the contractor. The MSFWS(s) and all components shall always be stored indoors and transported inside the original shipping container until the unit(s) are ready to be installed. The MSFWS shall always be handled with care and lifted according to OSHA and NIOSA lifting recommendations and/or contractor's workplace safety professional recommendations.

04.04.00 Maintenance and Inspection

04.04.01 Inspection – After installation, the contractor shall demonstrate that the MSFWS has been properly installed at the correct location(s), elevations, and with appropriate components. All components associated with the MSFWS and its installation shall be subject to inspection by the engineer at the place of installation. In addition, the contractor shall demonstrate that the MSFWS has been installed per the manufacturer's specifications and recommendations. All

components shall be inspected by a qualified person once a year and results of inspection shall be kept in an inspection log.

04.04.02 Maintenance – The manufacturer recommends cleaning and debris removal maintenance of once a year and replacement of the Cartridge Filters as needed. The maintenance shall be performed by someone qualified. A Maintenance Manual is available upon request from the manufacturer. The manual has detailed information regarding the maintenance of the MSFWS. A Maintenance/Inspection record shall be kept by the maintenance operator. The record shall include any maintenance activities preformed, amount and description of debris collected, and the condition of the filter.

04.04.03 Material Disposal - All debris, trash, organics, and sediments captured by the MSFWS shall be transported and disposed of at an approved facility for disposal in accordance with local and state requirements. Please refer to state and local regulations for the proper disposal of toxic and non-toxic material.

PART 5 – QUALITY ASSURNACE

05.01.00 Warranty

The Manufacturer shall guarantee the MSFWS against all manufacturing defects in materials and workmanship for a period of (5) years from the date of delivery to the _____. The manufacturer shall be notified of repair or replacement issues in writing within the warranty period. The MSFWS is limited to recommended application for which it was designed.

05.02.00 Performance Certification

The MSFWS manufacturer shall submit to the Engineer of Record a "Manufacturer's Performance Certificate" certifying the MSFWS is capable of achieving the specified removal efficiency for suspended solids, phosphorous and dissolved metals.

Installation Guidelines for Modular Wetland System

Delivery & Unloading/Lifting

1. Modular Wetland Systems, Inc. shall deliver the unit(s) to the site in coordination with the Contractor.

2. The Contractor will require spreader bars and chains/cables to safely and securely lift the main structure, lids and risers (if applicable). Modular Wetlands will supply a set of suitable lifting hooks, knuckles, shackles and eye bolts with each project at no extra charge.

3. The main structure and lid can be lifted together or separately.

   Please see Modular Wetland Weights and Lifting Details. Contact Modular Wetlands for additional lifting details.

Inspection

1. Inspection of the Modular Wetland unit and all parts contained in or shipped outside of the unit shall be inspected at time of delivery by the site Engineer/Inspector and the Contractor. Any non-conformance to approved drawings or damage to any part of the system shall be documented on the Modular Wetland shipping ticket. Damage to the unit during and after unloading shall be corrected at the expense of the Contractor. Any necessary repairs to the Modular Wetland unit shall be made to the acceptance of the Engineer/Inspector.

Site Preparation

1. The Contractor is responsible for providing adequate and complete site/inlet protection when the Modular Wetland unit is installed prior to final site stabilization (full landscaping, grass cover, final paving, and street sweeping completed).

2. The Contractor shall adhere to all jurisdictional and/or OSHA safety rules in providing temporary shoring of the excavation.

3. The Contractor or Owner is responsible for appropriately barricading the Modular Wetland unit from traffic (in accordance with local codes).

Installation Guidelines for Modular Wetland System

Installation

1. Each unit shall be constructed at the locations and elevations according to the sizes shown on the approved drawings. Any modifications to the elevation or location shall be at the direction of and approved by the Engineer.

2. The unit shall be placed on the compacted sub-grade with a minimum 6-inch gravel base matching the final grade of the curb line in the area of the unit. The unit is to be placed such that the unit and top slab match the grade of the curb in the area of the unit. Compact undisturbed sub-grade materials to 95% of maximum density at +1% to 2% of the optimum moisture. Unsuitable material below sub-grade shall be replaced to site engineer's approval. Please see Modular Wetlands Weights and Lifting Details. Contact Modular Wetlands for guidance where slope exceeds 5%.

3. Once the unit is set, the internal wooden forms and protective silt fabric cover must be left intact (if WetlandMedia pre-installed). The top lid(s) should be sealed onto the box section before backfilling, using a non-shrink grout, butyl rubber or similar waterproof seal. The boards on the top of the lid and boards sealed in the unit's throat must NOT be removed. The Supplier will remove these sections at the time of activation.

4. Outlet connections shall be aligned and sealed to meet the approved drawings with modifications necessary to meet site conditions and local regulations. The correct outlet will be marked on the Modular Wetland unit.

5. Backfilling should be performed in a careful manner, bringing the appropriate fill material up in 6-inch lifts on all sides. Precast sections shall be set in a manner that will result in a watertight joint. In all instances, installation of the Modular Wetland unit shall conform to ASTM specification C891 "Standard Practice for Installation of Underground Precast Utility Structures" unless specified otherwise in contract documents.

6. It is the responsibility of the Contractor to provide curb and gutter and transition to the Modular Wetland unit for proper stormwater flow into the system through the throat, pipe or grate opening. A standard drawing of the throat and gutter detail is available in the following section; however the plans and contract documents supersede all standard drawings. Several variations of the standard design are available. Effective bypass for the Modular Wetland System is essential for correct operation (i.e. bypass to an overflow at lower elevation).

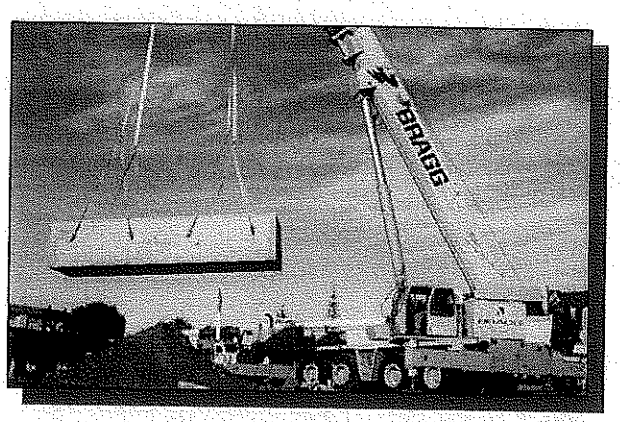
Installation Procedure

A set of lifting hooks, shackles, knuckles and eye bolts are provided by Modular Wetlands with the first delivery of every project.

The contractor **MUST** provide all rigging And lifting apparatus, such as all cables and chains or straps.

It is the contractor's responsibility to provide suitable lifting equipment to off-load the Modular Wetland unit.

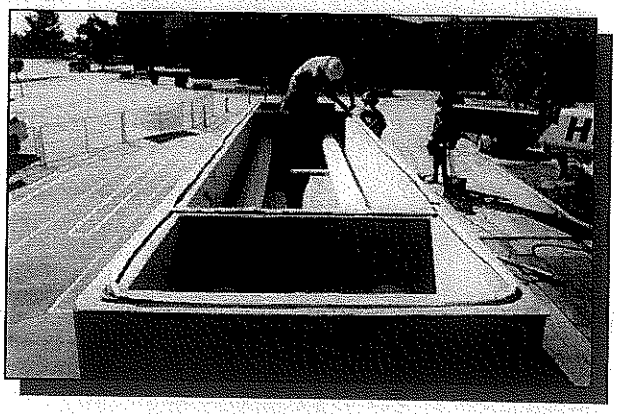
Modular Wetland units are designed to be off-loaded using the contractor's spreader bar.



1. Apply Butyl Tape Seal

Apply butyl tape seal along the top of the box section. Butyl tape seal is provided with every unit.

Modular Wetland installed protective throat board and installed silt fabric must be left in place to protect the unit from construction sediment.

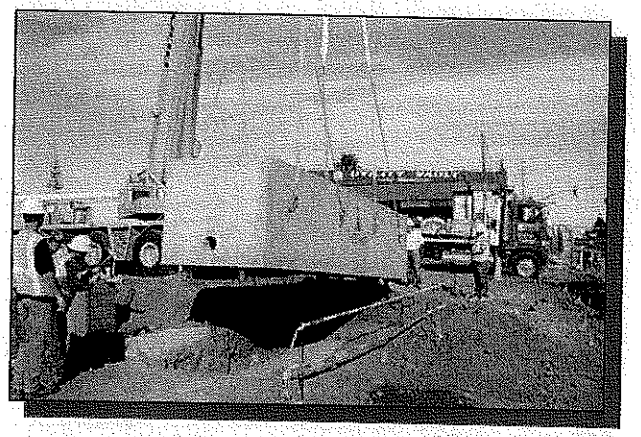


MODULAR WETLANDS

2. Unload and Set Box

Unload the Modular Wetland unit
the prepared hole with appropriate sub-grade.*

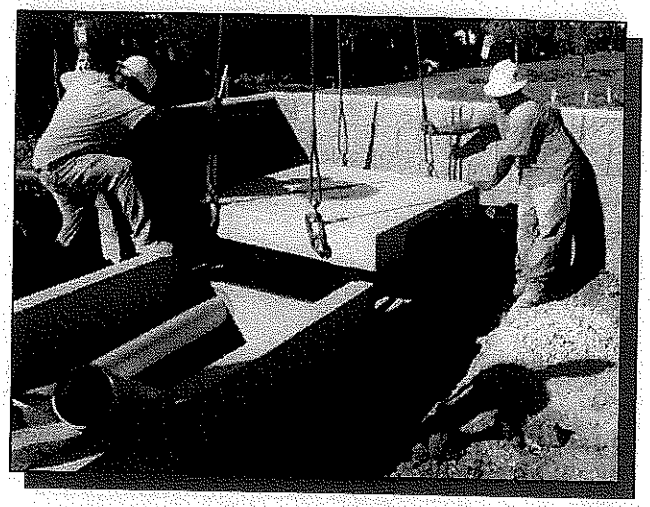
* Compacted sub-grade with a minimum
of six inches of gravel base which must match
the final grade of curb line the area of the unit.



3. Set Top On Box

Set the top slab on the box.

The Contractor is responsible for providing
adequate and complete site/inlet protection
when the Modular Wetland is installed prior
to final site stabilization (full landscaping,
grass cover, final paving, and street sweeping
completed).



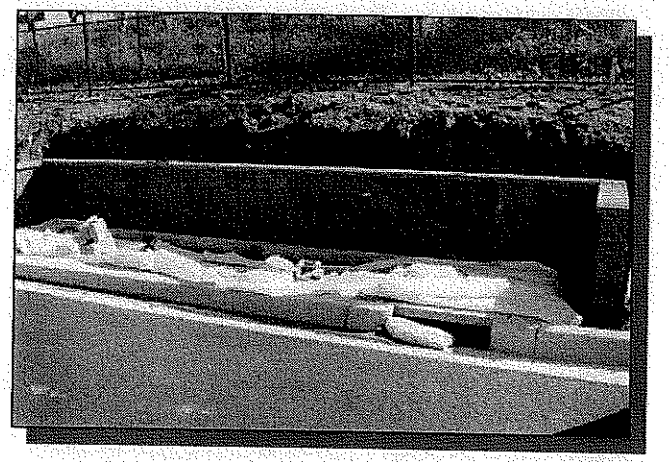
4. Connect Outfall Pipe

The correct outlet will be marked on the
Modular Wetland.

Invert of outlet pipe **MUST** be even
with the floor of the system.

5. Install Curb & Gutter

It is the responsibility of the Contractor to provide curb and gutter and transition to the Modular Wetland for proper flow into the system through a 5"- 7" throat opening. A standard drawing of the throat and gutter detail in the following section. CONTRACTOR RESPONSIBLE FOR GROUTING IN ANY VISIBLE LIFTING POINTS.

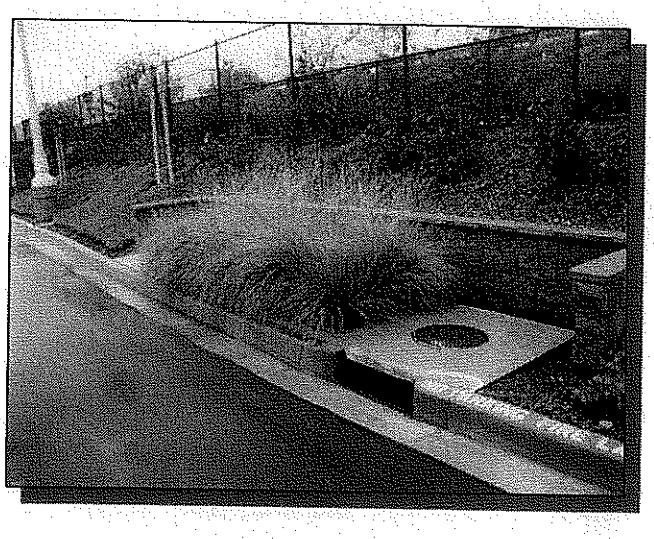


6. Activation

Activation is performed **ONLY** by Modular Wetland personnel.

Activation can occur once the project site is fully stabilized (full landscaping, grass cover, final paving and street sweeping completed) and there is a 5" - 7" throat opening.

Call 760-433-7640 to schedule your activation.



NOTE: WetlandMedia Installation

For Larger models (MWS-L-4-13 and above) the system will be delivered without WetlandMedia pre-installed to minimize pick weight and prevent contamination of the media during construction. For these models the WetlandMedia will be delivered in bulk or in super sacks. It will be responsibility of the contractor to fill the system with the WetlandMedia during the installation process. Installation of the WetlandMedia can be done after the unit is fully installed to avoid contamination. See following pages for details.

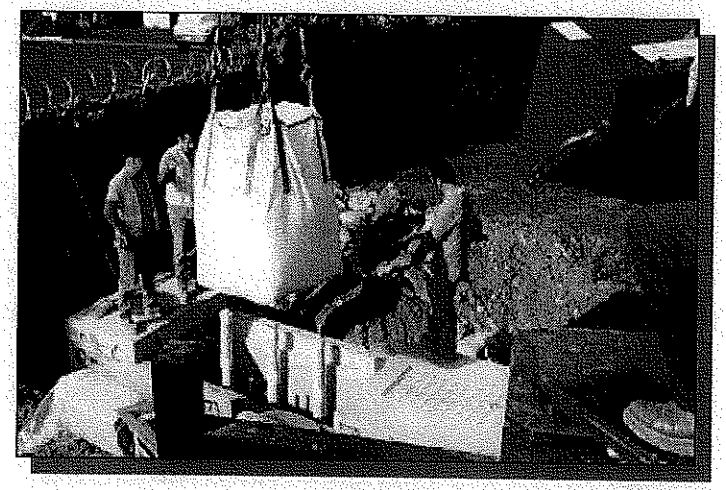
WetlandMedia Install (if applicable)

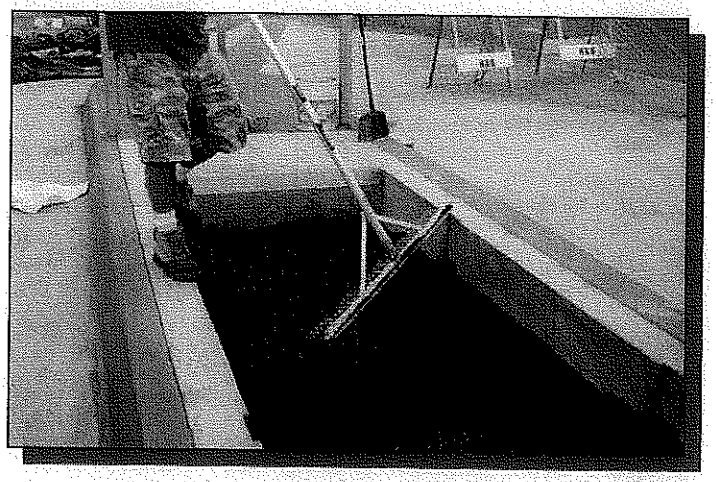
MODULAR WETLANDS

1. Fill WetlandMedia

Position super sack of WetlandMedia over wetland chamber. Bottom of sack should not be more than 2' above top of system. Open sack and fill evenly*.

* One to several hundred cubic yards of WetlandMedia will be required based upon the model number and size of the system. For large scale jobs WetlandMedia will be delivered in bulk and will require a bobcat of similar to fill the system. All equipment is the responsibility of the contractor.





2. Install Plant Propagation Layer

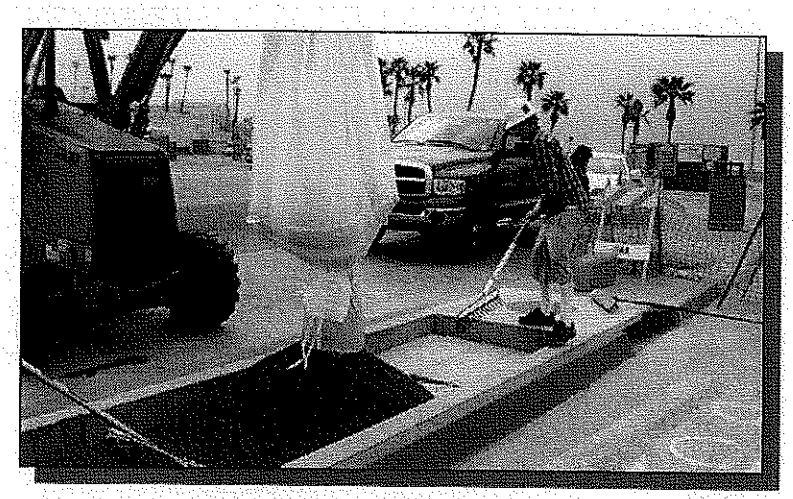
Fill WetlandMedia up to 9" below the top of the wetland chamber. Level out the WetlandMedia as shown. Ensure that the level does not vary more than one inch or plant growth will be affected.

3. Install Plant Propagation Layer

Utilize plant propagation blocks provided by the manufacturer. Each block is approximately 40" by 6" by 3" thick. Blocks shall be placed side by side and end to end and cover the entire length and width of the wetland chamber unless specified.

4. Finish Filling WetlandMedia

After plant propagation blocks are installed repeat step 1 and fill the system to the top of the wetland chamber as shown. WetlandMedia must be filled within 2" of the top of the unit.



5. Planting

After system is filled with WetlandMedia planting of vegetation can begin. Utilizing 1 gallon plants dig down until The plant propagation blocks are reached. Remove plant and it's root ball from the container. Set the bottom of the root ball on the tops of the blocks. Fill hole back in with WetlandMedia. After planting a thorough watering of the plants is necessary. The plant propagation blocks must be saturated to provide a water source for the plants during the establishment phase. It is recommended that hand watering is done three times a week for the first two months. Hand water can be supplemented with drip or spray irrigation after the second week. Please call the manufacturer for more details on plants, planting arrangement and irrigation options.

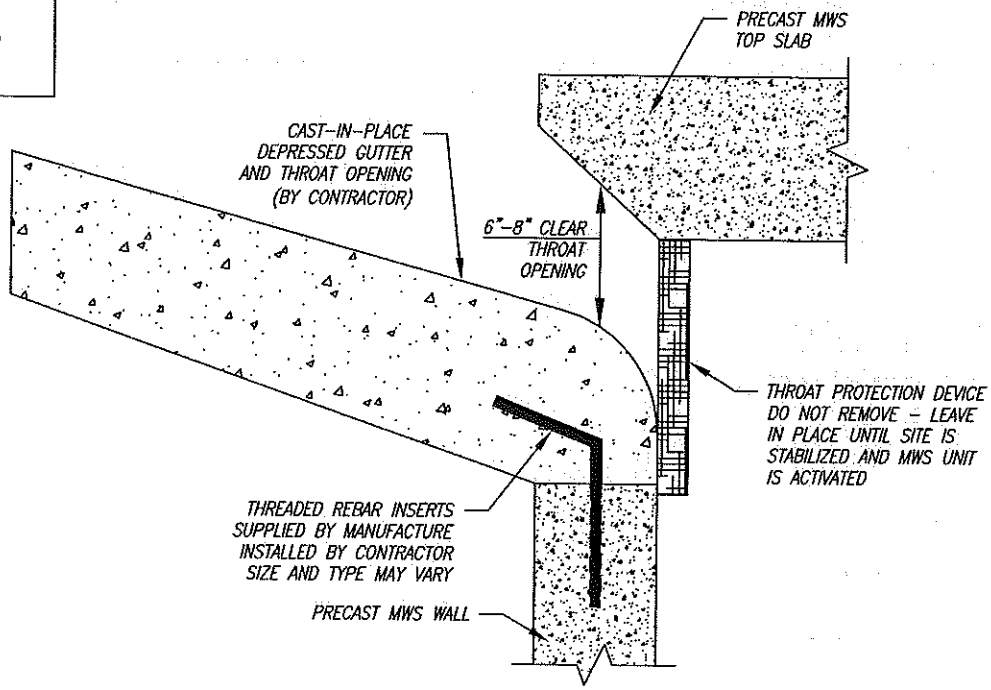
NOTE: planting is required on all units, including units delivered with WetlandMedia pre-installed.

Curb and Gutter Details

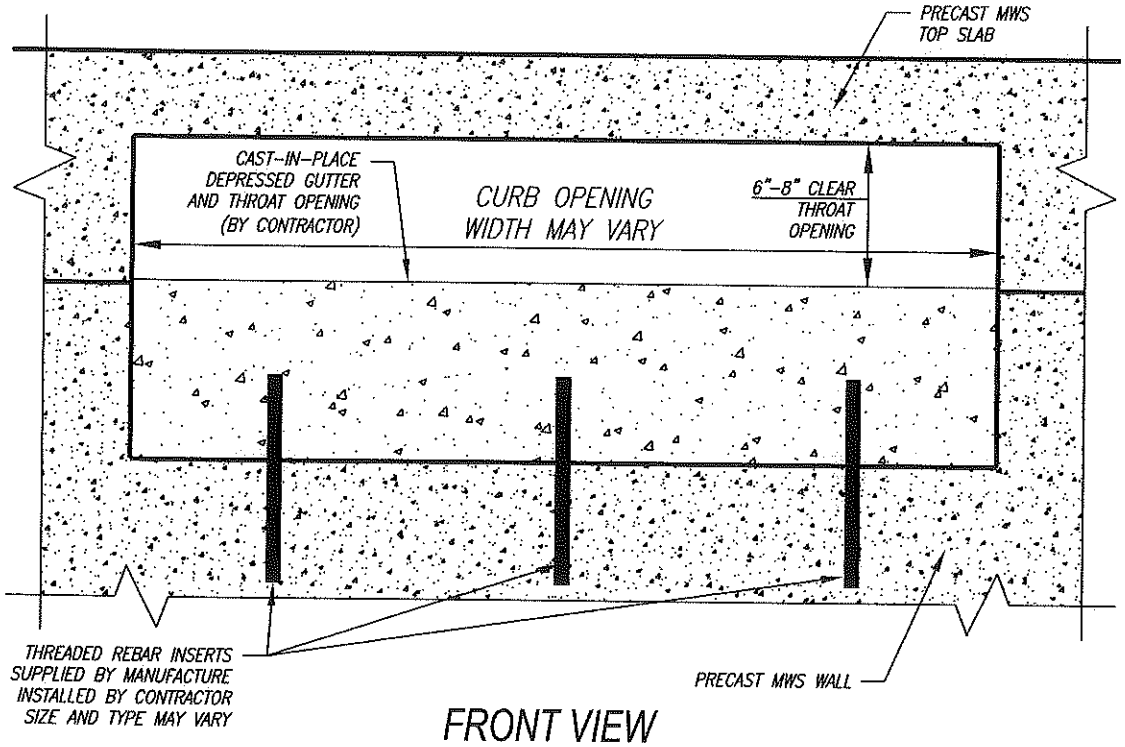
Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

MODULAR™ WETLANDS



SECTION VIEW
STANDARD MODULAR WETLAND CURB OPENING



FRONT VIEW
STANDARD MODULAR WETLAND CURB OPENING

MODULAR WETLAND SYSTEMS INC.
P.O. BOX 869
OCEANSIDE, CA 92049
www.ModularWetlands.com

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	NAME	DATE
DRAWN	John	5/3/13
EDITED		

COMMENTS:

TITLE: MWS LINEAR 2.0 CURB INLET DETAILS

SIZE	DWG. NO.	REV

SCALE NTS	UNITS = INCHES	SHEET 1 OF 1

Weights and Lifting Details

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P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

MWS-L 2.0 Max Pick Weights

Model #	Size (O.D)	Size (I.D)	Unit Weight (lbs)	Media Weight (lbs)	Total Weight (lbs)
MWS-L-4-4	5' x 5'	4' x 4'	7500.0	1447.1	8947.1
MWS-L-4-6 MWS-L-4-6.5	5' x 7' 5 x 7.5'	4' x 6' 4' x 6.5'	11,000 11,500	1619.2	12,619.2 13,119.2
MWS-L-4-8	5' x 9'	8' x 4'	12500	3570	16070
MWS-L-4-13	5' x 14'	13' x 4'	21200	5306	26506
MWS-L-4-15	5' x 16'	15' x 4'	23700	7236	30936
MWS-L-4-17	5' x 18'	17' x 4'	26500	9165	35665
MWS-L-4-19	5' x 20'	19' x 4'	28300	11095	39395
MWS-L-4-21	5' x 22'	21' x 4'	30000	13024	43024

Max Pick Weight if Shipped Without Media Installed

Max Pick Weight if Shipped With Media Installed

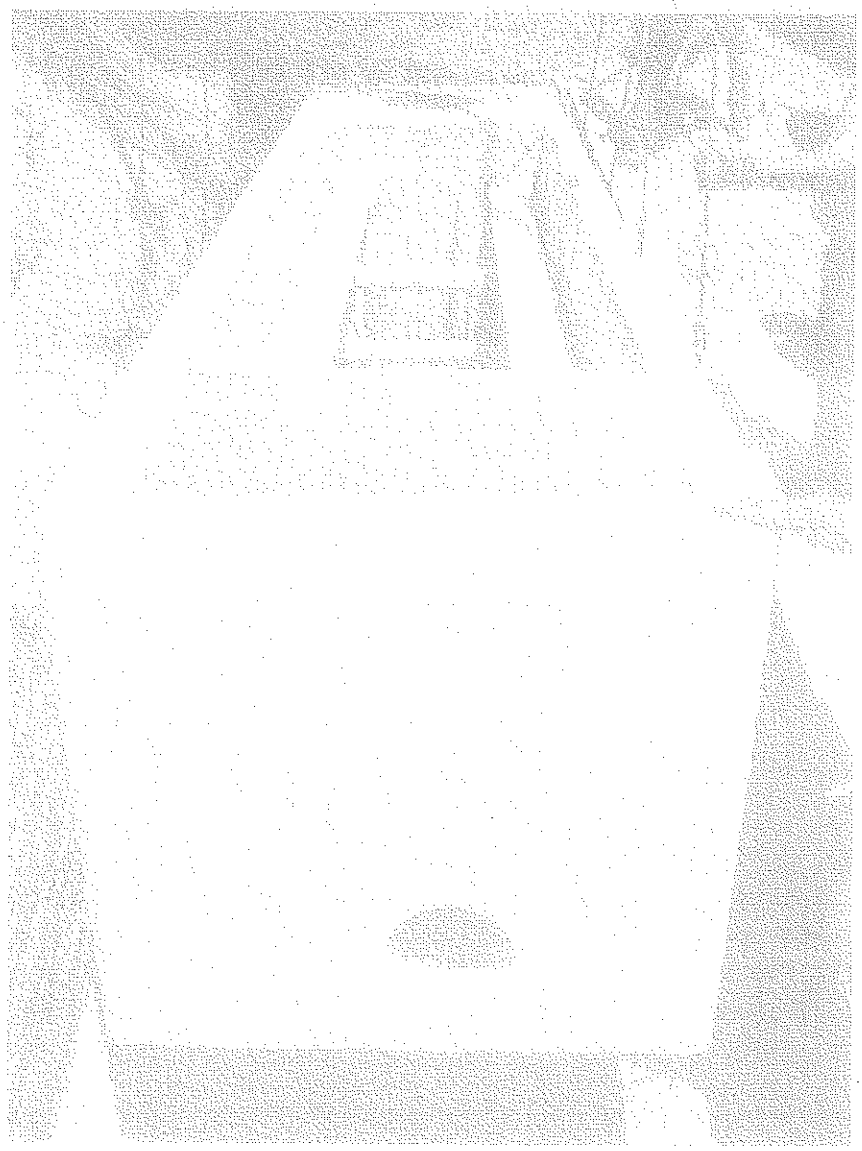
Note: All weights listed hereon are standard max pick weights, actual pick weights may vary based upon state and local regulations and variation in concerte and rebar standards. For project specific pick weights contact the manufacturer prior to shipping of the unit(s). Is is the contractors responsibility to off-load the unit with an adequate size crane. Units are shipped with WetlandMEDIA in superbags and installed by contractor.

When Available see project contract terms, if lifting points are on the inside of the unit due to custom designs or installations requiring pionts to be on the inside the media will be shipped in bags and the contractor will be reponsibile to install after the unit is installed. For example, units places against a wall.

For Questions or Comments Please Call 760-433-7640 or email: info@modularwetlands.com

MODULAR WETLANDS

Connection Details



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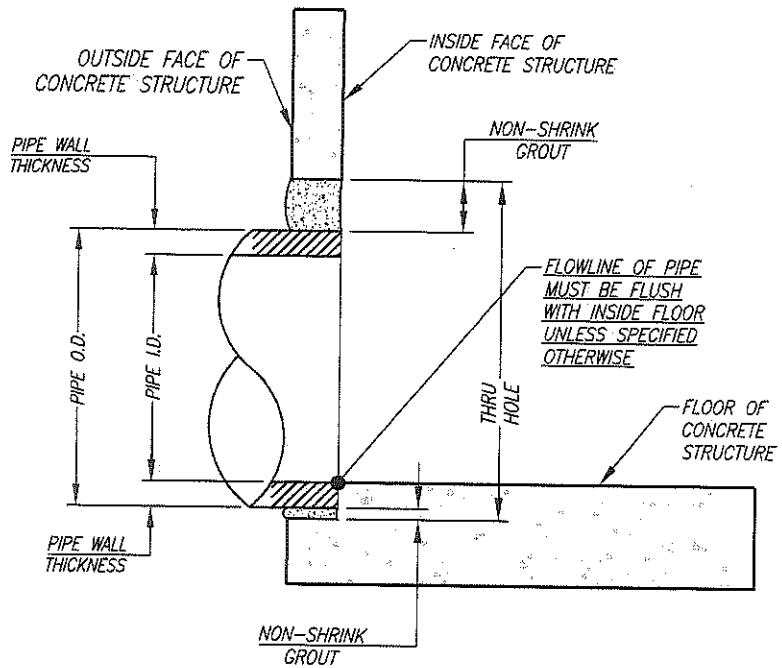
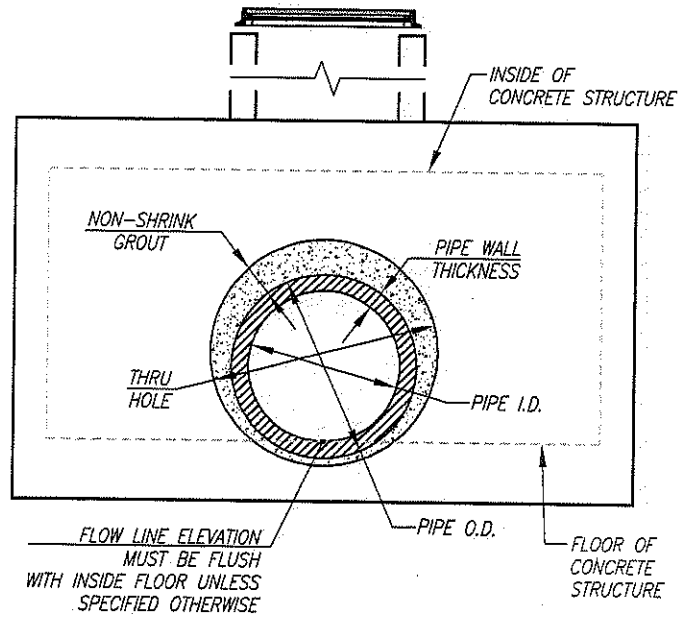


ELEVATION VIEW



END VIEW

INSTALLATION NOTES

1. ALL CONNECTION PIPES SUPPLIED AND INSTALLED BY CONTRACTOR. MODULAR WETLAND UNIT WILL BE DELIVERED WITH A THRU HOLE AND ITS THE CONTRACTORS RESPONSIBILITY TO SUPPLY PIPE, AND ALL LABOR AND MATERIAL TO CONNECT PIPE AND SEAL UNIT WATER TIGHT INCLUDING BUT NOT LIMITED TO GROUT, CONCRETE LUG, REBAR, PLUG, ANCHORS, COUPLER, FITTINGS AND/OR ALL SUPPORT AND CONNECTING HARDWARE.
2. ALL CONNECTIONS ARE TO BE FLUSH WITH THE INSIDE SURFACE OF THE CONCRETE STRUCTURE. (CAN NOT INTRUDE BEYOND FLUSH) ALL PIPE FLOWLINES SHALL BE FLUSH WITH INSIDE FLOOR UNLESS SPECIFIED OTHERWISE.
3. ALL GROUT AND/OR CONCRETE SHALL BE NON-SHRINK AND MEET OR EXCEED LOCAL PIPE CONNECTION STANDARDS.
4. REFER TO AGENCY SPECIFICATIONS WHERE APPLICABLE.

THE PRODUCT DESCRIBED MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

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MODULAR WETLANDS

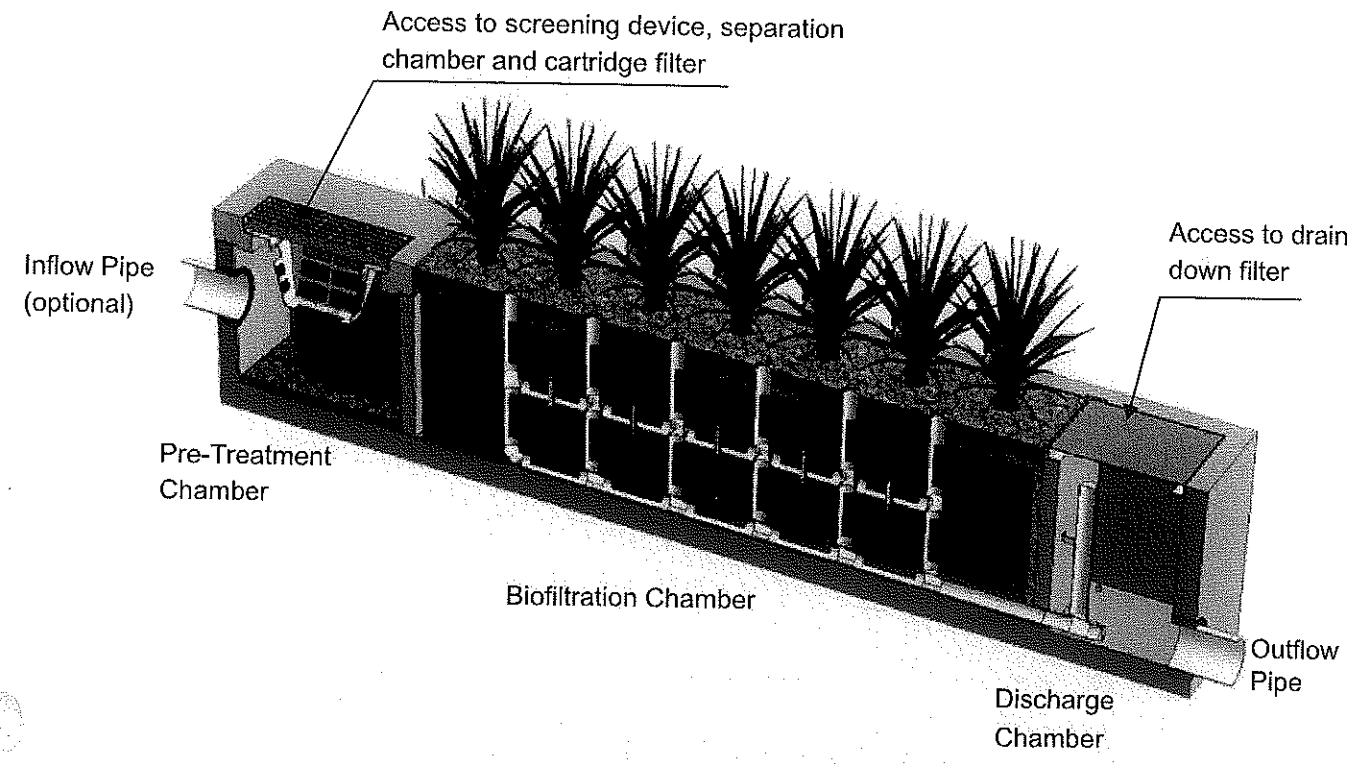
PIPE CONNECTION STANDARD DETAIL

Maintenance Guidelines for Modular Wetland System - Linear

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
  - (*5 minute average service time*).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
  - (*10 minute average service time*).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
  - (*10-15 minute per cartridge average service time*).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
  - (*5 minute average service time*).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre-Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screening device.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.

2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.

3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

4. Entry into chambers may require confined space training based on state and local regulations.

5. No fertilizer shall be used in the Biofiltration Chamber.

6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

Maintenance Procedure Illustration

Screening Device

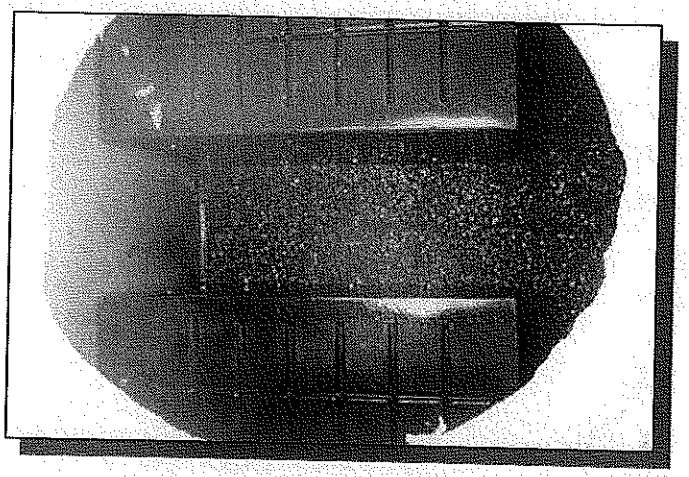
The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.

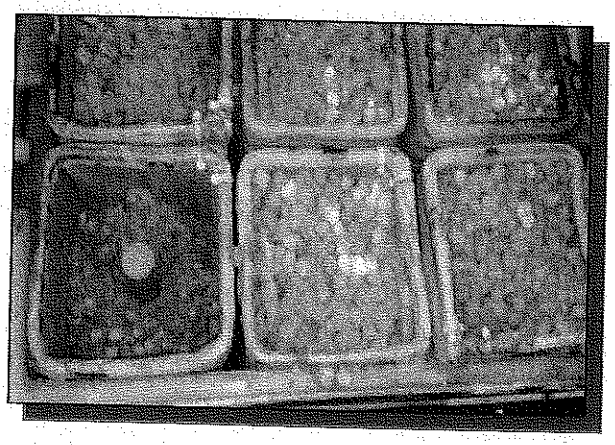
Separation Chamber

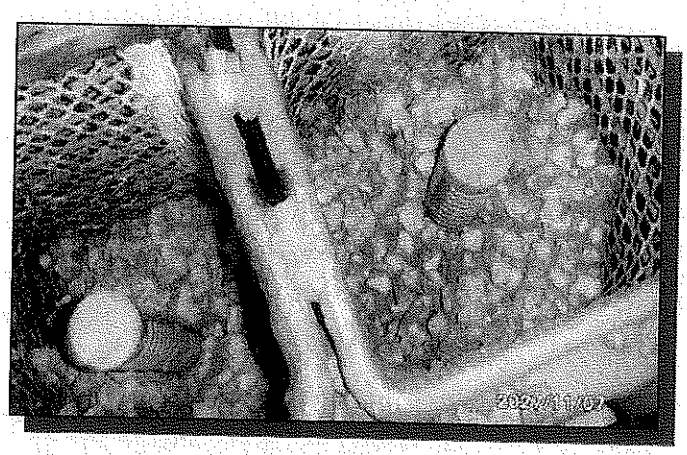
The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.

Cartridge Filters

The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.

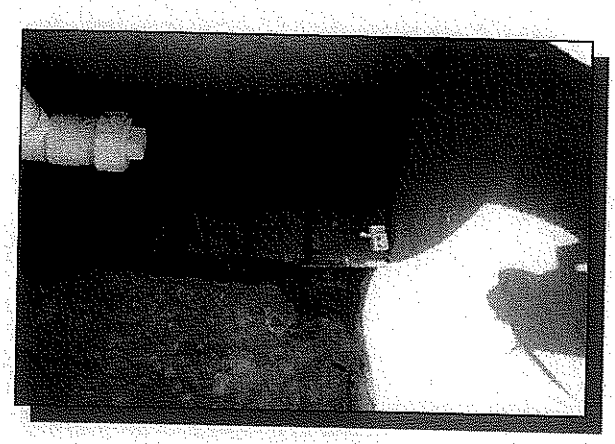






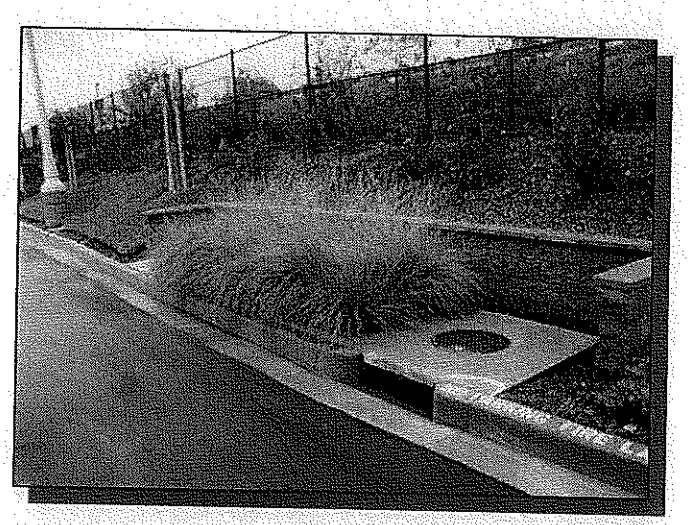
Drain Down Filter

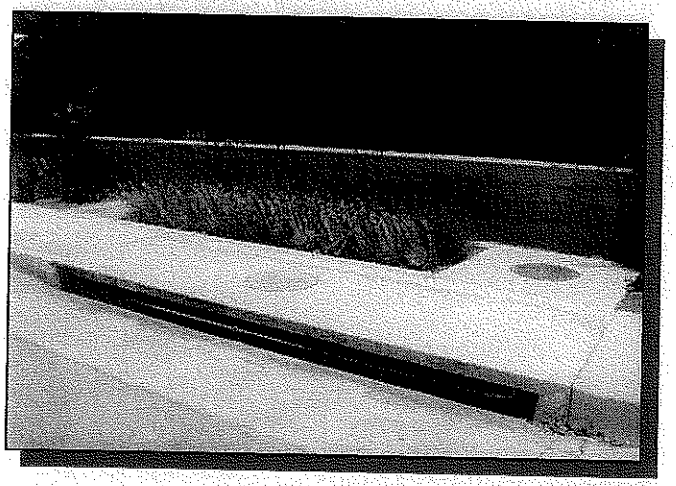
The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.

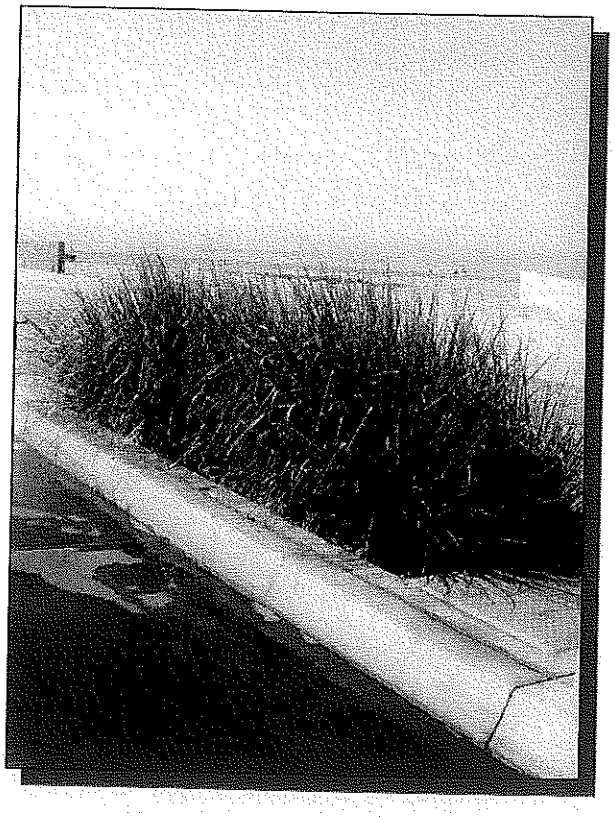


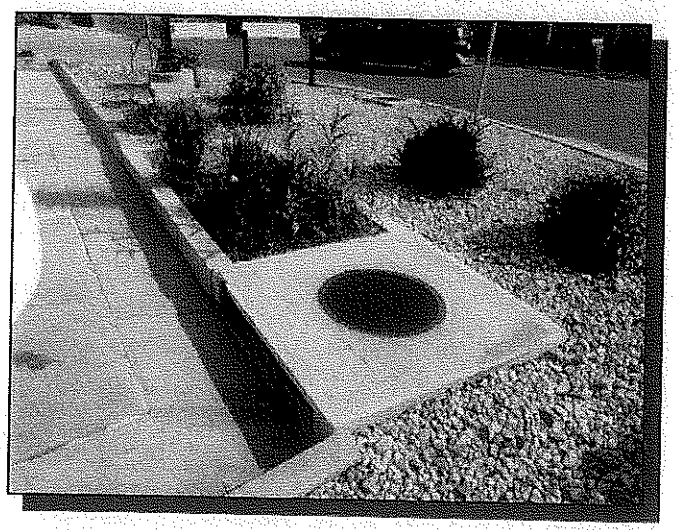
Trim Vegetation

Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.

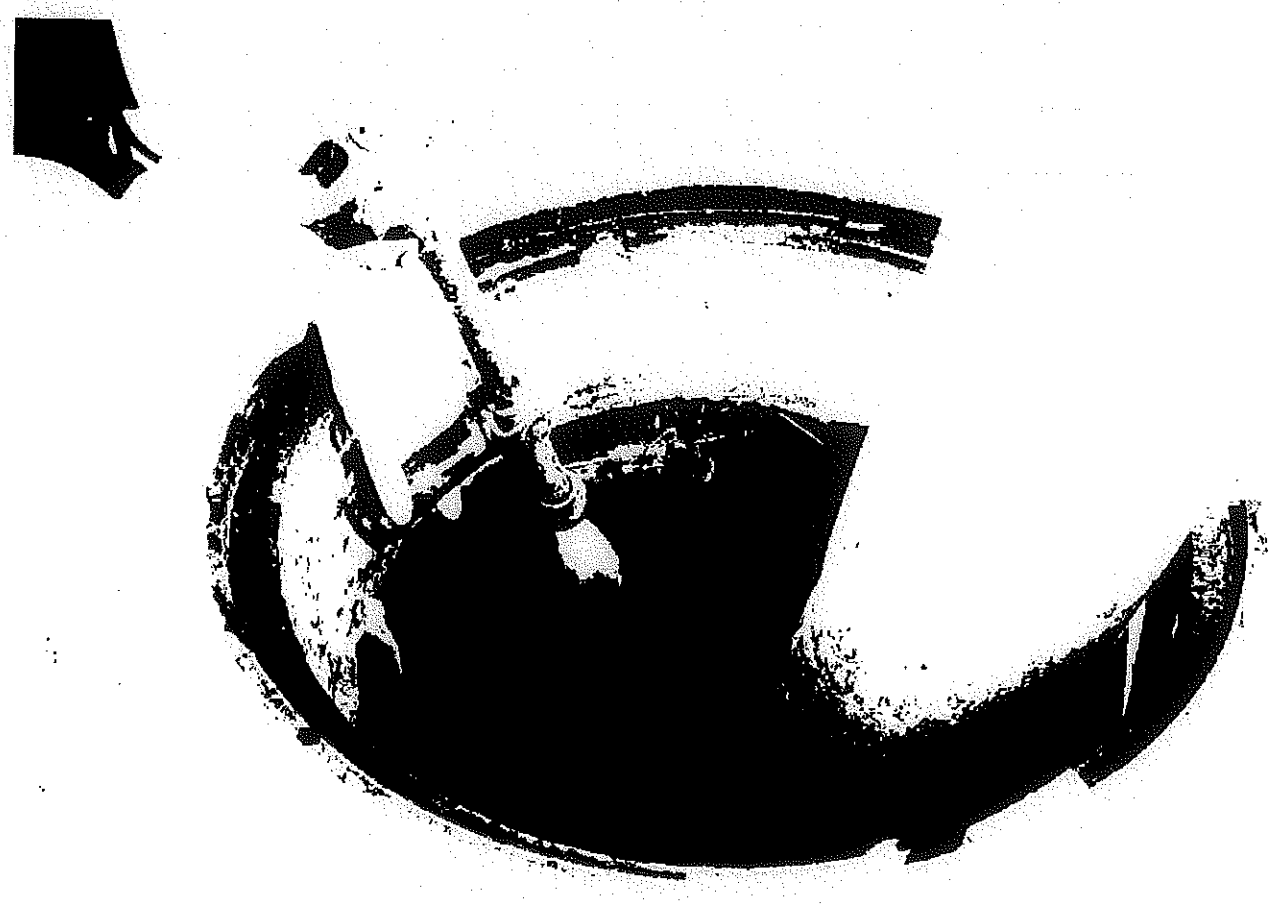








Inspection Form



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P. 760.433-7640
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E. Info@modularwetlands.com

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BIO CLEAN ENVIRONMENTAL SERVICES, INC.

Inspection Report
Modular Wetlands System

MODULAR WETLANDS

Project Name _____

Project Address _____ (city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) _

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

For Office Use Only
(Reviewed By)
(Date) Office personnel to complete section to the left.

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): _____ Size (22', 14' or etc.): _____

Structural Integrity:	Yes	No	Comments
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	Yes	No
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: _____

2972 San Luis Rey Road, Oceanside, CA 92058 P (760) 433-7640 F (760) 433-3176

MODULAR WETLANDS

Maintenance Report

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Cleaning and Maintenance Report
Modular Wetlands System

Project Name _____

Project Address _____ (city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/_____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

For Office Use Only

(Reviewed By)

(Date)

Office personnel to complete section to the left.

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:

2972 San Luis Rey Road, Oceanside, CA 92058 P. 760.433.7640 F. 760.433.3176

Modular Wetland System - Linear® Plants for Hardy Zone 10

Common Name *Latin Name*	Light Exposure	Hardy Range	Height	Flower Color
canna, canna tropicana, canna lilly *Canna X generalis*	full sun to partial shade	USDA Zones 8-11	2.5 to 8 feet	yellow, orange, red
Lily-of-the-Nile, African Lily, African Blue Lily *Agapanthus spp*	full sun to partial shade	USDA Zones 8-11	2 to 4 feet	blue
Vetiveria zizanioides (L.) Nash Vetiver Grass	full sun	USDA Zones 5-11	2 to 8 feet	green
giant wild rye *Leymus condensatus*	full sun	USDA Zones 3-11	4 to 8 feet	brown
society garlic, pink agapanthus *Tulbaghia violacea*	full sun to full shade	USDA Zones 7-10	1.5 to 3 feet	lavender
Gulf muhlygrass, mist grass, hairawn muhly *Muhlenbergia capillaris*	full sun to partial shade	USDA Zones 5-10	2 to 3 feet	pinkish purple
Lindheimer's muhlygrass, blue muhlygrass *Muhlenbergia lindheimeri*	full sun	USDA Zones 7-11	2 to 4 feet	purple to gray
horsetail, scouring rush, E. prealtum *Equisetum hyemale*	full sun to light shade	USDA Zones 3-11	2 to 4 feet	n/a
cattail, reed-mace *Typha latifolia*	full sun	USDA Zones 2-11	3 to 9 feet	brown
papyrus, Egyptian papyrus, bulrushes *Cyperus papyrus*	full sun to partial shade	USDA Zones 9-11	2 to 10 feet	white
lavender *Lavandula L.*	sun	USDA Zones 5-10	1 to 2 feet	purple

palm sedge *Carex phyllocephala*	full sun to full shade	USDA Zones 7-10	1 to 2 feet	green
lemongrass, oil grass *Cymbopogon citratus*	full sun to partial shade	USDA Zones 10-11	4 to 6 feet	n/a
umbrella sedge, umbrella plant *Cyperus involucratus*	full sun to partial shade	USDA Zones 8-11	2 to 6 feet	green/white
feather grass, Mexican needle grass *Nassella tenuissima*	full sun to partial shade	USDA Zones 7-11	2 to 3 feet	green/brown
sea oats, Chasmanthium paniculatum *Uniola paniculata*	full sun to partial shade	USDA Zones 6-10	3 to 6 feet	golden/brown
Cape lily, Powell's crinum lily *Crinum X powellii*	full sun to partial shade	USDA Zones 6-11	3 to 4 feet	white/pink
African iris, fortnight lily, morea iris *Dietes iridioides*	full sun to partial shade	USDA Zones 8-10	2 to 4 feet	white/purple
whirling butterflies, white gaura *Gaura lindheimeri*	full sun to partial shade	USDA Zones 5-10	2 to 4 feet	white/pink
daylily *Hemerocallis hybrids*	full sun to partial shade	USDA Zones 2-10	1 to 3.5 feet	various
Adam's needle, bear grass, weak-leaf yucca *Yucca filamentosa*	full sun	USDA Zones 5-10	3 to 5 feet	white
brome hummock sedge *carex bromoides*	full sun to partial shade	USDA Zones 2-10	1 ft	green

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The Modular Wetland System - Linear® standard 22' long system will require 18 to 20 plants. Different size systems will require different plant quanitities; please contact us for detailed information.

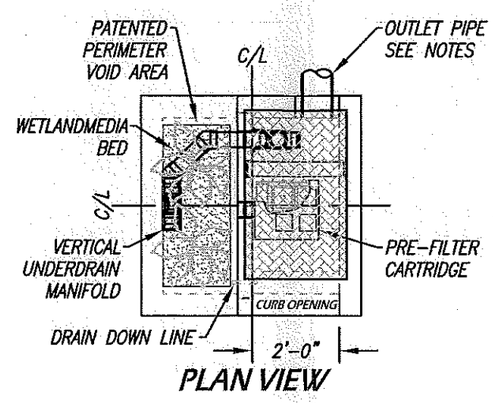
The plants listed are tolerant to drought and have deep roots to allow for ehanced pollutant removal.

These plants are subject to availability in local areas. If you would like to use a different plant please contact us. We will work with you to ensure the chosen plants work with the projects current landscape theme.

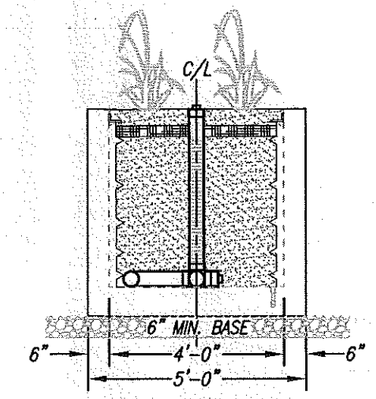
The Modular Wetland System - Linear® should be irrigated like any other planter area. The plants in the system must receive adequate irrigation to ensure plant survival during periods of drier weather. As with all landscape areas the plants within the Modular Wetland System - Linear will require more frequent watering during the establishment period.

For more information please contact at: 760-433-7640 or email: info@modularwetlands.com

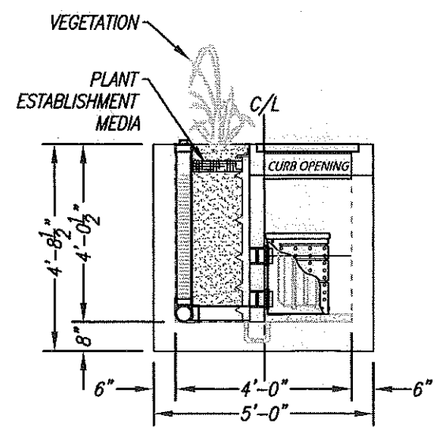
SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	24" x 42"	N/A	N/A
WETLANDMEDIA VOLUME (CY)			0.83
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø1.03"
MAXIMUM PICK WEIGHT (LBS)			9000
NOTES:			



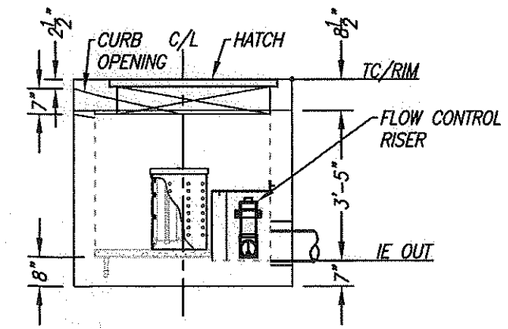
PLAN VIEW



LEFT END VIEW
BIOFILTRATION



ELEVATION VIEW



RIGHT END VIEW
PRETREATMENT/DISCHARGE

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
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4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

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TREATMENT FLOW (CFS)	0.052
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

THE PRODUCT DESCRIBED MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

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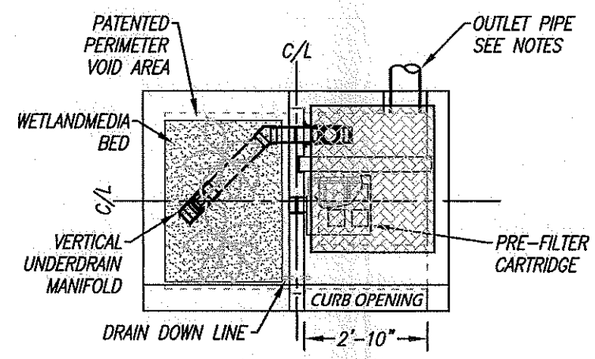
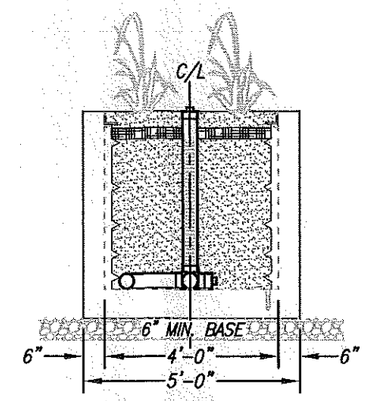
MWS-L-4-4-C
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

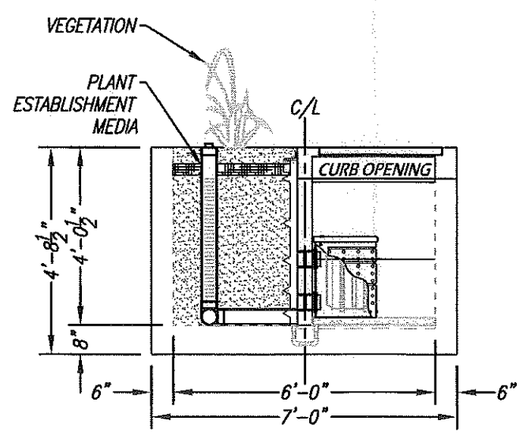
SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	30" X 36"	N/A	N/A
WETLANDMEDIA VOLUME (CY)			1.48
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø1.22"
MAXIMUM PICK WEIGHT (LBS)			TBD
NOTES:			



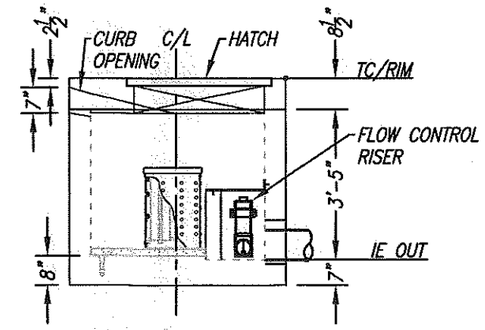
PLAN VIEW



LEFT END VIEW
BIOFILTRATION



ELEVATION VIEW



RIGHT END VIEW
PRETREATMENT/DISCHARGE

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TREATMENT FLOW (CFS)	0.073
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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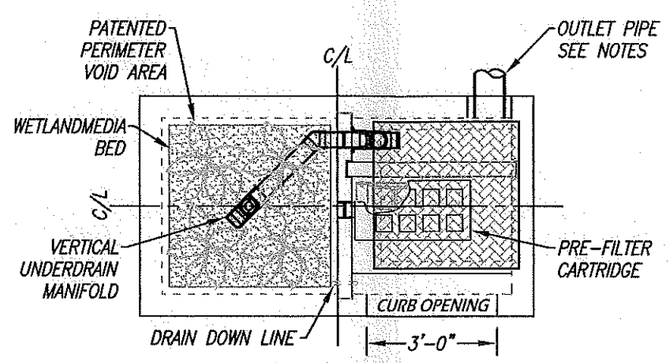
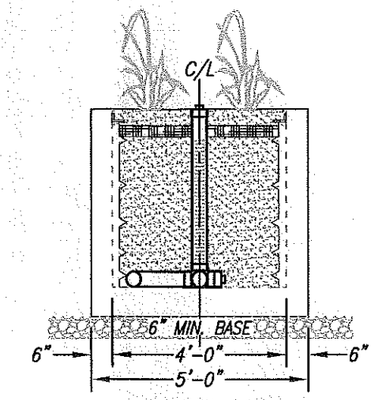
MWS-L-4-6-C
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

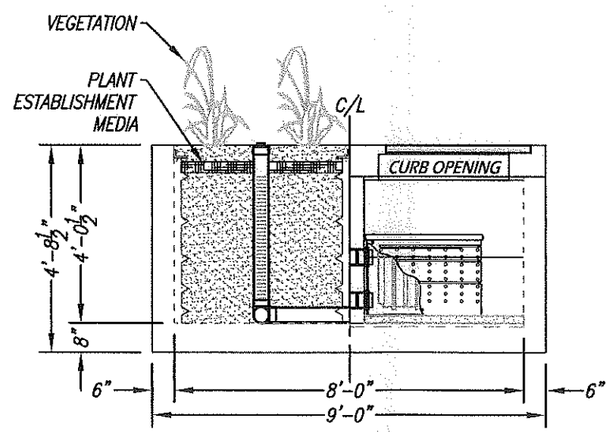
SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	36" X 36"	N/A	N/A
WETLANDMEDIA VOLUME (CY)			2.03
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø1.53"
MAXIMUM PICK WEIGHT (LBS)			15000
NOTES:			



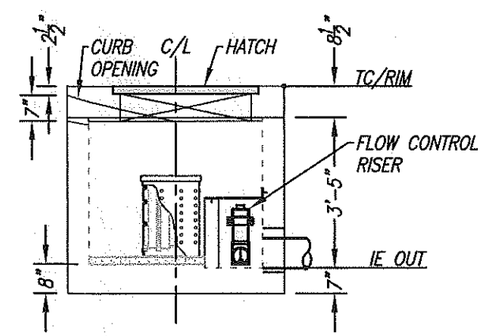
PLAN VIEW



LEFT END VIEW
BIOFILTRATION



ELEVATION VIEW



RIGHT END VIEW
PRETREATMENT/DISCHARGE

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TREATMENT FLOW (CFS)	0.115
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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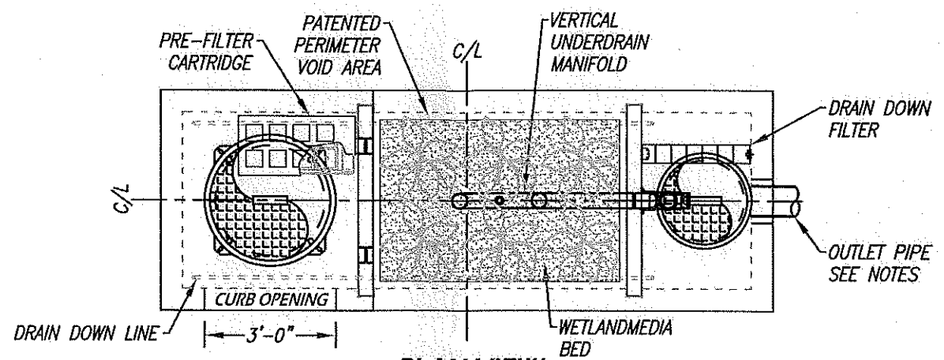
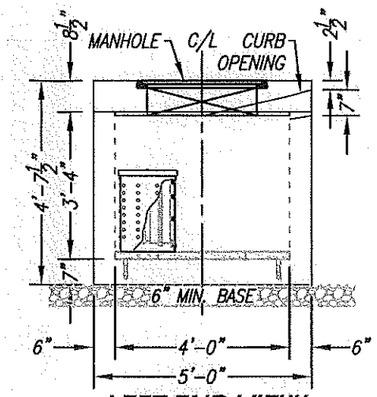
MWS-L-4-8-C
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

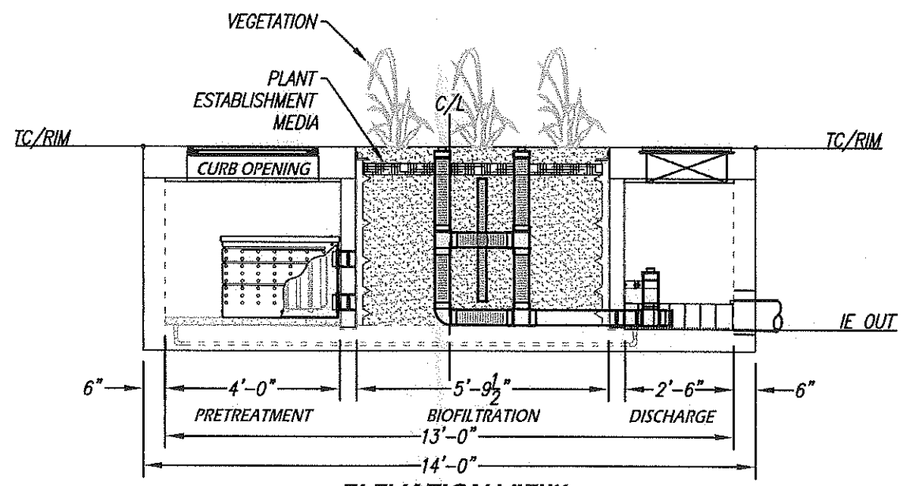
SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			3.05
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø1.71"
MAXIMUM PICK WEIGHT (LBS)			27000
NOTES:			



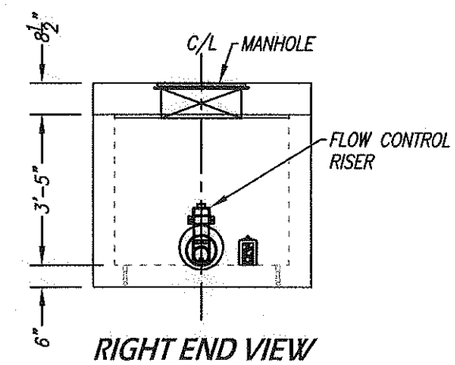
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

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TREATMENT FLOW (CFS)	0.144
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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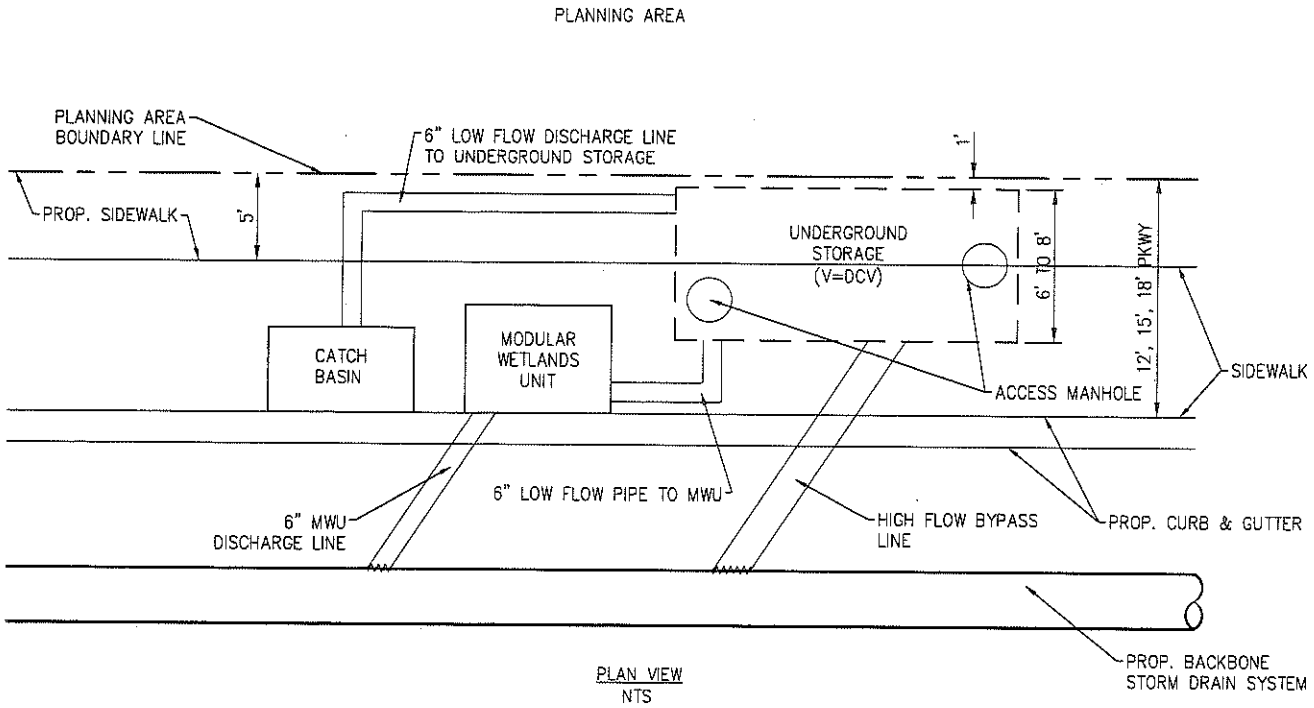
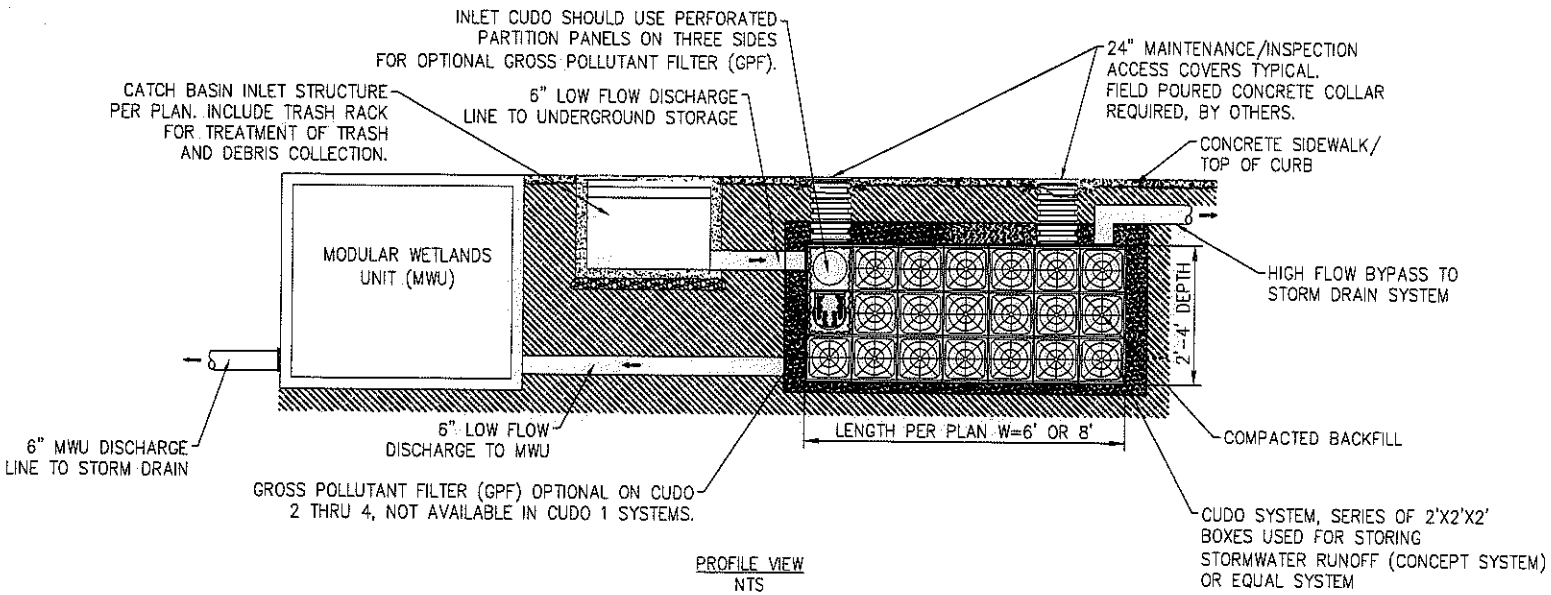
MWS-L-4-13-C
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL



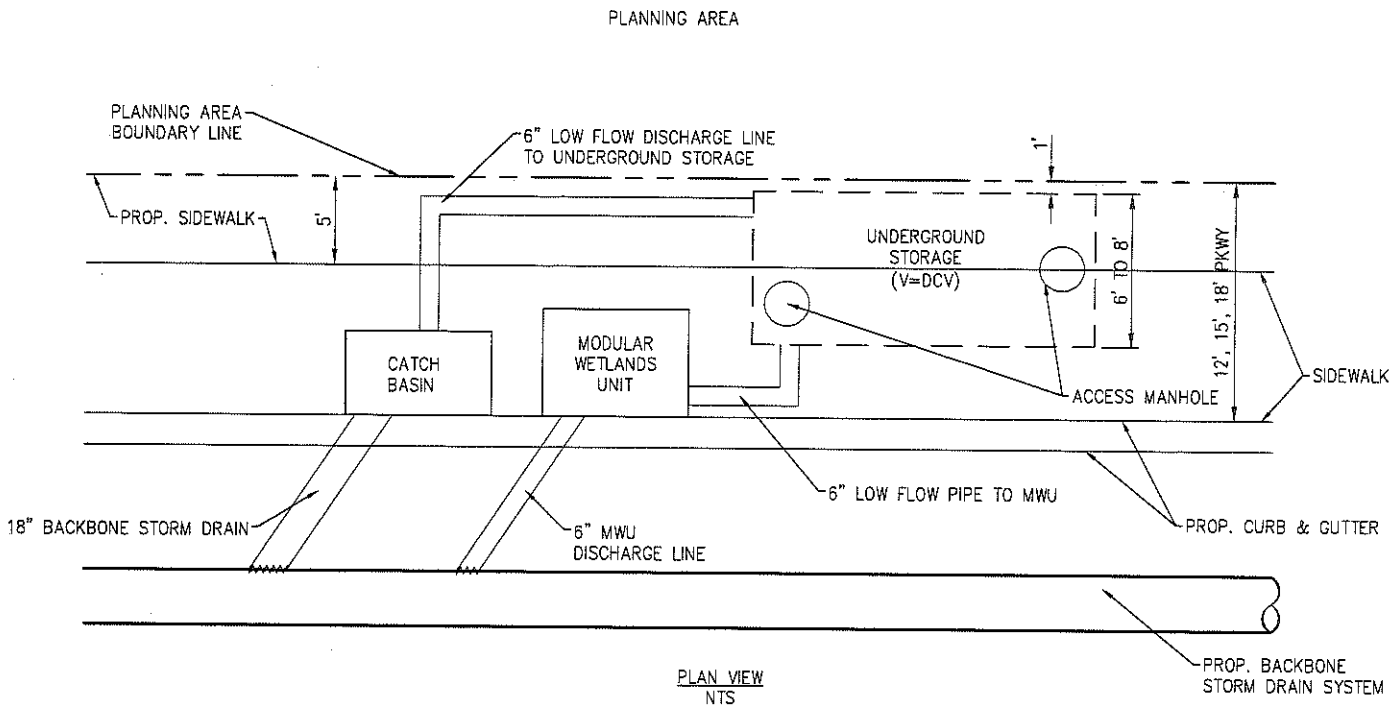
PLAN VIEW
NTS



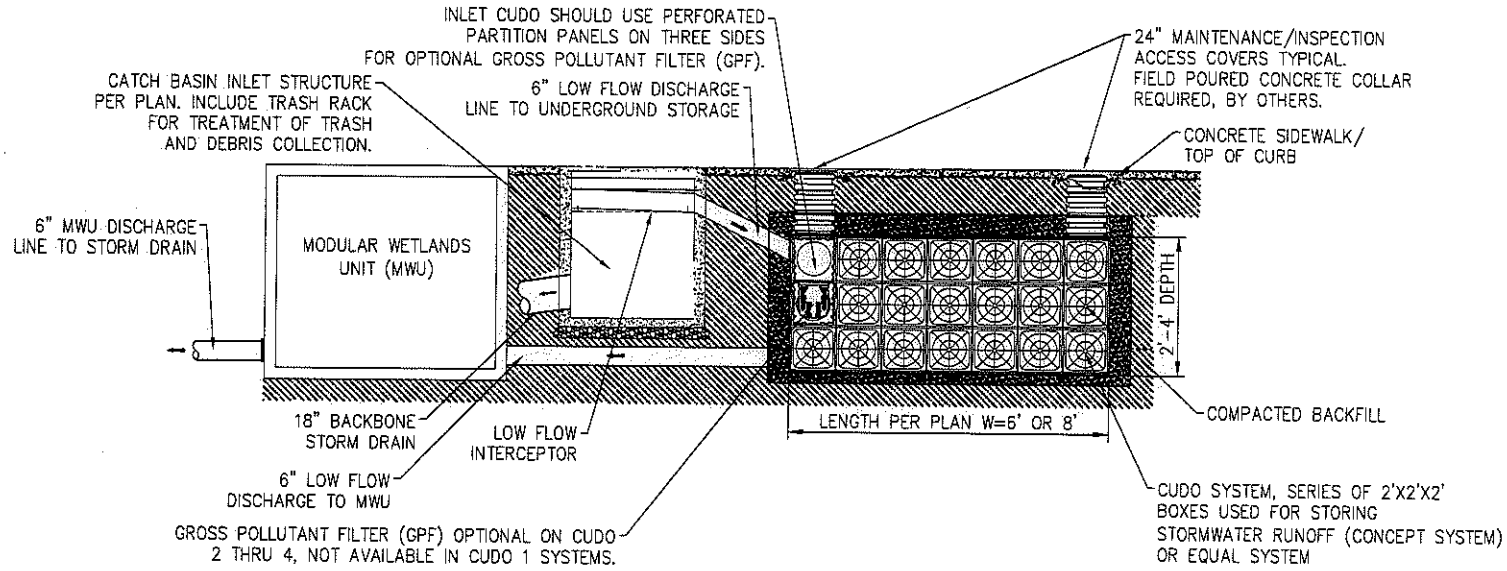
PROFILE VIEW
NTS

STREET STORMWATER RUNOFF WQMP BMP SYSTEM

OPTION A CONCEPT (NTS)



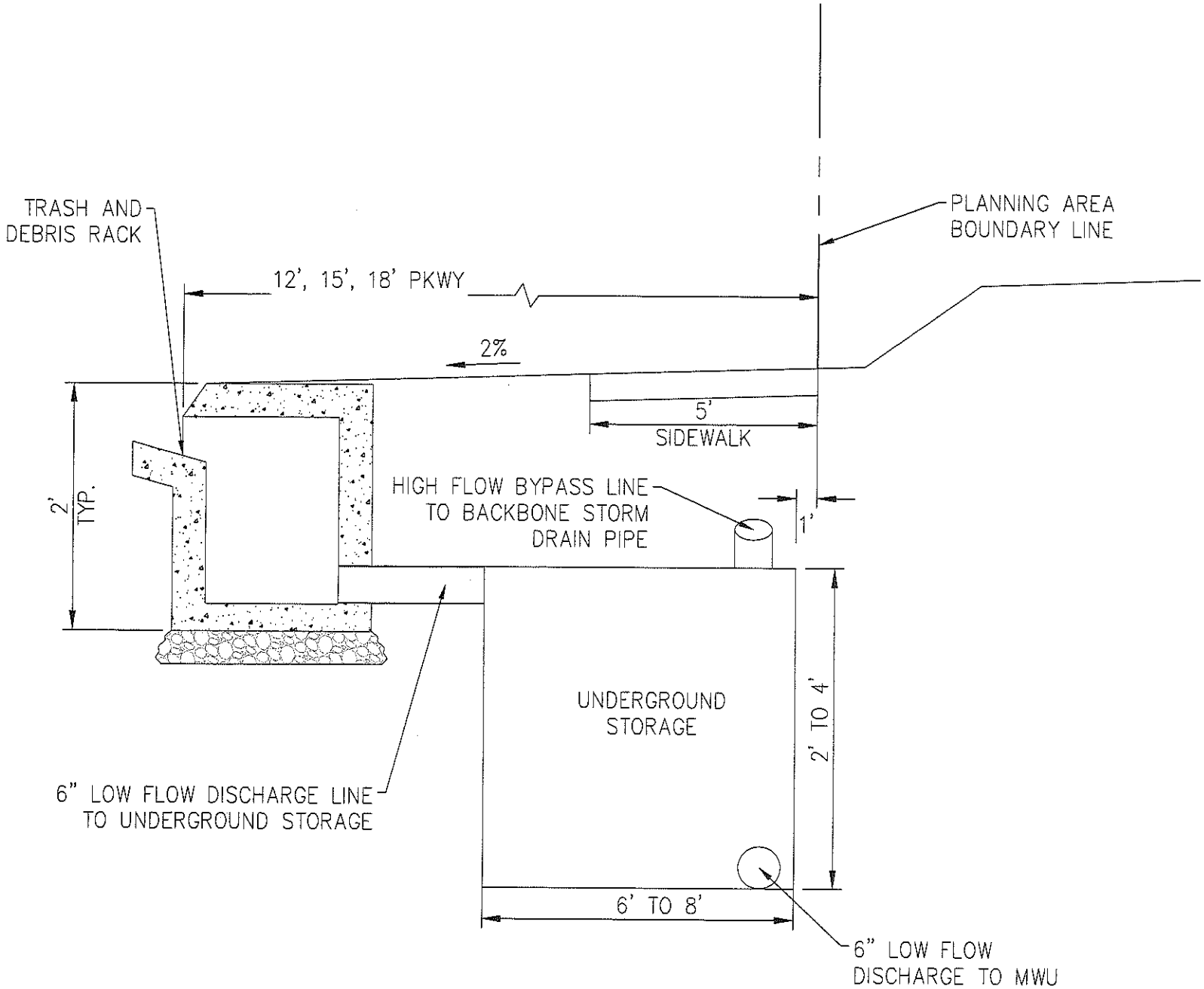
PLAN VIEW
NTS



PROFILE VIEW
NTS

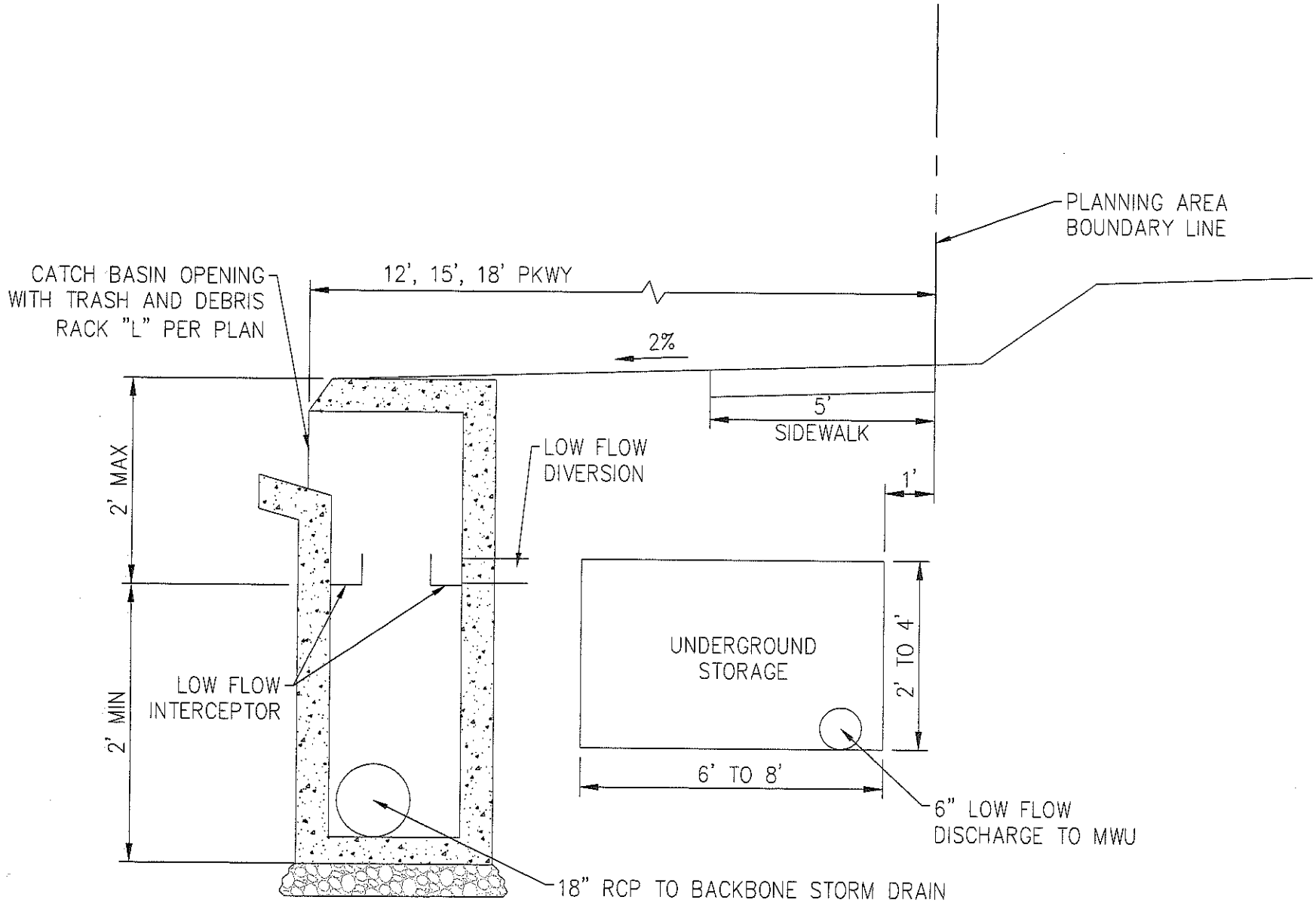
PRIVATE STREET STORMWATER RUNOFF WQMP BMP SYSTEM

OPTION B CONCEPT (NTS)



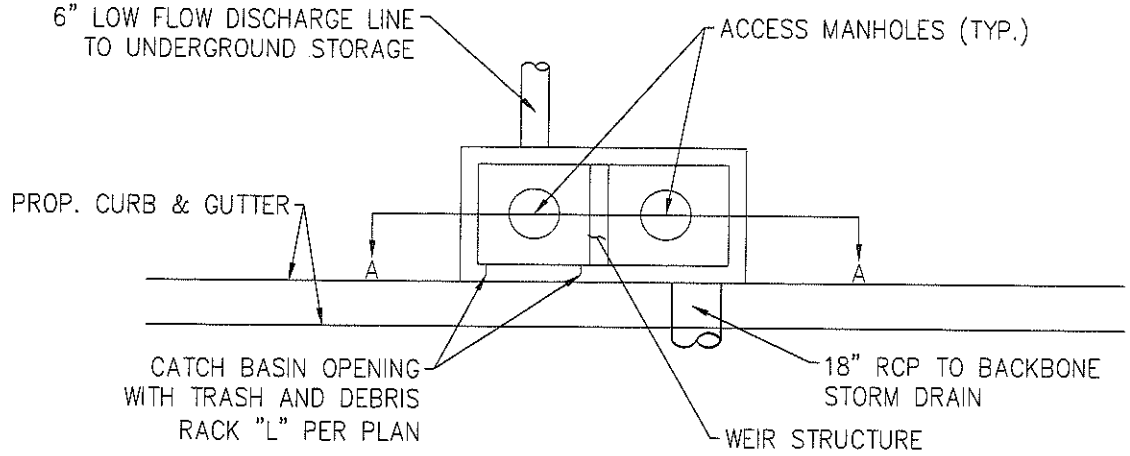
OPTION A

FULL CAPTURE CONCEPT SECTION VIEW (NTS)

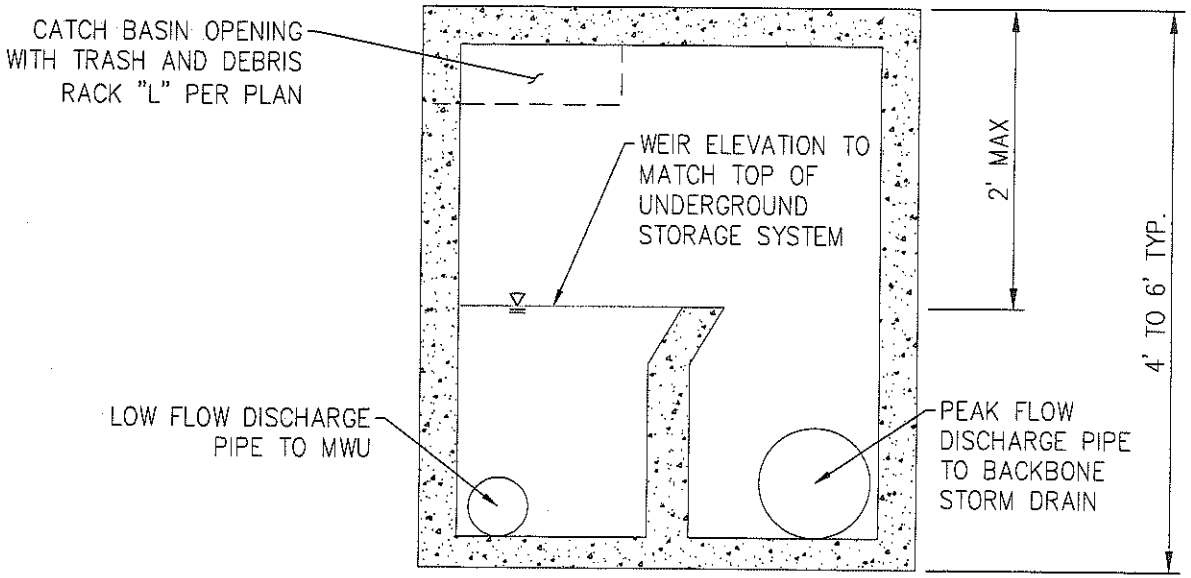


OPTION B

TROUGH DIVERSION CONCEPT SECTION VIEW (NTS)



PLAN VIEW



SECTION A–A

OPTION B

WEIR DIVERSION CONCEPT SECTION VIEW (NTS)

CUDO® Water Storage System

Detention / Infiltration

Shaping the future of compact underground stormwater storage

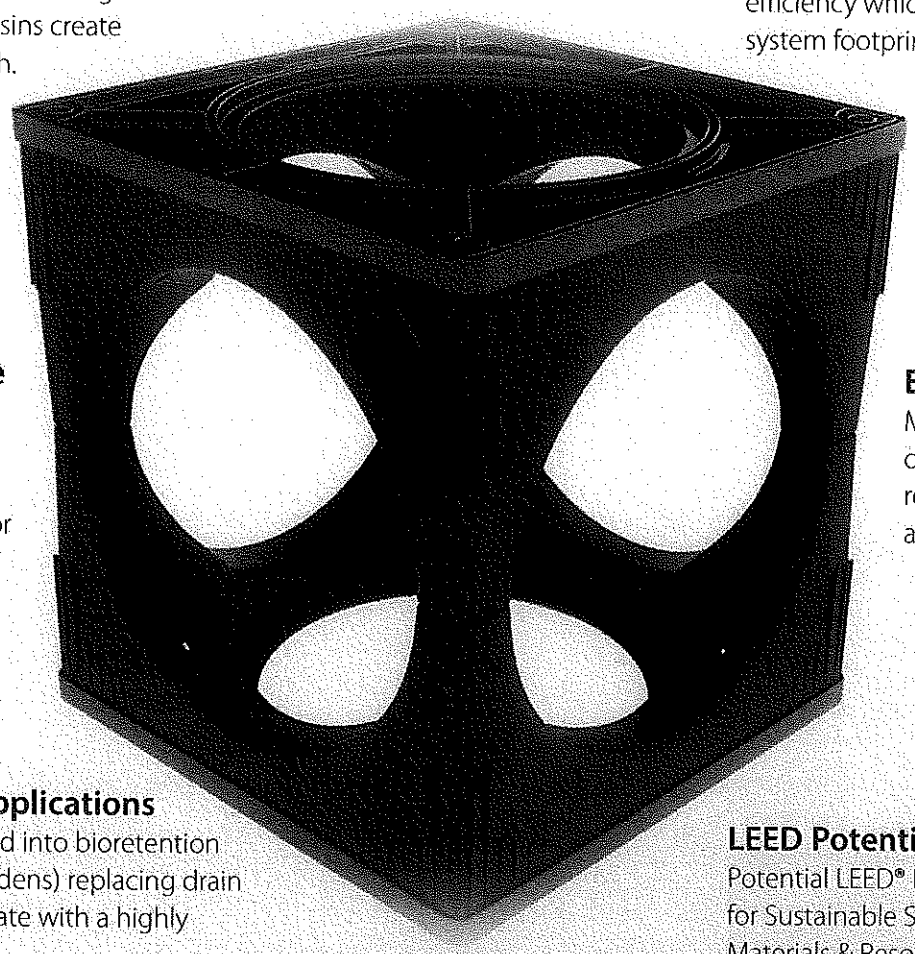
CUDO is a modular high-strength plastic cube that is used to create compact underground stormwater storage systems. The unique open design adds structural integrity, increased water storage, and enhanced access for inspection and maintenance. CUDO can be used for detention and retention, including infiltration and water harvesting, and its compact size (24"x24"x24") is ideal for small sites and shallow applications.

Efficient Storage

Each CUDO cube holds 7.7 ft^3 of stormwater, creating 95% storage efficiency which minimizes system footprint.

Superior Strength

Unique shape and the highest quality plastic resins create superior strength.



Maintenance Accessible

Large interior openings offer ease of access for inspection and maintenance.

Easy Assembly

Minimum number of components required for assembly.

Integrated Applications

May be integrated into bioretention systems (rain gardens) replacing drain pipe and aggregate with a highly porous matrix.

LEED Potential

Potential LEED® NC credits for Sustainable Sites (6.1, 6.2) Materials & Resources (5) and Water Efficiency (1, 3).

Compact Design

CUDO size (24" x 24" x 24") offers ease of handling and installation.

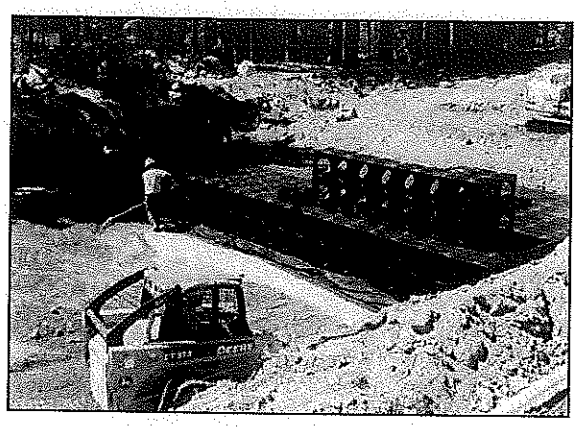
CUDO Water Storage System

Made in the USA of high-strength injection molded polypropylene plastic, a single CUDO assembly requires just two identical halves and a top and bottom panel, making installation in the field quick and easy. For the system perimeter at the soil/system interface and pipe connections, side panels and pipe adapter panels are available to complete the system.

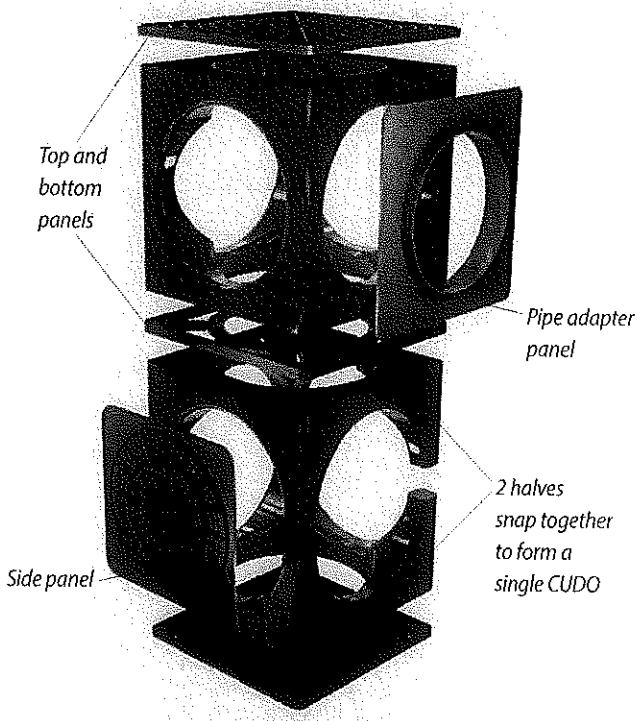
CUDO is designed to support HS-20 traffic loads and can be installed in a single layer or stacked to increase storage volume in the same footprint. Depending on the application, either a filter fabric (for infiltration) or watertight plastic liner (for detention) is placed beneath and around the CUDO modules, forming a secure envelope around the entire system. Let our team of engineers and experts help you design the most efficient and effective system for your site's requirements.

DESIGN CONSIDERATIONS

- CUDO can be used for detention and retention applications, including infiltration and water harvesting.
- CUDOs can be stacked up to four units high to increase storage volume without increasing system footprint.
- When used in conjunction with Dual Vortex Hydrodynamic Separator or PerkFilter™ Media Filtration, CUDO provides a complete stormwater management system.
- Integral "metered outlet" device eliminates the need for separate outlet and flow control structure.
- CUDO's circular openings create a secure connection point for inlet and outlet pipes.



Installation of CUDOs in Lake Tahoe, CA



CUDO components snap together, forming a single or multiple CUDO stack. Assembled stacks are installed to form the desired CUDO system size and shape with a maximum amount of footprint flexibility.

HydroCAD® Stormwater Modeling Supported Product

The CUDO system can easily be modeled with the HydroCAD® Stormwater Modeling System, allowing simplified calculation of the system storage and infiltration behavior. The HydroCAD Chamber Wizard also performs automated CUDO system layout and simplifies the process of designing a system to meet specific storage and footprint requirements. HydroCAD® is a registered trademark of HydroCAD Software Solutions LLC.

CUDO halves being assembled at the jobsite

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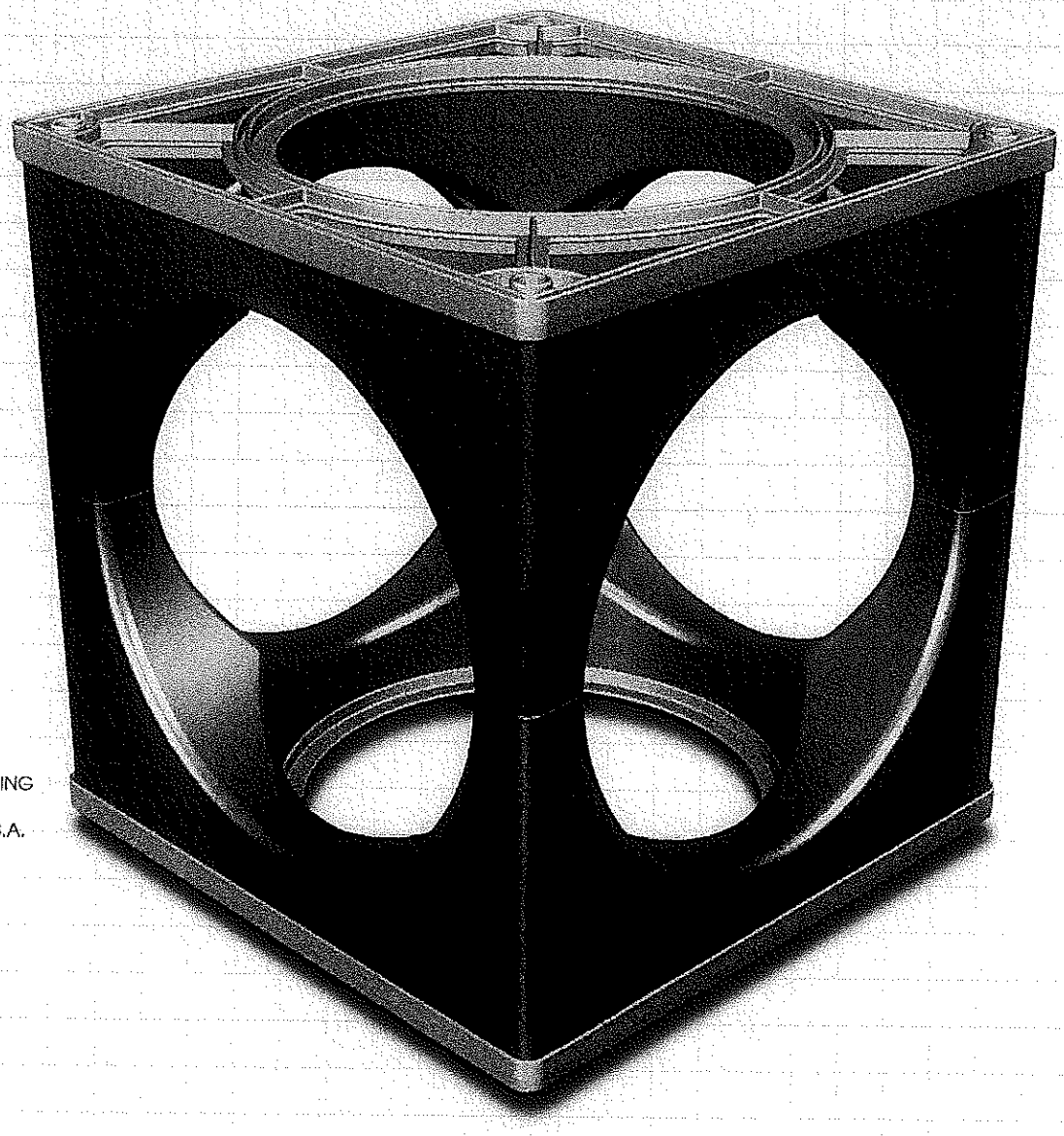
SHAPING THE FUTURE OF WATER QUALITY™



US PATENT PENDING

MADE IN THE U.S.A.

HOW
WE
STACK
UP

MORE
CAPACITY
PER
CUBIC
FOOT

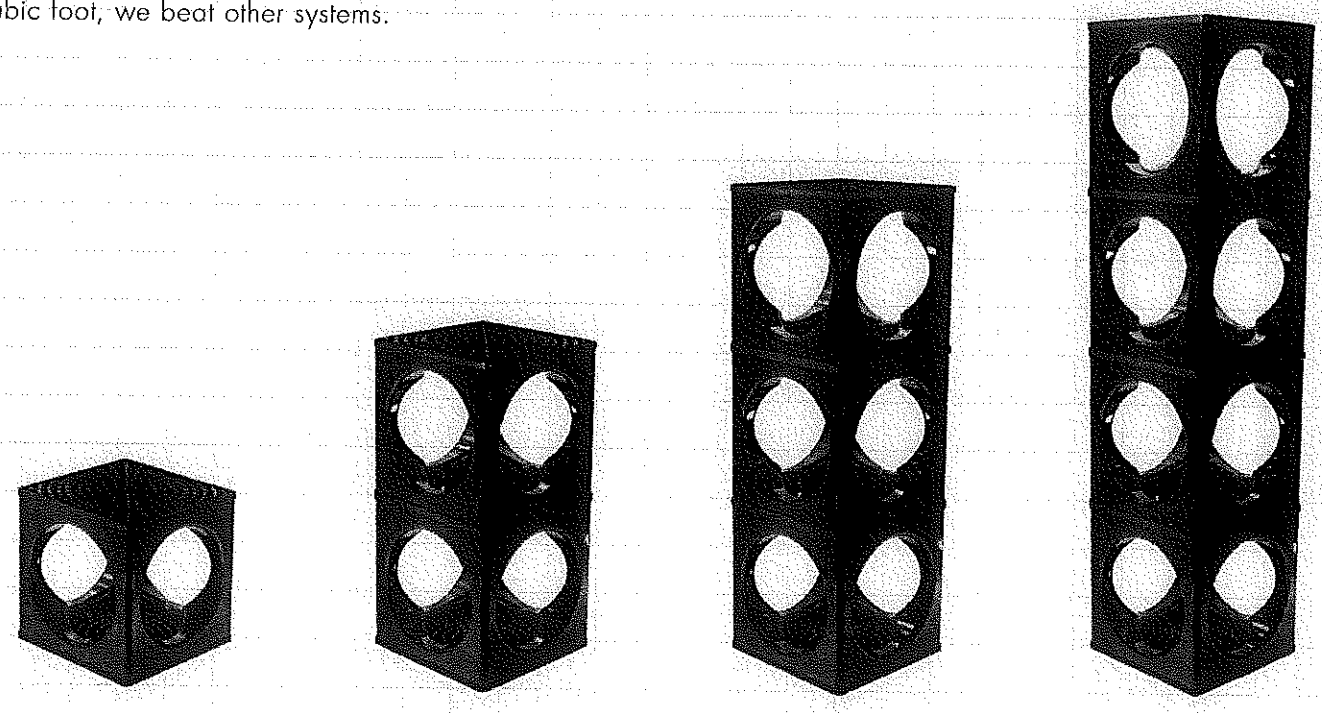
KRISTAR

CUDO®
C U D O
WATER STORAGE SYSTEM

MORE CAPACITY – EIGHT CUBIC FEET AT A TIME

HOW WE STACK UP

Each CUDO® module measures a large eight cubic feet, with 95% storage capacity. Cubic foot vs. cubic foot, we beat other systems.



2 ft. x 2 ft. x 2 ft.	2 ft. x 2 ft. x 4 ft.	2 ft. x 2 ft. x 6 ft.	2 ft. x 2 ft. x 8 ft.

MORE CAPACITY PER CUBIC FOOT

CUDO ASSEMBLY	UNIT WEIGHT (LBS.)	STORAGE (CUBIC FT.)	CAPACITY (GALLONS – 95%)
CUDO 1	21	7.7	57
CUDO 2	41	15.4	115
CUDO 3	62	23.0	172
CUDO 4	86	30.6	229

US PATENT PENDING

MADE IN THE U.S.A.

ALL DIMENSIONAL MEASUREMENTS ARE NOMINAL

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KRISTAR

360 SUTTON PLACE
SANTA ROSA
CA 95407
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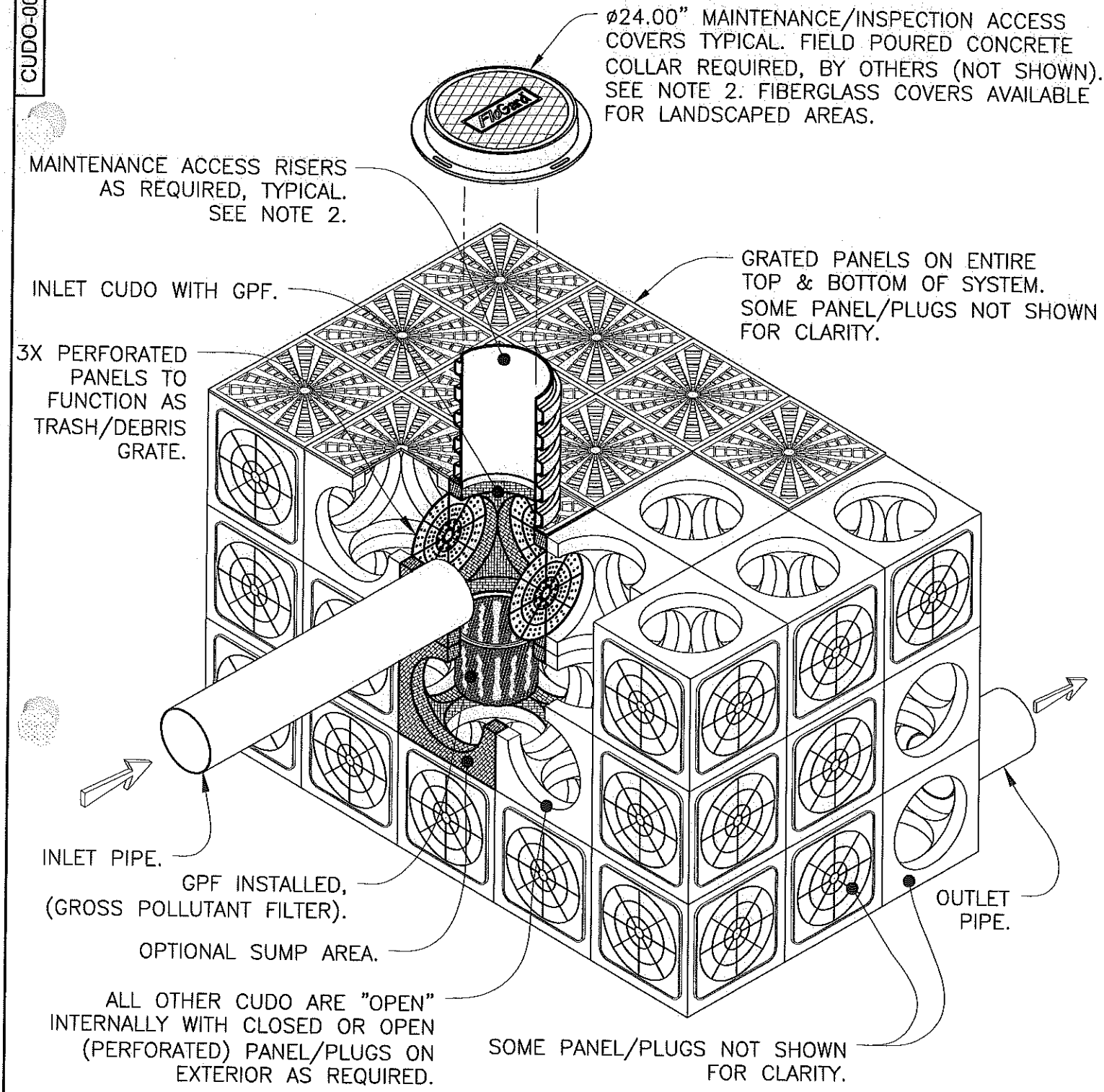
FAX 707.524.8186
WWW.KRISTAR.COM

CUDO®
WATER STORAGE SYSTEM

CUDO-0002



NOTES:

1. REFER TO CUDO INSTALLATION DETAILS.
2. SEE CUDO-0008 FOR TYPICAL MAINTENANCE ACCESS CONFIGURATION.

CUDO™ Water Storage System
with Gross Pollutant Filter (GPF).

KriStar Enterprises, Inc.
360 Sutton Place, Santa Rosa, CA 95407
Ph: 800.579.8819, Fax: 707.524.8186, www.kristar.com

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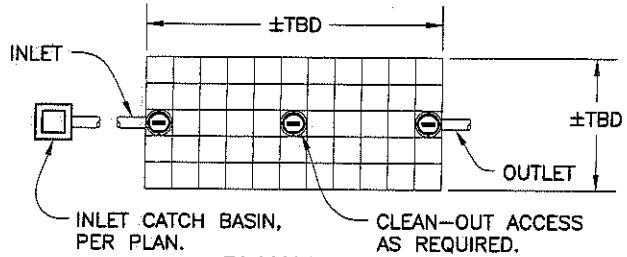
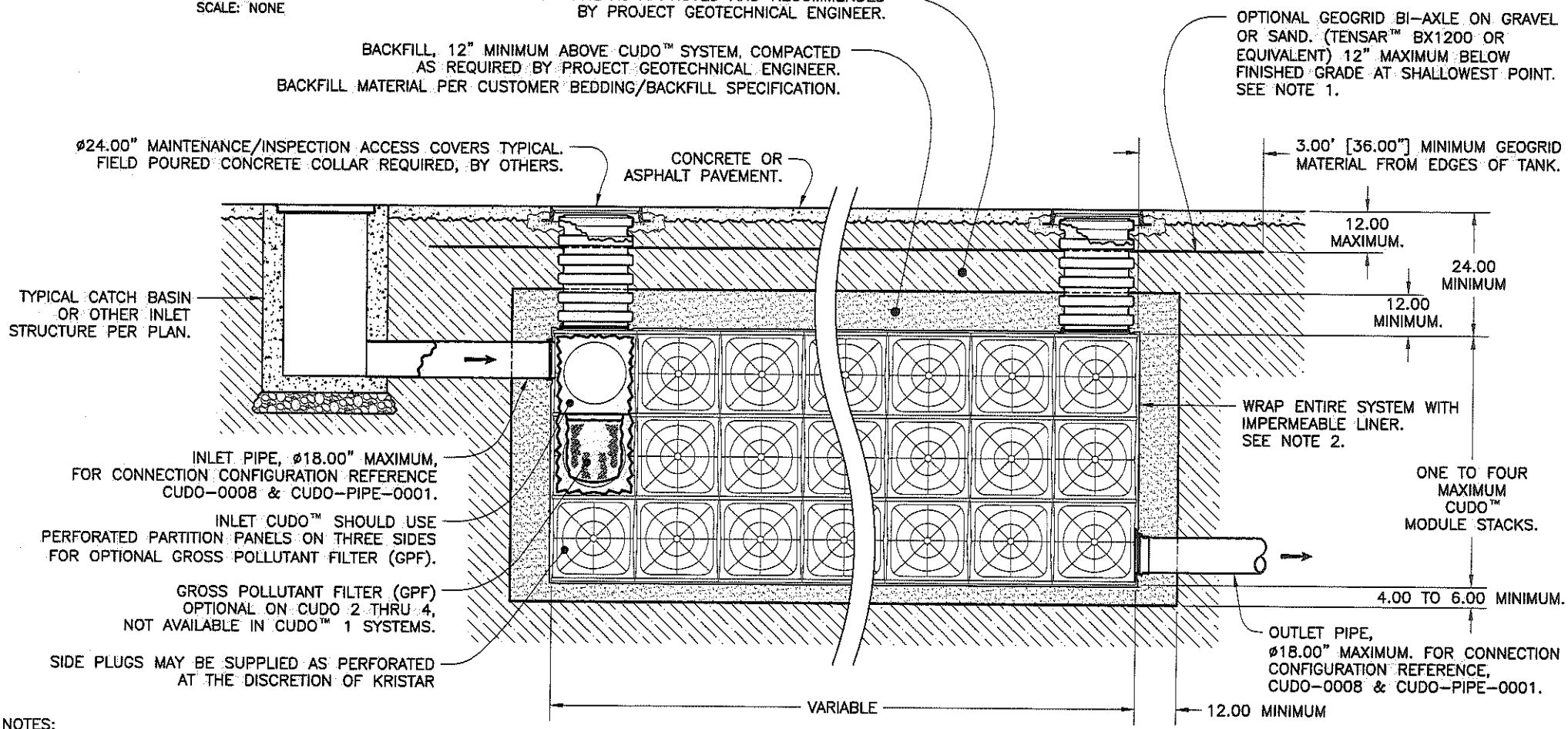
DO NOT SCALE DRAWING	SCALE: NONE	DRAWN / DATE JPR 7/24/08	CUDO ECO 0006 JPR 3/23/12	DRAWING NO. CUDO-0002	REV B	SHEET 1 OF 1

CUDO-DT-0001



PLAN VIEW

1 TO 4 MODULE STACKS
SCALE: NONE



SECTION / CUTAWAY VIEW

SCALE: NONE

NOTES:

1. INSTALL GEOGRID LAYER, (TENSAR™ BX1200 OR EQUIVALENT) IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS.
2. SYSTEM ENCASED ENTIRELY WITH 36 MIL REINFORCED POLYETHYLENE IMPERMEABLE LINER OR EQUIVALENT AS REQUIRED.
3. FIELD POURED CONCRETE COLLAR REQUIRED AROUND ALL ACCESS COVERS & HATCHES, BY OTHERS.
4. ALL EXTERN[illegible]NG & ANGLES BY OTHERS. REFER TO PLANS.

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TITLE: CUDO™ Stormwater Detention System

Typical Installation Detail

Impermeable Pavement Area

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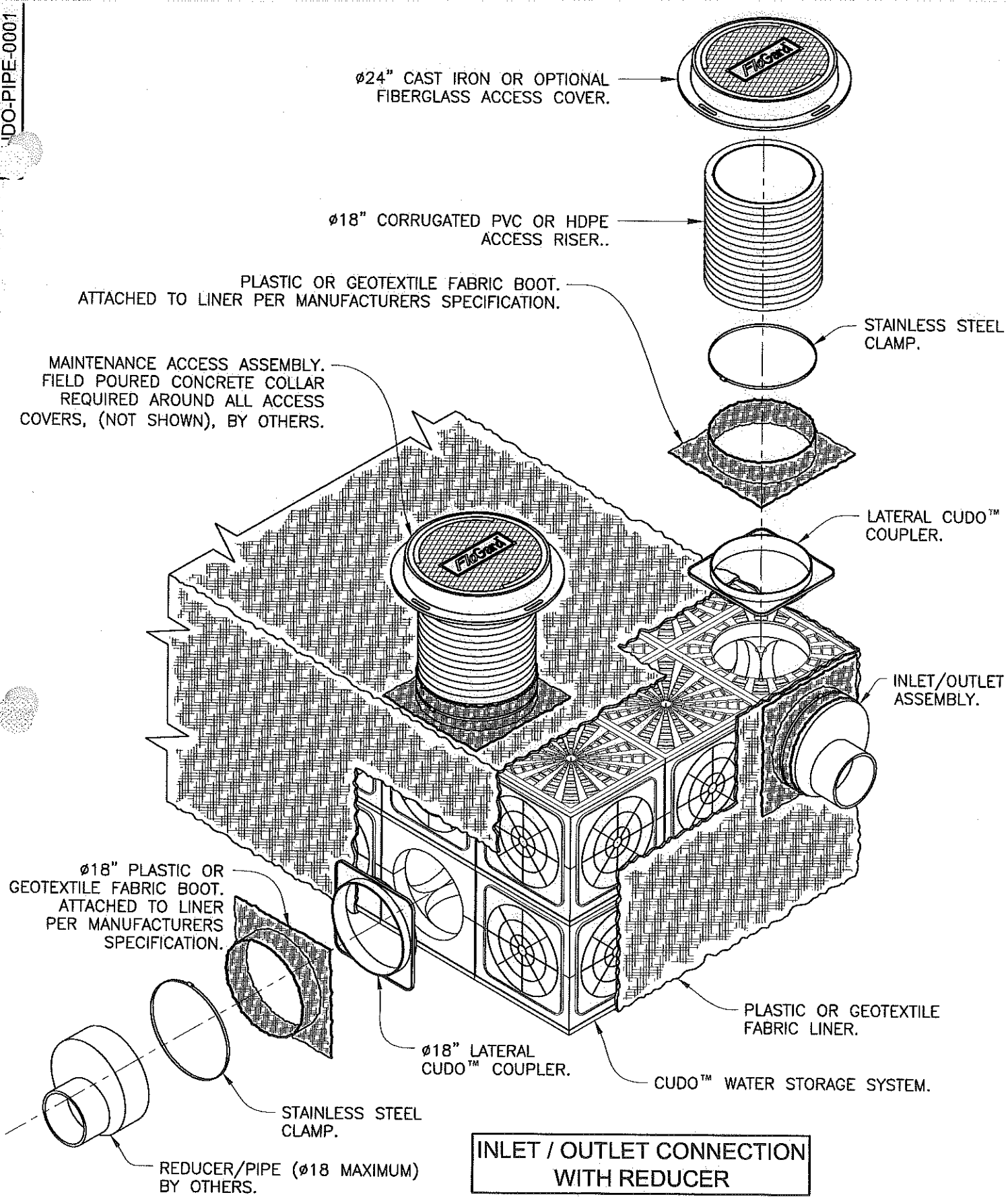

INLET / OUTLET CONNECTION WITH REDUCER

CUDO™ Water Storage System

Pipe Connection & Maintenance Access Installation Diagram

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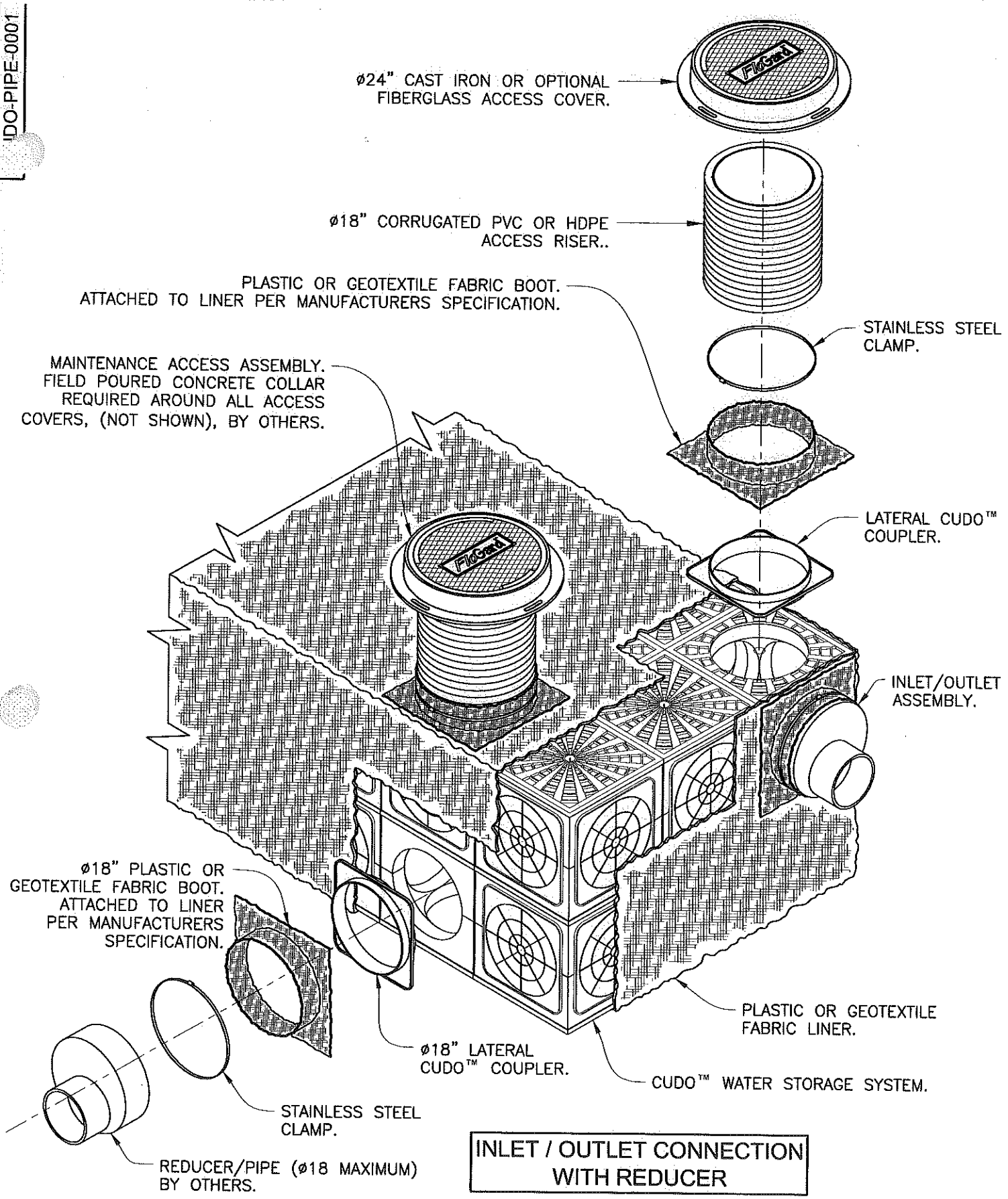
CUDO-PIPE-0001



INLET / OUTLET CONNECTION WITH REDUCER

CUDO™ Water Storage System
Pipe Connection & Maintenance Access Installation Diagram

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DO NOT SCALE DRAWING	SCALE: NONE	DRAWN / DATE JPR 7/22/09	CUDO ECO 0005 JPR 3/20/12	DRAWING NO. CUDO-PIPE-0001	REV A	SHEET 2 OF 2

CUDO™ Stormwater Systems

(Underground Retention / Detention / Infiltration / Water Reuse Systems)

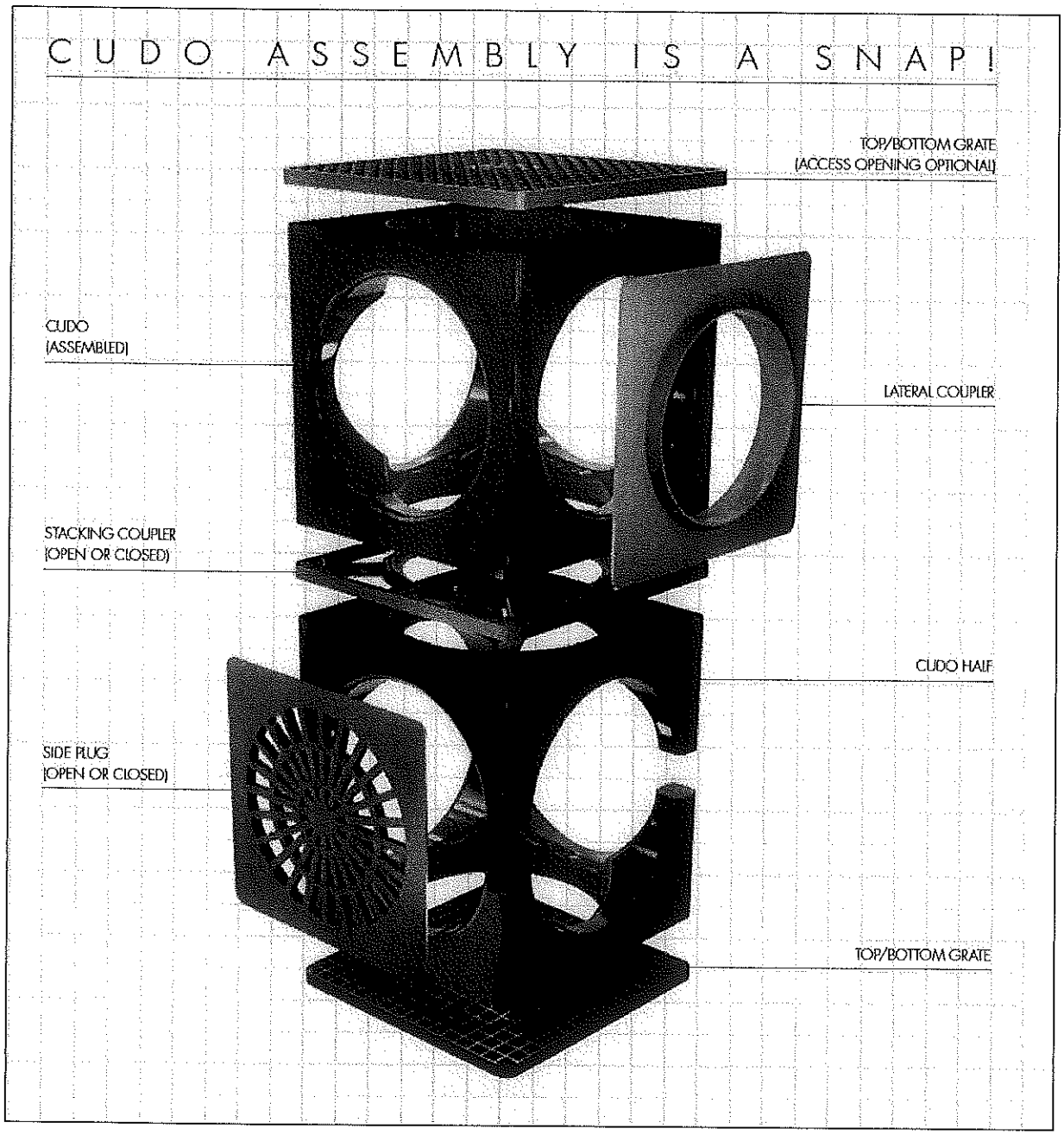
Installation Guide

Version 1.00c – November 5, 2008

CUDO Stormwater Cube – Modular Stormwater Systems

CUDO Assembly

The CUDO product will arrive on site with the required number of components to complete your project. Those components will consist of (as required) CUDO half cubes, top/bottom grates, stacking couplers, side plugs, and/or lateral connectors. Assembly of the completed CUDO system will be done on site per project specific assembly details with their simple snap together feature.



Cudo Stormwater Products, Inc.
P.O. Box 497
Occidental, CA 95465-0497
Phone: (877) 876-3346
www.cudocube.com

Site Excavation
The contractor shall excavate the site to the width, depth and length necessary to accommodate and install the CUDO stormwater system including provisions for cover over the system and depth below the system in accordance with the project engineer's specifications.

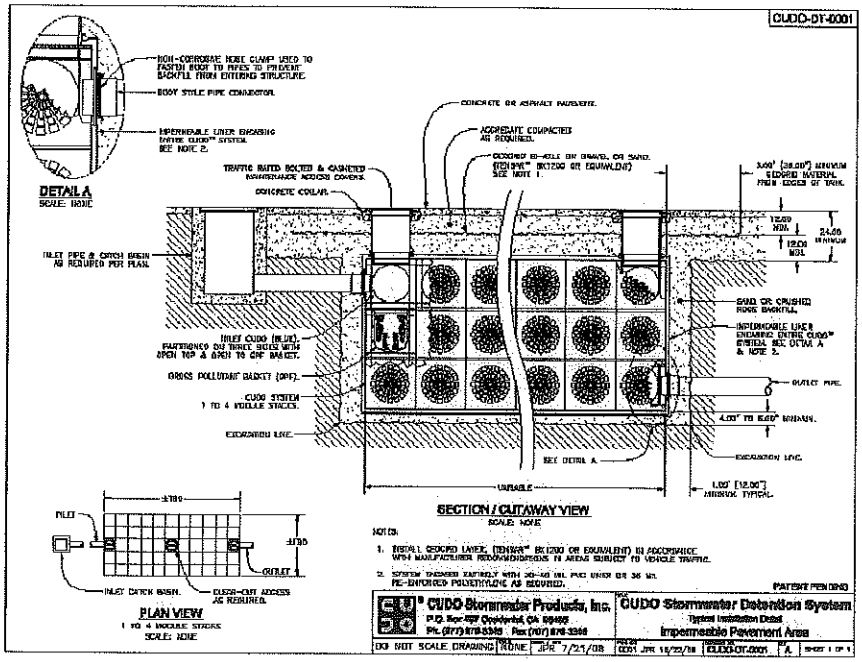
Base Preparation
Generally a base material of sand or stone should be used and be compacted to 95%. The specific nature of the material will depend upon a myriad of factors, including but not limited to soil reports and end use of system (detention or retention). The base must be finished evenly to provide a level surface for the CUDO installation.

Fabric/Liner Placement
Either a nonwoven filter fabric material or an impermeable liner will be required to surround the perimeter of the CUDO system. Either product shall be laid to the contour of the excavation bottom and side walls with a minimum of 12" overlapping, or as specified by the project engineer.

CUDO Placement
The assembled CUDO cubes shall be placed on top of the fabric/liner material in accordance with the project's specific layout details. Maintain a level top at all times and keep the units in a straight line in each direction. Complete any inlet/outlet pipe connections in accordance with the project's details. Connect the inspection/cleanout port riser material to the top of the CUDO as shown on the project layout detail.
Pull the fabric/liner material taut around the CUDO's to completely seal the system, using duct tape to temporarily secure the material overlaps in place.

Backfilling/Geogrid Placement
Using a compactable material as specified by the project engineer, backfill the sides of the CUDO system evenly in 12" lifts to a minimum of 95% with a mechanical compactor. Bring the backfill to the top of the CUDO system and then continue backfill placement in accordance with the project's specific requirements for the type and location of Geogrid over the top of the CUDO system.

Sample Installation Detail



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CUDO™ Stormwater Cube

(Underground Retention / Detention / Infiltration / Water Reuse Systems)

Operations and Maintenance Manual

Version 1.01 – July 08, 2009

CUDO™ Stormwater Cube – Modular Stormwater Systems

Description / Basic Function
CUDO™ is a modular stormwater system comprised of a grouping of modular polypropylene or concrete cubes that when constructed form an underground storage area for stormwater. This system can be used for infiltration, retention, detention or water reuse. CUDO™ can help achieve runoff detainment and storage to help attenuate the peak flow to pre-construction levels and can help conform to current Low Impact Development requirements.

Infiltration
The purpose of a CUDO™ infiltration system is to capture stormwater runoff, store the runoff, and then allow it to percolate into the ground via the open space area of the cubes and perforations in the side wall. The system is backfilled with a Class I material defined by ASTM D2321 as a cleaned open graded rock or a Class II permeable sand. The rock or sand provide additional storage capacity but also allow for a percolation interface with the native material. The ground water is "recharged" with this type of system.

Detention
The purpose of a CUDO™ detention system is to capture stormwater runoff, store the runoff, and then allow it to be released at a controlled rate through an appropriately sized orifice control. A detention system helps attenuate the peak flow from the site assuring that pre-development runoff flows are not exceeded as a result of the development. A CUDO™ detention requires the cubes to be encapsulated with an impermeable liner for the polypropylene system or the seams of the concrete system to be sealed with a water proof mastic.

Retention
A CUDO™ retention system is a hybrid system. It is a combination of a detention system and an infiltration system. A retention system is utilized to attenuate peak flow as well as promote groundwater re-charge. A retention system is outfitted with an overflow pipe at the top of the system which allows the system to fill for infiltration but also outlet if the ground is saturated.

Water Reuse
The purpose of a water-reuse CUDO™ system is to capture and store water for future use. The system is constructed in a similar fashion to a detention system but instead of a controlled outlet the system is constructed with an emergency overflow. A water reuse system is a LID device that helps attenuate peak flows as well as conserve water. Water may be reused through an active pump system or passive irrigation.

Inspection/Cleanout Ports
Inspection and cleanout ports are 18-inch diameter vertical risers connected to the uppermost polypropylene CUDO™ cubes or up to 30-inch manhole access connected to the concrete CUDO™. They are used for entrance into the system, or for access to place vacuum truck hoses or water-jetting devices or CCTV equipment. Ports are strategically located near inlet and outlet pipes and in other areas or probable deposition in the system. It is recommended to keep surface level access lids sealed and bolted at all times when the system is in service.

Inlet Bay
Some systems are configured so that pretreatment of the stormwater occurs within the CUDO™ system. In this case the CUDO™ system will house an inlet bay. The inlet bay is separated from the rest of the CUDO™ system by sidewall plugs and is intended to separate gross pollutants, trash and debris and floatables from the CUDO™ system and pre-treatment device. The bay contains its own sump area and unique access ports.

Maintenance Overview for CUDO

State and Local regulations require that stormwater storage systems be maintained and serviced on a recurring basis. The purpose of maintaining a clean and obstruction free CUDO™ system is to ensure the system performs the intended function of the primary design. Trash and debris, floatables, gross pollutants and sediment can build up in the CUDO™ leading to clogging of the native soil interface or blockage of the inlet or outlet pipes. This can cause the system to function improperly by limiting storage volume, limiting the design percolation rates or impeding flow in and out of the system. Downstream and upstream, areas could run the risk of flooding and deleterious environmental impact.

Recommended Frequency of Service

It is recommended that the CUDO™ stormwater systems be serviced on a regularly occurring basis. Ultimately the frequency depends on the amount of runoff, pollutant loading, and interference from trash, debris and gross pollutants as well as proper maintenance of upstream pretreatment devices. However, it is recommended that each installation be inspected at least two times per year to assess service needs.

Recommended Timing of Service

Guidelines for the timing of service are as follows:

1. For areas with a definite rainy season the system should be serviced prior to and following the rainy season.
2. For areas subject to year-round rainfall service should occur on a regularly occurring basis. (A minimum of two times per year.)
3. For areas with winter snow and summer rain the system should be serviced prior to and after the snow season.
4. For installed devices that are subject to dry weather flows only (i.e. wash racks, parking garages, etc...) the unit should be serviced on a regularly occurring basis. (A minimum of two times per year.)

Inspection

An inspection should be performed when the system is new. This allows the owner to establish a baseline condition for comparison to future inspections. Sediment build up can typically be monitored without entering the system. (No confined space entry.) Initial and subsequent inspection data should be recorded and filed for reference. Some regulatory agencies require that the results of the inspections be documented and reported. Inspection reports should comply with regulatory requirements and be submitted as required.

Inspection Procedures

1. Locate the inspection, cleanout and access ports. Inspection and cleanout ports are typically 18-inch diameter. Access ports are typically 24-inch or 30-inch diameter. Pictures should be taken to document the location or a site map should be generated to detail the as-built locations of the ports.
2. Unbolt and remove the access port lids.
3. Insert a measuring device into the opening making note of a point of reference to determine the quantity of sediment and other accumulated material. If access is required to measure, ensure only certified confined space entry personnel having appropriate equipment are allowed to enter the system.
4. In addition, for accessible concrete CUDO™ systems personnel should utilize appropriate confined space entry procedures to enter the system and photograph its condition.
5. Inspect inlet and outlet locations for obstructions. Obstructions should be removed at this time.
6. Inspect the structural components of the system.
7. Fill in the CUDO™ Inspection/Maintenance Data Sheet and send a copy to the regulatory agency if necessary.

Disinfection of Water Reuse System

Periodic disinfection of water held for reuse may be required to abate bacteria and algae growth. This may be done using calcium hypochlorite tablets or by the addition of an ozone generator in a small recirculation system.

Maintenance

Cleanout of the CUDO™ system should be considered if there is sediment buildup of two or more inches at over 50% of the inspection ports. Cleaning shall be performed if sediment buildup is two inches or more over 75% of the system floor. In the event of a spill of a foreign substance, cleanout of the system should be considered.

Maintenance Procedures

1. Locate the inspection, cleanout and access ports. Inspection and cleanout ports are typically 18-inch diameter. Access ports are typically 24-inch or 30-inch diameter. Pictures should be taken to document the location or a site map should be generated to detail the as-built locations of the ports.
2. Unbolt and remove the access port lids.
3. Measure the sediment buildup at each port. If access is required to measure ensure only certified confined space entry personnel having appropriate equipment are allowed to enter the system.
4. A thorough cleaning of the system (inlets, outlets, ports, and inlet bays) shall be performed by either a vacuum truck or by manual methods.
5. Inspect inlet and outlet locations for obstructions. Obstructions should be removed at this time.
6. Inspect the structural components of the system.
7. Fill in the CUDO™ Inspection/Maintenance Data Sheet and send a copy to the regulatory agency if necessary.

Inspection / Maintenance Requirements

Listed below are some recommendations for equipment and training for personnel to inspect and maintain a CUDO™ system.

Personnel – OSHA Confined Space Entry Training is a prerequisite for entrance into a system. In the state of California personnel should be CalOSHA certified.

Equipment –
Record Taking (pen, paper, voice recorder)
Proper Clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
Flashlight
Tape Measure
Measuring Stick
Pry Bar
Traffic Control (Flagging, barricades, signage, cones, etc.)
First aid materials
Debris and Contaminant collectors
Debris and Contaminant containers
Vacuum Truck

Disposal of Gross Pollutants, Hydrocarbons, and Sediment

The collected gross pollutants, hydrocarbons, and sediment shall be offloaded from the vacuum truck into DOT approved containers for disposal. Once in the container the maintenance contractor has possession and is responsible for disposal in accordance with local, state and federal agency requirements.

Note: As the generator, the landowner is ultimately responsible for the proper disposal of the collected materials. Because the material likely contains petroleum hydrocarbons, heavy metals, and other harmful pollutants, the materials must be treated as EPA class 2 Hazardous Waste. Proper disposal is required.

DESIGN COMPUTATIONS FOR:
CUDO® WATER STORAGE SYSTEM

PREPARED FOR:

CUDO® Stormwater Products, Inc.

Doug Allard

P.O. Box 497

Occidental, California 95406

PREPARED BY:

Terrain Engineering, Inc.

3609 Maidu Place

Davis, California 95618

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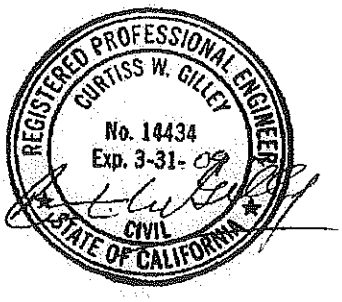

OBJECTIVE:

Determine the distributed load acting on the CUDO Water Storage Cube per AASHTO LRFD for live loads and earth loads and recommended minimum and maximum cover heights.

OVERVIEW:

The CUDO Water Storage Cube is manufactured from polypropylene by an injection molding process. The cubes consist of two halves that join together at the spring line of the circular opening of the cube, as well as a top and bottom grate. The cubes will be assembled and installed in rows and columns with no spacing between units.

Our evaluation included review of third party compressive test data, live and earth load calculations, and finite element analysis of the expected cube performance when subjected to live loads in a minimum cover scenario. Structural performance of the cube was assessed using current AASHTO procedures for design of thermoplastic culverts.

LABORATORY TESTING:

CUDO Stormwater Products, Inc. retained Testing Engineers, inc. of San Leandro, CA to perform a compressive test on three 24-in X 24-in x 24-in CUDO cubes. The testing was performed in general conformance with ASTM D2412, Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading. (A copy of this test report is included for reference.) It should be noted at the time this testing was completed there was/is no ASTM test uniquely tailored for modular filtration systems such as the CUDO and it was determined that this test is the most appropriate available test procedure.

The average ultimate load was determined to be 14,036.7lbs (14.0 K) for the 24-in x 24-in x 24-in CUDO cube. The load reference for this laboratory test is approximately 3,500lbs/sq-ft (3.5K/sq-ft).

LIVE LOAD AND EARTH LOAD CALCULATIONS:

Reference AASHTO Section 12-2006

Assumptions:

Load Factors:	Earth Load (EL) – 1.0 Live Load (LL) – 1.75 or As Required
Cover Height:	H = Total Cover Height H_S = Surface Treatment Cover Height H_F = Fill Cover Height
Soil Weight:	Surface = 145pcf Fill = 120pcf
Impact Factor:	IM = 1.3(1-0.125H) where H is cover height in feet
Earth Load:	$EL_S = H_S$ X 145pcf $EL_f = H_f$ X 120pcf
Live Load (HS20-44):	LL = 16,000lbs
Wheel Contact Area:	Length (l) = 20-inches Width (w) = 10-inches
Live Load Distribution Factor:	= 1.75
Geogrid Distribution Factor:	= 2.60
Earth Load:	= (SF_{DL}) X (Unit Weight Surface) X (H_S) + (SF_{DL}) X (Unit Weight Fill) X (H_F)
Live Load:	= (IM) X (SF_{LL}) X (Live Load) / Distributed Load Area
Total Load:	= EL + LL

LIVE LOAD AND EARTH LOAD CALCULATIONS (CONTINUED):

The ultimate loading was calculated and then compared to the laboratory test results for ultimate loading of the cubes. The calculations for loading include both live load and earth loads. Although the earth load at minimum cover heights is very minimal in comparison to the live load, the earth loads have been included. The live load and earth load use assumptions as listed above and are in general conformance with AASHTO LRFD. In these calculations it was assumed that the HS20-44 live load is a point load at surface with no wheel contact area. The load is distributed downward and outward with a distribution factor of 1.75. This is a conservative approach and considers that surface loads are not distributed over the footprint of the wheel contact area. Results of the calculations are found in Table 1.

Cover Height (H) in (in)	Impact Factor (IM)	Live Load Distribution (1.75) sq-in	H20 Live Load Transferred to cube (psi)	Earth Load Transferred to cube (psi)	Total Load Transferred to cube (psi)	Factor of Safety*
0	1.33	0	21280.0	0.0	21280.0	0.00
6	1.31	110	190.0	0.5	190.5	0.13
12	1.29	441	46.8	1.0	47.8	0.51
18	1.27	992	20.4	1.5	22.0	1.11
24	1.25	1764	11.3	2.0	13.3	1.82
30	1.23	2756	7.1	2.5	9.6	2.52
36	1.21	3969	4.9	3.0	7.9	3.08
42	1.19	5402	3.5	3.5	7.0	3.45
48	1.17	7056	2.6	4.0	6.7	3.64
54	1.14	8930	2.1	4.5	6.6	3.69
60	1.12	11025	1.6	5.0	6.7	3.65
66	1.10	13340	1.3	5.5	6.9	3.54
72	1.08	15876	1.1	6.0	7.1	3.41
78	1.06	18632	0.9	6.5	7.5	3.26
84	1.04	21609	0.8	7.0	7.8	3.11
90	1.02	24806	0.7	7.6	8.2	2.96
96	1.00	28224	0.6	8.1	8.6	2.82

*For design situations exceeding 60-inches of cover please contact the manufacturer for additional analysis.

Table 1

LIVE LOAD AND EARTH LOAD CALCULATIONS (CONTINUED):

Additional analysis was performed to determine the benefit of utilizing a geo-grid layer between the live load and the cubes. Using a program called Spectra Pave3 Version 1.0 developed by Tensar International Corporation it was found that when based on poor quality soil material (CBR 1 or R factor 5+/-) the spread factor is 2.60. This result is based on using Tensar geo-grid BX1200 or equal. The new load distribution factor was incorporated into the calculations and the results can be found in Table 2.

Cover Height (H) in (in)	Impact Factor (IM)	Live Load Distribution (2.6) sq-in	H20 Live Load Transferred to cube (psi)	Earth Load Transferred to cube (psi)	Total Load Transferred to cube (psi)	Factor of Safety*
0	1.33	0	21280.0	0.0	21280.0	0.00
6	1.31	243	86.1	0.5	86.6	0.28
12	1.29	973	21.2	1.0	22.2	1.10
18	1.27	2190	9.3	1.5	10.8	2.26
24	1.25	3894	5.1	2.0	7.1	3.40
30	1.23	6084	3.2	2.5	5.7	4.23
36	1.21	8761	2.2	3.0	5.2	4.65
42	1.19	11925	1.6	3.5	5.1	4.75
48	1.17	15575	1.2	4.0	5.2	4.65
54	1.14	19712	0.9	4.5	5.5	4.45
60	1.12	24336	0.7	5.0	5.8	4.21
66	1.10	29447	0.6	5.5	6.1	3.96
72	1.08	35044	0.5	6.0	6.5	3.72
78	1.06	41128	0.4	6.5	7.0	3.49
84	1.04	47699	0.3	7.0	7.4	3.28
90	1.02	54756	0.3	7.6	7.9	3.10
96	1.00	62300	0.3	8.1	8.3	2.92

*For design situations exceeding 60-inches of cover please contact the manufacturer for additional analysis.

Table 2

FINITE ELEMENT ANALYSIS:

A finite element analysis for the CUDO cube was performed using a finite element program, Visual Analysis ver5.5, by Integrated Engineering Software (www.iesweb.com). The model is 3-D with 2-D plate elements incorporating material stiffness with HS20-44 truck live loading, earth load, dead load and soil lateral loading.

For this analysis the following loadings and assumptions were utilized:

Live Load (LL) is H20-44 impacted for 2 ft cover, but applied at 3 ft cover

Earth Load (EL_V) is applied vertically at 130pcf for cover weight

Earth Load (EL_L) is applied laterally at 120pcf using an active lateral earth pressure coefficient (k_a) = 0.33

Dead Load (DL) is the weight of the CUDO cube itself. This number is relatively small in comparison to the earth load and live load and is left at zero for this analysis.

Material Stiffness = 75 ksi

Tensile Strength = 3.5 ksi

Material Thickness = 0.170 inch

The results of the analysis indicate that the greatest tensile stress for the 3 ft cover to finished grade is 1.25 ksi located near the point of joining the top and bottom half cubes. This allows for a Safety factor of 2.8 when compared to industry reported tensile strength of 3.5 ksi. The greatest tensile stress for 5 ft of cover to finished grade is 1.51 ksi. This results in a Safety Factor of 2.3 when compared to the industry reported tensile strength of 3.5 ksi.

CONCLUSION:

The CUDO cube can be installed with a minimum of 2ft of cover measured from the finished grade to the top of the cube with a geo-grid, Tensar BX1200 or equivalent, placed in the cover in accordance with the manufacturer's recommendations. Calculations indicate that the addition of the geo-grid helps to reduce point loads and live loads on the cube allowing for a safety factor of 3.4 at this depth. The analysis additionally supports the installation of the CUDO cube to a depth of 5ft measured from the top of the cube to finished grade. Backfill material shall be constructed per project geotechnical engineer requirements. Backfill construction equipment shall not apply loading greater than the design loading of 0.97K/sq-ft. For desired installation depths shallower or in excess of these recommendations the manufacturer should be contacted.

E

Attachment E

-Infiltration Feasibility Worksheet

-Summary of Harvested Water Demand and Feasibility Worksheet

-Soils Report Information (Percolation and Infiltration Testing)

Table 2.7: Infiltration BMP Feasibility Worksheet

	Infeasibility Criteria	*Yes*	*No*
1	**Would Infiltration BMPs pose significant risk for groundwater related concerns?** Refer to **Appendix VIII** (Worksheet I) for guidance on groundwater-related infiltration feasibility criteria.	X	
Provide basis: The project is located within the boundary of the "El Toro Marine Base" on the North Orange County Groundwater Protection Area. Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
2	Would Infiltration BMPs **pose significant risk of increasing risk of geotechnical hazards that cannot be mitigated to an acceptable level**? (Yes if the answer to any of the following questions is yes, as established by a geotechnical expert): • The BMP can only be located less than 50 feet away from slopes steeper than 15 percent • The BMP can only be located less than eight feet from building foundations or an alternative setback. • A study prepared by a geotechnical professional or an available watershed study substantiates that stormwater infiltration would potentially result in significantly increased risks of geotechnical hazards that cannot be mitigated to an acceptable level.		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
3	Would infiltration of the DCV from drainage area **violate downstream water rights**?		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

	Partial Infeasibility Criteria	*Yes*	*No*
4	Is proposed infiltration facility **located on HSG D soils** or the site geotechnical investigation identifies presence of soil characteristics which support categorization as D soils?		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
5	Is **measured infiltration rate below proposed facility less than 0.3 inches per hour**? This calculation shall be based on the methods described in **Appendix VII**.		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
6	Would **reduction of over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?**		X
Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
7	Would **an increase in infiltration over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?**		X
Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

Infiltration Screening Results (check box corresponding to result):		
8	Is there substantial evidence that infiltration from the project would result in a significant increase in I&I to the sanitary sewer that cannot be sufficiently mitigated? (See **Appendix XVII**) Provide narrative discussion and supporting evidence: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.	No, I & I has not been analyzed for this project at this time.
9	If any answer from row 1-3 is yes: infiltration of any volume is **not feasible** within the DMA or equivalent. Provide basis: The project is located within the boundary of the "El Toro Marine Base" on the North Orange County Groundwater Protection Area. Summarize findings of infeasibility screening	
10	If any answer from row 4-7 is yes, infiltration is **permissible but is not presumed to be feasible for the entire DCV.** Criteria for designing biotreatment BMPs to achieve the maximum feasible infiltration and ET shall apply. Provide basis: Summarize findings of infeasibility screening	
11	If all answers to rows 1 through 11 are no, infiltration of the full DCV is potentially feasible, BMPs must be designed to infiltrate the full DCV to the maximum extent practicable.	

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$					4.25
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					5.05
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$					1.19

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 01

From the Infiltration Rates Table -1, P-1and P-2 were used for this area.

P-1 = 2.2
P-2 = 7.9

Average Rate = 5.05

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$					4.25
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					5.05
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$					1.19

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 02

From the Infiltration Rates Table -1, P-1and P-2 were used for this area.

P-1 = 2.2
P-2 = 7.9

Average Rate = 5.05

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$				4.25	
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)				5.05	
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$				1.19	

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 03
From the Infiltration Rates Table -1, P-1and P-2 were used for this area.

P-1 = 2.2
P-2 = 7.9

Average Rate = 5.05

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$				4.25	
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)				5.05	
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$				1.19	

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 04
From the Infiltration Rates Table -1, P-1and P-2 were used for this area.

P-1 = 2.2
P-2 = 7.9

Average Rate = 5.05

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$					4.25
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					0.8
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$					0.19

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 05
From the Infiltration Rates Table -1, P-3 was used for this area.
P-3 = 0.8

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$				4.25	
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)				0.8	
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$				0.19	

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 06
From the Infiltration Rates Table -1, P-3 was used for this area.
P-3 = 0.8

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$					4.25
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					1.3
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$					0.31

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 07

From the Infiltration Rates Table -1, P-3 and P-4 were used for this area.

P-3 = 0.8
P-4 = 1.8

Average Rate = 1.3

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$				4.25	
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)				1.8	
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$				0.42	

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 08
From the Infiltration Rates Table -1, P-4 was used for this area.
P-4 = 1.8

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$					4.25
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					1.8
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$					0.42

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 09 & 17
From the Infiltration Rates Table -1, P-4 was used for this area.
P-4 = 1.8

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$					4.25
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					1.8
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$					0.42

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 10
From the Infiltration Rates Table -1, P-4 was used for this area.
P-4 = 1.8

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$				4.25	
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)				1.8	
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$				0.42	

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 11
From the Infiltration Rates Table -1, P-4 was used for this area.
P-4 = 1.8

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$				4.25	
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)				1.8	
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$				0.42	

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 12 & 13
From the Infiltration Rates Table -1, P-4 was used for this area.
P-4 = 1.8

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$					4.25
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					3.6
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$					0.85

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 14
From the Infiltration Rates Table -1, P-5 was used for this area.
P-5 = 3.6

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$				4.25	
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)				2.7	
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$				0.64	

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 15
From the Infiltration Rates Table -1, P-5 and P-4 were used for this area.

P-5 = 3.6
P-4 = 1.8

Average Rate = 2.7

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$				4.25	
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)				1.8	
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$				0.42	

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 16
From the Infiltration Rates Table -1, P-4 was used for this area.
P-4 = 1.8

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$				4.25	
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)				1.8	
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$				0.42	

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 18
From the Infiltration Rates Table -1, P-4 was used for this area.
P-4 = 1.8

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$					4.25
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					1.3
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$					0.31

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 19

From the Infiltration Rates Table -1, P-3 and P-4 were used for this area.

P-3 = 0.8
P-4 = 1.8

Average Rate = 1.3

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$					4.25
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					0.8
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$					0.19

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 20
From the Infiltration Rates Table -1, P-3 was used for this area.
P-3 = 0.8

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$					4.25
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					0.8
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$					0.19

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Area PA 21
From the Infiltration Rates Table -1, P-3 was used for this area.
P-3 = 0.8

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Table X.8: Minimum Irrigated Area for Potential Partial Capture Feasibility

General Landscape Type	Conservation Design: $K_L = 0.35$			Active Turf Areas: $K_L = 0.7$		
Closest ET Station	*Irvine*	*Santa Ana*	*Laguna*	*Irvine*	*Santa Ana*	*Laguna*
Design Capture Storm Depth, inches	**Minimum Required Irrigated Area per Tributary Impervious Acre for Potential Partial Capture, ac/ac**					
0.60	0.66	0.68	0.72	0.33	0.34	0.36
0.65	0.72	0.73	0.78	0.36	0.37	0.39
0.70	0.77	0.79	0.84	0.39	0.39	0.42
0.75	0.83	0.84	0.90	0.41	0.42	0.45
0.80	0.88	0.90	0.96	0.44	0.45	0.48
0.85	0.93	0.95	1.02	0.47	0.48	0.51
0.90	0.99	1.01	1.08	0.49	0.51	0.54
0.95	1.04	1.07	1.14	0.52	0.53	0.57
1.00	1.10	1.12	1.20	0.55	0.56	0.60

Worksheet J: Summary of Harvested Water Demand and Feasibility

1	What demands for harvested water exist in the tributary area (check all that apply):			
2	Toilet and urinal flushing		☐	
3	Landscape irrigation		☒	
4	Other:_____		☐	
5	What is the design capture storm depth? (Figure III.1)	d	0.80	inches
6	What is the project size?	A	108.86	ac
7	What is the acreage of impervious area?	IA	97.97	ac
	For projects with multiple types of demand (toilet flushing, indoor demand, and/or other demand)			
8	What is the minimum use required for partial capture? (Table X.6)	N.A.		gpd
9	What is the project estimated wet season total daily use?	N.A.		gpd
10	Is partial capture potentially feasible? (Line 9 > Line 8?)	N.A.		
	For projects with only toilet flushing demand			
11	What is the minimum TUTIA for partial capture? (Table X.7)	N.A.		
12	What is the project estimated TUTIA?	N.A.		

Worksheet J: Summary of Harvested Water Demand and Feasibility

13	Is partial capture potentially feasible? (Line 12 > Line 11?)	N.A.	
	For projects with only irrigation demand		
14	What is the minimum irrigation area required based on conservation landscape design? (Table X.8)	86.21	ac
15	What is the proposed project irrigated area? (multiply conservation landscaping by 1; multiply active turf by 2)	10.89	ac
16	Is partial capture potentially feasible? (Line 15 > Line 14?)	NO	

Provide supporting assumptions and citations for controlling demand calculation:

Line 15 < Line 14 Therefore, re-use for irrigation is not feasible.

RESULTS OF FIELD PERCOLATION TESTING
100-ACRE PARCEL AND WEST ALTON PARCEL
FORMER EL TORO MARINE CORPS AIR STATION
IRVINE, CALIFORNIA

Prepared for:

Lowe Enterprises Real Estate Group

9001 Irvine Center Drive, Suite 1460
Irvine, California 92618

Project No. 10695.003

January 16, 2015

Leighton and Associates, Inc.
A LEIGHTON GROUP COMPANY

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January 16, 2015

Project No. 10695.003

Lowe Enterprises Real Estate Group
9001 Irvine Center Drive, Suite 1460
Irvine, California 92618

Attention: Mr. Robert Reitenour, Senior Vice President

Subject: Results of Field Percolation Testing
100-Acre Parcel and West Alton Parcel
Former El Toro Marine Corps Air Station
Irvine, California

INTRODUCTION

In accordance with your request and authorization, Leighton and Associates, Inc. (Leighton) has performed percolation testing for the subject project. The purpose of our study was to evaluate the feasibility of infiltrating stormwater runoff on site. In-situ percolation testing was performed per County of Orange guidelines (County of Orange, 2013). Literature reviewed in preparation of this report are listed in Appendix A, *References*. Leighton has previously prepared a feasibility level geotechnical investigation for the project (Leighton, 2014).

Based on the results of our subsurface exploration and field percolation testing, the site soils are deemed suitable for stormwater infiltration. This report presents results of field exploration, testing procedures used, percolation test results, and recommended infiltration rates for design.

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SCOPE OF WORK

The purpose of our study was to determine subsurface soil and groundwater characteristics and to evaluate infiltration rates to aid in the preliminary design of stormwater infiltration systems. The scope of work included the following tasks:

- *Background Review* – Reviewed the County of Orange guidance document for percolation testing (County of Orange, 2013). We also reviewed available geotechnical literature pertinent to the subject site including previous geotechnical reports, and historic groundwater levels.

- *Pre-Field Exploration Activities* – Boring locations were marked and Underground Service Alert (USA) was notified to locate and mark existing underground utilities prior to our subsurface exploration. The tenant of West Alton Parcel was contacted for site access coordination for the borings located within the leased property, and was notified of our testing.

  Leighton obtained a water meter from the Irvine Ranch Water District (IRWD), which was affixed to a local water hydrant in order to provide the water supply required for testing.

- *Field Exploration* – Our field exploration was performed on December 8 and 9, 2014. We advanced 13 hollow-stem auger borings, P-1 through P-13, drilled to a maximum depth of 15 feet below the existing ground surface (bgs). Borings P-1 through P-5 were drilled within the 100-Acre Parcel; and borings P-6 through P-13 within West Alton Parcel. Approximate boring locations are shown on Plates 1A and 1B, *Site Exploration Map*. During drilling, both bulk and relatively undisturbed drive samples were obtained from the borings for evaluation. The relatively undisturbed samples were collected utilizing a Modified California Ring sampler conducted in accordance with ASTM Test Method D 3550. Standard Penetration Tests (SPTs) were performed in the hollow stem auger borings in general accordance with ASTM Test Method D1586. The samplers were driven for a total penetration of 18 inches, unless practical refusal, using a 140-pound automatic hammer falling freely for 30 inches. The number of blow counts per 6 inches of penetration was recorded on the boring logs. Logging and sampling of the borings were conducted by an engineer or geologist from our firm. Logs of the boring are presented in Appendix B.

- *Field Percolation Tests* – In-situ percolation testing was performed in accordance with County of Orange (2013). After sampling and logging, the borings were converted to test wells and pre-soaked for testing. A 2-inch-diameter polyvinyl chloride (PVC) section of 0.020-inch slotted pipe was installed within the zones where percolation rates were to be determined. The remaining installed pipe sections were solid where applicable. The depths of borings and screen interval are presented in Table 1. Filter pack consisting of No. 3 Monterey Beach Sand was placed in the annulus from the bottom of the boring to approximately 1 foot above the slotted pipe section. A 3-foot-thick bentonite seal was placed above the filter pack where applicable and balanced with onsite soils to the top of pipe.

  After pre-soaking, the test wells were filled to a water level at least 12 inches above the slotted pipe to determine the standard time interval for the percolation test. The standard time interval for all the test wells was 10 minutes. However, for test wells where the water was draining very fast, the time interval was reduced to better evaluate infiltration rate. Once the standard time interval was established for each well, the wells were filled to the top of the slotted pipe. The water drop was then generally measured at 10 minute intervals using a manual water sounder. At the end of the time interval, the wells were refilled to the top of the slotted pipe. Testing was terminated after a minimum of one hour from the beginning of the test. Field data and calculated infiltration rate for each well is presented in Appendix C, *Percolation Test Data*. After the conclusion of percolation testing, the PVC pipes were removed from the test hole. The test holes were backfilled with the soil cuttings.

- *Laboratory Testing* – Laboratory tests were performed on representative samples to determine the geotechnical properties of the subsurface materials. The following laboratory tests were performed on selected samples:

  - In-situ moisture content and density (ASTM D2216 and ASTM D2937); and
  - Percent passing No. 200 Sieve (ASTM D1140);

  The laboratory tests were performed in general conformance with ASTM and/or Caltrans procedures. The results of our laboratory tests from our current exploration are presented in Appendix D, *Laboratory Test Results*. The results of the in-situ moisture contents and dry densities of the ring samples are presented on our geotechnical boring logs (Appendix B).

- *Engineering Analysis* - The data obtained from our background review, field exploration, and in-situ percolation testing program were evaluated and analyzed to obtain infiltration rates at each location.

- *Report Preparation* - The results of the exploration and in-situ percolation testing are summarized in this report presenting our findings and conclusions.

SUBSURFACE CONDITIONS

Based on our review of previous studies for the sites and our current field exploration, the upper onsite soils consist of a relatively thin mantle of undocumented fill materials (Afu) overlying young alluvial fan deposits (Qyf). The geotechnical conditions for each site are described below:

- *100-Acre Parcel* – We encountered up to 5½ feet of fill in our borings; it is understood that man-made fills are present within portions of the parcel. The fill materials consist predominantly of silty sand and sandy clay. Additionally, fill soils are expected to be encountered within areas of pre-existing drainages since filled by the placement of storm drains during earlier development of the air base. These materials are anticipated to be approximately 5 to 10 feet in thickness.

  Below the fill, we encountered young alluvial fan deposits to the maximum drilled depth of 15 feet. The alluvium can also be encountered at or near the ground surface and consist mostly of interbedded medium dense to dense sands, silty sands, and clayey sands to medium stiff to stiff sandy clays.

- *West Alton Parcel* – We encountered up to 3½ feet of fill in our exploration; it is understood that man-made fills are present within portions of the parcel. The fill materials consist predominantly of silty sand.

  Below the fill, we encountered young alluvial fan deposits to the maximum drilled depth of 15 feet. The alluvium can also be encountered at or near the ground surface and consist mostly of medium dense to dense sand with isolated layers of stiff sandy clay.

A detailed description of the soils encountered in our borings is presented in the boring logs (Appendix B).

GROUNDWATER

Groundwater was not encountered in our exploration to the maximum drilled depth of 15 feet. Based on the previous study (Leighton, 2014), possible perched water was detected at several CPT soundings at depths of 49 to 57 feet bgs. It should be noted that similar subsurface conditions and perched water were encountered at depths generally between 48 and 56 feet within nearby adjacent properties, previously investigated by this firm (Leighton, 2001).
Based on our review of Seismic Hazard Report for the Tustin and El Toro Quadrangles prepared by California Division of Mines and Geology (CDMG, 1998 and 2000), the historic high groundwater was reported to be as shallow as 40 feet bgs.

Fluctuations of the groundwater level, localized zones of perched water, and an increase in soil moisture should be anticipated during and following the rainy seasons or periods of locally intense rainfall and storm water runoff. Irrigation of landscape areas can also cause a fluctuation of local groundwater levels.

INFILTRATION RATES

The measured infiltration rates at tested locations and depths are summarized in the table below. The percolation test locations are shown in Plates 1A and 1B. Field data and calculated infiltration rate for each percolation test well is presented in Appendix C.

Based on our percolation test results the measured soil infiltration rates range from 0.8 to 7.9 inches per hour at 100-Acre Parcel; and from 0.3 to 9.7 inches per hour at West Alton Parcel. It should be emphasized that the infiltration test results are only representative of the tested location and depth where they are performed. Varying subsurface conditions will exist outside of the test location, which could alter the calculated infiltration rate indicated below.

Table 1 – Infiltration Rates

Boring No.	Drilled Depth (ft)	Screen Interval Depth (ft)	Observed Infiltration Rate (Inches/Hour)	Measured Infiltration Rate (Inches/Hour)
100-Acre Parcel				
P-1	15	5-15	4.4	2.2
P-2	10	0-10	15.7	7.9
P-3	10	5-10	1.5	0.8
P-4	15	5-15	3.7	1.8
P-5	15	10-15	7.1	3.6
West Alton Parcel				
P-6	5	0-5	5.7	2.9
P-7	15	5-15	4.8	2.4
P-8	5	0-5	19.3	9.7
P-9	15	5-15	12.2	6.1
P-10	15	5-15	0.6	0.3
P-11	5	0-5	1.5	0.7
P-12	5	0-5	13.8	6.9
P-13	15	5-15	5.6	2.8

Per the county guidelines, the measured infiltration rates include a mandatory factor of safety of 2.0 applied to the testing results (observed infiltration rates) to account for uncertainty in observed data and potential for long term clogging. Note that the design infiltration rate is obtained by applying a factor of safety to the measured infiltration rate.

It is possible that the long term rate of transmissivity of permeable soil strata may be much lower than the values obtained by testing. This could be influenced by: the highly variable vertical character and limited lateral extent of the more permeable soil strata, reduction of permeability rates over time due to silting of the soil pore spaces, and other factors. Accordingly, the possibility of future surface ponding of water as well as shallow groundwater impacts on subterranean structures such as basements, underground utilities, etc. should be anticipated as possible future conditions in all design aspects of the site.

The measured infiltration rates presented above may be used for the preliminary design phase for site planning; once the locations of proposed infiltration facilities/systems are known, it is recommended to conduct additional percolation testing as close to the proposed facilities as possible to verify these values.

ENVIRONMENTAL

The scope of this investigation does not include the evaluation of environmental conditions and/or issues. As a geotechnical consultant, it is within our area of expertise and obligation to assess limited aspects of the potential impact of site development on the groundwater system as affected by geotechnical conditions. We present the following comments to be considered by those responsible for site assessment and design relative to environmental issues.

Due to the vertical and lateral variation in subsurface soils, and the introduction of surface water associated with sustainable design elements, it is our opinion, that any remnant areas of existing contaminated soils or groundwater may be affected by surface water percolation. The present depth to the existing permanent groundwater surface may also be affected by surface water infiltration.

Between the existing groundwater surface and the ground surface, interfingered strata of relatively low and highly permeable soils are present to great depth beneath the site. The relatively impermeable strata, hindering downward percolation of surface water, may result in localized perched water conditions. Such perched water table conditions may vary considerably in lateral extent. Groundwater mounding and lateral groundwater movement may occur, possibly over large areas. Lateral groundwater movement conceivably could remobilize contamination within soils previously unaffected by the presence of groundwater or have an effect on dissolved groundwater contamination.

A decrease in the depth to the permanent groundwater surface may occur, having similar affects on the mobilization of contamination within the soils or groundwater.

In general, it would be difficult to quantify the change in depth of groundwater, lateral and vertical flow rates, etc. without detailed evaluation. Based upon the geomorphology of the area and our understanding of the history and environment of deposition, it is our opinion that movement of groundwater would be in a south-southwesterly direction. It is possible that such movement could extend offsite.

Incorporation of sustainable design elements in site planning should consider all possible affects of changes to the present groundwater conditions over time.

CONCLUSION

Based on the results of our subsurface exploration, field percolation testing, and provided that the provisions of the county are implemented, it is Leighton's opinion that the subsurface soils at the project sites are deemed suitable for onsite infiltration devices.

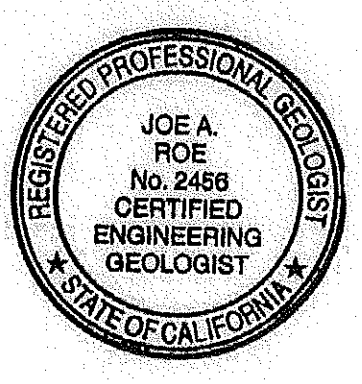
LIMITATIONS

This letter report was based on data obtained from limited number of observations, site visits, soil excavations, samples, and tests. Such information is, by necessity, incomplete. The nature of many sites is such that differing soil or geologic conditions can be present within small distances and under varying climatic conditions. Changes in subsurface conditions can and do occur over time. Therefore, the findings presented in this report are only valid if Leighton and Associates, Inc. has the opportunity to observe subsurface conditions during grading and construction, to confirm that our preliminary data are representative for the site. Leighton and Associates, Inc. should also review the construction plans and project specifications, when available, to comment on the geotechnical aspects.

This report was prepared using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. The findings included in this report are considered preliminary and are subject to verification. We do not make any warranty, either expressed or implied.

CLOSING

We appreciate the opportunity to be of continued service. If you have any questions regarding this report, please do not hesitate to contact us.



Respectfully submitted,

LEIGHTON AND ASSOCIATES, INC.

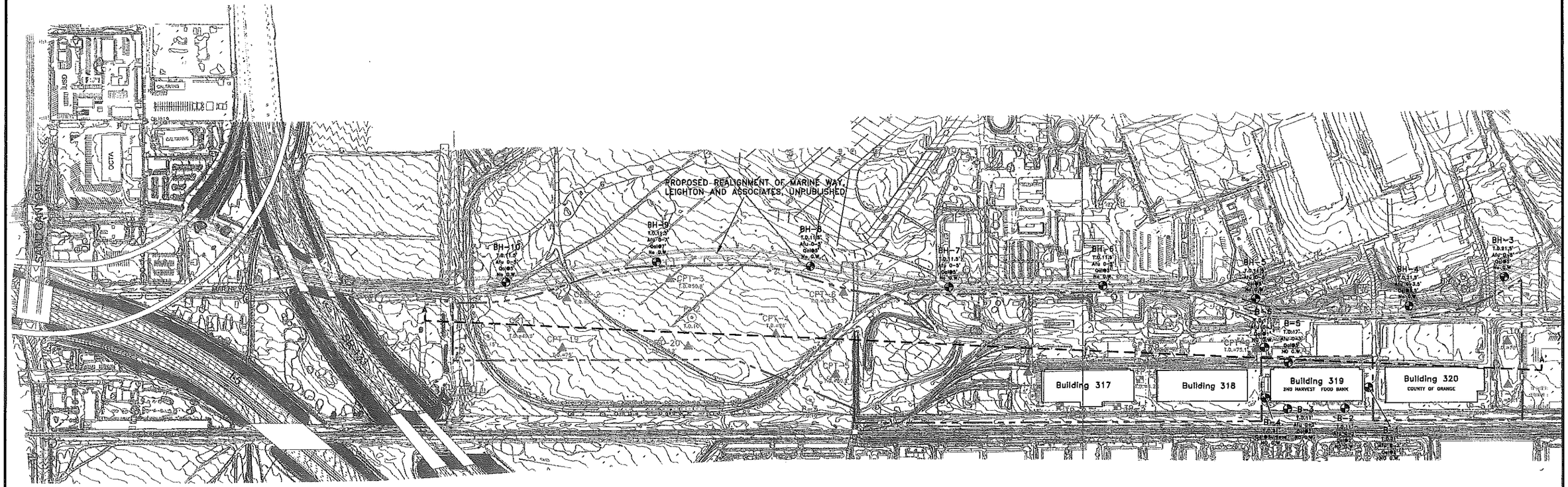
Joe Roe, PG, CEG 2456
Associate Geologist

Carl Kim, PE, GE 2620
Senior Principal Engineer

CD/JAR/CCK/lr

Attachments: Plates 1A and 1B – Site Exploration Maps
Appendix A – References
Appendix B – Boring Logs
Appendix C – Percolation Test Results
Appendix D – Laboratory Test Results

Distribution: (1) Addressee



LEGEND

SURFACE EARTH MATERIAL

Afu — ARTIFICIAL FILL, UNDOCUMENTED. DERIVED PREDOMINATELY FROM UNDERLYING PARRENT MATERIAL. FILL MATERIALS COULD CONSIST OF MIXED SANDS, SILTS AND CLAYS WITH GRAVEL, CONCRETE AND ABANDONED UTILITY DEBRIS. ACCESS ROADS AND PARKING AREAS CONSIST OF EITHER ASPHALT AND CONCRETE UNDERLAIN BY STRUCTURAL BASE MATERIALS OF VARIABLE THICKNESS. RAILROAD BALLAST, 2-3 INCHES IN SIZE CONSISTING OF CRUSHED ROCK UNDERLIES ALL RAIL LINES.

Qal — QUATERNARY AGE YOUTHFUL ALLUVIAL FAN AND ACTIVE WASH DEPOSITS. CONSISTS OF INTERBEDDED AND LATERALLY DISCONTINUOUS BEDS TO MASSIVE STRATIGRAPHY CHARACTERIZED ASO UNCONSOLIDATED SAND, SILT AND CLAY WITH VARYING PROPORTIONS OF GRAVEL. CORRELATES TO UNIT DESIGNATION Qyf, YOUNG ALLUVIAL FAN DEPOSITS USED IN THIS REPORT. COLLUVIUM AND ALLUVIUM UNDIFFERENTIATED.

SITE BOUNDARY

A — A' GEOLOGIC CROSS SECTION

CPT-21 / T.D.=50.2' — APPROXIMATE LOCATION OF CONE PENETROMETER TEST SHOWN WITH TOTAL DEPTH (T.D.) IN FEET

TP-4 / T.D.=6' — APPROXIMATE LOCATION OF TEST PIT SHOWN WITH TOTAL DEPTH (T.D.) IN FEET

BH-10 / T.D.11.5' / Afu 0-5' / Qal@5' / NO G.W. — APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING SHOWN WITH TOTAL DEPTH (T.D.), AND DEPTH TO EARTH UNITS IN FEET. GROUNDWATER (G.W.) NOT ENCOUNTERED DURING DRILLING. LEIGHTON AND ASSOCIATES, INC., UNPUBLISHED. PROJECT NO. 011783-020

B-6 / T.D.10' / NO G.W. — APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING SHOWN WITH TOTAL DEPTH (T.D.) AND DEPTH TO EARTH UNITS IN FEET GROUNDWATER (G.W.) NOT ENCOUNTERED DURING DRILLING. LEIGHTON AND ASSOCIATES, INC., JANUARY 2007a, PROJECT NO. 012095-001

P-5 / T.D.15' — APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING CONVERTED TO PERCOLATION TEST WELL SHOWN WITH TOTAL DEPTH (T.D.)

N

0 300 600
SCALE FEET

SITE EXPLORATION MAP

100-ACRE PARCEL
FORMER EL TORO MARINE CORPS AIR STATION
IRVINE, CALIFORNIA

Proj: 10695.003	Eng/Geol: CCK/JAR
Scale: 1"=300'	Date: January 2015

PLATE 1A

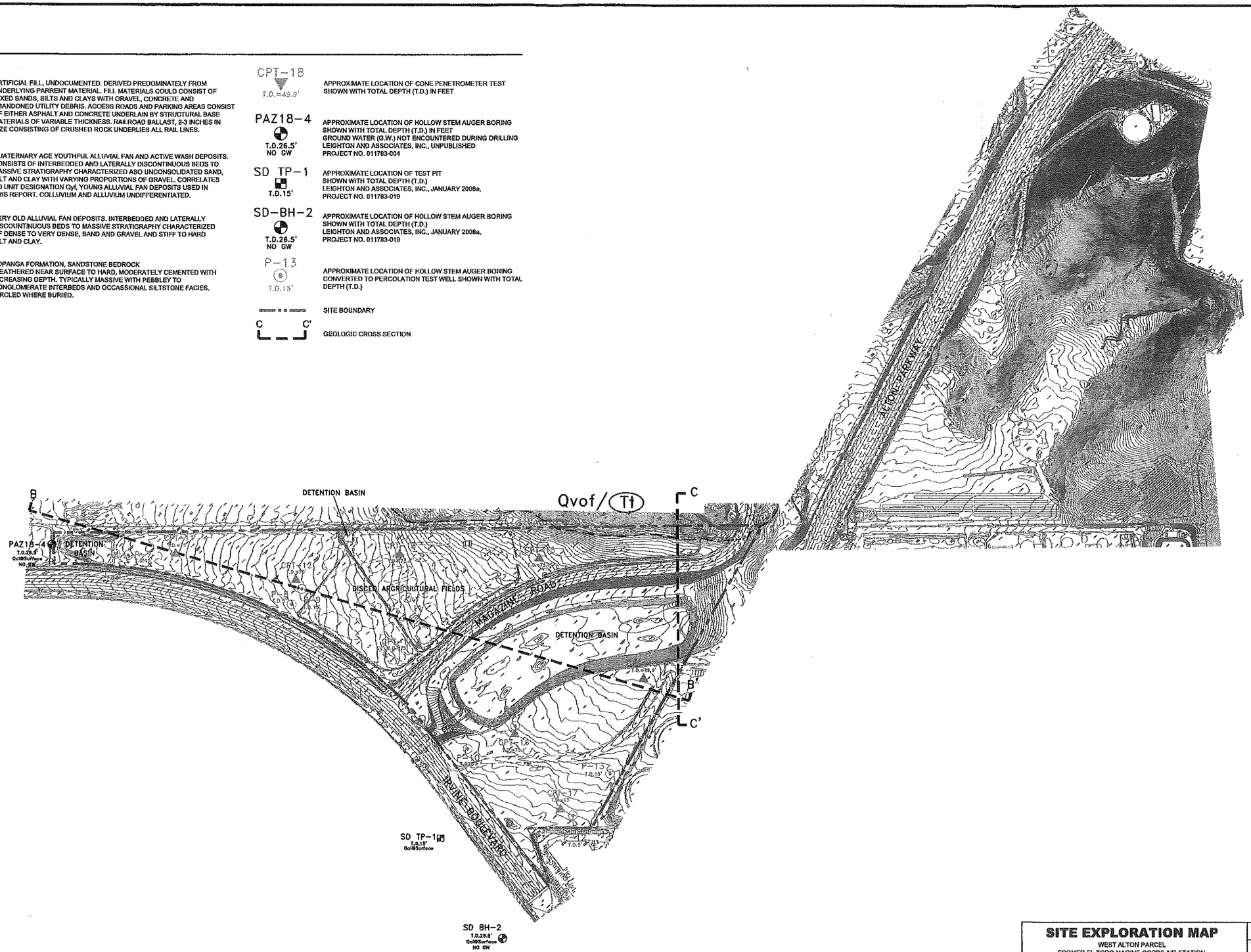
Leighton

LEGEND

SURFACE EARTH MATERIAL

Afu	ARTIFICIAL FILL, UNDOCUMENTED. DERIVED PREDOMINATELY FROM UNDERLYING PARRENT MATERIAL. FILL MATERIALS COULD CONSIST OF MIXED SANDS, SILTS AND CLAYS WITH GRAVEL, CONCRETE AND ABANDONED UTILITY DEBRIS. ACCESS ROADS AND PARKING AREAS CONSIST OF EITHER ASPHALT AND CONCRETE UNDERLAIN BY STRUCTURAL BASE MATERIALS OF VARIABLE THICKNESS. RAILROAD BALLAST, 2-3 INCHES IN SIZE CONSISTING OF CRUSHED ROCK UNDERLIES ALL RAIL LINES.
Qal	QUATERNARY AGE YOUTHFUL ALLUVIAL FAN AND ACTIVE WASH DEPOSITS. CONSISTS OF INTERBEDDED AND LATERALLY DISCONTINUOUS BEDS TO MASSIVE STRATIGRAPHY CHARACTERIZED ASO UNCONSOLIDATED SAND, SILT AND CLAY WITH VARYING PROPORTIONS OF GRAVEL. CORRELATES TO UNIT DESIGNATION Qyf, YOUNG ALLUVIAL FAN DEPOSITS USED IN THIS REPORT. COLLUVIUM AND ALLUVIUM UNDIFFERENTIATED.
Qvof	VERY OLD ALLUVIAL FAN DEPOSITS. INTERBEDDED AND LATERALLY DISCOUNTINUOUS BEDS TO MASSIVE STRATIGRAPHY CHARACTERIZED OF DENSE TO VERY DENSE, SAND AND GRAVEL AND STIFF TO HARD SILT AND CLAY.
Tt	TOPANGA FORMATION, SANDSTONE BEDROCK WEATHERED NEAR SURFACE TO HARD, MODERATELY CEMENTED WITH INCREASING DEPTH. TYPICALLY MASSIVE WITH PEBBLEY TO CONGLOMERATE INTERBEDS AND OCCASSIONAL SILTSTONE FACIES, CIRCLED WHERE BURIED.

CPT-18 T.D.=49.9'	APPROXIMATE LOCATION OF CONE PENETROMETER TEST SHOWN WITH TOTAL DEPTH (T.D.) IN FEET
PAZ18-4 T.D.26.5' NO GW	APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING SHOWN WITH TOTAL DEPTH (T.D.) IN FEET GROUND WATER (G.W.) NOT ENCOUNTERED DURING DRILLING LEIGHTON AND ASSOCIATES, INC., UNPUBLISHED PROJECT NO. 011783-004
SD TP-1 T.D.15'	APPROXIMATE LOCATION OF TEST PIT SHOWN WITH TOTAL DEPTH (T.D.) LEIGHTON AND ASSOCIATES, INC., JANUARY 2008a, PROJECT NO. 011783-019
SD-BH-2 T.D.26.5' NO GW	APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING SHOWN WITH TOTAL DEPTH (T.D.) LEIGHTON AND ASSOCIATES, INC., JANUARY 2008a, PROJECT NO. 011783-019
P-13 T.D.15'	APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING CONVERTED TO PERCOLATION TEST WELL SHOWN WITH TOTAL DEPTH (T.D.)
	SITE BOUNDARY
C C'	GEOLOGIC CROSS SECTION



SITE EXPLORATION MAP

WEST ALTON PARCEL
FORMER EL TORO MARINE CORPS AIR STATION
IRVINE, CALIFORNIA

Proj: 10695.001	Eng/Geol: CCK/JAR
Scale: 1"=200'	Date: January 2015

Drafted By: DGT Checked By: DGT

PLATE 1B

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APPENDIX A

REFERENCES

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APPENDIX A

REFERENCES

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_____, 2001, Report of Geotechnical Feasibility Study for Planning Areas I-08A and I-09A, City of Irvine, California, Project No. 990258-001, Revision dated August 10, 2001.

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_____, 2007b, Preliminary Geotechnical Investigation for Proposed Wildlife Corridor Development at Former Marine Corps Air Station, Irvine, California, Project No. 011783-012, dated June 27, 2007.

_____, 2007c, Preliminary Geotechnical Investigation for Proposed Golf Course Development PAZ 19, Park District, Heritage Fields, Former Marine Corps Air Station, Irvine, California, Project No. 011783-004, dated November 14, 2007.

_____, 2008a, Geotechnical Investigation for Available Sand Deposits for the Proposed Golf Course, PAZ 19, Park District, Heritage Fields, Former Marine Corps Air Station, Irvine, California, Project No. 011783-019, dated January 21, 2008.

_____, 2008b, Preliminary Geotechnical Investigation for The Proposed Lifelong Learning District Development, Tentative Tract 17283, Heritage Fields, Heritage Fields, Former Marine Corps Air Station, Irvine, California, Project No. 011783-016, dated April 9, 2008.

Leighton and Associates, Inc., 2014, Feasibility Level Geotechnical Investigation, 100-Acre Parcel and West Alton Parcel, Former El Toro Marine Corps Air Station, Irvine, California, Project No. 10695-001, dated August 7, 2014.

APPENDIX B
BORING LOGS

Leighton

GEOTECHNICAL BORING LOG P-1

Project No.	10695.003	**Date Drilled**	12-9-14
Project	El Toro 100 Acre and West Alton Parcels - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	228'
Location	See Plate 1A - *Site Exploration Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-1				SM	**Artificial fill, undocumented: (Afu)** @0': Silty SAND, olive brown, scattered vegetation	
								CL	@1': Sandy CLAY, olive brown, moist, some root hairs	
				S-1	4 5 6		9			
225									**Quaternary young alluvial fan deposits: (Qyf)** @2.5': Sandy CLAY, olive brown, dry, medium stiff, low plasticity with $CaCO_3$	
	5			R-1	11 14 18	107	10		@5': Becomes stiff	
220				R-2	10 13 14	111	4	SC	@8.5': Clayey SAND, light yellow brown, dry, medium dense to dense, fine grained sand, trace $CaCO_3$	-200
	10									
215				R-3	9 10 11	104	14	SM	@13.5': Grades to Silty SAND, trace of gravel, fine grained sand	
	15							CL	@14.5': Silty CLAY, brown, moist, medium stiff, low plasticity	
210									Total Depth of Boring: 15 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 5-15 feet, solid PVC Pipe to ground surface. Percolation testing performed on 12/11/2014.	
	20									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

***** This log is a part of a report by Leighton and should not be used as a stand-alone document. *****

GEOTECHNICAL BORING LOG P-2

Project No.	10695.003	**Date Drilled**	12-9-14
Project	El Toro 100 Acre and West Alton Parcels - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	241'
Location	See Plate 1A - *Site Exploration Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
	0							SM	**Artificial fill, undocumented: (Afu)** @0': Silty SAND, dark brown, moist, trace clay, root hairs, trace gravel	
240				S-1	4 6 8		4			-200
									Quaternary young alluvial fan deposits: (Qyf) @2.5': Silty SAND, yellow brown, dry to moist, medium dense, fine grained	
	5			R-1		115	3			
5								SP	@6': Grades to SAND	
				R-2					@ 8.5': No recovery	
	10									
230									Total Depth of Boring: 10 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 0-10 feet, solid PVC Pipe to ground surface. Percolation testing performed on 12/11/2014.	
	15									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

***** This log is a part of a report by Leighton and should not be used as a stand-alone document. *****

GEOTECHNICAL BORING LOG P-3

Project No.	10695.003	**Date Drilled**	12-9-14
Project	El Toro 100 Acre and West Alton Parcels - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	242'
Location	See Plate 1A - *Site Exploration Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-1				SC	**Artificial fill, undocumented: (Afu)** @0': Clayey SAND, brown, scattered vegetation, hard drilling, thin gravelly layer	
				R-1	15 27 21	116	5	SM	@1': Silty SAND, yellow brown, dry to moist, dense, trace clay, trace gravel	
240										
				R-2	40 15 14	116	5			
	5								**Quaternary young alluvial fan deposits: (Qyf)** @ 5': Silty SAND, yellow brown, dry to moist	
235										
				S-1	5 3 3		14	ML	@8.5': Sandy SILT, yellow brown to light yellow brown, dry to moist, loose to medium dense, fine grained	-200
								CL	@9.5': Silty CLAY, yellow brown, moist, medium stiff, low plasticity, moderate $CaCO_3$ in matrix	
	10									
230									Total Depth of Boring: 10 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 5-10 feet, solid PVC Pipe to ground surface. Percolation testing performed on 12/11/2014.	
	15									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

***** This log is a part of a report by Leighton and should not be used as a stand-alone document. *****

GEOTECHNICAL BORING LOG P-4

Project No.	10695.003	**Date Drilled**	12-9-14
Project	El Toro 100 Acre and West Alton Parcels - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	255'
Location	See Plate 1A - *Site Exploration Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
255	0			B-1					@0': 7-inches Asphalt Concrete over 7-inches Aggregate Base	
									Artificial fill, undocumented: (Afu)	
				S-1	2 2 4		15	CL	@2': Sandy CLAY, dark brown, moist, soft to medium stiff, low plasticity, fine grained sand	
250	5			R-1	2 4 4	113	14			-200
								SC	**Quaternary young alluvial fan deposits: (Qyf)** @5.5': Clayey SAND, dark yellow brown, moist, medium dense, low plasticity, fine grained sand	
				R-2	4 7 8	112	13			
245	10									
				R-3	6 9 9	112	7			
								SM	@14': Silty SAND, light yellow brown, moist, medium dense, fine to medium grained	
240	15							SP	@14.5': SAND, light yellow brown, moist, medium dense, fine grained	
235	20								Total Depth of Boring: 15 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 5-15 feet, solid PVC Pipe to ground surface. Percolation testing performed on 12/11/2014.	

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

***** This log is a part of a report by Leighton and should not be used as a stand-alone document. *****

GEOTECHNICAL BORING LOG P-5

Project No.	10695.003	**Date Drilled**	12-9-14
Project	El Toro 100 Acre and West Alton Parcels - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	268'
Location	See Plate 1A - *Site Exploration Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0			B-1				SM	**Artificial fill, undocumented: (Afu)** @0': Silty SAND with Gravel, olive brown, dry, scattered vegetation	
								SM-SC	@1': Becomes Silty SAND to Clayey SAND, yellow brown, trace gravel	
				S-1	2 3 4		9			
265								CL	**Quaternary young alluvial fan deposits: (Qyf)** @2.5': Sandy CLAY, yellow brown, dry, medium stiff, low plasticity, fine grained sand	
	5			R-1	11 17 23	117	6			
				R-2	11 12 13	111	5	SM	@8.5': Silty SAND, yellow brown, dry to moist, medium dense, fine grained	
	10									
255				R-3	6 8 11	103	11		@13.5': Silty SAND, light yellow brown, moist, medium dense, very fine to fine grained	-200
	15									
250									Total Depth of Boring: 15 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 5-15 feet, solid PVC Pipe to ground surface. Percolation testing performed on 12/11/2014.	
	20									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG P-6

Project No.	10695.003	**Date Drilled**	12-8-14
Project	El Toro 100 Acre and West Alton Parcels - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	428'
Location	See Plate 1B - *Site Exploration Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SM	**Artificial fill, undocumented:** @0': Silty SAND, brown, loose, wet	
				R-1	8 14 16	109	4		@1': Becomes dark brown, fine grained	
									Quaternary young alluvial fan deposits: (Qyf) @1.5': Silty SAND, light yellow brown, dry to moist, medium dense, fine to medium grained sand, trace gravel	
425				R-2	7 12 17	105	6		@3.5': Fine grained, trace unlined pores, 1 to 3 mm in size	-200
	5									
									Total Depth of Boring: 5 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 0-5 feet. Percolation testing performed on 12/10/2014.	
420										
	10									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG P-7

Project No.	10695.003	**Date Drilled**	12-8-14
Project	El Toro 100 Acre and West Alton Parcels - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	430'
Location	See Plate 1B - *Site Exploration Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
430	0			B-1				SM	**Artificial fill, undocumented: (Afu)** @0': Silty SAND, brown, moist, loose	
				R-1	10 11 12		4		**Quaternary young alluvial fan deposits: (Qyf)** @1.5': Silty SAND, light yellow brown, dry to moist, medium dense, fine to medium grained, trace gravel	
425	5			S-1	3 4 5	106	5			
420	10			R-2	12 24 40	128	9	SC	@9.5': Clayey SAND, brown, moist, very dense, low plasticity, medium to coarse grained sand, trace gravel	
				R-3	29 18 30	95	30			
415	15							CL	@14.5': Sandy CLAY, yellow brown, moist, stiff, low plasticity, fine grained sand, grades to clayey sand	
410	20								Total Depth of Boring: 15 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 5-15 feet, solid PVC Pipe to ground surface. Percolation testing performed on 12/10/2014.	

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG P-8

Project No.	10695.003	**Date Drilled**	12-8-14
Project	El Toro 100 Acre and West Alton Parcels - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	445'
Location	See Plate 1B - *Site Exploration Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
445	0							SM	**Artificial fill, undocumented: (Afu)** @0': Silty SAND, yellow brown, moist	
				R-1	8 12 13	106	3		**Quaternary young alluvial fan deposits: (Qyf)** @1': Silty SAND, light olive brown to yellow brown, dry, medium dense, fine grained sand, trace root hairs, grades to medium grained sand, friable	-200
								SP	@2.5': SAND, pale yellow brown, medium dense, dry, medium grained sand, trace gravel, friable	
				R-2	6 7 10	109	2			
440	5									
									Total Depth of Boring: 5 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 0-5 feet. Percolation testing performed on 12/10/2014.	
435	10									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG P-9

Project No.	10695.003	**Date Drilled**	12-8-14
Project	El Toro 100 Acre and West Alton Parcels - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	447'
Location	See Plate 1B - *Site Exploration Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SM	**Artificial fill, undocumented: (Afu)** @0': Silty SAND, yellow brown, loose, moist @1': Becomes dark brown	
445								SP-SM	**Quaternary young alluvial fan deposits: (Qyf)**	
				S-1	4 4 6		2		@1.5': SAND with Silt, light yellow brown, dry, dense, fine to medium grained	
	5			R-1	11 8 13	107	3	SM	@5': Silty SAND, dark brown, moist, medium dense, trace clay	-200
440								SP	@6': SAND, pale yellow brown, dry, medium dense, medium grained	
				R-2	5 7 9	103	4			
	10									
435										
				R-3	8 10 12	102	2		@13.5': Increase in grain size, friable	
	15									
430									Total Depth of Boring: 15 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 5-15 feet, solid PVC Pipe to ground surface. Percolation testing performed on 12/10/2014.	
	20									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG P-10

Project No.	10695.003	**Date Drilled**	12-8-14
Project	El Toro 100 Acre and West Alton Parcels - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	458'
Location	See Plate 1B - *Site Exploration Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SM	**Artificial fill, undocumented: (Afu)** @0': Silty SAND, yellow brown, moist,	
								SC	@1': Clayey SAND, brown, moist	
				S-1	4 3 4		2			
455								SM	**Quaternary young alluvial fan deposits: (Qyf)** @2.5': Silty SAND, light yellow brown, dry, loose, fine grained sand	
	5			R-1	4 7 12	106	15	CL	@5': Sandy CLAY, yellow brown, moist, medium stiff, low plasticity, moderate $CaCO_3$ development	
0				R-2	9 11 14	108	7			-200
	10							SM	@9': Silty SAND, light yellow brown, dry, medium dense, fine grained sand	
445				R-3	18 24 34	120	12	CL	@13.5': Sandy CLAY, yellow brown, moist, stiff to very stiff, low plasticity, fine grained sand, $CaCO_3$ stringers	
	15								Total Depth of Boring: 15 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 5-15 feet, solid PVC Pipe to ground surface. Percolation testing performed on 12/11/2014.	
440										
	20									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
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- SG SPECIFIC GRAVITY
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GEOTECHNICAL BORING LOG P-11

Project No.	10695.003	**Date Drilled**	12-8-14
Project	El Toro 100 Acre and West Alton Parcels - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	463'
Location	See Plate 1B - *Site Exploration Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SM	**Artificial fill, undocumented: (Afu)** @0': Silty SAND, yellow brown, moist	
				R-1	15 28 42	122	10		**Quaternary young alluvial fan deposits: (Qyf)** @1': Silty SAND, yellow brown, moist, dense, fine to medium grained sand, trace subangular gravel, trace clay	-200
460										
				R-2	19 24 40	123	5		@3.5': Some subangular gravel, up to 1-inch in long dimension	
	5									
									Total Depth of Boring: 5 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 0-5 feet. Percolation testing performed on 12/11/2014.	
455										
	10									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
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GEOTECHNICAL BORING LOG P-12

Project No.	10695.003	**Date Drilled**	12-8-14
Project	El Toro 100 Acre and West Alton Parcels - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	456'
Location	See Plate 1B - *Site Exploration Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SM	**Artificial fill, undocumented: (Afu)**	
455				R-1	9 9 7	106	8		@1': Silty SAND, dark yellow brown, moist, loose to medium dense, trace gravel, concrete fragments, trace clay, fine grained sand	
				R-2	6 10 11	108	5		**Quaternary young alluvial fan deposits: (Qyf)** @3.5': Silty SAND, yellow brown, moist, loose to medium dense, fine grained sand, grades to sand to silty sand	-200
	5									
450									Total Depth of Boring: 5 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 0-5 feet. Percolation testing performed on 12/11/2014.	
	10									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG P-13

Project No.	10695.003	**Date Drilled**	12-8-14
Project	El Toro 100 Acre and West Alton Parcels - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	462'
Location	See Plate 1B - *Site Exploration Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-1				SM	**Artificial fill, undocumented: (Afu)** @0': Silty SAND, yellow brown, moist @1': Becomes dark brown, fine to medium grained sand	
460				S-1	2 3 4		4			
								SP-SM	**Quaternary young alluvial fan deposits: (Qyf)** @2.5': Silty SAND to SAND, light yellow brown, moist, loose, fine grained	
	5			R-1	10 8 9	101	9	SP	@5': SAND, pale yellow brown, dry, medium dense, friable, medium grained	
455								CL	@6': Sandy CLAY, olive brown, dry, stiff, low plasticity, fine grained sand	
	10			R-2	14 26 33	86	5	SM	@8.5': Silty SAND, pale yellow brown, dry, medium dense to dense, friable, fine to medium grained, some mechanically fractured gravel	-200
450				R-3	6 10 13	108	6		@13.5': Silty SAND, light yellow brown, dry, medium dense, fine grained, grades to silty clay, dry	
	15									
445									Total Depth of Boring: 15 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 5-15 feet, solid PVC Pipe to ground surface. Percolation testing performed on 12/11/2014.	
	20									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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APPENDIX C
PERCOLATION TEST RESULTS

Leighton

PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: SC and SM
Liquid Description: Clear clean water
Tested By: CD

Test Hole Number: P-1
Date Excavated: 12-9-14
Date Tested: 12-11-14
Depth of boring (ft): 15
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	12:07 12:32	25	60.0	139.6	79.6	Yes
2	12:41 13:06	25	60.7	131.6	70.9	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
1:10 1:24	14	14	180	63.7	109.8	46.1	197.5
1:27 1:37	10	27	180	68.6	106.3	37.7	226.1
1:38 1:48	10	38	180	67.3	105.6	38.3	229.7
1:51 2:01	10	51	180	69.7	105.1	35.4	212.4
2:02 2:12	10	62	180	67.8	104.2	36.4	218.2
2:14 2:24	10	74	180	68.2	103.2	35.0	210.2

Initial Height of Water (Ho) = 111.84
Final Height of Water (Hf) = 76.8
Change in Height Over Time (ΔH) = 35.04
Average Head Over Time (Havg) = 94.32

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

I_t= 4.37 in/hr

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PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: SP and SM
Liquid Description: Clear clean water
Tested By: CD/ZS

Test Hole Number: P-2
Date Excavated: 12-9-14
Date Tested: 12-11-14
Depth of boring (ft): 10
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	11:56 12:21	25	9.6	111.1	101.5	Yes
2	12:27 12:52	25	11.4	111.4	100.0	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
2:45 2:50	5	5	120	13.2	91.8	78.6	943.2
2:58 3:03	5	18	120	23.4	104.6	81.2	974.9
3:09 3:12	3	27	120	13.4	56.4	43.0	859.2
3:12 3:15	3	30	120	14.0	54.5	40.4	808.8
3:16 3:19	3	34	120	14.2	55.8	41.6	832.8
3:20 3:23	3	38	120	16.3	54.1	37.8	756.0
3:24 3:27	3	42	120	15.4	51.7	36.4	727.2
3:28 3:31	3	46	120	14.0	49.8	35.8	715.2
3:32 3:35	3	50	120	14.2	50.1	35.9	718.0
3:35 3:38	3	53	120	14.4	49.7	35.3	706.0
3:39 3:42	3	57	120	14.1	49.8	35.7	714.0
3:43 3:46	3	61	120	14.2	49.6	35.4	708.0

Initial Height of Water (Ho) = 105.8
Final Height of Water (Hf) = 70.4
Change in Height Over Time (ΔH) = 35.4
Average Head Over Time (Havg) = 88.1

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

I_t= **15.72** in/hr

PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: SM and ML
Liquid Description: Clear clean water
Tested By: CD

Test Hole Number: P-3
Date Excavated: 12-9-14
Date Tested: 12-11-14
Depth of boring (ft): 10
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	12:16 12:41	25	62.4	89.9	27.5	Yes
2	12:48 13:13	25	60.2	88.2	28.0	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
1:20 1:31	11	11	120	62.4	72.6	10.2	55.6
1:32 1:42	10	22	120	62.4	69.8	7.4	44.6
1:43 1:54	11	34	120	62.0	69.7	7.7	41.9
1:56 2:06	10	46	120	64.4	71.4	7.0	41.8
2:08 2:18	10	58	120	62.8	70.3	7.6	45.4
2:19 2:29	10	69	120	64.9	71.8	6.8	41.0

Initial Height of Water (Ho) = 55.08
Final Height of Water (Hf) = 48.24
Change in Height Over Time (ΔH) = 6.84
Average Head Over Time (Havg) = 51.66

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

I_t = 1.53 in/hr

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PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: SM and CL
Liquid Description: Clear clean water
Tested By: ZS

Test Hole Number: P-4
Date Excavated: 12-9-14
Date Tested: 12-11-14
Depth of boring (ft): 15
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	11:26 11:51	25	69.6	141.6	72.0	Yes
2	12:08 12:38	30	70.8	125.0	54.2	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
12:40 12:52	12	12	180	66.0	110.4	44.4	222.0
12:57 13:11	14	31	180	63.6	105.5	41.9	179.5
13:16 13:31	15	51	180	64.2	108.6	44.4	177.6
13:35 13:47	12	67	180	69.5	105.5	36.0	180.0
13:51 14:05	14	85	180	66.8	107.6	40.8	174.9
14:09 14:24	15	104	180	64.7	108.2	43.6	174.2

Initial Height of Water (Ho) = 115.32
Final Height of Water (Hf) = 71.76
Change in Height Over Time (ΔH) = 43.56
Average Head Over Time (Havg) = 93.54

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

I_t = 3.65 in/hr

PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: SM and CL
Liquid Description: Clear clean water
Tested By: ZS

Test Hole Number: P-5
Date Excavated: 12-9-14
Date Tested: 12-11-14
Depth of boring (ft): 15
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	11:40 12:05	25	123.6	169.8	46.2	Yes
2	12:15 12:44	29	114.0	167.6	53.6	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
12:46 13:03	17	17	180	123.6	162.6	39.0	137.6
13:13 13:23	10	37	180	122.9	162.8	40.0	239.8
13:25 13:40	15	54	180	122.5	160.7	38.2	152.6
13:42 13:57	15	71	180	120.6	159.8	39.2	157.0
14:00 14:15	15	89	180	121.1	160.2	39.1	156.5
14:16 14:27	11	101	180	121.8	151.4	29.6	161.7

Initial Height of Water (Ho) = 58.2
Final Height of Water (Hf) = 28.56
Change in Height Over Time (ΔH) = 29.64
Average Head Over Time (Havg) = 43.38

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

I_t= 7.13 in/hr

PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: SM and SP
Liquid Description: Clear clean water
Tested By: CD

Test Hole Number: P-6
Date Excavated: 12-8-14
Date Tested: 12-10-14
Depth of boring (ft): 5
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	8:57 9:22	25	11.4	56.4	45.0	Yes
2	9:23 9:48	25	7.8	54.0	46.2	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
10:03 10:13	10	10	60	7.2	29.8	22.6	135.4
10:14 10:26	12	23	60	8.4	35.4	27.0	135.0
10:27 10:37	10	34	60	8.0	30.6	22.6	135.4
10:39 10:49	10	46	60	7.8	30.8	23.0	138.2
10:51 11:01	10	58	60	7.4	28.7	21.2	127.4
11:02 11:12	10	69	60	7.6	28.6	21.0	126.0

Initial Height of Water (Ho) = 52.44
Final Height of Water (Hf) = 31.44
Change in Height Over Time (ΔH) = 21
Average Head Over Time (Havg) = 41.94

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

I_t= 5.74 in/hr

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PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: SM and SC
Liquid Description: Clear clean water
Tested By: CD

Test Hole Number: P-7
Date Excavated: 12-8-14
Date Tested: 12-10-14
Depth of boring (ft): 15
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	10:06 10:31	25	60.0	148.8	88.8	Yes
2	10:33 10:53	20	60.0	122.4	62.4	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
10:57 11:07	10	10	180	64.8	106.2	41.4	248.4
11:09 11:23	14	26	180	68.2	124.8	56.6	242.7
11:24 11:34	10	37	180	67.8	107.2	39.4	236.2
11:37 11:47	10	50	180	67.2	106.2	39.0	234.0
11:49 11:59	10	62	180	65.4	116.4	51.0	306.0
12:00 12:10	10	73	180	66.5	105.2	38.8	232.6

Initial Height of Water (Ho) = 113.52
Final Height of Water (Hf) = 74.76
Change in Height Over Time (ΔH) = 38.76
Average Head Over Time (Havg) = 94.14

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

I_t = 4.84 in/hr

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PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: SM and SP
Liquid Description: Clear clean water
Tested By: CD

Test Hole Number: P-8
Date Excavated: 12-8-14
Date Tested: 12-10-14
Depth of boring (ft): 5
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	9:06 9:31	25	9.0	60.0	51.0	Yes
2	9:33 9:58	25	9.0	60.0	51.0	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
11:17 11:23	6	6	60	18.0	55.2	37.2	372.0
11:25 11:30	5	13	60	17.8	51.4	33.6	403.2
12:09 12:15	6	58	60	12.7	47.8	35.0	350.4
12:16 12:22	6	65	60	12.0	47.4	35.4	354.0
12:25 12:30	5	73	60	11.0	40.2	29.2	349.9
12:31 12:36	5	79	60	12.5	42.2	29.8	357.1
12:37 12:42	5	85	60	12.4	42.5	30.1	361.4
12:43 12:48	5	91	60	13.4	43.0	29.5	354.2
12:49 12:54	5	97	60	12.7	40.9	28.2	338.4
12:55 13:00	5	103	60	12.6	40.4	27.8	334.1
13:01 13:06	5	109	60	13.2	40.9	27.7	332.6
13:07 13:12	5	115	60	13.6	41.4	27.8	334.1

Initial Height of Water (Ho) = 46.44
Final Height of Water (Hf) = 18.6
Change in Height Over Time (ΔH) = 27.84
Average Head Over Time (Havg) = 32.52

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

I_t = **19.36** in/hr

PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: SM and SP
Liquid Description: Clear clean water
Tested By: CD

Test Hole Number: P-9
Date Excavated: 12-8-14
Date Tested: 12-10-14
Depth of boring (ft): 15
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	10:21 10:46	25	76.8	180.0	103.2	Yes
2	10:55 11:20	25	74.4	180.0	105.6	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
11:21 11:26	5	5	180	66.2	120.0	53.8	645.1
12:08 12:13	5	52	180	64.8	123.6	58.8	705.6
12:14 12:20	6	59	180	74.4	121.8	47.4	474.0
12:22 12:27	5	66	180	65.4	116.6	51.2	614.9
12:29 12:34	5	73	180	67.4	117.2	49.8	597.6
12:35 12:40	5	79	180	66.1	113.8	47.6	571.7
12:41 12:46	5	85	180	67.3	115.2	47.9	574.6
12:47 12:52	5	91	180	66.5	112.8	46.3	555.8
12:53 12:58	5	97	180	65.0	112.4	47.4	568.8
12:59 13:04	5	103	180	66.6	113.8	47.2	565.9
13:05 13:10	5	109	180	66.2	112.8	46.6	558.7
13:11 13:16	5	115	180	66.4	113.2	46.8	561.6

Initial Height of Water (Ho) = 113.64
Final Height of Water (Hf) = 66.84
Change in Height Over Time (ΔH) = 46.8
Average Head Over Time (Havg) = 90.24

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

I_t= **12.18** in/hr

PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: CL and SM
Liquid Description: Clear clean water
Tested By: ZS

Test Hole Number: P-10
Date Excavated: 12-8-14
Date Tested: 12-11-14
Depth of boring (ft): 15
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	7:41 8:04	23	65.9	108.1	42.2	Yes
2	8:08 8:33	25	67.2	109.1	41.9	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
8:37 8:47	10	10	180	68.5	78.5	10.0	59.8
8:47 8:57	10	20	180	71.4	77.3	5.9	35.3
8:57 9:07	10	30	180	66.0	72.1	6.1	36.7
9:07 9:17	10	40	180	66.0	72.1	6.1	36.7
9:17 9:27	10	50	180	66.0	72.8	6.8	41.0
9:27 9:37	10	60	180	66.0	72.0	6.0	36.0

Initial Height of Water (Ho) = 114
Final Height of Water (Hf) = 108
Change in Height Over Time (ΔH) = 6
Average Head Over Time (Havg) = 111

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

I_t= 0.64 in/hr

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PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: SM
Liquid Description: Clear clean water
Tested By: ZS

Test Hole Number: P-11
Date Excavated: 12-8-14
Date Tested: 12-11-14
Depth of boring (ft): 5
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	7:35 8:00	25	11.6	28.8	17.2	Yes
2	8:00 8:25	25	8.6	23.2	14.5	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
8:31 8:41	10	10	60	12.0	19.2	7.2	43.2
8:41 8:51	10	20	60	12.0	17.5	5.5	33.1
8:51 9:01	10	30	60	12.0	17.2	5.2	31.0
9:01 9:11	10	40	60	11.6	16.7	5.0	30.2
9:11 9:21	10	50	60	10.9	17.8	6.8	41.0
9:21 9:31	10	60	60	12.0	17.8	5.8	34.6

Initial Height of Water (Ho) = 48
Final Height of Water (Hf) = 42.24
Change in Height Over Time (ΔH) = 5.76
Average Head Over Time (Havg) = 45.12

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

I_t = 1.47 in/hr

PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: SM
Liquid Description: Clear clean water
Tested By: CD

Test Hole Number: P-12
Date Excavated: 12-8-14
Date Tested: 12-11-14
Depth of boring (ft): 5
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	7:58 8:23	25	9.0	55.8	46.8	Yes
2	8:27 8:52	25	9.0	55.6	46.6	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
8:56 9:06	10	10	60	11.0	45.6	34.6	207.4
9:08 9:18	10	22	60	12.4	46.7	34.3	205.9
9:19 9:29	10	33	60	9.6	47.2	37.6	225.4
9:30 9:40	10	44	60	14.4	48.6	34.2	205.2
9:43 9:53	10	57	60	12.5	48.7	36.2	217.4
9:55 10:05	10	69	60	12.6	48.7	36.1	216.7

Initial Height of Water (Ho) = 47.4
Final Height of Water (Hf) = 11.28
Change in Height Over Time (ΔH) = 36.12
Average Head Over Time (Havg) = 29.34

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

I_t= 13.83 in/hr

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PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: SM, SP and CL
Liquid Description: Clear clean water
Tested By: CD

Test Hole Number: P-12
Date Excavated: 12-8-14
Date Tested: 12-11-14
Depth of boring (ft): 15
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	7:52 8:17	25	60.0	156.6	96.6	Yes
2	8:22 8:47	25	60.0	153.4	93.4	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
8:51 9:01	10	10	180	61.2	114.6	53.4	320.4
9:03 9:13	10	22	180	66.7	113.8	47.0	282.2
9:15 9:25	10	34	180	67.8	113.9	46.1	276.5
9:27 9:37	10	46	180	61.2	108.1	46.9	281.5
9:38 9:48	10	57	180	63.7	109.0	45.2	271.4
9:50 10:00	10	69	180	62.6	107.6	45.0	270.0

Initial Height of Water (Ho) = 117.36
Final Height of Water (Hf) = 72.36
Change in Height Over Time (ΔH) = 45
Average Head Over Time (Havg) = 94.86

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

I_t= **5.58** **in/hr**

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APPENDIX D
LABORATORY TEST RESULTS

Leighton

Boring No.	P-1	P-2	P-3	P-4	P-5	P-6	P-8	P-9
Sample No.	R-2	S-1	S-1	R-1	R-3	R-2	R-1	R-1
Depth (ft.)	8.5	2.0	8.5	5.0	13.5	3.5	1.0	5.0
Sample Type	Ring	SPT	SPT	Ring	Ring	Ring	Ring	Ring
Soil Identification	Brown clayey sand (SC)	Brown silty sand (SM)	Brown sandy silt s(ML)	Dark olive gray clayey sand (SC)	Brown silty sand (SC)	Brown silty sand (SM)	Brown silty sand (SM)	Light brown silty sand (SM)
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dry Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weight of Container (g)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Moisture Content (%)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Sample Dry Weight Determination								
Weight of Sample + Container (g)	553.4	522.7	491.4	561.6	531.2	520.1	556.5	528.2
Weight of Container (g)	132.7	126.7	136.8	133.1	144.9	138.4	135.7	137.9
Weight of Dry Sample (g)	**420.7**	**396.0**	**354.6**	**428.5**	**386.3**	**381.7**	**420.8**	**390.3**
Container No.:								
After Wash								
Method (A or B)	B	B	B	B	B	B	B	B
Dry Weight of Sample + Cont. (g)	463.2	410.2	270.8	388.9	414.6	341.0	448.7	470.5
Weight of Container (g)	132.7	126.7	136.8	133.1	144.9	138.4	135.7	137.9
Dry Weight of Sample (g)	330.5	283.5	134.0	255.8	269.7	202.6	313.0	332.6
% Passing No. 200 Sieve	**21.4**	**28.4**	**62.2**	**40.3**	**30.2**	**46.9**	**25.6**	**14.8**
% Retained No. 200 Sieve	78.6	71.6	37.8	59.7	69.8	53.1	74.4	85.2

Leighton

PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: Lowe Enterprises/El Toro 100-Acre Redevelopment

Project No.: 10695.003

Tested By: S. Felter Date: 12/18/14

Boring No.	P-10	P-11	P-12	P-13				
Sample No.	R-2	R-1	R-2	R-2				
Depth (ft.)	8.5	1.0	3.5	8.5				
Sample Type	Ring	Ring	Ring	Ring				
Soil Identification	Brown silty sand (SM)	Brown silty sand (SM)	Brown silty sand (SM)	Brown silty sand (SM)				
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00	0.00	0.00				
Dry Weight of Soil + Container (g)	0.00	0.00	0.00	0.00				
Weight of Container (g)	1.00	1.00	1.00	1.00				
Moisture Content (%)	**0.00**	**0.00**	**0.00**	**0.00**				
Sample Dry Weight Determination								
Weight of Sample + Container (g)	542.1	610.4	552.2	540.9				
Weight of Container (g)	140.0	142.6	140.8	140.6				
Weight of Dry Sample (g)	**402.1**	**467.8**	**411.4**	**400.3**				
Container No.:								
After Wash								
Method (A or B)	B	B	B	B				
Dry Weight of Sample + Cont. (g)	448.2	470.4	482.4	448.2				
Weight of Container (g)	140.0	142.6	140.8	140.6				
Dry Weight of Sample (g)	308.2	327.8	341.6	307.6				
% Passing No. 200 Sieve	**23.4**	**29.9**	**17.0**	**23.2**				
% Retained No. 200 Sieve	76.6	70.1	83.0	76.8				

Leighton

PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: Lowe Enterprises/El Toro 100-Acre Redevelopment

Project No.: 10695.003

Tested By: S. Felter Date: 12/18/14

F

Attachment F

Operations and Maintenance (O&M) & Inspection Form

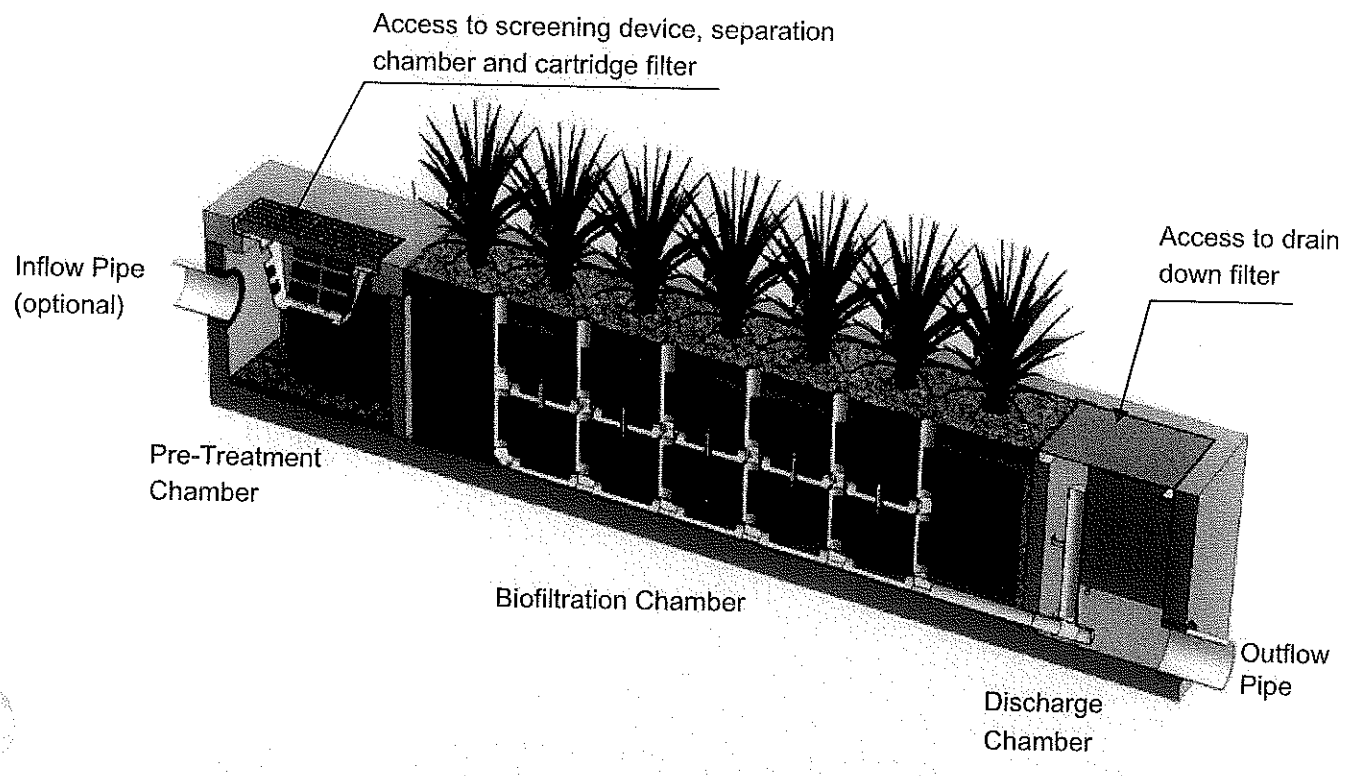
(Section to be updated with Final WQMP)

Maintenance Guidelines for Modular Wetland System - Linear

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
  - (*5 minute average service time*).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
  - (*10 minute average service time*).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
  - (*10-15 minute per cartridge average service time*).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
  - (*5 minute average service time*).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre-Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screening device.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.

2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.

3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

4. Entry into chambers may require confined space training based on state and local regulations.

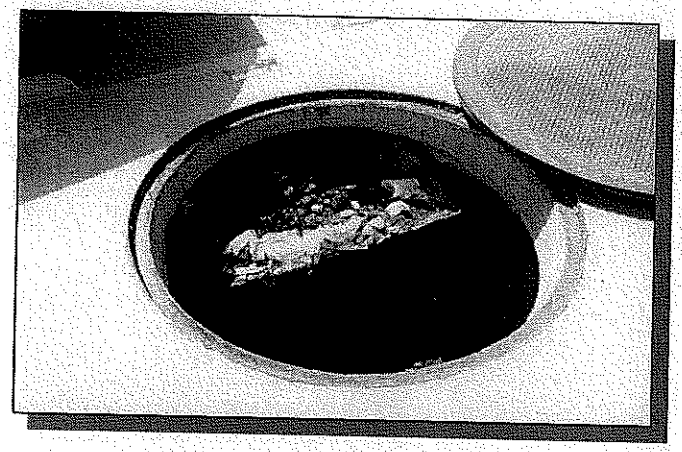
5. No fertilizer shall be used in the Biofiltration Chamber.

6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

Maintenance Procedure Illustration

Screening Device

The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.

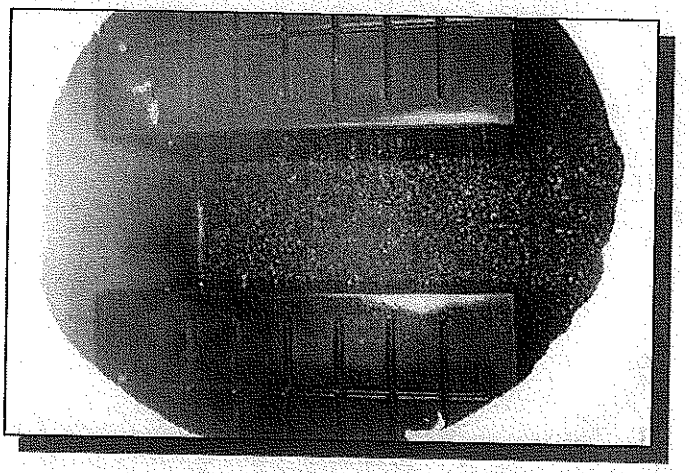


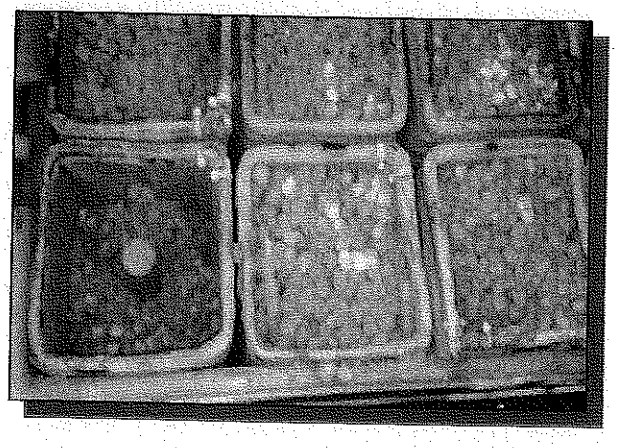
Separation Chamber

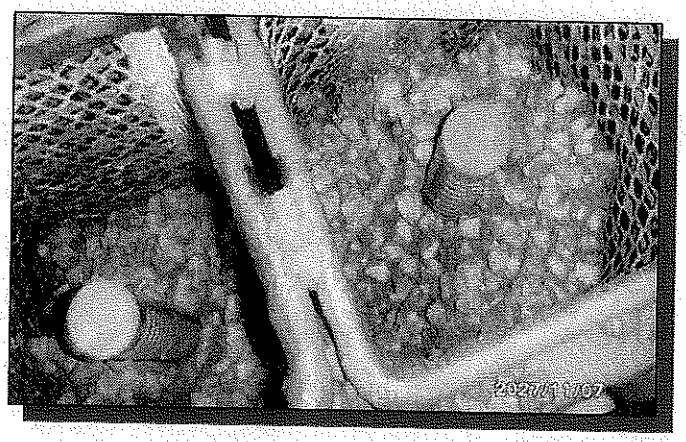
The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.

Cartridge Filters

The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.

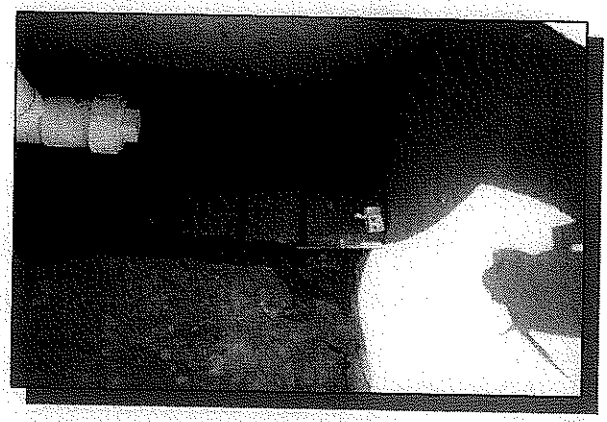






Drain Down Filter

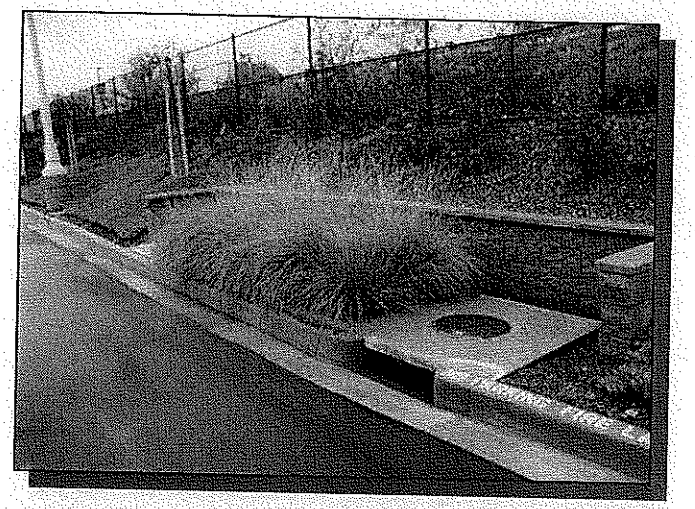
The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.

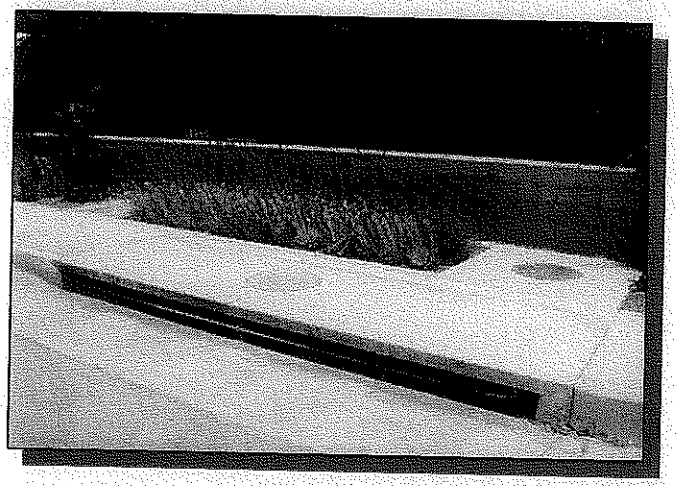


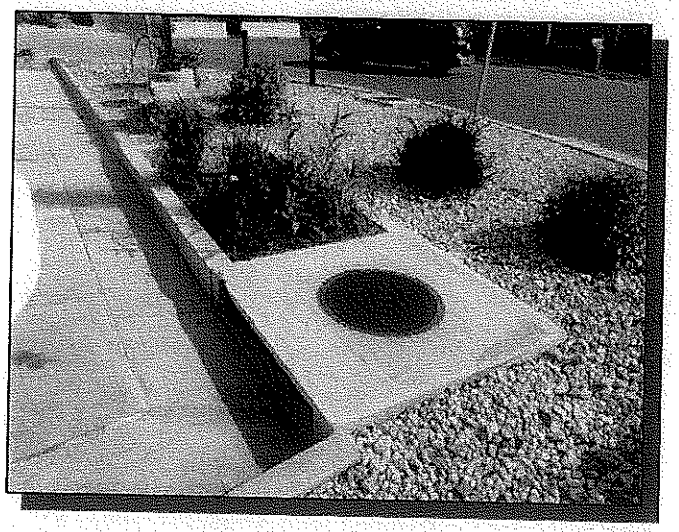
MODULAR WETLANDS

Trim Vegetation

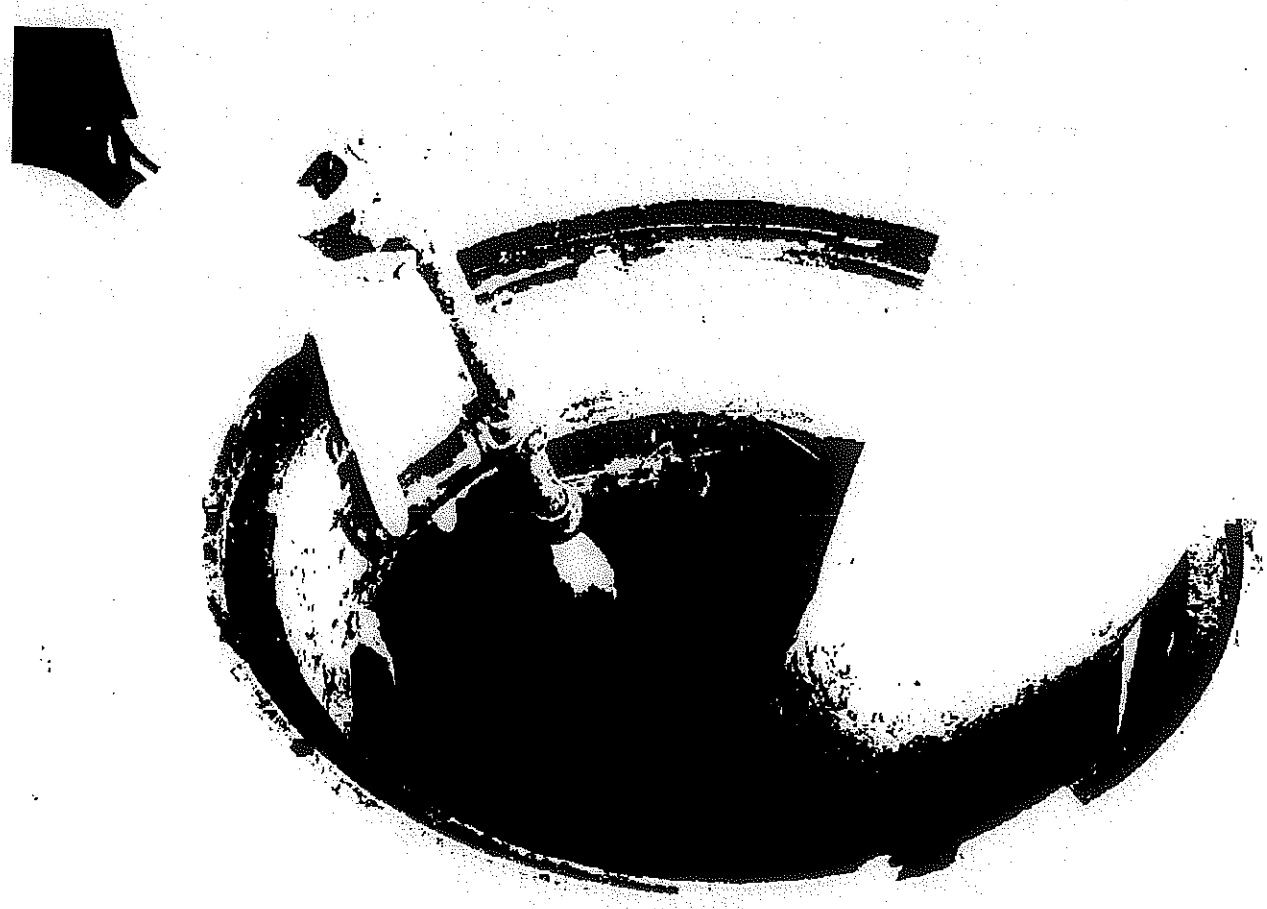
Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.







Inspection Form



Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

BIO CLEAN ENVIRONMENTAL SERVICES, INC.

Inspection Report
Modular Wetlands System

MODULAR WETLANDS

Project Name _____

Project Address _____ (city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): _____ Size (22', 14' or etc.): _____

Structural Integrity:	Yes	No	Comments
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	Yes	No
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

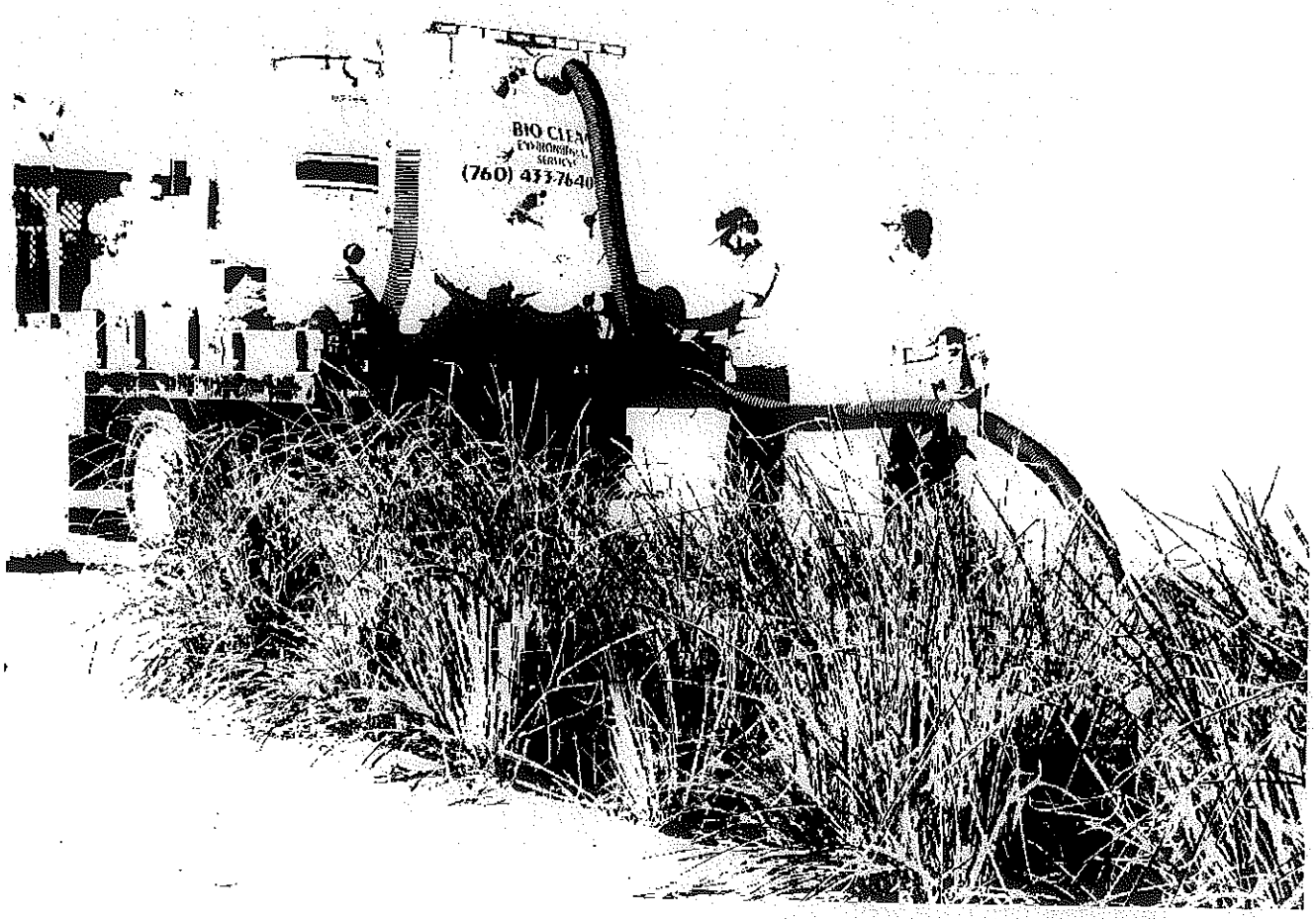
Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: _____

2972 San Luis Rey Road, Oceanside, CA 92058 P (760) 433-7640 F (760) 433-3176

MODULAR WETLANDS

Maintenance Report



Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

BIG CLEAN ENVIRONMENTAL SERVICES, INC.

Cleaning and Maintenance Report
Modular Wetlands System

MODULAR WETLANDS

Project Name _____

Project Address _____ (city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) _

Inspector Name _____ Date ____/____/_____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

For Office Use Only

(Reviewed By)

(Date)

Office personnel to complete section to the left.

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:

2972 San Luis Rey Road, Oceanside, CA 92058 P. 760.433.7640 F. 760.433.3176

CUDO™ Stormwater Cube

(Underground Retention / Detention / Infiltration / Water Reuse Systems)

Operations and Maintenance Manual

Version 1.01 – July 08, 2009

CUDO™ Stormwater Cube – Modular Stormwater Systems

Description / Basic Function
CUDO™ is a modular stormwater system comprised of a grouping of modular polypropylene or concrete cubes that when constructed form an underground storage area for stormwater. This system can be used for infiltration, retention, detention or water reuse. CUDO™ can help achieve runoff detainment and storage to help attenuate the peak flow to pre-construction levels and can help conform to current Low Impact Development requirements.

Infiltration
The purpose of a CUDO™ infiltration system is to capture stormwater runoff, store the runoff, and then allow it to percolate into the ground via the open space area of the cubes and perforations in the side wall. The system is backfilled with a Class I material defined by ASTM D2321 as a cleaned open graded rock or a Class II permeable sand. The rock or sand provide additional storage capacity but also allow for a percolation interface with the native material. The ground water is "recharged" with this type of system.

Detention
The purpose of a CUDO™ detention system is to capture stormwater runoff, store the runoff, and then allow it to be released at a controlled rate through an appropriately sized orifice control. A detention system helps attenuate the peak flow from the site assuring that pre-development runoff flows are not exceeded as a result of the development. A CUDO™ detention requires the cubes to be encapsulated with an impermeable liner for the polypropylene system or the seams of the concrete system to be sealed with a water proof mastic.

Retention
A CUDO™ retention system is a hybrid system. It is a combination of a detention system and an infiltration system. A retention system is utilized to attenuate peak flow as well as promote groundwater re-charge. A retention system is outfitted with an overflow pipe at the top of the system which allows the system to fill for infiltration but also outlet if the ground is saturated.

Water Reuse
The purpose of a water-reuse CUDO™ system is to capture and store water for future use. The system is constructed in a similar fashion to a detention system but instead of a controlled outlet the system is constructed with an emergency overflow. A water reuse system is a LID device that helps attenuate peak flows as well as conserve water. Water may be reused through an active pump system or passive irrigation.

Inspection/Cleanout Ports
Inspection and cleanout ports are 18-inch diameter vertical risers connected to the uppermost polypropylene CUDO™ cubes or up to 30-inch manhole access connected to the concrete CUDO™. They are used for entrance into the system, or for access to place vacuum truck hoses or water-jetting devices or CCTV equipment. Ports are strategically located near inlet and outlet pipes and in other areas or probable deposition in the system. It is recommended to keep surface level access lids sealed and bolted at all times when the system is in service.

Inlet Bay
Some systems are configured so that pretreatment of the stormwater occurs within the CUDO™ system. In this case the CUDO™ system will house an inlet bay. The inlet bay is separated from the rest of the CUDO™ system by sidewall plugs and is intended to separate gross pollutants, trash and debris and floatables from the CUDO™ system and pre-treatment device. The bay contains its own sump area and unique access ports.

Maintenance Overview for CUDO

State and Local regulations require that stormwater storage systems be maintained and serviced on a recurring basis. The purpose of maintaining a clean and obstruction free CUDO™ system is to ensure the system performs the intended function of the primary design. Trash and debris, floatables, gross pollutants and sediment can build up in the CUDO™ leading to clogging of the native soil interface or blockage of the inlet or outlet pipes. This can cause the system to function improperly by limiting storage volume, limiting the design percolation rates or impeding flow in and out of the system. Downstream and upstream, areas could run the risk of flooding and deleterious environmental impact.

Recommended Frequency of Service

It is recommended that the CUDO™ stormwater systems be serviced on a regularly occurring basis. Ultimately the frequency depends on the amount of runoff, pollutant loading, and interference from trash, debris and gross pollutants as well as proper maintenance of upstream pretreatment devices. However, it is recommended that each installation be inspected at least two times per year to assess service needs.

Recommended Timing of Service

Guidelines for the timing of service are as follows:

1. For areas with a definite rainy season the system should be serviced prior to and following the rainy season.
2. For areas subject to year-round rainfall service should occur on a regularly occurring basis. (A minimum of two times per year.)
3. For areas with winter snow and summer rain the system should be serviced prior to and after the snow season.
4. For installed devices that are subject to dry weather flows only (i.e. wash racks, parking garages, etc...) the unit should be serviced on a regularly occurring basis. (A minimum of two times per year.)

Inspection

An inspection should be performed when the system is new. This allows the owner to establish a baseline condition for comparison to future inspections. Sediment build up can typically be monitored without entering the system. (No confined space entry.) Initial and subsequent inspection data should be recorded and filed for reference. Some regulatory agencies require that the results of the inspections be documented and reported. Inspection reports should comply with regulatory requirements and be submitted as required.

Inspection Procedures

1. Locate the inspection, cleanout and access ports. Inspection and cleanout ports are typically 18-inch diameter. Access ports are typically 24-inch or 30-inch diameter. Pictures should be taken to document the location or a site map should be generated to detail the as-built locations of the ports.
2. Unbolt and remove the access port lids.
3. Insert a measuring device into the opening making note of a point of reference to determine the quantity of sediment and other accumulated material. If access is required to measure, ensure only certified confined space entry personnel having appropriate equipment are allowed to enter the system.
4. In addition, for accessible concrete CUDO™ systems personnel should utilize appropriate confined space entry procedures to enter the system and photograph its condition.
5. Inspect inlet and outlet locations for obstructions. Obstructions should be removed at this time.
6. Inspect the structural components of the system.
7. Fill in the CUDO™ Inspection/Maintenance Data Sheet and send a copy to the regulatory agency if necessary.

Disinfection of Water Reuse System

Periodic disinfection of water held for reuse may be required to abate bacteria and algae growth. This may be done using calcium hypochlorite tablets or by the addition of an ozone generator in a small recirculation system.

Maintenance

Cleanout of the CUDO™ system should be considered if there is sediment buildup of two or more inches at over 50% of the inspection ports. Cleaning shall be performed if sediment buildup is two inches or more over 75% of the system floor. In the event of a spill of a foreign substance, cleanout of the system should be considered.

Maintenance Procedures

1. Locate the inspection, cleanout and access ports. Inspection and cleanout ports are typically 18-inch diameter. Access ports are typically 24-inch or 30-inch diameter. Pictures should be taken to document the location or a site map should be generated to detail the as-built locations of the ports.
2. Unbolt and remove the access port lids.
3. Measure the sediment buildup at each port. If access is required to measure ensure only certified confined space entry personnel having appropriate equipment are allowed to enter the system.
4. A thorough cleaning of the system (inlets, outlets, ports, and inlet bays) shall be performed by either a vacuum truck or by manual methods.
5. Inspect inlet and outlet locations for obstructions. Obstructions should be removed at this time.
6. Inspect the structural components of the system.
7. Fill in the CUDO™ Inspection/Maintenance Data Sheet and send a copy to the regulatory agency if necessary.

Inspection / Maintenance Requirements

Listed below are some recommendations for equipment and training for personnel to inspect and maintain a CUDO™ system.

Personnel – OSHA Confined Space Entry Training is a prerequisite for entrance into a system. In the state of California personnel should be CalOSHA certified.

Equipment – Record Taking (pen, paper, voice recorder)
Proper Clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
Flashlight
Tape Measure
Measuring Stick
Pry Bar
Traffic Control (Flagging, barricades, signage, cones, etc.)
First aid materials
Debris and Contaminant collectors
Debris and Contaminant containers
Vacuum Truck

Disposal of Gross Pollutants, Hydrocarbons, and Sediment

The collected gross pollutants, hydrocarbons, and sediment shall be offloaded from the vacuum truck into DOT approved containers for disposal. Once in the container the maintenance contractor has possession and is responsible for disposal in accordance with local, state and federal agency requirements.

Note: As the generator, the landowner is ultimately responsible for the proper disposal of the collected materials. Because the material likely contains petroleum hydrocarbons, heavy metals, and other harmful pollutants, the materials must be treated as EPA class 2 Hazardous Waste. Proper disposal is required.

DESIGN COMPUTATIONS FOR:
CUDO® WATER STORAGE SYSTEM

PREPARED FOR:

CUDO® Stormwater Products, Inc.

Doug Allard

P.O. Box 497

Occidental, California 95406

PREPARED BY:

Terrain Engineering, Inc.

3609 Maidu Place

Davis, California 95618

Voice: (916) 952-0704

Fax: (530) 792-1008

email: cwgilley@sbcglobal.net

REGISTERED PROFESSIONAL ENGINEER
CURTISS W. GILLEY
No. 14434
Exp. 3-31-09
CIVIL
STATE OF CALIFORNIA

OBJECTIVE:

Determine the distributed load acting on the CUDO Water Storage Cube per AASHTO LRFD for live loads and earth loads and recommended minimum and maximum cover heights.

OVERVIEW:

The CUDO Water Storage Cube is manufactured from polypropylene by an injection molding process. The cubes consist of two halves that join together at the spring line of the circular opening of the cube, as well as a top and bottom grate. The cubes will be assembled and installed in rows and columns with no spacing between units.

Our evaluation included review of third party compressive test data, live and earth load calculations, and finite element analysis of the expected cube performance when subjected to live loads in a minimum cover scenario. Structural performance of the cube was assessed using current AASHTO procedures for design of thermoplastic culverts.

LABORATORY TESTING:

CUDO Stormwater Products, Inc. retained Testing Engineers, inc. of San Leandro, CA to perform a compressive test on three 24-in X 24-in x 24-in CUDO cubes. The testing was performed in general conformance with ASTM D2412, Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading. (A copy of this test report is included for reference.) It should be noted at the time this testing was completed there was/is no ASTM test uniquely tailored for modular filtration systems such as the CUDO and it was determined that this test is the most appropriate available test procedure.

The average ultimate load was determined to be 14,036.7lbs (14.0 K) for the 24-in x 24-in x 24-in CUDO cube. The load reference for this laboratory test is approximately 3,500lbs/sq-ft (3.5K/sq-ft).

LIVE LOAD AND EARTH LOAD CALCULATIONS:

Reference AASHTO Section 12-2006

Assumptions:

Load Factors:	Earth Load (EL) – 1.0 Live Load (LL) – 1.75 or As Required
Cover Height:	H = Total Cover Height H_S = Surface Treatment Cover Height H_F = Fill Cover Height
Soil Weight:	Surface = 145pcf Fill = 120pcf
Impact Factor:	IM = 1.3(1-0.125H) where H is cover height in feet
Earth Load:	$EL_S = H_S$ X 145pcf $EL_f = H_f$ X 120pcf
Live Load (HS20-44):	LL = 16,000lbs
Wheel Contact Area:	Length (l) = 20-inches Width (w) = 10-inches
Live Load Distribution Factor:	= 1.75
Geogrid Distribution Factor:	= 2.60
Earth Load:	= (SF_{DL}) X (Unit Weight Surface) X (H_S) + (SF_{DL}) X (Unit Weight Fill) X (H_F)
Live Load:	= (IM) X (SF_{LL}) X (Live Load) / Distributed Load Area
Total Load:	= EL + LL

LIVE LOAD AND EARTH LOAD CALCULATIONS (CONTINUED):

The ultimate loading was calculated and then compared to the laboratory test results for ultimate loading of the cubes. The calculations for loading include both live load and earth loads. Although the earth load at minimum cover heights is very minimal in comparison to the live load, the earth loads have been included. The live load and earth load use assumptions as listed above and are in general conformance with AASHTO LRFD. In these calculations it was assumed that the HS20-44 live load is a point load at surface with no wheel contact area. The load is distributed downward and outward with a distribution factor of 1.75. This is a conservative approach and considers that surface loads are not distributed over the footprint of the wheel contact area. Results of the calculations are found in Table 1.

Cover Height (H) in (in)	Impact Factor (IM)	Live Load Distribution (1.75) sq-in	H20 Live Load Transferred to cube (psi)	Earth Load Transferred to cube (psi)	Total Load Transferred to cube (psi)	Factor of Safety*
0	1.33	0	21280.0	0.0	21280.0	0.00
6	1.31	110	190.0	0.5	190.5	0.13
12	1.29	441	46.8	1.0	47.8	0.51
18	1.27	992	20.4	1.5	22.0	1.11
24	1.25	1764	11.3	2.0	13.3	1.82
30	1.23	2756	7.1	2.5	9.6	2.52
36	1.21	3969	4.9	3.0	7.9	3.08
42	1.19	5402	3.5	3.5	7.0	3.45
48	1.17	7056	2.6	4.0	6.7	3.64
54	1.14	8930	2.1	4.5	6.6	3.69
60	1.12	11025	1.6	5.0	6.7	3.65
66	1.10	13340	1.3	5.5	6.9	3.54
72	1.08	15876	1.1	6.0	7.1	3.41
78	1.06	18632	0.9	6.5	7.5	3.26
84	1.04	21609	0.8	7.0	7.8	3.11
90	1.02	24806	0.7	7.6	8.2	2.96
96	1.00	28224	0.6	8.1	8.6	2.82

*For design situations exceeding 60-inches of cover please contact the manufacturer for additional analysis.

Table 1

LIVE LOAD AND EARTH LOAD CALCULATIONS (CONTINUED):

Additional analysis was performed to determine the benefit of utilizing a geo-grid layer between the live load and the cubes. Using a program called Spectra Pave3 Version 1.0 developed by Tensar International Corporation it was found that when based on poor quality soil material (CBR 1 or R factor 5+/-) the spread factor is 2.60. This result is based on using Tensar geo-grid BX1200 or equal. The new load distribution factor was incorporated into the calculations and the results can be found in Table 2.

Cover Height (H) in (in)	Impact Factor (IM)	Live Load Distribution (2.6) sq-in	H20 Live Load Transferred to cube (psi)	Earth Load Transferred to cube (psi)	Total Load Transferred to cube (psi)	Factor of Safety*
0	1.33	0	21280.0	0.0	21280.0	0.00
6	1.31	243	86.1	0.5	86.6	0.28
12	1.29	973	21.2	1.0	22.2	1.10
18	1.27	2190	9.3	1.5	10.8	2.26
24	1.25	3894	5.1	2.0	7.1	3.40
30	1.23	6084	3.2	2.5	5.7	4.23
36	1.21	8761	2.2	3.0	5.2	4.65
42	1.19	11925	1.6	3.5	5.1	4.75
48	1.17	15575	1.2	4.0	5.2	4.65
54	1.14	19712	0.9	4.5	5.5	4.45
60	1.12	24336	0.7	5.0	5.8	4.21
66	1.10	29447	0.6	5.5	6.1	3.96
72	1.08	35044	0.5	6.0	6.5	3.72
78	1.06	41128	0.4	6.5	7.0	3.49
84	1.04	47699	0.3	7.0	7.4	3.28
90	1.02	54756	0.3	7.6	7.9	3.10
96	1.00	62300	0.3	8.1	8.3	2.92

*For design situations exceeding 60-inches of cover please contact the manufacturer for additional analysis.

Table 2

FINITE ELEMENT ANALYSIS:

A finite element analysis for the CUDO cube was performed using a finite element program, Visual Analysis ver5.5, by Integrated Engineering Software (www.iesweb.com). The model is 3-D with 2-D plate elements incorporating material stiffness with HS20-44 truck live loading, earth load, dead load and soil lateral loading.

For this analysis the following loadings and assumptions were utilized:

Live Load (LL) is H20-44 impacted for 2 ft cover, but applied at 3 ft cover

Earth Load (EL_V) is applied vertically at 130pcf for cover weight

Earth Load (EL_L) is applied laterally at 120pcf using an active lateral earth pressure coefficient (k_a) = 0.33

Dead Load (DL) is the weight of the CUDO cube itself. This number is relatively small in comparison to the earth load and live load and is left at zero for this analysis.

Material Stiffness = 75 ksi

Tensile Strength = 3.5 ksi

Material Thickness = 0.170 inch

The results of the analysis indicate that the greatest tensile stress for the 3 ft cover to finished grade is 1.25 ksi located near the point of joining the top and bottom half cubes. This allows for a Safety factor of 2.8 when compared to industry reported tensile strength of 3.5 ksi. The greatest tensile stress for 5 ft of cover to finished grade is 1.51 ksi. This results in a Safety Factor of 2.3 when compared to the industry reported tensile strength of 3.5 ksi.

CONCLUSION:

The CUDO cube can be installed with a minimum of 2ft of cover measured from the finished grade to the top of the cube with a geo-grid, Tensar BX1200 or equivalent, placed in the cover in accordance with the manufacturer's recommendations. Calculations indicate that the addition of the geo-grid helps to reduce point loads and live loads on the cube allowing for a safety factor of 3.4 at this depth. The analysis additionally supports the installation of the CUDO cube to a depth of 5ft measured from the top of the cube to finished grade. Backfill material shall be constructed per project geotechnical engineer requirements. Backfill construction equipment shall not apply loading greater than the design loading of 0.97K/sq-ft. For desired installation depths shallower or in excess of these recommendations the manufacturer should be contacted.

G

Attachment G

Conditions of Approval

(Section to be updated with Final WQMP)

H

Attachment H

California Department of Public Health

Regulations Related to Recycled Water – June 2014

NOTE: This publication is meant to be an aid to the staff of the CDPH—formerly the Department of Health Services (DHS)—Drinking Water Program and cannot be relied upon by the regulated community as the State of California's representation of the law. The published codes are the only official representation of the law. Refer to the published codes—in this case, Title 17 and 22 CCR—whenever specific citations are required.

California Department of Public Health

Regulations Related to Recycled Water
June 18, 2014 (Revisions effective on 6/18/14)

Sections amended, adopted, repealed, or not included in the previous version are highlighted in yellow. If the text in a section, subsection, or paragraph is highlighted, it is new. If only the section/paragraph number is highlighted, it was amended or repealed. Nonsubstantive revisions may not be shown.

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TITLE 17 CODE OF REGULATIONS

Division 1. State Department of Health Services

Chapter 5. Sanitation (Environmental)

Group 4. Drinking Water Supplies

Article 1. General.

§7583. Definitions.
In addition to the definitions in Section 4010.1 of the Health and Safety Code, the following terms are defined for the purpose of this Chapter:

(a) "Approved Water Supply" is a water supply whose potability is regulated by a State of local health agency.

(b) "Auxiliary Water Supply" is any water supply other than that received from a public water system.

(c) "Air-gap Separation (AG)" is a physical break between the supply line and a receiving vessel.

(d) "AWWA Standard" is an official standard developed and approved by the American Water Works Association (AWWA).

(e) "Cross-Connection" is an unprotected actual or potential connection between a potable water system used to supply water for drinking purposes and any source or system containing unapproved water or a substance that is not or cannot be approved as safe, wholesome, and potable. By-pass arrangements, jumper connections, removable sections, swivel or changeover devices, or other devices through which backflow could occur, shall be considered to be cross-connections.

(f) "Double Check Valve Assembly (DC)" is an assembly of at least two independently acting check valves including tightly closing shut-off valves on each side of the check valve assembly and test cocks available for testing the watertightness of each check valve.

(g) "Health Agency" means the California Department of Health Services, or the local health officer with respect to a small water system.

(h) "Local Health Agency" means the county or city health authority.

(i) "Reclaimed Water" is a wastewater which as a result of treatment is suitable for uses other than potable use.

(j) "Reduced Pressure Principle Backflow Prevention Device (RP)" is a backflow preventer incorporating not less than two check valves, an automatically operated differential relief valve located between the two check valves, a tightly closing shut-off valve on each side of the check valve assembly, and equipped with necessary test cocks for testing.

(k) "User Connection" is the point of connection of a user's piping to the water supplier's facilities.

(l) "Water Supplier" is the person who owns or operates the public water system.

(m) "Water User" is any person obtaining water from a public water supply.

§7584. Responsibility and scope of program.

The water supplier shall protect the public water supply from contamination by implementation of a cross-connection control program. The program, or any portion thereof, may be implemented directly by the water supplier or by means of a contract with the local health agency, or with another agency approved by the health agency. The water supplier's cross-connection control program shall for the purpose of addressing the requirements of Sections 7585 through 7605 include, but not be limited to, the following elements:

(a) The adoption of operating rules or ordinances to implement the cross-connection program.

(b) The conducting of surveys to identify water user premises where cross-connections are likely to occur,

(c) The provisions of backflow protection by the water user at the user's connection or within the user's premises or both,

(d) The provision of at least one person trained in cross-connection control to carry out the cross-connection program,

(e) The establishment of a procedure or system for testing backflow preventers, and

(f) The maintenance of records of locations, tests, and repairs of backflow preventers.

§7585. Evaluation of hazard.

The water supplier shall evaluate the degree of potential health hazard to the public water supply which may be created as a result of conditions existing on a user's premises. The water supplier, however, shall not be responsible for abatement of cross-connections which may exist within a user's premises. As a minimum, the evaluation should consider: the existence of cross-connections, the nature of materials handled on the property, the probability of a backflow occurring, the degree of piping system complexity and the potential for piping system modification. Special consideration shall be given to the premises of the following types of water users:

(a) Premises where substances harmful to health are handled under pressure in a manner which could permit their entry into the public water system. This includes chemical or biological process waters and water from public water supplies which have deteriorated in sanitary quality.

(b) Premises having an auxiliary water supply, unless the auxiliary supply is accepted as an additional source by the water supplier and is approved by the health agency.

(c) Premises that have internal cross-connections that are not abated to the satisfaction of the water supplier or the health agency.

(d) Premises where cross-connections are likely to occur and entry is restricted so that cross-connection inspections cannot be made with sufficient frequency or at sufficiently short notice to assure that cross-connections do not exist.

(e) Premises having a repeated history of cross-connections being established or re-established.

§7586. User supervisor.

The health agency and water supplier may, at their discretion, require an industrial water user to designate a user supervisor when the water user's premises has a multipiping system that convey various types of fluids, some of which may be hazardous and where changes in the piping system are frequently made. The user supervisor shall be responsible for the avoidance of cross-connections during the installation, operation and maintenance of the water user's pipelines and equipment.

Article 2. Protection of Water System.

§7601. Approval of backflow preventers.

Backflow preventers required by this Chapter shall have passed laboratory and field evaluation tests performed by a recognized testing organization which has demonstrated their competency to perform such tests to the Department.

§7602. Construction of backflow preventers.

(a) Air-gap Separation. An Air-gap separation (AG) shall be at least double the diameter of the supply pipe, measured vertically from the flood rim of the receiving vessel to the supply pipe; however, in no case shall this separation be less than one inch.

(b) Double Check Valve Assembly. A required double check valve assembly (DC) shall, as a minimum, conform to the AWWA Standard C506-78 (R83) adopted on January 28, 1978 for Double Check Valve Type Backflow Preventive Devices which is herein incorporated by reference.

(c) Reduced Pressure Principle Backflow Prevention Device. A required reduced pressure principle backflow prevention device (RP) shall, as a minimum, conform to the AWWA Standard C506-78 (R83) adopted on January 28, 1978 for Reduced Pressure Principle Type Backflow Prevention Devices which is herein incorporated by reference.

§7603. Location of backflow preventers.

(a) Air-gap Separation. An air-gap separation shall be located as close as practical to the user's connection and all piping between the user's connection and the receiving tank shall be entirely visible unless otherwise approved in writing by the water supplier and the health agency.

(b) Double Check Valve Assembly. A double check valve assembly shall be located as close as practical to the user's connection and shall be installed above grade, if possible, and in a manner where it is readily accessible for testing and maintenance.

(c) Reduced Pressure Principle Backflow Prevention Device. A reduced pressure principle backflow prevention device shall be located as close as practical to the user's connection and shall be installed a minimum of twelve inches (12") above grade and not more than thirty-six inches (36") above grade measured from the bottom of the device and with a minimum of twelve inches (12") side clearance.

§7604. Type of protection required.

The type of protection that shall be provided to prevent backflow into the public water supply shall be commensurate with the degree of hazard that exists on the consumer's premises. The type of protective device that may be required (listed in an increasing level of protection) includes: Double check Valve Assembly--(DC), Reduced Pressure Principle Backflow Prevention Device--(RP) and an Air gap Separation--(AG). The water user may choose a higher level of protection than required by the water supplier. The minimum types of backflow protection required to protect the public water supply, at the water user's connection to premises with various degrees of hazard, are given in Table 1. Situations not covered in Table 1 shall be evaluated on a case-by-case basis and the

appropriate backflow protection shall be determined by the water supplier or health agency.

TABLE 1
TYPE OF BACKFLOW PROTECTION REQUIRED

Degree of Hazard	Minimum Type of Backflow Prevention
(a) Sewage and Hazardous Substances	
(1) Premises where there are waste water pumping and/or treatment plants and there is no interconnection with the potable water system. This does not include a single-family residence that has a sewage lift pump. A RP be provided in lieu of an AG if approved by the health agency and water supplier.	AG
(2) Premises where hazardous substances are handled in any manner in which the substances may enter the potable water system. This does not include a single-family residence that has a sewage lift pump. A RP may be provided in lieu of an AG if approved by the health agency and water supplier.	AG
(3) Premises where there are irrigation systems into which fertilizers, herbicides, or pesticides are, or can be, injected.	RP
(b) Auxiliary Water Supplies	
(1) Premises where there is an unapproved auxiliary water supply which is interconnected with the public water system. A RP or DC may be provided in lieu of an AG if approved by the health agency and water supplier	AG
(2) Premises where there is an unapproved auxiliary RP water supply and there are no interconnections with the public water system. A DC may be provided in lieu of a RP if approved by the health agency and water supplier.	RP
(c) Recycled water	
(1) Premises where the public water system is used to supplement the recycled water supply.	AG
(2) Premises where recycled water is used, other than as allowed in paragraph (3), and there is no interconnection with the potable water system.	RP
(3) Residences using recycled water for landscape irrigation as part of an approved dual plumbed use area established pursuant to sections 60313 through 60316 unless the recycled water supplier obtains approval of the	DC

local public water supplier, or the Department if the water supplier is also the supplier of the recycled water, to utilize an alternative backflow protection plan that includes an annual inspection and annual shutdown test of the recycled water and potable water systems pursuant to subsection 60316(a).

(d) Fire Protection Systems

(1) Premises where the fire system is directly supplied from the public water system and there is an unapproved auxiliary water supply on or to the premises (not interconnected). DC

(2) Premises where the fire system is supplied from the public water system and interconnected with an unapproved auxiliary water supply. A RP may be provided in lieu of an AG if approved by the health agency and water supplier. AG

(3) Premises where the fire system is supplied from the public water system and where either elevated storage tanks or fire pumps which take suction from private reservoirs or tanks are used. DC

(4) Premises where the fire system is supplied from the public water system and where recycled water is used in a separate piping system within the same building. DC

(e) Dockside Watering Points and Marine Facilities

(1) Pier hydrants for supplying water to vessels for any purpose. RP

(2) Premises where there are marine facilities. RP

(f) Premises where entry is restricted so that inspections for cross-connections cannot be made with sufficient frequency or at sufficiently short notice to assure that do not exist. RP

(g) Premises where there is a repeated history of crossconnections being established or re-established. RP RP

§7605. Testing and maintenance of backflow preventers.

(a) The water supplier shall assure that adequate maintenance and periodic testing are provided by the water user to ensure their proper operation.

(b) Backflow preventers shall be tested by persons who have demonstrated their competency in testing of these devices to the water supplier or health agency.

(c) Backflow preventers shall be tested at least annually or more frequently if determined to be necessary by the health agency or water supplier. When devices are

found to be defective, they shall be repaired or replaced in accordance with the provisions of this Chapter.

(d) Backflow preventers shall be tested immediately after they are installed, relocated or repaired and not placed in service unless they are functioning as required.

(e) The water supplier shall notify the water user when testing of backflow preventers is needed. The notice shall contain the date when the test must be completed.

(f) Reports of testing and maintenance shall be maintained by the water supplier for a minimum of three years.

TITLE 22 CODE OF REGULATIONS

Division 4. Environmental Health

Chapter 1. Introduction

Article 1. Definitions

§60001. Department.
Whenever the term "department" is used in this division, it means the State Department of Health Services, unless otherwise specified.

§60003. Director.
Whenever the term "director" is used in this division, it means the Director, State Department of Health Services, unless otherwise specified.

Chapter 2. Regulations for the Implementation of the California Environmental Quality

Article 1. General Requirements and Categorical Exemptions

§60100. General requirements.
The Department of Health Services incorporates by reference the objectives, criteria, and procedures as delineated in Chapters 1, 2, 2.5, 2.6, 3, 4, 5, and 6, Division 13, Public Resources Code, Sections 21000 et seq., and the Guidelines for the Implementation of the California Environmental Quality Act, Title 14, Division 6, Chapter 3, California Administrative Code, Sections 15000 et seq.

§60101. Specific activities within categorical exempt classes.
The following specific activities are determined by the Department to fall within the classes of categorical exemptions set forth in Sections 15300 et seq. of Title 14 of the California Administrative Code:

(a) Class 1: Existing Facilities.

(1) Any interior or exterior alteration of water treatment units, water supply systems, and pump station buildings where the alteration involves the addition, deletion, or modification of mechanical, electrical, or hydraulic controls.

(2) Maintenance, repair, replacement, or reconstruction to any water treatment process units, including structures, filters, pumps, and chlorinators.

(b) Class 2: Replacement or Reconstruction.

(1) Repair or replacement of any water service connections, meters, and valves for backflow prevention, air release, pressure regulating, shut-off and blow-off or flushing.

(2) Replacement or reconstruction of any existing water supply distribution lines, storage tanks and reservoirs of substantially the same size.

(3) Replacement or reconstruction of any water wells, pump stations and related appurtenances.

(c) Class 3: New Construction of Small Structures.

(1) Construction of any water supply and distribution lines of less than sixteen inches in diameter, and related appurtenances.

(2) Construction of any water storage tanks and reservoirs of less than 100,000 gallon capacity.

(d) Class 4: Minor Alterations to Land.

(1) Minor alterations to land, water, or vegetation on any officially existing designated wildlife management areas or fish production facilities for the purpose of reducing the environmental potential for nuisances or vector production.

(2) Any minor alterations to highway crossings for water supply and distribution lines.

Chapter 3. Water Recycling Criteria

Article 1. Definitions.

§60301.050. 24-hour Composite Sample.
"24-hour Composite Sample" means an aggregate sample derived from no fewer than eight discrete samples collected at equal time intervals or collected proportional to the flow rate over the compositing period. The aggregate sample shall reflect the average source water quality covering the composite 24-hour sample period.

§60301.080. Added Tracer.
"Added Tracer" means a non-reactive substance, with measureable characteristics distinctly different from the receiving groundwater, intentionally added to the water applied at a Groundwater Replenishment Reuse Project (GRRP) for the purpose of being a tracer such that the tracer can be readily identified in the groundwater downgradient of the GRRP to determine the underground retention time of the applied water.

§60301.100. Approved laboratory.
"Approved laboratory" means a laboratory that has been certified by the Department to perform microbiological analyses pursuant to section 116390, Health and Safety Code.

§60301.160. Coagulated wastewater.
"Coagulated wastewater" means oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated upstream from a filter by the addition of suitable floc-forming chemicals.

§60301.170. Conventional treatment.
"Conventional treatment" means a treatment chain that utilizes a sedimentation unit process between the coagulation and filtration processes and produces an effluent that meets the definition for disinfected tertiary recycled water.

§60301.180. Department.
"Department" means the California Department of Public Health or its successor with authority to regulate public water systems.

§60301.190. Diluent Water.
"Diluent Water" means water, meeting the diluent requirements of this Chapter, used for reducing the recycled municipal wastewater contribution over time.

§60301.200. Direct beneficial use.
"Direct beneficial use" means the use of recycled water that has been transported from the point of treatment or production to the point of use without an intervening discharge to waters of the State.

§60301.220. Disinfected secondary-2.2 recycled water.
"Disinfected secondary-2.2 recycled water" means recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a most probable number (MPN) of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period.

§60301.225. Disinfected secondary-23 recycled water.
"Disinfected secondary-23 recycled water" means recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a most probable number (MPN) of 23 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 240 per 100 milliliters in more than one sample in any 30 day period.

§60301.230. Disinfected tertiary recycled water.

"Disinfected tertiary recycled water" means a filtered and subsequently disinfected wastewater that meets the following criteria:

(a) The filtered wastewater has been disinfected by either:

(1) A chlorine disinfection process following filtration that provides a CT (the product of total chlorine residual and modal contact time measured at the same point) value of not less than 450 milligram-minutes per liter at all times with a modal contact time of at least 90 minutes, based on peak dry weather design flow; or

(2) A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent of the plaque forming units of F-specific bacteriophage MS2, or polio virus in the wastewater. A virus that is at least as resistant to disinfection as polio virus may be used for purposes of the demonstration.

(b) The median concentration of total coliform bacteria measured in the disinfected effluent does not exceed an MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period. No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters.

§60301.240. Drift.

"Drift" means the water that escapes to the atmosphere as water droplets from a cooling system.

§60301.245. Drift eliminator.

"Drift eliminator" means a feature of a cooling system that reduces to a minimum the generation of drift from the system.

§60301.250. Dual plumbed system.

"Dual plumbed system" or "dual plumbed" means a system that utilizes separate piping systems for recycled water and potable water within a facility and where the recycled water is used for either of the following purposes:

(a) To serve plumbing outlets (excluding fire suppression systems) within a building or

(b) Outdoor landscape irrigation at individual residences.

§60301.300. F-Specific bacteriophage MS-2.

"F-specific bacteriophage MS-2" means a strain of a specific type of virus that infects coliform bacteria that is traceable to the American Type Culture Collection (ATCC15597B1) and is grown on lawns of E. coli (ATCC 15597).

§60301.310. Facility.
"Facility" means any type of building or structure, or a defined area of specific use that receives water for domestic use from a public water system as defined in section 116275 of the Health and Safety Code.

§60301.320. Filtered wastewater.
"Filtered wastewater" means an oxidized wastewater that meets the criteria in subsection (a) or (b):

(a) Has been coagulated and passed through natural undisturbed soils or a bed of filter media pursuant to the following:

(1) At a rate that does not exceed 5 gallons per minute per square foot of surface area in mono, dual or mixed media gravity, upflow or pressure filtration systems, or does not exceed 2 gallons per minute per square foot of surface area in traveling bridge automatic backwash filters; and

(2) So that the turbidity of the filtered wastewater does not exceed any of the following:

(A) An average of 2 NTU within a 24-hour period;
(B) 5 NTU more than 5 percent of the time within a 24-hour period; and
(C) 10 NTU at any time.

(b) Has been passed through a microfiltration, ultrafiltration, nanofiltration, or reverse osmosis membrane so that the turbidity of the filtered wastewater does not exceed any of the following:

(1) 0.2 NTU more than 5 percent of the time within a 24-hour period; and
(2) 0.5 NTU at any time.

§60301.330. Food crops.
"Food crops" means any crops intended for human consumption.

§60301.370. Groundwater.
"Groundwater" means water below the land surface in a saturated zone.

§60301.390. Groundwater Replenishment Reuse Project or GRRP.
"Groundwater Replenishment Reuse Project" or "GRRP" means a project involving the planned use of recycled municipal wastewater that is operated for the purpose of replenishing a groundwater basin designated in the Water Quality Control Plan [as defined in Water Code section 13050(j)] for use as a source of municipal and domestic water supply.

§60301.400. Hose bibb.
"Hose bibb" means a faucet or similar device to which a common garden hose can be readily attached.

§60301.450. Indicator Compound.
"Indicator Compound" means an individual chemical in a GRRP's municipal wastewater that represents the physical, chemical, and biodegradable characteristics of a specific family of trace organic chemicals; is present in concentrations that provide information relative to the environmental fate and transport of those chemicals; may be used to monitor the efficiency of trace organic compounds removal by treatment processes; and provides an indication of treatment process failure.

§60301.455. Intrinsic Tracer.
"Intrinsic Tracer" means a substance or attribute present in the recharge water at levels different from the receiving groundwater such that the substance in the water applied at the GRRP can be distinctly and sufficiently detected in the groundwater downgradient of the GRRP to determine the underground retention time of the water.

§60301.550. Landscape impoundment.
"Landscape impoundment" means an impoundment in which recycled water is stored or used for aesthetic enjoyment or landscape irrigation, or which otherwise serves a similar function and is not intended to include public contact.

§60301.575. Maximum Contaminant Level or MCL.
"Maximum Contaminant Level" or "MCL" means the maximum permissible concentration of a contaminant established pursuant to sections 116275(c)(1) and (d) of the Health and Safety Code or established by the U.S. Environmental Protection Agency.

§60301.600. Modal contact time.
"Modal contact time" means the amount of time elapsed between the time that a tracer, such as salt or dye, is injected into the influent at the entrance to a chamber and the time that the highest concentration of the tracer is observed in the effluent from the chamber.

§60301.620. Nonrestricted recreational impoundment.
"Nonrestricted recreational impoundment" means an impoundment of recycled water, in which no limitations are imposed on body-contact water recreational activities.

§60301.625. Notification Level or NL.
"Notification Level" or "NL" means the concentration of a contaminant established by the Department pursuant to section 116455 of the Health and Safety Code.

§60301.630. NTU.
"NTU" (Nephelometric turbidity unit) means a measurement of turbidity as determined by the ratio of the intensity of light scattered by the sample to the intensity of incident light as measured by method 2130 B. in Standard Methods for the Examination of Water and Wastewater, 20th ed.; Eaton, A. D., Clesceri, L. S., and Greenberg, A. E., Eds; American Public Health Association: Washington, DC, 1995; p. 2-8.

§60301.650. Oxidized wastewater.
"Oxidized wastewater" means wastewater in which the organic matter has been stabilized, is nonputrescible, and contains dissolved oxygen.

§60301.660. Peak dry weather design flow.
"Peak Dry Weather Design Flow" means the arithmetic mean of the maximum peak flow rates sustained over some period of time (for example three hours) during the maximum 24-hour dry weather period. Dry weather period is defined as periods of little or no rainfall.

§60301.670. Project Sponsor.
"Project Sponsor" means an entity subject to a Regional Water Quality Control Board's (Regional Board's) water recycling requirements for a Groundwater Replenishment Reuse Project (GRRP) and is, in whole or part, responsible for applying to the Regional Board for a permit, obtaining a permit, operation of a GRRP, and complying with the terms and conditions of the permit and the requirements of this Chapter.

§60301.680. Public Water System.
"Public Water System" has the same meaning as defined in section 116275(h) of the Health and Safety Code.

§60301.685. Recharge Water.
"Recharge Water" means recycled municipal wastewater, or the combination of recycled municipal wastewater and credited diluent water, which is utilized by a GRRP for groundwater replenishment.

§60301.690. Recycled Municipal Wastewater.
"Recycled Municipal Wastewater" means recycled water that is the effluent from the treatment of wastewater of municipal origin.

§60301.700. Recycled water agency.
"Recycled water agency" means the public water system, or a publicly or privately owned or operated recycled water system, that delivers or proposes to deliver recycled water to a facility.

§60301.705. Recycled Municipal Wastewater Contribution or RWC.
"Recycled Municipal Wastewater Contribution" or "RWC" means the fraction equal to the quantity of recycled municipal wastewater applied at the GRRP divided by the sum of the quantity of recycled municipal wastewater and credited diluent water.

§60301.710. Recycling plant.
"Recycling plant" means an arrangement of devices, structures, equipment, processes and controls which produce recycled water.

§60301.740. Regulatory agency.
"Regulatory agency" means the California Regional Water Quality Control Board(s) that have jurisdiction over the recycling plant and use areas.

§60301.750. Restricted access golf course.
"Restricted access golf course" means a golf course where public access is controlled so that areas irrigated with recycled water cannot be used as if they were part of a park, playground, or school yard and where irrigation is conducted only in areas and during periods when the golf course is not being used by golfers.

§60301.760. Restricted recreational impoundment.
"Restricted recreational impoundment" means an impoundment of recycled water in which recreation is limited to fishing, boating, and other non-body-contact water recreational activities.

§60301.770. Regional Board.
"Regional Board" means the Regional Water Quality Control Board.

§60301.780. Saturated Zone.
"Saturated Zone" means an underground region or regions in which all interstices in, between, and below natural geologic materials are filled with water, with the uppermost surface of the saturated zone being the water table.

§60301.800. Spray irrigation.
"Spray irrigation" means the application of recycled water to crops to maintain vegetation or support growth of vegetation by applying it from sprinklers.

§60301.810. Spreading Area.
"Spreading Area" means a natural or constructed impoundment with a depth equal to or less than its widest surface dimension used by a GRRP to replenish a groundwater basin with recharge water infiltrating and percolating through a zone that, in the absence of a GRRP, would be an unsaturated zone.

§60301.830. Standby unit process.
"Standby unit process" means an alternate unit process or an equivalent alternative process which is maintained in operable condition and which is capable of providing comparable treatment of the actual flow through the unit for which it is a substitute.

§60301.840. Subsurface Application.
"Subsurface Application" means the application of recharge water to a groundwater basin(s) by a means other than surface application.

§60301.850. Surface Application.
"Surface Application" means the application of recharge water to a spreading area.

§60301.855. Surrogate Parameter.
"Surrogate Parameter" means a measurable physical or chemical property that has been demonstrated to provide a direct correlation with the concentration of an indicator compound, can be used to monitor the efficiency of trace organic compounds removal by a treatment process, and/or provides an indication of a treatment process failure.

§60301.860. Total Nitrogen.
"Total Nitrogen" means the sum of concentrations of ammonia, nitrite, nitrate, and organic nitrogen-containing compounds, expressed as nitrogen.

§60301.870. Total Organic Carbon or TOC.
"Total Organic Carbon" or "TOC" means the concentration of organic carbon present in water.

§60301.900. Undisinfected secondary recycled water.
"Undisinfected secondary recycled water" means oxidized wastewater.

§60301.910. Unsaturated Zone.
"Unsaturated Zone" means the volume between the land surface and the uppermost saturated zone.

§60301.920. Use area.
"Use area" means an area of recycled water use with defined boundaries. A use area may contain one or more facilities.

Article 2. Sources of Recycled Water.

§60302. Source specifications.

The requirements in this chapter shall only apply to recycled water from sources that contain domestic waste, in whole or in part.

Article 3. Uses of Recycled Water.

§60303. Exceptions.

The requirements set forth in this chapter shall not apply to the use of recycled water onsite at a water recycling plant, or wastewater treatment plant, provided access by the public to the area of onsite recycled water use is restricted.

§60304. Use of recycled water for irrigation.

(a) Recycled water used for the surface irrigation of the following shall be a disinfected tertiary recycled water, except that for filtration pursuant to Section 60301.320(a) coagulation need not be used as part of the treatment process provided that the filter effluent turbidity does not exceed 2 NTU, the turbidity of the influent to the filters is continuously measured, the influent turbidity does not exceed 5 NTU for more than 15 minutes and never exceeds 10 NTU, and that there is the capability to automatically activate chemical addition or divert the wastewater should the filter influent turbidity exceed 5 NTU for more than 15 minutes:

(1) Food crops, including all edible root crops, where the recycled water comes into contact with the edible portion of the crop,

(2) Parks and playgrounds,

(3) School yards,

(4) Residential landscaping,

(5) Unrestricted access golf courses, and

(6) Any other irrigation use not specified in this section and not prohibited by other sections of the California Code of Regulations.

(b) Recycled water used for the surface irrigation of food crops where the edible portion is produced above ground and not contacted by the recycled water shall be at least disinfected secondary-2.2 recycled water.

(c) Recycled water used for the surface irrigation of the following shall be at least disinfected secondary-23 recycled water:

(1) Cemeteries,

(2) Freeway landscaping,

(3) Restricted access golf courses,

(4) Ornamental nursery stock and sod farms where access by the general public is not restricted,

(5) Pasture for animals producing milk for human consumption, and

(6) Any nonedible vegetation where access is controlled so that the irrigated area cannot be used as if it were part of a park, playground or school yard

(d) Recycled wastewater used for the surface irrigation of the following shall be at least undisinfected secondary recycled water:

(1) Orchards where the recycled water does not come into contact with the edible portion of the crop,

(2) Vineyards where the recycled water does not come into contact with the edible portion of the crop,

(3) Non food-bearing trees (Christmas tree farms are included in this category provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting or allowing access by the general public),

(4) Fodder and fiber crops and pasture for animals not producing milk for human consumption,

(5) Seed crops not eaten by humans,

(6) Food crops that must undergo commercial pathogen-destroying processing before being consumed by humans, and

(7) Ornamental nursery stock and sod farms provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting, retail sale, or allowing access by the general public.

(e) No recycled water used for irrigation, or soil that has been irrigated with recycled water, shall come into contact with the edible portion of food crops eaten raw by humans unless the recycled water complies with subsection (a).

§60305. Use of recycled water for impoundments.

(a) Except as provided in subsection (b), recycled water used as a source of water supply for nonrestricted recreational impoundments shall be disinfected tertiary recycled water that has been subjected to conventional treatment.

(b) Disinfected tertiary recycled water that has not received conventional treatment may be used for nonrestricted recreational impoundments provided the recycled water is monitored for the presence of pathogenic organisms in accordance with the following:

(1) During the first 12 months of operation and use the recycled water shall be sampled and analyzed monthly for *Giardia*, enteric viruses, and *Cryptosporidium*. Following the first 12 months of use, the recycled water shall be sampled and analyzed quarterly for *Giardia*, enteric viruses, and *Cryptosporidium*. The ongoing monitoring may be discontinued after the first two years of operation with the approval of the

department. This monitoring shall be in addition to the monitoring set forth in section 60321.

(2) The samples shall be taken at a point following disinfection and prior to the point where the recycled water enters the use impoundment. The samples shal be analyzed by an approved laboratory and the results submitted quarterly to the regulatory agency.

(c) The total coliform bacteria concentrations in recycled water used for nonrestricted recreational impoundments, measured at a point between the disinfection process and the point of entry to the use impoundment, shall comply with the criteria specified in section 60301.230 (b) for disinfected tertiary recycled water.

(d) Recycled water used as a source of supply for restricted recreational impoundments and for any publicly accessible impoundments at fish hatcheries shall be at least disinfected secondary-2.2 recycled water.

(e) Recycled water used as a source of supply for landscape impoundments that do not utilize decorative fountains shall be at least disinfected secondary-23 recycled water.

§60306. Use of recycled water for cooling.

(a) Recycled water used for industrial or commercial cooling or air conditioning that involves the use of a cooling tower, evaporative condenser, spraying or any mechanism that creates a mist shall be a disinfected tertiary recycled water.

(b) Use of recycled water for industrial or commercial cooling or air conditioning that does not involve the use of a cooling tower, evaporative condenser, spraying, or any mechanism that creates a mist shall be at least disinfected secondary-23 recycled water.

(c) Whenever a cooling system, using recycled water in conjunction with an air conditioning facility, utilizes a cooling tower or otherwise creates a mist that could come into contact with employees or members of the public, the cooling system shall comply with the following:

(1) A drift eliminator shall be used whenever the cooling system is in operation.

(2) A chlorine, or other, biocide shall be used to treat the cooling system recirculating water to minimize the growth of *Legionella* and other microorganisms.

§60307. Use of recycled water for other purposes.

(a) Recycled water used for the following shall be disinfected tertiary recycled water, except that for filtration being provided pursuant to Section 60301.320(a) coagulation need not be used as part of the treatment process provided that the filter effluent turbidity does not exceed 2 NTU, the turbidity of the influent to the filters is continuously measured, the influent turbidity does not exceed 5 NTU for more than 15 minutes and

never exceeds 10 NTU, and that there is the capability to automatically activate chemical addition or divert the wastewater should the filter influent turbidity exceed 5 NTU for more than 15 minutes:

(1) Flushing toilets and urinals,
(2) Priming drain traps,
(3) Industrial process water that may come into contact with workers,
(4) Structural fire fighting,
(5) Decorative fountains,
(6) Commercial laundries,
(7) Consolidation of backfill around potable water pipelines,
(8) Artificial snow making for commercial outdoor use, and
(9) Commercial car washes, including hand washes if the recycled water is not heated, where the general public is excluded from the washing process.

(b) Recycled water used for the following uses shall be at least disinfected secondary-23 recycled water:

(1) Industrial boiler feed,
(2) Nonstructural fire fighting,
(3) Backfill consolidation around nonpotable piping,
(4) Soil compaction,
(5) Mixing concrete,
(6) Dust control on roads and streets,
(7) Cleaning roads, sidewalks and outdoor work areas and
(8) Industrial process water that will not come into contact with workers.

(c) Recycled water used for flushing sanitary sewers shall be at least undisinfected secondary recycled water.

Article 4. Use Area Requirements.

§60310. Use area requirements.

(a) No irrigation with disinfected tertiary recycled water shall take place within 50 feet of any domestic water supply well unless all of the following conditions have been met:

(1) A geological investigation demonstrates that an aquitard exists at the well between the uppermost aquifer being drawn from and the ground surface.

(2) The well contains an annular seal that extends from the surface into the aquitard.

(3) The well is housed to prevent any recycled water spray from coming into contact with the wellhead facilities.

(4) The ground surface immediately around the wellhead is contoured to allow surface water to drain away from the well.

(5) The owner of the well approves of the elimination of the buffer zone requirement.

(b) No impoundment of disinfected tertiary recycled water shall occur within 100 feet of any domestic water supply well.

(c) No irrigation with, or impoundment of, disinfected secondary-2.2 or disinfected secondary-23 recycled water shall take place within 100 feet of any domestic water supply well.

(d) No irrigation with, or impoundment of, undisinfected secondary recycled water shall take place within 150 feet of any domestic water supply well.

(e) Any use of recycled water shall comply with the following:

(1) Any irrigation runoff shall be confined to the recycled water use area, unless the runoff does not pose a public health threat and is authorized by the regulatory agency.

(2) Spray, mist, or runoff shall not enter dwellings, designated outdoor eating areas, or food handling facilities.

(3) Drinking water fountains shall be protected against contact with recycled water spray, mist, or runoff.

(f) No spray irrigation of any recycled water, other than disinfected tertiary recycled water, shall take place within 100 feet of a residence or a place where public exposure could be similar to that of a park, playground, or school yard.

(g) All use areas where recycled water is used that are accessible to the public shall be posted with signs that are visible to the public, in a size no less than 4 inches high by 8 inches wide, that include the following wording : "RECYCLED WATER - DO NOT DRINK". Each sign shall display an international symbol similar to that shown in figure 60310-A. The Department may accept alternative signage and wording, or an educational program, provided the applicant demonstrates to the Department that the alternative approach will assure an equivalent degree of public notification.

(h) Except as allowed under section 7604 of title 17, California Code of Regulations, no physical connection shall be made or allowed to exist between any recycled water system and any separate system conveying potable water.

(i) The portions of the recycled water piping system that are in areas subject to access by the general public shall not include any hose bibbs. Only quick couplers that differ from those used on the potable water system shall be used on the portions of the recycled water piping system in areas subject to public access.

Water Recycling Criteria

FIGURE 60310-A

Article 5. Dual Plumbed Recycled Water Systems.

§60313. General requirements.

(a) No person other than a recycled water agency shall deliver recycled water to a dual plumbed facility.

(b) No recycled water agency shall deliver recycled water for any internal use to any individually-owned residential units including free-standing structures, multiplexes, or condominiums.[1]

(c) No recycled water agency shall deliver recycled water for internal use except for fire suppression systems, to any facility that produces or processes food products or beverages. For purposes of this Subsection, cafeterias or snack bars in a facility whose primary function does not involve the production or processing of foods or beverages are not considered facilities that produce or process foods or beverages.

(d) No recycled water agency shall deliver recycled water to a facility using a dual plumbed system unless the report required pursuant to section 13522.5 of the Water Code, and which meets the requirements set forth in section 60314, has been submitted to, and approved by, the regulatory agency.

§60314. Report submittal.

(a) For dual-plumbed recycled water systems, the report submitted pursuant to section13522.5 of the Water Code shall contain the following information in addition to the information required by section 60323:

(1) A detailed description of the intended use area identifying the following:

(A) The number, location, and type of facilities within the use area proposing to use dual plumbed systems,

(B) The average number of persons estimated to be served by each facility on a daily basis,

(C) The specific boundaries of the proposed use area including a map showing the location of each facility to be served,

(D) The person or persons responsible for operation of the dual plumbed system at each facility, and

(E) The specific use to be made of the recycled water at each facility.

(2) Plans and specifications describing the following:

(A) Proposed piping system to be used,

(B) Pipe locations of both the recycled and potable systems,

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[1] AB 1406, Chapter 537, Statutes of 2007, Water Code 13553, et seq., allows condominiums to be plumbed with recycled water, subject to a number of provisions. This regulation will be changed in future CDPH rulemaking to be consistent with the revised statutory requirements.

(C) Type and location of the outlets and plumbing fixtures that will be accessible to the public, and

(D) The methods and devices to be used to prevent backflow of recycled water into the public water system.

(3) The methods to be used by the recycled water agency to assure that the installation and operation of the dual plumbed system will not result in cross connections between the recycled water piping system and the potable water piping system. This shall include a description of pressure, dye or other test methods to be used to test the system every four years.

(b) A master plan report that covers more than one facility or use site may be submitted provided the report includes the information required by this section. Plans and specifications for individual facilities covered by the report may be submitted at any time prior to the delivery of recycled water to the facility.

§60315. Design requirements.

The public water supply shall not be used as a backup or supplemental source of water for a dual-plumbed recycled water system unless the connection between the two systems is protected by an air gap separation which complies with the requirements of sections 7602 (a) and 7603 (a) of title 17, California Code of Regulations, and the approval of the public water system has been obtained.

§60316. Operation requirements.

(a) Prior to the initial operation of the dual-plumbed recycled water system and annually thereafter, the Recycled Water Agency shall ensure that the dual plumbed system within each facility and use area is inspected for possible cross connections with the potable water system. The recycled water system shall also be tested for possible cross connections at least once every four years. The testing shall be conducted in accordance with the method described in the report submitted pursuant to section 60314. The inspections and the testing shall be performed by a cross connection control specialist certified by the California-Nevada section of the American Water Works Association or an organization with equivalent certification requirements. A written report documenting the result of the inspection or testing for the prior year shall be submitted to the department within 30 days following completion of the inspection or testing.

(b) The recycled water agency shall notify the department of any incidence of backflow from the dual-plumbed recycled water system into the potable water system within 24 hours of the discovery of the incident.

(c) Any backflow prevention device installed to protect the public water system serving the dual-plumbed recycled water system shall be inspected and maintained in accordance with section 7605 of Title 17, California Code of Regulations.

Article 5.1. Indirect Potable Reuse: Groundwater Replenishment – Surface Application.

~~§60320. Groundwater recharge.~~ *(repealed)*

~~(a) Reclaimed water used for groundwater recharge of domestic water supply aquifers by surface spreading shall be at all times of a quality that fully protects public health. The State Department of Health Services' recommendations to the Regional Water Quality Control Boards for proposed groundwater recharge projects and for expansion of existing projects will be made on an individual case basis where the use of reclaimed water involves a potential risk to public health.~~

~~(b) The State Department of Health Services' recommendations will be based on all relevant aspects of each project, including the following factors: treatment provided; effluent quality and quantity; spreading area operations; soil characteristics; hydrogeology; residence time; and distance to withdrawal.~~

~~(c) The State Department of Health Services will hold a public hearing prior to making the final determination regarding the public health aspects of each groundwater recharge project. Final recommendations will be submitted to the Regional Water Quality Control Board in an expeditious manner.~~

§60320.100. General Requirements.

(a) The requirements of this Article apply to Groundwater Replenishment Reuse Projects (GRRPs) utilizing surface application, which receive initial permits from the Regional Board after June 18, 2014. Within 12 months after June 18, 2014, a project sponsor for a GRRP permitted on or before June 18, 2014, shall submit a report to the Department and appropriate Regional Board assessing its compliance with the requirements of this Article. For each requirement considered noncompliant and applicable by the Department or Regional Board, a project sponsor shall submit a schedule to the Department and Regional Board, for demonstrating and/or achieving compliance with the applicable requirements of this Article. Unless directed otherwise by the Department, a project sponsor's report for a GRRP permitted on or before June 18, 2014, need not assess compliance with requirements of this Article that are required to be met prior to operation of a GRRP, except subsection (b) of this section. The report is subject to review and approval by the Department and Regional Board.

(b) Prior to operation of a GRRP, the GRRP's project sponsor shall obtain Department approval of a plan describing the steps a project sponsor will take to provide an alternative source of drinking water supply to all users of a producing drinking water well, or a Department-approved treatment mechanism a project sponsor will provide to all owners of a producing drinking water well, that as a result of the GRRP's operation, as determined by the Department:

(1) violates a California or federal drinking water standard;

(2) has been degraded to the degree that it is no longer a safe source of drinking water; or

(3) receives water that fails to meet section 60320.108.

(c) Prior to operating a GRRP, a project sponsor shall collect at least four samples, at least one sample each quarter, from each potentially affected aquifer. The samples shall be representative of water in each aquifer, taking into consideration seasonal variations, and be analyzed for the chemicals, contaminants, and characteristics pursuant to sections 60320.110, 60320.112, 60320.118, and 60320.120.

(d) A GRRP's recycled municipal wastewater shall be retained underground for a period of time no less than the retention time required pursuant to sections 60320.108 and 60320.124. The GRRP shall be designed and operated in a manner that ensures water treated pursuant to this Article, beyond the boundary described in subsection (e)(2), meets the recycled municipal wastewater contributions (RWC) requirements in section 60320.116.

(e) Based on hydrogeologic flowpaths, a GRRP's project sponsor shall provide the Department, Regional Board, and local well-permitting authorities a map of the GRRP site at a scale of 1:24,000 or larger (1 inch equals 2,000 feet or 1 inch equals less than 2,000 feet) or, if necessary, a site sketch at a scale providing more detail, that clearly indicates the criteria in paragraphs (1) – (4) below. A revised map shall be prepared and provided when conditions change such that the previous map no longer accurately reflects current conditions.

(1) the location and boundaries of the GRRP;

(2) a boundary representing a zone of controlled drinking water well construction, the greatest of the horizontal and vertical distances reflecting the retention times required pursuant to sections 60320.108 and 60320.124;

(3) a secondary boundary representing a zone of potential controlled drinking water well construction, depicting the zone within which a well would extend the boundary in paragraph (2) to include existing or potential future drinking water wells, thereby requiring further study and potential mitigating activities prior to drinking water well construction; and

(4) the location of all monitoring wells established pursuant to section 60320.126, and drinking water wells within two years travel time of the GRRP based on groundwater flow directions and velocities expected under GRRP operating conditions.

(f) Prior to operating a GRRP, a project sponsor shall demonstrate to the Department and Regional Board that a project sponsor possesses adequate managerial and technical capability to assure compliance with this Article.

(g) Prior to replenishing a groundwater basin or an aquifer with recycled municipal wastewater, a GRRP's project sponsor shall demonstrate that all treatment processes have been installed and can be operated by a project sponsor to achieve their intended function. A protocol describing the actions to be taken to meet this subsection shall be included in the engineering report submitted pursuant section 60323.

(h) In the engineering report required pursuant to section 60323, a project sponsor for a GRRP shall include a hydrogeological assessment of the proposed GRRP's setting. The assessment shall include the following:

(1) the qualifications of the individual(s) preparing the assessment;

(2) a general description of geologic and hydrogeological setting of the groundwater basin(s) potentially directly impacted by the GRRP;

(3) a detailed description of the stratigraphy beneath the GRRP, including the composition, extent, and physical properties of the affected aquifers; and

(4) based on at least four rounds of consecutive quarterly monitoring to capture seasonal impacts;

(A) the existing hydrogeology and the hydrogeology anticipated as a result of the operation of the GRRP, and

(B) maps showing quarterly groundwater elevation contours, along with vector flow directions and calculated hydraulic gradients.

(i) If a project sponsor fails to complete compliance monitoring required pursuant to this Article, the Regional Board may determine water quality-related compliance based on available data.

(j) A project sponsor shall ensure that the recycled municipal wastewater used for a GRRP shall be from a wastewater management agency that is not in violation of the effluent limits pertaining to groundwater replenishment pursuant to this Article, as established in the wastewater management agency's Regional Board permit.

(k) If a project sponsor has been directed by the Department or Regional Board to suspend surface application pursuant to this Article, surface application shall not resume until the project sponsor has obtained Department and Regional Board approval.

§60320.102. Public Hearing.

(a) A public hearing for a GRRP shall be held by a project sponsor prior to the Department's submittal of its recommendations to the Regional Board for the GRRP's

initial permit and any time an increase in maximum RWC has been proposed but not addressed in a prior public hearing. Prior to a public hearing conducted pursuant to this section, a project sponsor shall provide the Department, for its review and approval, the information a project sponsor intends to present at the hearing. Following the Department's approval of the information, a project sponsor shall place the information on a project sponsor's Web site and in a repository that provides at least 30 days of public access to the information prior to the public hearing.

(b) Prior to placing the information required pursuant to subsection (a) in a repository, a project sponsor shall:

(1) Notify the public of the following;

(A) the location and hours of operation of the repository,

(B) the Internet address where the information may be viewed,

(C) the purpose of the repository and public hearing,

(D) the manner in which the public can provide comments, and

(E) the date, time, and location of the public hearing; and

(2) At a minimum, notify the first downgradient drinking water well owner and well owners whose drinking water well is within 10 years from the GRRP based on groundwater flow directions and velocities.

(c) Unless directed otherwise by the Department, the public notification made pursuant to subsection (b)(2) shall be by direct mail and the notification made pursuant to subsection (b)(1) shall be delivered in a manner to reach persons whose source of drinking water may be impacted by the GRRP, using one or more of the following methods:

(1) local newspaper(s) publication of general circulation;

(2) mailed or direct delivery of a newsletter;

(3) conspicuously placed statement in water bills; and/or

(4) television and/or radio.

§60320.104. Lab Analyses.

(a) Analyses for contaminants having primary or secondary MCLs shall be performed by laboratories approved to perform such analyses by the Department utilizing Department-approved drinking water methods.

(b) Analyses for chemicals other than those having primary or secondary MCLs shall be described in the GRRP's Operation Optimization Plan prepared pursuant to section 60320.122.

§60320.106. Wastewater Source Control.

A project sponsor shall ensure that the recycled municipal wastewater used for a GRRP shall be from a wastewater management agency that:

(a) administers an industrial pretreatment and pollutant source control program; and

(b) implements and maintains a source control program that includes, at a minimum;

(1) an assessment of the fate of Department-specified and Regional Board-specified chemicals and contaminants through the wastewater and recycled municipal wastewater treatment systems,

(2) chemical and contaminant source investigations and monitoring that focuses on Department-specified and Regional Board-specified chemicals and contaminants,

(3) an outreach program to industrial, commercial, and residential communities within the portions of the sewage collection agency's service area that flows into the water reclamation plant subsequently supplying the GRRP, for the purpose of managing and minimizing the discharge of chemicals and contaminants at the source, and

(4) a current inventory of chemicals and contaminants identified pursuant to this section, including new chemicals and contaminants resulting from new sources or changes to existing sources, that may be discharged into the wastewater collection system.

§60320.108. Pathogenic Microorganism Control.

(a) A project sponsor shall design and operate a GRRP such that the recycled municipal wastewater used as recharge water for a GRRP receives treatment that achieves at least 12-log enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction. The treatment train shall consist of at least three separate treatment processes. Except as provided in subsection (c), for each pathogen (i.e., virus, Giardia cyst, or Cryptosporidium oocyst), a separate treatment process may be credited with no more than 6-log reduction, with at least three processes each being credited with no less than 1.0-log reduction.

(b) At a minimum, the recycled municipal wastewater applied at a GRRP shall receive treatment that meets:

(1) the definition of filtered wastewater, pursuant to section 60301.320; and

(2) the definition of disinfected tertiary recycled water, pursuant to section 60301.230.

(c) For each month retained underground as demonstrated in subsection (e), the recycled municipal wastewater or recharge water will be credited with 1-log virus reduction. A GRRP meeting subsections (b)(1) and (2) or providing advanced treatment in accordance with section 60320.201 for the entire flow of the recycled municipal wastewater used for groundwater replenishment, that also demonstrates at least six months retention underground pursuant to subsection (e), will be credited with 10-log Giardia cyst reduction and 10-log Cryptosporidium oocyst reduction.

(d) With the exception of log reduction credited pursuant to subsection (c), a project sponsor shall validate each of the treatment processes used to meet the requirements in subsection (a) for their log reduction by submitting a report for the Department's review and approval, or by using a challenge test approved by the Department, that provides evidence of the treatment process's ability to reliably and consistently achieve the log reduction. The report and/or challenge test shall be prepared by an engineer licensed in California with at least five years of experience, as a licensed engineer, in wastewater treatment and public water supply, including the evaluation of treatment processes for pathogen control. With the exception of retention time underground and a soil-aquifer treatment process, a project sponsor shall propose and include in its Operation Optimization Plan prepared pursuant to section 60320.122, on-going monitoring using the pathogenic microorganism of concern or a microbial, chemical, or physical surrogate parameter(s) that verifies the performance of each treatment process's ability to achieve its credited log reduction.

(e) To demonstrate the retention time underground in subsection (c), a tracer study utilizing an added tracer shall be implemented under hydraulic conditions representative of normal GRRP operations. The retention time shall be the time representing the difference from when the water with the tracer is applied at the GRRP to when either; two percent (2%) of the initially introduced tracer concentration has reached the downgradient monitoring point, or ten percent (10%) of the peak tracer unit value observed at the downgradient monitoring point reached the monitoring point. A project sponsor for a GRRP shall initiate the tracer study prior to the end of the third month of operation. A project sponsor for a GRRP permitted on or before June 18, 2014, that has not already performed such a tracer study shall complete a tracer study demonstrating the retention time underground. With Department approval, an intrinsic tracer may be used in lieu of an added tracer, with no more credit provided than the corresponding virus log reduction in column 2 of Table 60320.108.

(f) For the purpose of siting a GRRP location during project planning and until a GRRP's project sponsor has met the requirements of subsection (e), for each month of retention time estimated using the method in column 1, the recycled municipal wastewater or recharge water shall be credited with no more than the corresponding virus log reduction in column 2 of Table 60320.108.

Table 60320.108

Column 1	Column 2
Method used to estimate the retention time to the nearest downgradient drinking water well	**Virus Log Reduction Credit per Month**
Tracer study utilizing an added tracer.[1]	1.0 log
Tracer study utilizing an intrinsic tracer.[1]	0.67 log
Numerical modeling consisting of calibrated finite element or finite difference models using validated and verified computer codes used for simulating groundwater flow.	0.50 log
Analytical modeling using existing academically-accepted equations such as Darcy's Law to estimate groundwater flow conditions based on simplifying aquifer assumptions.	0.25 log

[1] The retention time shall be the time representing the difference from when the water with the tracer is applied at the GRRP to when either; two percent (2%) of the initially introduced tracer concentration has reached the downgradient monitoring point, or ten percent (10%) of the peak tracer unit value observed at the downgradient monitoring point reached the monitoring point.

(g) A project sponsor shall obtain Department approval for the protocol(s) to be used to establish the retention times in subsections (e) and (f).

(h) Based on changes in hydrogeological or climatic conditions since the most recent demonstration, the Department may require a GRRP's project sponsor to demonstrate that the underground retention times required in this section are being met.

(i) If a pathogen reduction in subsection (a) is not met based on the on-going monitoring required pursuant to subsection (d), within 24 hours of being aware a project sponsor shall immediately investigate the cause and initiate corrective actions. The project sponsor shall immediately notify the Department and Regional Board if the GRRP fails to meet the pathogen reduction criteria longer than 4 consecutive hours, or more than a total of 8 hours during any 7-day period. Failures of shorter duration shall be reported to the Regional Board by a project sponsor no later than 10 days after the month in which the failure occurred.

(j) If the effectiveness of a treatment train's ability to reduce enteric virus is less than 10-logs, or Giardia cyst or Cryptosporidium oocyst reduction is less than 8-logs, a project sponsor shall immediately notify the Department and Regional Board, and discontinue application of recycled municipal wastewater at the GRRP, unless directed otherwise by the Department or Regional Board.

§60320.110. Nitrogen Compounds Control.

(a) To demonstrate control of the nitrogen compounds, a project sponsor shall:

(1) Each week, at least three days apart as specified in the GRRP's Operation Optimization Plan, collect at least two total nitrogen samples (grab or 24-hour composite) representative of the recycled municipal wastewater or recharge water applied throughout the spreading area. Samples may be collected before or after surface application;

(2) Have the samples collected pursuant to paragraph (1) analyzed for total nitrogen, with the laboratory being required by a project sponsor to complete each analysis within 72 hours and have the result reported to a project sponsor within the same 72 hours if the result of any single sample exceeds 10 mg/L;

(3) If the average of the results of two consecutive samples collected pursuant to paragraph (1) exceeds 10 mg/L total nitrogen;

(A) take a confirmation sample and notify the Department and the Regional Board within 48 hours of being notified of the results by the laboratory,

(B) investigate the cause for the exceedances and take actions to reduce the total nitrogen concentrations to ensure continued or future exceedances do not occur, and

(C) initiate additional monitoring for nitrogen compounds as described in the GRRP's Operation Optimization Plan, including locations in the groundwater basin and spreading area, to identify elevated concentrations and determine whether such elevated concentrations exceed or may lead to an exceedance of a nitrogen-based MCL; and

(4) If the average of the results of four consecutive samples collected pursuant to paragraph (1) exceeds 10 mg/L total nitrogen, suspend the surface application of recycled municipal wastewater. Surface application shall not resume until corrective actions have been taken and at least two consecutive total nitrogen sampling results are less than 10 mg/L.

(b) As determined by the Department and based on a GRRP's operation, including but not limited to the time the spreading area is out of service and utilization of a denitrification process, a project sponsor shall initiate additional monitoring for nitrogen compounds to identify elevated concentrations in the groundwater and determine whether such elevated concentrations exceed or may lead to an exceedance of a nitrogen-based MCL.

(c) Following Department and Regional Board approval, a project sponsor may initiate reduced monitoring frequencies for total nitrogen. A project sponsor may apply to the Department and Regional Board for reduced monitoring frequencies for total nitrogen if, for the most recent 24 months:

(1) the average of all results did not exceed 5 mg/L total nitrogen; and

(2) the average of a result and its confirmation sample (taken within 24 hours of receipt of the initial result) did not exceed 10 mg/L total nitrogen.

(d) If the results of reduced monitoring conducted as approved pursuant to subsection (c) exceed the total nitrogen concentration criteria in subsection (c), a project sponsor shall revert to the monitoring frequencies for total nitrogen prior to implementation of the reduced frequencies. Reduced frequency monitoring shall not resume unless the requirements of subsection (c) are met.

§60320.112. Regulated Contaminants and Physical Characteristics Control.

(a) Each quarter, as specified in the GRRP's Operation Optimization Plan, a project sponsor shall collect samples (grab or 24-hour composite) representative of the applied recycled municipal wastewater and have the samples analyzed for:

(1) the inorganic chemicals in Table 64431-A, except for nitrogen compounds;

(2) the radionuclide chemicals in Tables 64442 and 64443;

(3) the organic chemicals in Table 64444-A;

(4) the disinfection byproducts in Table 64533-A; and

(5) lead and copper.

(b) Recharge water (including recharge water after surface application) may be monitored in lieu of recycled municipal wastewater to satisfy the monitoring requirements in subsection (a)(4) if the fraction of recycled municipal wastewater in the recharge water is equal to or greater than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter. If the fraction of recycled municipal wastewater in the recharge water being monitored is less than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter, the reported value shall be adjusted to exclude the effects of dilution.

(c) Each year, the GRRP's project sponsor shall collect at least one representative sample (grab or 24-hour composite) of the recycled municipal wastewater or recharge

water and have the sample(s) analyzed for the secondary drinking water contaminants in Tables 64449-A and 64449-B.

(d) If a result of the monitoring performed pursuant to subsection (a) exceeds a contaminant's MCL or action level (for lead and copper), a project sponsor shall collect another sample within 72 hours of notification of the result and then have it analyzed for the contaminant as confirmation.

(1) For a contaminant whose compliance with its MCL or action level is not based on a running annual average, if the average of the initial and confirmation sample exceeds the contaminant's MCL or action level, or the confirmation sample is not collected and analyzed pursuant to this subsection, the GRRP's project sponsor shall notify the Department and Regional Board within 24 hours and initiate weekly monitoring until four consecutive weekly results are below the contaminant's MCL or action level. If the running four-week average exceeds the contaminant's MCL or action level, the GRRP's project sponsor shall notify the Department and Regional Board within 24 hours and, if directed by the Department or Regional Board, suspend application of the recycled municipal wastewater.

(2) For a contaminant whose compliance with its MCL is based on a running annual average, if the average of the initial and confirmation sample exceeds the contaminant's MCL, or a confirmation sample is not collected and analyzed pursuant to this subsection, the GRRP shall initiate weekly monitoring for the contaminant until the running four-week average no longer exceeds the contaminant's MCL.

(A) If the running four-week average exceeds the contaminant's MCL, a project sponsor shall describe the reason(s) for the exceedance and provide a schedule for completion of corrective actions in a report submitted to the Department and Regional Board no later than 45 days following the quarter in which the exceedance occurred.

(B) If the running four-week average exceeds the contaminant's MCL for sixteen consecutive weeks, a project sponsor shall notify the Department and Regional Board within 48 hours of knowledge of the exceedance and, if directed by the Department or Regional Board, suspend application of the recycled municipal wastewater.

(e) If the annual average of the results of the monitoring performed pursuant to subsection (c) exceeds a contaminant's secondary MCL in Table 64449-A or the upper limit in Table 64449-B, a project sponsor shall initiate quarterly monitoring of the recycled municipal wastewater for the contaminant and, if the running annual average of quarterly-averaged results exceeds a contaminant's secondary MCL or upper limit, describe the reason(s) for the exceedance and any corrective actions taken in a report submitted to Regional Board no later than 45 days following the quarter in which the exceedance occurred, with a copy concurrently provided to the Department. The annual monitoring in subsection (c) may resume if the running annual average of quarterly results does not exceed a contaminant's secondary MCL or upper limit.

(f) If four consecutive quarterly results for asbestos are below the detection limit in Table 64432-A for asbestos, monitoring for asbestos may be reduced to one sample every three years. Quarterly monitoring shall resume if asbestos is detected.

§60320.114. Diluent Water Requirements.

To be credited with diluent water used in calculating an RWC pursuant to section 60320.116, the GRRP shall comply with the requirements of this section and receive Department approval. For diluent water that is a Department-approved drinking water source, the GRRP's project sponsor is exempt from subsections (a) and (b). The GRRP's project sponsor shall:

(a) Monitor the diluent water quarterly for nitrate and nitrite and, within 72 hours of being informed by the laboratory of a nitrate, nitrite, or nitrate plus nitrite result exceeding a maximum contaminant level (MCL), collect a confirmation sample. If the average of the two samples is greater than an MCL;

(1) notify the Department and the Regional Board within 48 hours of receiving the confirmation sample result,

(2) investigate the cause(s) and implement corrective actions, and

(3) each week, collect and analyze two grab samples at least three days apart as specified in the GRRP's Operation Optimization Plan. If the average of the results for a two-week period exceeds the MCL, surface application of the diluent water shall not be used in the calculation of RWC until corrective actions are made. Quarterly monitoring may resume if four consecutive results are below the MCL.

(b) Conduct a source water evaluation per the California-Nevada Section of American Water Works Association's Watershed Sanitary Survey Guidance Manual (1993), as it may be amended, or other Department-approved evaluation, of the diluent water for Department review and approval that includes, but is not limited to:

(1) a description of the source of the diluent water;

(2) delineation of the origin and extent of the diluent water;

(3) the susceptibility of the diluent water to contamination;

(4) the identification of known or potential contaminants; and

(5) an inventory of the potential sources of diluent water contamination.

(c) Ensure diluent water does not exceed a primary MCL, a secondary MCL upper limit (if not historically used to recharge the basin), or a notification level (NL), and implement a Department-approved water quality monitoring plan for Department-specified contaminants to demonstrate compliance with the primary MCLs, secondary MCLs (except turbidity, color, and odor), and NLs. The plan shall also include:

(1) except for Department-approved drinking water sources used as a diluent water, monitoring of any chemicals or contaminants required pursuant to section 60320.120, based on the source water evaluation performed in subsection (b); and

(2) actions to be taken in the event of non-compliance with a primary MCL, secondary MCL, or exceedance of a NL.

(d) Develop a method for determining the volume of diluent water to be credited and demonstrate that the diluent water will be introduced in a manner such that the diluent water volume will not result in the GRRP's 120-month running monthly average RWC exceeding its maximum RWC at or beyond the boundary established pursuant to section 60320.100(e)(2). The method shall be submitted to the Department for review and approval, and be conducted at a frequency specified in the engineering report prepared pursuant to section 60323. The method shall address all conditions that influence how and when the recycled municipal wastewater and diluent water arrive at all points along the boundary. The conditions must include, but are not limited to, temporal variability in the diluent water supply and regional groundwater gradients, the difference in the distribution of the recycled municipal wastewater and diluent water between individual aquifers where more than one aquifer is replenished, and the difference in travel-time when recycled municipal wastewater and diluent water are introduced at different locations and/or times.

(e) For credit prior to the operation of the GRRP, but not to exceed 120 months:

(1) demonstrate that the diluent water met the nitrate, nitrite, and nitrate plus nitrite MCLs, NLs, and the water quality requirements in section 60320.112;

(2) provide evidence that the quantity of diluent water has been accurately determined and was distributed such that the proposed or permitted maximum RWC would not have been exceeded; and

(3) conduct a source water evaluation of the diluent water pursuant to subsection (b).

(f) In the Operation Optimization Plan prepared pursuant to section 60320.122, include a description of:

(1) how the diluent water will be distributed in a manner that ensures that the maximum RWC will not be exceeded during normal operations; and

(2) the actions to be taken in the event the diluent water is curtailed or is no longer available.

(g) If approved by the Department, recharge water may be monitored in lieu of a diluent water source if the diluent water source cannot be monitored directly in a manner that provides samples representative of the diluent water being applied.

§60320.116. Recycled Municipal Wastewater Contribution (RWC) Requirements.

(a) Each month, for each surface application GRRP used for replenishing a groundwater basin, the GRRP's project sponsor shall calculate the running monthly average (RMA) RWC based on the total volume of the recycled municipal wastewater and credited diluent water for the preceding 120 months. For GRRPs in operation less than 120 months, calculation of the RMA RWC shall commence after 30 months of recycled municipal wastewater application, based on the total volume of the recycled municipal wastewater and credited diluent water introduced during the preceding months.

(b) The GRRP's RMA RWC, as determined in subsection (a), shall not exceed the maximum RWC specified for the GRRP by the Department.

(c) The initial maximum RWC shall not exceed 0.20 or an alternative initial RWC approved by the Department. An alternative initial RWC up to 1.0 may be approved by the Department based on, but not limited to, the Department's review of the engineering report, the information obtained as a result of the public hearing(s), and a project sponsor's demonstration that the treatment processes preceding the soil-aquifer treatment process will reliably achieve total organic carbon (TOC) concentrations no greater than 0.5 mg/L divided by the proposed initial RWC.

(d) A GRRP may increase its maximum RWC, provided:

(1) the increase has been approved by the Department and Regional Board;

(2) for the previous 52 weeks, the TOC 20-week running average, as monitored pursuant to section 62320.118, has not exceeded 0.5 mg/L divided by the proposed maximum RWC; and

(3) the GRRP has received a permit from the Regional Board that allows operation of the GRRP at the increased maximum RWC.

(e) In addition to the requirements in subsection (d), prior to operating a GRRP at an RWC greater than 0.50 or 0.75, which must be achieved sequentially, a project sponsor shall:

(1) provide a proposal to the Department prepared and signed by an engineer licensed in California with at least three years of experience in wastewater treatment and public water supply;

(2) submit an updated engineering report and Operation Optimization Plan; and

(3) provide evidence of compliance with section 60320.126(a).

(f) If the RMA RWC exceeds its maximum RWC, the GRRP's project sponsor shall:

(1) notify the Department and Regional Board in writing within seven days of knowledge of the exceedance; and

(2) within 60 days of knowledge of the exceedance, implement corrective action(s) and additional actions that may be required by the Department or Regional Board, and submit a report to the Department and Regional Board describing the reason(s) for the exceedance and the corrective action(s) taken to avoid future exceedances.

§60320.118. Total Organic Carbon (TOC) and Soil-Aquifer Treatment (SAT) Process Requirements.

For each surface application GRRP used for replenishing a groundwater basin, the GRRP's project sponsor shall assess the SAT process through the monitoring of TOC, indicator compounds, and surrogate parameters, as approved by the Department.

(a) At least once each week, a project sponsor shall analyze TOC from representative 24-hour composite samples of the following:

(1) the undiluted recycled municipal wastewater, prior to application or within the zone of percolation;

(2) the diluted percolated recycled municipal wastewater, with the value amended to negate the effect of the diluent water; or

(3) the undiluted recycled municipal wastewater prior to application, with the value amended using a soil-aquifer treatment factor approved by the Department and based on demonstration studies, which reliably predicts the removal efficiency of the process.

(b) Grab samples may be used in lieu of the 24-hour composite samples required in subsection (a) if:

(1) the GRRP demonstrates that a grab sample is representative of the water quality throughout a 24-hour period; or

(2) the entire recycled municipal wastewater stream has been treated by reverse osmosis meeting the criteria in sections 60320.201(a) and (b).

(c) Analytical results of the TOC monitoring performed pursuant to subsection (a) shall not exceed 0.5 mg/L divided by the RMA RWC based on:

(1) the 20-week running average of all TOC results; and

(2) the average of the last four TOC results.

(d) If the GRRP exceeds the limit in subsection (c)(1) or its approved increased TOC limit obtained pursuant to section 60320.130(c), based on a 20-week running average, a project sponsor shall take the following actions upon being notified of the results:

(1) immediately suspend the addition of recycled municipal wastewater until at least two consecutive results, three days apart, are less than the limit;

(2) notify the Department and Regional Board within seven days of suspension; and

(3) within 60 days, submit a report to the Department and Regional Board describing the reasons for the exceedance and the corrective actions to avoid future exceedances. At a minimum, the corrective actions shall include;

(A) a reduction of RWC sufficient to comply with the limit, and/or

(B) additional treatment demonstrated to the Department to remove TOC and chemicals or contaminants of concern to public health.

(e) If the GRRP exceeds the limit in subsection (c)(2) or its approved increased TOC limit obtained pursuant to section 60320.130(c), based on the average of the last four results, a project sponsor shall, within 60 days of being notified of the results, submit a report to the Department and Regional Board describing the reasons for the exceedance and the corrective actions taken to avoid future exceedances.

(f) Prior to a GRRP beginning initial operation and at five-year intervals thereafter, a project sponsor shall conduct a study to determine the occurrence of indicator compounds in the recycled municipal wastewater to be applied at the GRRP. Following completion of the study, a project sponsor shall propose at least three indicator compounds for use in meeting subsection (g). The protocol for the occurrence study, the study's results, and the indicator compounds to be used shall be reviewed and approved by the Department.

(g) Quarterly, a project sponsor shall monitor the GRRP's recycled municipal wastewater or recharge water prior to the SAT process and the water after the SAT process, but at a point no farther than 30 days downgradient of the spreading area. The monitoring shall include at least three indicator compounds based on the results of an occurrence study approved by the Department. If the monitoring results do not indicate a reduction of at least 90 percent in the concentration of indicator compounds by the SAT, excluding the effects of dilution from diluent water that may be present, a project sponsor shall investigate the reason for the low reduction and report the indicator compound and investigative results within 90 days of receipt of the analytical results.

(h) If the result of the investigation in subsection (g) concludes that the 90 percent reduction could not be demonstrated because the concentration of indicator compounds prior to the SAT process was not sufficient, a project sponsor shall consult with the Department and comply with an alternative monitoring plan approved by the Department. If a project sponsor demonstrates that there are not three compounds available and suitable for indicating a 90 percent reduction pursuant to subsection (g), a project sponsor may utilize an indicator compound that achieves a reduction less than 90 percent, with Department approval of the alternative indicator compound and reduction criteria.

(i) To use one or more wastewater chemicals in lieu of TOC, a project sponsor shall obtain approval from the Department. At a minimum, the chemical(s) used in lieu of TOC shall:

(1) be quantifiable in the wastewater, recycled municipal wastewater, groundwater, and throughout the treatment processes; and

(2) have identifiable treatment performance standards as protective of public health as the TOC standards in this Article.

§60320.120. Additional Chemical and Contaminant Monitoring.

(a) Each quarter, the GRRP's project sponsor shall sample and analyze the recycled municipal wastewater and the groundwater (from the downgradient monitoring wells established pursuant to section 60320.126) for the following:

(1) Priority Toxic Pollutants (chemicals listed in 40 CFR section 131.38, "Establishment of numeric criteria for priority toxic pollutants for the State of California," as the foregoing may be amended) specified by the Department, based on the Department's review of the GRRP's engineering report; and

(2) Chemicals that the Department has specified, based on a review of the GRRP's engineering report, the affected groundwater basin(s), and the results of the assessment performed pursuant to section 60320.106(b)(1).

(b) Each quarter, the GRRP's project sponsor shall sample and analyze the recycled municipal wastewater for Department-specified chemicals having notification levels (NLs). Recharge water (including recharge water after surface application) may be monitored in lieu of recycled municipal wastewater if the fraction of recycled municipal wastewater in the recharge water is equal to or greater than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter. If the fraction of recycled municipal wastewater in the recharge water being monitored is less than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter, the reported value shall be adjusted to exclude the effects of dilution. If a result exceeds a NL, within 72 hours of notification of the result a project sponsor shall collect another sample and have it analyzed for the contaminant as confirmation. If the average of the initial and confirmation sample exceeds the contaminant's NL, or a confirmation sample is not collected and analyzed pursuant to this subsection, the GRRP shall initiate weekly monitoring for the contaminant until the running four-week average no longer exceeds the NL.

(1) If the running four-week average exceeds the contaminant's NL, a project sponsor shall describe the reason(s) for the exceedance and provide a schedule for completion of corrective actions in a report submitted to the Regional Board no later than 45 days following the quarter in which the exceedance occurred, with a copy concurrently provided to the Department.

(2) If the running four-week average exceeds the contaminant's NL for sixteen consecutive weeks, a project sponsor shall notify the Department and Regional Board within 48 hours of knowledge of the exceedance.

(c) A project sponsor may reduce monitoring for the chemicals in this section to once each year following Department approval based on the Department's review of the most recent two years of results of the monitoring performed pursuant to this section.

(d) Annually, a project sponsor shall monitor the recycled municipal wastewater for indicator compounds specified by the Department and Regional Board based on the following:

(1) a review of the GRRP's engineering report;

(2) the inventory developed pursuant to section 60320.106(b)(4);

(3) the affected groundwater basin(s);

(4) an indicator compound's ability to characterize the presence of pharmaceuticals, endocrine disrupting chemicals, personal care products, and other indicators of the presence of municipal wastewater; and

(5) the availability of a test method for a chemical.

(e) A chemical or contaminant detected as a result of monitoring conducted pursuant to this section shall be reported to the Department and Regional Board no later than the quarter following the quarter in which the results are received by the GRRP's project sponsor.

§60320.122. Operation Optimization and Plan.

(a) Prior to operation of a GRRP, a project sponsor shall submit an Operation Optimization Plan to the Department and Regional Board for review and approval. At a minimum, the Operation Optimization Plan shall identify and describe the operations, maintenance, analytical methods, monitoring necessary for the GRRP to meet the requirements of this Article, and the reporting of monitoring results to the Department and Regional Board. A project sponsor shall be responsible for ensuring that the Operation Optimization Plan is, at all times, representative of the current operations, maintenance, and monitoring of the GRRP. A GRRP's project sponsor shall make the Operation Optimization Plan available to the Department or Regional Board for review upon request.

(b) During the first year of operation of a GRRP and at all times thereafter, all treatment processes shall be operated in a manner providing optimal reduction of all chemicals and contaminants including:

(1) microbial contaminants;

(2) regulated contaminants identified in section 60320.112 and the nitrogen compounds required pursuant to section 60320.110; and

(3) chemicals and contaminants required pursuant to section 60320.120.

(c) Within six months of optimizing treatment processes pursuant to subsection (b) and anytime thereafter operations are optimized that result in a change in operation, a

project sponsor shall update the GRRP's Operation Optimization Plan to include such changes in operational procedures and submit the operations plan to the Department for review.

§60320.124. Response Retention Time.

(a) The recycled municipal wastewater applied by a GRRP shall be retained underground for a period of time necessary to allow a project sponsor sufficient response time to identify treatment failures and implement actions, including those required pursuant to section 60320.100(b), necessary for the protection of public health.

(b) The response retention time required in subsection (a) must be approved by the Department, based on information provided in the engineering report required pursuant to section 60323. The response retention time shall be no less than two months.

(c) To demonstrate the retention time underground is no less than the response retention time approved pursuant to subsection (b), a tracer study utilizing an added tracer shall be implemented under hydraulic conditions representative of normal GRRP operations. With Department approval, an intrinsic tracer may be used in lieu of an added tracer. For each month of retention time estimated utilizing the approved intrinsic tracer, a project sponsor shall receive no more than 0.67 months credit. The retention time shall be the time representing the difference from when the water with the tracer is applied at the GRRP to when either; two percent (2%) of the initially introduced tracer concentration has reached the downgradient monitoring point, or ten percent (10%) of the peak tracer unit value observed at the downgradient monitoring point reaches the monitoring point. A project sponsor for a GRRP shall initiate the tracer study prior to the end of the third month of operation. A project sponsor for a GRRP permitted on or before June 18, 2014, that has not performed a tracer study shall complete a tracer study demonstrating the retention time underground.

(d) For the purpose of siting a GRRP location during project planning and until a GRRP's project sponsor has met the requirements of subsection (c), for each month of retention time estimated using the method in column 1, the recycled municipal wastewater or recharge water may be credited with no more than the corresponding response time in column 2 of Table 60320.124.

Table 60320.124

Column 1	Column 2
Method used to estimate the retention time	**Response Time Credit per Month**
Tracer study utilizing an added tracer.[1]	1.0 month
Tracer study utilizing an intrinsic tracer.[1]	0.67 month
Numerical modeling consisting of calibrated finite element or finite difference models using validated and verified computer codes used for simulating groundwater flow.	0.50 month
Analytical modeling using existing academically-accepted equations such as Darcy's Law to estimate groundwater flow conditions based on simplifying aquifer assumptions.	0.25 month

[1] The retention time shall be the time representing the difference from when the water with the tracer is applied at the GRRP to when either; two percent (2%) of the initially introduced tracer concentration has reached the downgradient monitoring point, or ten percent (10%) of the peak tracer unit value observed at the downgradient monitoring point reaches the monitoring point.

(e) A project sponsor shall obtain Department approval for the protocol(s) to be used to establish the retention times in subsections (c) and (d).

(f) Upon request from the Department, a project sponsor shall demonstrate that the underground retention times required in this section are being met based on changes in hydrogeological or climatic conditions since the most recent demonstration.

§60320.126. Monitoring Well Requirements.

(a) Prior to operating a GRRP, a project sponsor shall site and construct at least two monitoring wells downgradient of the GRRP such that:

(1) at least one monitoring well is located;

(A) no less than two weeks but no more than six months of travel through the saturated zone affected by the GRRP, and

(B) at least 30 days upgradient of the nearest drinking water well;

(2) in addition to the well(s) in paragraph (1) and after consultation with the Department, at least one monitoring well is located between the GRRP and the nearest downgradient drinking water well; and

(3) samples from the monitoring wells in paragraphs (1) and (2) can be;

(A) obtained independently from each aquifer, initially receiving the water used as a source of drinking water supply, that will receive the GRRP's recharge water, and

(B) validated as receiving recharge water from the GRRP.

(b) In addition to the monitoring required pursuant to section 60320.120, from each monitoring well in subsection (a)(1), and each monitoring well in subsection (a)(2) that has recharge water located within one year travel time of the well(s), a project sponsor shall collect two samples prior to GRRP operation and at least one sample each quarter after operation begins. Each sample shall be analyzed for total nitrogen, nitrate, nitrite, the contaminants in Tables 64449-A and B of section 64449, and any contaminants and chemicals specified by the Department or Regional Board based on the results of the recycled municipal wastewater monitoring conducted pursuant to this Article.

(c) If a result from the monitoring conducted pursuant to subsection (b) exceeds 80 percent of a nitrate, nitrite, or nitrate plus nitrite MCL a project sponsor shall, within 48 hours of being notified of the result by the laboratory, collect another sample and have it analyzed for the contaminant. If the average of the result of the initial sample and the confirmation sample exceed the contaminant's MCL, a project sponsor shall:

(1) within 24 hours of being notified by the laboratory of the confirmation sample result, notify the Department and Regional Board; and

(2) discontinue surface application of recycled municipal wastewater until corrective actions have been taken or evidence is provided to the Department and Regional Board that the contamination was not a result of the GRRP.

(d) For Department-specified chemical analyses completed in a month, a project sponsor shall ensure the laboratory electronically submits results to the Department no later than 45 days after the end of the month in which monitoring occurred, in a manner such that data is readily uploaded into the Department's database. Utilization of the process described on the Department's Web site will satisfy this requirement.

(e) The GRRP's project sponsor may reduce monitoring for the chemicals and contaminants in subsection (b) to once each year following Department approval based on the Department's review of the most recent two years of monitoring results.

§60320.128. Reporting.

(a) No later than six months after the end of each calendar year, a project sponsor shall provide a report to the Department and Regional Board. Public water systems and drinking water well owners having downgradient sources potentially affected by the GRRP and within 10 years groundwater travel time from the GRRP shall be notified by direct mail and/or electronic mail of the availability of the report. The report shall be prepared by an engineer licensed in California and experienced in the fields of wastewater treatment and public water supply. The report shall include the following:

(1) A summary of the GRRP's compliance status with the monitoring requirements and criteria of this Article during the previous calendar year;

(2) For any violations of this Article during the previous calendar year;

(A) the date, duration, and nature of the violation,

(B) a summary of any corrective actions and/or suspensions of surface application of recycled municipal wastewater resulting from a violation, and

(C) if uncorrected, a schedule for and summary of all remedial actions;

(3) Any detections of monitored chemicals or contaminants, and any observed trends in the monitoring wells and diluent water supplies;

(4) Information pertaining to the vertical and horizontal migration of the recharge water plume;

(5) A description of any changes in the operation of any unit processes or facilities;

(6) A description of any anticipated changes, along with an evaluation of the expected impact of the changes on subsequent unit processes;

(7) The estimated quantity and quality of the recycled municipal wastewater and diluent water to be applied for the next calendar year;

(8) A summary of the measures taken to comply with section 60320.106 and 60320.100(j), and the effectiveness of the implementation of the measures; and

(9) Increases in RWC during the previous calendar year and RWC increases anticipated for the next calendar year.

(b) Every five years from the date of the initial approval of the engineering report required pursuant to section 60323, a project sponsor shall update the report to address any project changes and submit the report to the Department and Regional Board. The update shall include, but not be limited to:

(1) anticipated RWC increases, a description of how the RWC requirements in section 60320.116 will be met, and the expected impact the increase will have on the GRRP's ability to meet the requirements of this Article;

(2) evidence that the requirements associated with retention time in section 60320.108, if applicable, and section 60320.124 have been met; and

(3) a description of any inconsistencies between previous groundwater model predictions and the observed and/or measured values, as well as a description of how subsequent predictions will be accurately determined.

§60320.130. Alternatives.

(a) A project sponsor may use an alternative to a requirement in this Article if the GRRP's project sponsor:

(1) demonstrates to the Department that the proposed alternative assures at least the same level of protection to public health;

(2) receives written approval from the Department prior to implementation of the alternative; and

(3) if required by the Department or Regional Board, conducts a public hearing on the proposed alternative, disseminates information to the public, and receives public comments, pursuant to sections 60320.102(b) and (c).

(b) Unless specified otherwise by the Department, the demonstration in subsection (a)(1) shall include the results of a review of the proposed alternative by an independent scientific advisory panel that includes a toxicologist, a registered engineering geologist or hydrogeologist, an engineer licensed in California with at least three years of experience in wastewater treatment and public drinking water supply, a microbiologist, and a chemist.

(c) The TOC limit specified in section 60320.118(c) may be increased if:

(1) The increased TOC limit is approved by the Department and Regional Board;

(2) The GRRP has been in operation for the most recent ten consecutive years;

(3) A project sponsor submits a proposal to the Department prepared and signed by an engineer licensed in California with at least three years of experience in the fields of wastewater treatment and public water supply. The proposal shall include the following, based on the most recent ten consecutive years of operation;

(A) GRRP operations, monitoring, and compliance data,

(B) Evidence that the GRRP has a history of compliance with the requirements of their Regional Board permit,

(C) Evidence that the water collected at all downgradient drinking water wells and monitoring wells impacted by the GRRP has met the primary drinking water standards,

(D) Analytical or treatment studies requested by the Department to make the determination in subparagraph (C),

(E) Validation of appropriate construction and siting of monitoring wells pursuant to section 60320.126(a), and

(F) A study defining the water quality changes, including organic carbon characterization, as a result of the impact of the GRRP; and

(4) A project sponsor performs a health effects evaluation that assesses the health risks to consumers of water impacted by the GRRP, including any anticipated water quality changes resulting from the proposed increased TOC limit. The evaluation shall include the following;

(A) An exposure assessment that characterizes the quality of the water consumed and the quantity of contaminants and chemicals consumed,

(B) All available human epidemiologic studies of the population that has consumed water impacted by the GRRP,

(C) The results of laboratory animal studies and health risk assessments available in peer-reviewed literature pertaining to water impacted by the GRRP and anticipated water quality changes resulting from the proposed increased TOC, including studies or assessments where extrapolation of data may be relevant,

(D) A health risk assessment of the potential individual and cumulative effects of each of the regulated contaminants identified in section 62320.112, and the chemicals or contaminants monitored pursuant to sections 60320.120(a) and (c), that includes;

1. lifetime risks of cancer, and
2. risks of non-cancer effects, and

(E) A report detailing comments, questions, concerns, and conclusions of a review by an independent scientific peer review advisory panel that includes, as a minimum, a toxicologist, an epidemiologist, an engineering geologist or hydrogeologist registered in California, an engineer licensed in California with at least three years of experience in wastewater treatment and public water supply, a microbiologist, and a chemist.

Article 5.2. Indirect Potable Reuse: Groundwater Replenishment – Subsurface Application.

§60320.200. General Requirements.

(a) The requirements of this Article apply to Groundwater Replenishment Reuse Projects (GRRPs) utilizing subsurface application, which receive initial permits from the Regional Board after June 18, 2014. Within 12 months after June 18, 2014, a project sponsor for a GRRP permitted on or before June 18, 2014, shall submit a report to the Department and appropriate Regional Board assessing its compliance with the requirements of this Article. For each requirement considered noncompliant and applicable by the Department or Regional Board, a project sponsor shall submit a schedule to the Department and Regional Board, for demonstrating and/or achieving compliance with the applicable requirements of this Article. Unless directed otherwise by the Department, a project sponsor's report for a GRRP permitted on or before June 18, 2014, need not assess compliance with requirements of this Article that are required to be

met prior to operation of a GRRP, except subsection (b) of this section. The report is subject to review and approval by the Department and Regional Board. A project sponsor shall ensure the GRRP continuously treats, with full advanced treatment meeting the criteria in section 60320.201, the entire recycled municipal wastewater stream prior to application.

(b) Prior to operation of a GRRP, the GRRP's project sponsor shall obtain Department approval of a plan describing the steps a project sponsor will take to provide an alternative source of drinking water supply to all users of a producing drinking water well, or a Department-approved treatment mechanism a project sponsor will provide to all owners of a producing drinking water well, that as a result of the GRRP's operation, as determined by the Department:

(1) violates a California or federal drinking water standard;

(2) has been degraded to the degree that it is no longer a safe source of drinking water; or

(3) receives water that fails to meet section 60320.208.

(c) Prior to operating a GRRP, a project sponsor shall collect at least four samples, at least one sample each quarter, from each potentially affected aquifer. The samples shall be representative of water in each aquifer, taking into consideration seasonal variations, and be analyzed for the chemicals, contaminants, and characteristics pursuant to sections 60320.210, 60320.212, 60320.218, and 60320.220.

(d) A GRRP's recycled municipal wastewater shall be retained underground for a period of time no less than the retention time required pursuant to sections 60320.208 and 60320.224. The GRRP shall be designed and operated in a manner that ensures water treated pursuant to this Article, beyond the boundary described in subsection (e)(2), meets the recycled municipal wastewater contributions (RWC) requirements in section 60320.216.

(e) Based on hydrogeologic flowpaths, a GRRP's project sponsor shall provide the Department, Regional Board, and local well-permitting authorities a map of the GRRP site at a scale of 1:24,000 or larger (1 inch equals 2,000 feet or 1 inch equals less than 2,000 feet) or, if necessary, a site sketch at a scale providing more detail, that clearly indicates the criteria in paragraphs (1) – (4) below. A revised map shall be prepared and provided when conditions change such that the previous map no longer accurately reflects current conditions.

(1) the location and boundaries of the GRRP;

(2) a boundary representing a zone of controlled drinking water well construction, the greatest of the horizontal and vertical distances reflecting the retention times required pursuant to sections 60320.208 and 60320.224;

(3) a secondary boundary representing a zone of potential controlled drinking water well construction, depicting the zone within which a well would extend the

boundary in paragraph (2) to include existing or potential future drinking water wells, thereby requiring further study and potential mitigating activities prior to drinking water well construction; and

(4) the location of all monitoring wells established pursuant to section 60320.226, and drinking water wells within two years travel time of the GRRP based on groundwater flow directions and velocities expected under GRRP operating conditions.

(f) Prior to operating a GRRP, a project sponsor shall demonstrate to the Department and Regional Board that a project sponsor possesses adequate managerial and technical capability to assure compliance with this Article.

(g) Prior to replenishing a groundwater basin or an aquifer with recycled municipal wastewater, a GRRP's project sponsor shall demonstrate that all treatment processes have been installed and can be operated by a project sponsor to achieve their intended function. A protocol describing the actions to be taken to meet this subsection shall be included in the engineering report submitted pursuant section 60323.

(h) In the engineering report required pursuant to section 60323, a project sponsor for a GRRP shall include a hydrogeological assessment of the proposed GRRP's setting. The assessment shall include the following:

(1) the qualifications of the individual(s) preparing the assessment;

(2) a general description of geologic and hydrogeological setting of the groundwater basin(s) potentially directly impacted by the GRRP;

(3) a detailed description of the stratigraphy beneath the GRRP, including the composition, extent, and physical properties of the affected aquifers; and

(4) based on at least four rounds of consecutive quarterly monitoring to capture seasonal impacts;

(A) the existing hydrogeology and the hydrogeology anticipated as a result of the operation of the GRRP, and

(B) maps showing quarterly groundwater elevation contours, along with vector flow directions and calculated hydraulic gradients.

(i) If a project sponsor fails to complete compliance monitoring required pursuant to this Article, the Regional Board may determine water quality-related compliance based on available data.

(j) A project sponsor shall ensure that the recycled municipal wastewater used for a GRRP shall be from a wastewater management agency that is not in violation of the effluent limits pertaining to groundwater replenishment pursuant to this Article, as established in the wastewater management agency's Regional Board permit.

(k) If a project sponsor has been directed by the Department or Regional Board to suspend subsurface application pursuant to this Article, subsurface application shall not resume until the project sponsor has obtained Department and Regional Board approval.

§60320.201. Advanced Treatment Criteria.

Full advanced treatment is the treatment of an oxidized wastewater, as defined in section 60301.650, using a reverse osmosis and an oxidation treatment process that, at a minimum, meets the criteria of this section.

(a) A project sponsor shall select for use a reverse osmosis membrane such that:

(1) each membrane element used in the project has achieved a minimum rejection of sodium chloride of no less than 99.0 percent (99.0%) and an average (nominal) rejection of sodium chloride of no less than 99.2 percent (99.2%), as demonstrated through Method A of ASTM International's method D4194-03 (2008) using the following substitute test conditions:

(A) tests are operated at a recovery of no less than 15 percent (15%);

(B) sodium chloride rejection is based on three or more successive measurements, after flushing and following at least 30 minutes of operation having demonstrated that rejection has stabilized;

(C) an influent pH no less than 6.5 and no greater than 8.0; and

(D) an influent sodium chloride concentration of no greater than 2,000 mg/L, to be verified prior to the start of testing; and

(2) during the first twenty weeks of full-scale operation the membrane produces a permeate with no more than five percent (5%) of the sample results having TOC concentrations greater than 0.25 mg/L, as verified through monitoring no less frequent than weekly.

(b) For the reverse osmosis treatment process, a project sponsor shall propose, for Department review and approval, on-going performance monitoring (e.g., conductivity or TOC) that indicates when the integrity of the process has been compromised. The proposal shall include at least one form of continuous monitoring, as well as the associated surrogate and/or operational parameter limits and alarm settings that indicate when the integrity has been compromised.

(c) To demonstrate a sufficient oxidation process has been designed for implementation, a project sponsor shall:

(1) Perform an occurrence study on the project's municipal wastewater to identify indicator compounds and select a total of at least nine indicator compounds, with at least one from each of the functional groups in subparagraphs (A) through (I) below. A project sponsor shall submit an occurrence study protocol, as well as the subsequent results and chosen indicator compounds, to the Department for review and approval.

(A) Hydroxy Aromatic

(B) Amino/Acylamino Aromatic

(C) Nonaromatic with carbon double bonds
(D) Deprotonated Amine
(E) Alkoxy Polyaromatic
(F) Alkoxy Aromatic
(G) Alkyl Aromatic
(H) Saturated Aliphatic
(I) Nitro Aromatic

(2) Utilize an oxidation process that achieves optimal removal of the indicator compounds selected in paragraph (1) such that removal is no less than;

(A) 0.5-log (69 percent) for each indicator compound representing the functional groups in paragraphs (1)(A) through (1)(G), and

(B) 0.3-log (50 percent) for each indicator compound representing the functional groups in paragraphs (1)(H) and (1)(I).

(3) Establish at least one surrogate or operational parameter that reflects the removal of at least five of the nine indicator compounds selected pursuant to paragraph (1) such that;

(A) at least one of the five indicator compounds represents at least one functional group in paragraphs (1)(A) through (1)(G),

(B) at least one of the five indicator compounds represents at least one functional group in paragraphs (1)(H) or (1)(I),

(C) at least one surrogate or operational parameter is capable of being monitored continuously, recorded, and have associated alarms, and

(D) a surrogate or operational parameter, including the parameter in subparagraph (C), is identified that indicates when the process may no longer meet the criteria established in paragraph (2).

(4) Conduct testing that includes confirmation of the findings of the occurrence study in paragraph (1) and provides evidence that the requirements of paragraphs (2) and (3) can be met with a full-scale oxidation process. The testing shall include challenge or spiking tests conducted to determine the removal differential under normal operating conditions utilizing, at minimum, the nine indicator compounds identified in paragraph (1). A project sponsor shall submit a testing protocol, as well as the subsequent results, to the Department for review and approval.

(d) In lieu of demonstrating that a sufficient oxidation process has been designed for implementation pursuant to subsection (c), a project sponsor may conduct testing demonstrating that the oxidation process will provide no less than 0.5-log (69 percent) reduction of 1,4-dioxane.

(1) A project sponsor shall submit a testing protocol, as well as the subsequent results, to the Department for review and approval. The testing shall include challenge or spiking tests, using 1,4-dioxane, to demonstrate the proposed oxidation process will achieve the minimum 0.5-log reduction under the proposed oxidation process's normal full-scale operating conditions.

(2) A project sponsor shall establish surrogate and/or operational parameters that reflect whether the minimum 0.5-log 1,4-dioxane reduction design criteria is being met. At least one surrogate or operational parameter shall be capable of being monitored continuously, recorded, and have associated alarms that indicate when the process is not operating as designed.

(e) During the full-scale operation of the oxidation process designed pursuant to subsection (c) or (d), a project sponsor shall continuously monitor the surrogate and/or operational parameters established pursuant to subsection (c)(3)(C) or (d)(2), as applicable. A project sponsor shall implement, in full-scale operation, the oxidation process as designed pursuant to subsection (c) or (d).

(f) Within 60 days after completing the initial 12-months of monitoring pursuant to subsection (e), a project sponsor shall submit a report to the Department and Regional Board that includes:

(1) the results of the monitoring performed in subsection (e);

(2) the removal differential of the indicator compounds;

(3) a description of the efficacy of the surrogate and/or operational parameters to reflect the removal differential of the indicator compounds; and

(4) a description of actions taken, or to be taken, if the indicator compound removal did not meet the associated design criteria in subsection (c) or (d), the continuous surrogate and/or operational parameter monitoring in subsection (c)(3)(C) or (d)(2) fails to correspond to the differential indicator compound removal, or the surrogate and/or operational parameter established in subsection (c)(3)(D) or (d)(2) is not met.

(g) Within 60 days after completing the initial 12 months of operation of the reverse osmosis process, a project sponsor shall submit a report to the Department and Regional Board describing the effectiveness of the treatment, process failures, and actions taken in the event the on-going monitoring in subsection (b) indicated that process integrity was compromised.

(h) Each quarter, a project sponsor shall calculate what percent of results of the quarter's monitoring, conducted pursuant to subsections (b) and (e), did not meet the surrogate and/or operational parameter limits established to assure proper on-going performance of the reverse osmosis and oxidation processes. If the percent is greater than ten, within 45 days after the end of the quarter a project sponsor shall:

(1) submit a report to the Department and Regional Board describing the corrective actions planned or taken to reduce the percent to ten percent (10%) or less; and

(2) consult with the Department and, if required, comply with an alternative monitoring plan approved by the Department.

(i) Each month a project sponsor shall collect samples (grab or composite) representative of the effluent of the advanced treatment process and have the samples

analyzed for contaminants having MCLs and notification levels (NLs). After 12 consecutive months with no results exceeding an MCL or NL, a project sponsor may apply for a reduced monitoring frequency. The reduced monitoring frequency shall be no less than quarterly. Monitoring conducted pursuant to this subsection may be used in lieu of the monitoring (for the same contaminants) required pursuant to sections 60320.212 and 60320.220. The effluent of the advanced treatment process shall not exceed an MCL.

§60320.202. Public Hearing.

(a) A public hearing for a GRRP shall be held by a project sponsor prior to the Department's submittal of its recommendations to the Regional Board for the GRRP's initial permit and any time an increase in maximum RWC has been proposed but not addressed in a prior public hearing. Prior to a public hearing conducted pursuant to this section, a project sponsor shall provide the Department, for its review and approval, the information a project sponsor intends to present at the hearing. Following the Department's approval of the information, a project sponsor shall place the information on a project sponsor's Web site and in a repository that provides at least 30 days of public access to the information prior to the public hearing.

(b) Prior to placing the information required pursuant to subsection (a) in a repository, a project sponsor shall:

(1) Notify the public of the following;

(A) the location and hours of operation of the repository,

(B) the Internet address where the information may be viewed,

(C) the purpose of the repository and public hearing,

(D) the manner in which the public can provide comments, and

(E) the date, time, and location of the public hearing; and

(2) At a minimum, notify the first downgradient drinking water well owner and well owners whose drinking water well is within 10 years from the GRRP based on groundwater flow directions and velocities.

(c) Unless directed otherwise by the Department, the public notification made pursuant to subsection (b)(2) shall be by direct mail and the notification made pursuant to subsection (b)(1) shall be delivered in a manner to reach persons whose source of drinking water may be impacted by the GRRP, using one or more of the following methods:

(1) local newspaper(s) publication of general circulation;

(2) mailed or direct delivery of a newsletter;

(3) conspicuously placed statement in water bills; and/or

(4) television and/or radio.

§60320.204. Lab Analyses.

(a) Analyses for contaminants having primary or secondary MCLs shall be performed by laboratories approved to perform such analyses by the Department utilizing Department-approved drinking water methods.

(b) Analyses for chemicals other than those having primary or secondary MCLs shall be described in the GRRP's Operation Optimization Plan prepared pursuant to section 60320.222.

§60320.206. Wastewater Source Control.

A project sponsor shall ensure that the recycled municipal wastewater used for a GRRP shall be from a wastewater management agency that:

(a) administers an industrial pretreatment and pollutant source control program; and

(b) implements and maintains a source control program that includes, at a minimum;

(1) an assessment of the fate of Department-specified and Regional Board-specified chemicals and contaminants through the wastewater and recycled municipal wastewater treatment systems,

(2) chemical and contaminant source investigations and monitoring that focuses on Department-specified and Regional Board-specified chemicals and contaminants,

(3) an outreach program to industrial, commercial, and residential communities within the portions of the sewage collection agency's service area that flows into the water reclamation plant subsequently supplying the GRRP, for the purpose of managing and minimizing the discharge of chemicals and contaminants at the source, and

(4) a current inventory of chemicals and contaminants identified pursuant to this section, including new chemicals and contaminants resulting from new sources or changes to existing sources, that may be discharged into the wastewater collection system.

§60320.208. Pathogenic Microorganism Control.

(a) A project sponsor shall design and operate a GRRP such that the recycled municipal wastewater used as recharge water for a GRRP receives treatment that achieves at least 12-log enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction. The treatment train shall consist of at least three separate treatment processes. For each pathogen (i.e., virus, Giardia cyst, or Cryptosporidium oocyst), a separate treatment process may be credited with no more than 6-log reduction, with at least three processes each being credited with no less than 1.0-log reduction.

(b) For each month retained underground as demonstrated in subsection (e), the recycled municipal wastewater or recharge water will be credited with 1-log virus reduction.

(c) With the exception of log reduction credited pursuant to subsection (b), a project sponsor shall validate each of the treatment processes used to meet the requirements in subsection (a) for their log reduction by submitting a report for the Department's review and approval, or by using a challenge test approved by the Department, that provides evidence of the treatment process's ability to reliably and consistently achieve the log reduction. The report and/or challenge test shall be prepared by an engineer licensed in California with at least five years of experience, as a licensed engineer, in wastewater treatment and public water supply, including the evaluation of treatment processes for pathogen control. With the exception of retention time underground, a project sponsor shall propose and include in its Operation Optimization Plan prepared pursuant to section 60320.222, on-going monitoring using the pathogenic microorganism of concern or a microbial, chemical, or physical surrogate parameter(s) that verifies the performance of each treatment process's ability to achieve its credited log reduction.

(d) To demonstrate the retention time underground in subsection (b) a tracer study utilizing an added tracer shall be implemented under hydraulic conditions representative of normal GRRP operations. The retention time shall be the time representing the difference from when the water with the tracer is applied at the GRRP to when either; two percent (2%) of the initially introduced tracer concentration has reached the downgradient monitoring point, or ten percent (10%) of the peak tracer unit value observed at the downgradient monitoring point reached the monitoring point. A project sponsor for a GRRP shall initiate the tracer study prior to the end of the third month of operation. A project sponsor for a GRRP permitted on or before June 18, 2014, that has not already performed such a tracer study shall complete a tracer study demonstrating the retention time underground. With Department approval, an intrinsic tracer may be used in lieu of an added tracer, with no more credit provided than the corresponding virus log reduction in column 2 of Table 60320.208.

(e) For the purpose of siting a GRRP location during project planning and until a GRRP's project sponsor has met the requirements of subsection (d), for each month of retention time estimated using the method in column 1, the recycled municipal wastewater or recharge water shall be credited with no more than the corresponding virus log reduction in column 2 of Table 60320.208.

Table 60320.208

Column 1	Column 2
Method used to estimate the retention time to the nearest downgradient drinking water well	**Virus Log Reduction Credit per Month**
Tracer study utilizing an added tracer.[1]	1.0 log
Tracer study utilizing an intrinsic tracer.[1]	0.67 log
Numerical modeling consisting of calibrated finite element or finite difference models using validated and verified computer codes used for simulating groundwater flow.	0.50 log
Analytical modeling using existing academically-accepted equations such as Darcy's Law to estimate groundwater flow conditions based on simplifying aquifer assumptions.	0.25 log

[1] The retention time shall be the time representing the difference from when the water with the tracer is applied at the GRRP to when either; two percent (2%) of the initially introduced tracer concentration has reached the downgradient monitoring point, or ten percent (10%) of the peak tracer unit value observed at the downgradient monitoring point reached the monitoring point.

(f) A project sponsor shall obtain Department approval for the protocol(s) to be used to establish the retention times in subsections (d) and (e).

(g) Based on changes in hydrogeological or climatic conditions since the most recent demonstration, the Department may require a GRRP's project sponsor to demonstrate that the underground retention times required in this section are being met.

(h) If a pathogen reduction in subsection (a) is not met based on the on-going monitoring required pursuant to subsection (c), within 24 hours of being aware a project sponsor shall immediately investigate the cause and initiate corrective actions. The project sponsor shall immediately notify the Department and Regional Board if the GRRP fails to meet the pathogen reduction criteria longer than 4 consecutive hours, or more than a total of 8 hours during any 7-day period. Failures of shorter duration shall be reported to the Regional Board by a project sponsor no later than 10 days after the month in which the failure occurred.

(i) If the effectiveness of a treatment train's ability to reduce enteric virus is less than 10-logs, or Giardia cyst or Cryptosporidium oocyst reduction is less than 8-logs, a project sponsor shall immediately notify the Department and Regional Board, and discontinue application of recycled municipal wastewater at the GRRP, unless directed otherwise by the Department or Regional Board.

§60320.210. Nitrogen Compounds Control.

(a) To demonstrate control of the nitrogen compounds, a project sponsor shall:

(1) Each week, at least three days apart as specified in the GRRP's Operation Optimization Plan, collect at least two total nitrogen samples (grab or 24-hour composite) representative of the recycled municipal wastewater or recharge water applied. Samples may be collected before or after subsurface application;

(2) Have the samples collected pursuant to paragraph (1) analyzed for total nitrogen, with the laboratory being required by a project sponsor to complete each analysis within 72 hours and have the result reported to a project sponsor within the same 72 hours if the result of any single sample exceeds 10 mg/L;

(3) If the average of the results of two consecutive samples collected pursuant to paragraph (1) exceeds 10 mg/L total nitrogen;

(A) take a confirmation sample and notify the Department and the Regional Board within 48 hours of being notified of the results by the laboratory,

(B) investigate the cause for the exceedances and take actions to reduce the total nitrogen concentrations to ensure continued or future exceedances do not occur, and

(C) initiate additional monitoring for nitrogen compounds as described in the GRRP's Operation Optimization Plan, including locations in the groundwater basin, to identify elevated concentrations and determine whether such elevated concentrations exceed or may lead to an exceedance of a nitrogen-based MCL; and

(4) If the average of the results of four consecutive samples collected pursuant to paragraph (1) exceeds 10 mg/L total nitrogen, suspend the subsurface application of recycled municipal wastewater. Subsurface application shall not resume until corrective actions have been taken and at least two consecutive total nitrogen sampling results are less than 10 mg/L.

(b) Following Department and Regional Board approval, a project sponsor may initiate reduced monitoring frequencies for total nitrogen. A project sponsor may apply to the Department and Regional Board for reduced monitoring frequencies for total nitrogen if, for the most recent 12 months:

(1) the average of all results did not exceed 5 mg/L total nitrogen; and

(2) the average of a result and its confirmation sample (taken within 24 hours of receipt of the initial result) did not exceed 10 mg/L total nitrogen.

(c) If the results of reduced monitoring conducted as approved pursuant to subsection (b) exceed the total nitrogen concentration criteria in subsection (b), a project sponsor shall revert to the monitoring frequencies for total nitrogen prior to implementation of the reduced frequencies. Reduced frequency monitoring shall not resume unless the requirements of subsection (b) are met.

§60320.212. Regulated Contaminants and Physical Characteristics Control.

(a) Each quarter, as specified in the GRRP's Operation Optimization Plan, a project sponsor shall collect samples (grab or 24-hour composite) representative of the applied recycled municipal wastewater and have the samples analyzed for:

(1) the inorganic chemicals in Table 64431-A, except for nitrogen compounds;

(2) the radionuclide chemicals in Tables 64442 and 64443;

(3) the organic chemicals in Table 64444-A;

(4) the disinfection byproducts in Table 64533-A; and

(5) lead and copper.

(b) Recharge water may be monitored in lieu of recycled municipal wastewater to satisfy the monitoring requirements in subsection (a)(4) if the fraction of recycled municipal wastewater in the recharge water is equal to or greater than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter. If the fraction of recycled municipal wastewater in the recharge water being monitored is less than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter, the reported value shall be adjusted to exclude the effects of dilution.

(c) Each year, the GRRP's project sponsor shall collect at least one representative sample (grab or 24-hour composite) of the recycled municipal wastewater and have the sample(s) analyzed for the secondary drinking water contaminants in Tables 64449-A and 64449-B.

(d) If a result of the monitoring performed pursuant to subsection (a) exceeds a contaminant's MCL or action level (for lead and copper), a project sponsor shall collect another sample within 72 hours of notification of the result and then have it analyzed for the contaminant as confirmation.

(1) For a contaminant whose compliance with its MCL or action level is not based on a running annual average, if the average of the initial and confirmation sample exceeds the contaminant's MCL or action level, or the confirmation sample is not collected and analyzed pursuant to this subsection, the GRRP's project sponsor shall notify the Department and Regional Board within 24 hours and initiate weekly monitoring until four consecutive weekly results are below the contaminant's MCL or action level. If the running four-week average exceeds the contaminant's MCL or action level, the GRRP's project sponsor shall notify the Department and Regional Board within 24 hours and, if directed by the Department or Regional Board, suspend application of the recycled municipal wastewater.

(2) For a contaminant whose compliance with its MCL is based on a running annual average, if the average of the initial and confirmation sample exceeds the contaminant's MCL, or a confirmation sample is not collected and analyzed pursuant to this subsection, the GRRP shall initiate weekly monitoring for the contaminant until the running four-week average no longer exceeds the contaminant's MCL.

(A) If the running four-week average exceeds the contaminant's MCL, a project sponsor shall describe the reason(s) for the exceedance and provide a schedule for completion of corrective actions in a report submitted to the Department and Regional Board no later than 45 days following the quarter in which the exceedance occurred.

(B) If the running four-week average exceeds the contaminant's MCL for sixteen consecutive weeks, a project sponsor shall notify the Department and Regional Board within 48 hours of knowledge of the exceedance and, if directed by the Department or Regional Board, suspend application of the recycled municipal wastewater.

(e) If the annual average of the results of the monitoring performed pursuant to subsection (c) exceeds a contaminant's secondary MCL in Table 64449-A or the upper limit in Table 64449-B, a project sponsor shall initiate quarterly monitoring of the recycled municipal wastewater for the contaminant and, if the running annual average of quarterly-averaged results exceeds a contaminant's secondary MCL or upper limit, describe the reason(s) for the exceedance and any corrective actions taken a report submitted to the Regional Board no later than 45 days following the quarter in which the exceedance occurred, with a copy concurrently provided to the Department. The annual monitoring in subsection (c) may resume if the running annual average of quarterly results does not exceed a contaminant's secondary MCL or upper limit.

(f) If four consecutive quarterly results for asbestos are below the detection limit in Table 64432-A for asbestos, monitoring for asbestos may be reduced to one sample every three years. Quarterly monitoring shall resume if asbestos is detected.

§60320.214. Diluent Water Requirements.

To be credited with diluent water used in calculating an RWC pursuant to section 60320.216, the GRRP shall comply with the requirements of this section and receive Department approval. For diluent water that is a Department-approved drinking water source, the GRRP's project sponsor is exempt from subsections (a) and (b). The GRRP's project sponsor shall:

(a) Monitor the diluent water quarterly for nitrate and nitrite and, within 72 hours of being informed by the laboratory of a nitrate, nitrite, or nitrate plus nitrite result exceeding a maximum contaminant level (MCL), collect a confirmation sample. If the average of the two samples is greater than an MCL;

(1) notify the Department and the Regional Board within 48 hours of receiving the confirmation sample result,

(2) investigate the cause(s) and implement corrective actions, and

(3) each week, collect and analyze two grab samples at least three days apart as specified in the GRRP's Operation Optimization Plan. If the average of the results for a two-week period exceeds the MCL, subsurface application of the diluent water shall not be used in the calculation of RWC until corrective actions are made. Quarterly monitoring may resume if four consecutive results are below the MCL.

(b) Conduct a source water evaluation per the California-Nevada Section of American Water Works Association's Watershed Sanitary Survey Guidance Manual (1993), as it may be amended, or other Department-approved evaluation, of the diluent water for Department review and approval that includes, but is not limited to:

(1) a description of the source of the diluent water;

(2) delineation of the origin and extent of the diluent water;

(3) the susceptibility of the diluent water to contamination;

(4) the identification of known or potential contaminants; and

(5) an inventory of the potential sources of diluent water contamination.

(c) Ensure diluent water does not exceed a primary MCL, a secondary MCL upper limit, or a notification level (NL), and implement a Department-approved water quality monitoring plan for Department-specified contaminants to demonstrate compliance with the primary MCLs, secondary MCLs, and NLs. The plan shall also include:

(1) except for Department-approved drinking water sources used as a diluent water, monitoring of any chemicals or contaminants required pursuant to section 60320.220, based on the source water evaluation performed in subsection (b); and

(2) actions to be taken in the event of non-compliance with a primary MCL, secondary MCL, or exceedance of a NL.

(d) Develop a method for determining the volume of diluent water to be credited and demonstrate that the diluent water will be introduced in a manner such that the diluent water volume will not result in the GRRP's 120-month running monthly average RWC

exceeding its maximum RWC at or beyond the boundary established pursuant to section 60320.200(e)(2). The method shall be submitted to the Department for review and approval, and be conducted at a frequency specified in the engineering report prepared pursuant to section 60323. The method shall address all conditions that influence how and when the recycled municipal wastewater and diluent water arrive at all points along the boundary. The conditions must include, but are not limited to, temporal variability in the diluent water supply and regional groundwater gradients, the difference in the distribution of the recycled municipal wastewater and diluent water between individual aquifers where more than one aquifer is replenished, and the difference in travel-time when recycled municipal wastewater and diluent water are introduced at different locations and/or times.

(e) For credit prior to the operation of the GRRP, but not to exceed 120 months:

(1) demonstrate that the diluent water met the nitrate, nitrite, and nitrate plus nitrite MCLs, NLs, and the water quality requirements in section 60320.212;

(2) provide evidence that the quantity of diluent water has been accurately determined and was distributed such that the proposed or permitted maximum RWC would not have been exceeded; and

(3) conduct a source water evaluation of the diluent water pursuant to subsection (b).

(f) In the Operation Optimization Plan prepared pursuant to section 60320.222, include a description of:

(1) how the diluent water will be distributed in a manner that ensures that the maximum RWC will not be exceeded during normal operations; and

(2) the actions to be taken in the event the diluent water is curtailed or is no longer available.

(g) If approved by the Department, recharge water may be monitored in lieu of a diluent water source if the diluent water source cannot be monitored directly in a manner that provides samples representative of the diluent water being applied.

§60320.216. Recycled Municipal Wastewater Contribution (RWC) Requirements.

(a) Each month, for each subsurface application GRRP used for replenishing a groundwater basin, the GRRP's project sponsor shall calculate the running monthly average (RMA) RWC based on the total volume of the recycled municipal wastewater and credited diluent water for the preceding 120 months. For GRRPs in operation less than 120 months, calculation of the RMA RWC shall commence after 30 months of recycled municipal wastewater application, based on the total volume of the recycled municipal wastewater and credited diluent water introduced during the preceding months.

(b) The GRRP's RMA RWC, as determined in subsection (a), shall not exceed the maximum RWC specified for the GRRP by the Department.

(c) The initial maximum RWC, which may be up to 1.0, will be based on, but not limited to, the Department's review of the engineering report, information obtained as a result of the public hearing(s), and a project sponsor's demonstration that the treatment processes will reliably achieve TOC concentrations no greater than 0.5 mg/L.

(d) A GRRP may increase its maximum RWC, provided:

(1) the increase has been approved by the Department and Regional Board;

(2) for the previous 52 weeks the TOC 20-week running average, as monitored pursuant to section 62320.218, has not exceeded 0.5 mg/L; and

(3) the GRRP has received a permit from the Regional Board that allows operation of the GRRP at the increased maximum RWC.

(e) If the RMA RWC exceeds its maximum RWC, the GRRP's project sponsor shall:

(1) notify the Department and Regional Board in writing within seven days of knowledge of the exceedance; and

(2) within 60 days of knowledge of the exceedance, implement corrective action(s) and additional actions that may be required by the Department or Regional Board, and submit a report to the Department and Regional Board describing the reason(s) for the exceedance and the corrective action(s) taken to avoid future exceedances.

§60320.218. Total Organic Carbon Requirements.

(a) For each subsurface application GRRP used for replenishing a groundwater basin, the GRRP's project sponsor shall monitor the applied recycled municipal wastewater for TOC as follows:

(1) Prior to replenishment, at least one 24-hour composite sample each week.

(2) Grab samples may be used in lieu of the 24-hour composite samples required in paragraph (1) if the GRRP demonstrates that a grab sample is representative of the water quality throughout a 24-hour period.

(b) Analytical results of the TOC monitoring performed pursuant to subsection (a) shall not exceed 0.5 mg/L based on:

(1) the 20-week running average of all TOC results; and

(2) the average of the last four TOC results.

(c) If the GRRP exceeds the limit in subsection (b)(1) based on a 20-week running average, a project sponsor shall take the following actions upon being notified of the results:

(1) immediately suspend the addition of recycled municipal wastewater until at least two consecutive results, three days apart, are less than the limit;

(2) notify the Department and Regional Board within seven days of suspension; and

(3) within 60 days, submit a report to the Department and Regional Board describing the reasons for the exceedance and the corrective actions to avoid future exceedances. At a minimum, the corrective actions shall include a reduction of RWC sufficient to comply with the limit.

(d) If the GRRP exceeds the limit in subsection (b)(2) based on the average of the last four results, a project sponsor shall, within 60 days of being notified of the results, submit a report to the Department and Regional Board describing the reasons for the exceedance and the corrective actions taken to avoid future exceedances.

(e) To use one or more wastewater chemicals in lieu of TOC, a project sponsor shall obtain approval from the Department. At a minimum, the chemical(s) used in lieu of TOC shall:

(1) be quantifiable in the wastewater, recycled municipal wastewater, groundwater, and throughout the treatment processes; and

(2) have identifiable treatment performance standards as protective of public health as the TOC standards in this Article.

§60320.220. Additional Chemical and Contaminant Monitoring.

(a) Each quarter, the GRRP's project sponsor shall sample and analyze the recycled municipal wastewater and the groundwater (from the downgradient monitoring wells established pursuant to section 60320.226) for the following:

(1) Priority Toxic Pollutants (chemicals listed in 40 CFR section 131.38, "Establishment of numeric criteria for priority toxic pollutants for the State of California", as the foregoing may be amended) specified by the Department, based on the Department's review of the GRRP's engineering report; and

(2) Chemicals that the Department has specified, based on a review of the GRRP's engineering report, the affected groundwater basin(s), and the results of the assessment performed pursuant to section 60320.206(b)(1).

(b) Each quarter, the GRRP's project sponsor shall sample and analyze the recycled municipal wastewater for Department-specified chemicals having notification levels (NLs). Recharge water may be monitored in lieu of recycled municipal wastewater if the fraction of recycled municipal wastewater in the recharge water is equal to or greater than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter. If the fraction of recycled municipal wastewater in the recharge water being monitored is less than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter, the reported value shall be adjusted to exclude

the effects of dilution. If a result exceeds a NL, within 72 hours of notification of the result a project sponsor shall collect another sample and have it analyzed for the contaminant as confirmation. If the average of the initial and confirmation sample exceeds the contaminant's NL, or a confirmation sample is not collected and analyzed pursuant to this subsection, the GRRP shall initiate weekly monitoring for the contaminant until the running four-week average no longer exceeds the NL.

(1) If the running four-week average exceeds the contaminant's NL, a project sponsor shall describe the reason(s) for the exceedance and provide a schedule for completion of corrective actions in a report submitted to the Regional Board no later than 45 days following the quarter in which the exceedance occurred, with a copy concurrently provided to the Department.

(2) If the running four-week average exceeds the contaminant's NL for sixteen consecutive weeks, a project sponsor shall notify the Department and Regional Board within 48 hours of knowledge of the exceedance.

(c) A project sponsor may reduce monitoring for the chemicals in this section to once each year following Department approval based on the Department's review of the most recent two years of results of the monitoring performed pursuant to this section.

(d) Annually, a project sponsor shall monitor the recycled municipal wastewater for indicator compounds specified by the Department and Regional Board based on the following:

(1) a review of the GRRP's engineering report;

(2) the inventory developed pursuant to section 60320.206(b)(4);

(3) the affected groundwater basin(s);

(4) an indicator compound's ability to characterize the presence of pharmaceuticals, endocrine disrupting chemicals, personal care products, and other indicators of the presence of municipal wastewater; and

(5) the availability of a test method for a chemical.

(e) A chemical or contaminant detected as a result of monitoring conducted pursuant to this section shall be reported to the Department and Regional Board no later than the quarter following the quarter in which the results are received by the GRRP's project sponsor.

§60320.222. Operation Optimization and Plan.

(a) Prior to operation of a GRRP, a project sponsor shall submit an Operation Optimization Plan to the Department and Regional Board for review and approval. At a minimum, the Operation Optimization Plan shall identify and describe the operations, maintenance, analytical methods, monitoring necessary for the GRRP to meet the requirements of this Article, and the reporting of monitoring results to the Department and Regional Board. A project sponsor shall be responsible for ensuring that the

Operation Optimization Plan is, at all times, representative of the current operations, maintenance, and monitoring of the GRRP. A GRRP's project sponsor shall make the Operation Optimization Plan available to the Department or Regional Board for review upon request.

(b) During the first year of operation of a GRRP and at all times thereafter, all treatment processes shall be operated in a manner providing optimal reduction of all chemicals and contaminants including:

(1) microbial contaminants;

(2) regulated contaminants identified in section 60320.212 and the nitrogen compounds required pursuant to section 60320.210; and

(3) chemicals and contaminants required pursuant to section 60320.220.

(c) Within six months of optimizing treatment processes pursuant to subsection (b) and anytime thereafter operations are optimized that result in a change in operation, a project sponsor shall update the GRRP's Operation Optimization Plan to include such changes in operational procedures and submit the operations plan to the Department for review.

§60320.224. Response Retention Time.

(a) The recycled municipal wastewater applied by a GRRP shall be retained underground for a period of time necessary to allow a project sponsor sufficient response time to identify treatment failures and implement actions, including those required pursuant to section 60320.200(b), necessary for the protection of public health.

(b) The response retention time required in subsection (a) must be approved by the Department, based on information provided in the engineering report required pursuant to section 60323. The response retention time shall be no less than two months.

(c) To demonstrate the retention time underground is no less than the response retention time approved pursuant to subsection (b), a tracer study utilizing an added tracer shall be implemented under hydraulic conditions representative of normal GRRP operations. With Department approval, an intrinsic tracer may be used in lieu of an added tracer. For each month of retention time estimated utilizing the approved intrinsic tracer, a project sponsor shall receive no more than 0.67 months credit. The retention time shall be the time representing the difference from when the water with the tracer is applied at the GRRP to when either; two percent (2%) of the initially introduced tracer concentration has reached the downgradient monitoring point, or ten percent (10%) of the peak tracer unit value observed at the downgradient monitoring point reaches the monitoring point. A project sponsor for a GRRP shall initiate the tracer study prior to the end of the third month of operation. A project sponsor for a GRRP permitted on or

before June 18, 2014, that has not performed a tracer study shall complete a tracer study demonstrating the retention time underground.

(d) For the purpose of siting a GRRP location during project planning and until a GRRP's project sponsor has met the requirements of subsection (c), for each month of retention time estimated using the method in column 1, the recycled municipal wastewater or recharge water may be credited with no more than the corresponding response time in column 2 of Table 60320.224.

Table 60320.224

Column 1	Column 2
Method used to estimate the retention time	**Response Time Credit per Month**
Tracer study utilizing an added tracer.[1]	1.0 month
Tracer study utilizing an intrinsic tracer.[1]	0.67 month
Numerical modeling consisting of calibrated finite element or finite difference models using validated and verified computer codes used for simulating groundwater flow.	0.50 month
Analytical modeling using existing academically-accepted equations such as Darcy's Law to estimate groundwater flow conditions based on simplifying aquifer assumptions.	0.25 month

[1] The retention time shall be the time representing the difference from when the water with the tracer is applied at the GRRP to when either; two percent (2%) of the initially introduced tracer concentration has reached the downgradient monitoring point, or ten percent (10%) of the peak tracer unit value observed at the downgradient monitoring point reaches the monitoring point.

(e) A project sponsor shall obtain Department approval for the protocol(s) to be used to establish the retention times in subsections (c) and (d).

(f) Upon request from the Department, a project sponsor shall demonstrate that the underground retention times required in this section are being met based on changes in hydrogeological or climatic conditions since the most recent demonstration.

§60320.226. Monitoring Well Requirements.

(a) Prior to operating a GRRP, a project sponsor shall site and construct at least two monitoring wells downgradient of the GRRP such that:

(1) at least one monitoring well is located;

(A) no less than two weeks but no more than six months of travel time from the GRRP, and

(B) at least 30 days upgradient of the nearest drinking water well;

(2) in addition to the well(s) in paragraph (1) and after consultation with the Department, at least one monitoring well is located between the GRRP and the nearest downgradient drinking water well; and

(3) samples from the monitoring wells in paragraphs (1) and (2) can be;

(A) obtained independently from each aquifer initially receiving the water used as a source of drinking water supply that will receive the GRRP's recharge water, and

(B) validated as receiving recharge water from the GRRP.

(b) In addition to the monitoring required pursuant to section 60320.220, from each monitoring well in subsection (a)(1), and each monitoring well in subsection (a)(2) that has recharge water located within one year travel time of the well(s), a project sponsor shall collect two samples prior to GRRP operation and at least one sample each quarter after operation begins. Each sample shall be analyzed for total nitrogen, nitrate, nitrite, the contaminants in Tables 64449-A and B of section 64449, and any contaminants and chemicals specified by the Department or Regional Board based on the results of the recycled municipal wastewater monitoring conducted pursuant to this Article.

(c) If a result from the monitoring conducted pursuant to subsection (b) exceeds 80 percent of a nitrate, nitrite, or nitrate plus nitrite MCL a project sponsor shall, within 48 hours of being notified of the result by the laboratory, collect another sample and have it analyzed for the contaminant. If the average of the result of the initial sample and the confirmation sample exceed the contaminant's MCL, a project sponsor shall:

(1) within 24 hours of being notified by the laboratory of the confirmation sample result, notify the Department and Regional Board; and

(2) discontinue subsurface application of recycled municipal wastewater until corrective actions have been taken or evidence is provided to the Department and Regional Board that the contamination was not a result of the GRRP.

(d) For Department-specified chemical analyses completed in a month, a project sponsor shall ensure the laboratory electronically submits results to the Department no later than 45 days after the end of the month in which monitoring occurred, in a manner such that data is readily uploaded into the Department's database. Utilization of the process described on the Department's Web site will satisfy this requirement.

(e) The GRRP's project sponsor may discontinue monitoring for the chemicals and contaminants in subsection (b) following Department approval based on the Department's review of the most recent two years of monitoring results.

§60320.228. Reporting.

(a) No later than six months after the end of each calendar year, a project sponsor shall provide a report to the Department and Regional Board. Public water systems and drinking water well owners having downgradient sources potentially affected by the GRRP and within 10 years groundwater travel time from the GRRP shall be notified by direct mail and/or electronic mail of the availability of the report. The report shall be prepared by an engineer licensed in California and experienced in the fields of wastewater treatment and public water supply. The report shall include the following:

(1) A summary of the GRRP's compliance status with the monitoring requirements and criteria of this Article during the previous calendar year;

(2) For any violations of this Article during the previous calendar year;

(A) the date, duration, and nature of the violation,

(B) a summary of any corrective actions and/or suspensions of subsurface application of recycled municipal wastewater resulting from a violation, and

(C) if uncorrected, a schedule for and summary of all remedial actions;

(3) Any detections of monitored chemicals or contaminants, and any observed trends in the monitoring wells and diluent water supplies;

(4) Information pertaining to the vertical and horizontal migration of the recharge water plume;

(5) A description of any changes in the operation of any unit processes or facilities;

(6) A description of any anticipated changes, along with an evaluation of the expected impact of the changes on subsequent unit processes;

(7) The estimated quantity and quality of the recycled municipal wastewater and diluent water to be applied for the next calendar year;

(8) A summary of the measures taken to comply with section 60320.206 and 60320.200(j), and the effectiveness of the implementation of the measures; and

(9) Increases in RWC during the previous calendar year and RWC increases anticipated for the next calendar year.

(b) Every five years from the date of the initial approval of the engineering report required pursuant to section 60323, a project sponsor shall update the report to address any project changes and submit the report to the Department and Regional Board. The update shall include, but not be limited to:

(1) anticipated RWC increases, a description of how the RWC requirements in section 60320.216 will be met, and the expected impact the increase will have on the GRRP's ability to meet the requirements of this Article;

(2) evidence that the requirements associated with retention time in section 60320.208, if applicable, and section 60320.224 have been met; and

(3) a description of any inconsistencies between previous groundwater model predictions and the observed and/or measured values, as well as a description of how subsequent predictions will be accurately determined.

§60320.230. Alternatives.

(a) A project sponsor may use an alternative to a requirement in this Article if the GRRP's project sponsor:

(1) demonstrates to the Department that the proposed alternative assures at least the same level of protection to public health;

(2) receives written approval from the Department prior to implementation of the alternative; and

(3) if required by the Department or Regional Board, conducts a public hearing on the proposed alternative, disseminates information to the public, and receives public comments, pursuant to sections 60320.202(b) and (c).

(b) Unless specified otherwise by the Department, the demonstration in subsection (a)(1) shall include the results of a review of the proposed alternative by an independent scientific advisory panel that includes a toxicologist, a registered engineering geologist or hydrogeologist, an engineer licensed in California with at least three years of experience in wastewater treatment and public drinking water supply, a microbiologist, and a chemist.

Article 5.5. Other Methods of Treatment.

§60320.5. Other methods of treatment.

Methods of treatment other than those included in this chapter and their reliability features may be accepted if the applicant demonstrates to the satisfaction of the State Department of Health that the methods of treatment and reliability features will assure an equal degree of treatment and reliability.

Article 6. Sampling and Analysis.

§60321. Sampling and analysis.

(a) Disinfected secondary-23, disinfected secondary-2.2, and disinfected tertiary recycled water shall be sampled at least once daily for total coliform bacteria. The samples shall be taken from the disinfected effluent and shall be analyzed by an approved laboratory.

(b) Disinfected tertiary recycled water shall be continuously sampled for turbidity using a continuous turbidity meter and recorder following filtration. Compliance with the daily average operating filter effluent turbidity shall be determined by averaging the levels of recorded turbidity taken at four-hour intervals over a 24-hour period. Compliance with turbidity pursuant to section 60301.320 (a)(2)(B) and (b)(1) shall be determined using the levels of recorded turbidity taken at intervals of no more than 1.2-hours over a 24- hour period. Should the continuous turbidity meter and recorder fail, grab sampling at a minimum frequency of 1.2-hours may be substituted for a period of up to 24-hours. The results of the daily average turbidity determinations shall be reported quarterly to the regulatory agency.

(c) The producer or supplier of the recycled water shall conduct the sampling required in subsections (a) and (b).

Article 7. Engineering Report and Operational Requirements.

§60323. Engineering report.

(a) No person shall produce or supply recycled water for reuse from a water reclamation plant without a Department-approved engineering report.

(b) The report shall be prepared by a qualified engineer licensed in California and experienced in the field of wastewater treatment, and shall contain a description of the design of the proposed reclamation system. The report shall clearly indicate the means for compliance with these regulations and any other features specified by the regulatory agency.

(c) The report shall contain a contingency plan which will assure that no untreated or inadequately treated wastewater will be delivered to the use area.

§60325. Personnel.

(a) Each reclamation plant shall be provided with a sufficient number of qualified personnel to operate the facility effectively so as to achieve the required level of treatment at all times.

(b) Qualified personnel shall be those meeting requirements established pursuant to Chapter 9 (commencing with Section 13625) of the Water Code.

§60327. Maintenance.

A preventive maintenance program shall be provided at each reclamation plant to ensure that all equipment is kept in a reliable operating condition.

§60329. Operating records and reports.

(a) Operating records shall be maintained at the reclamation plant or a central depository within the operating agency. These shall include: all analyses specified in the reclamation criteria; records of operational problems, plant and equipment breakdowns, and diversions to emergency storage or disposal; all corrective or preventive action taken.

(b) Process or equipment failures triggering an alarm shall be recorded and maintained as a separate record file. The recorded information shall include the time and cause of failure and corrective action taken.

(c) A monthly summary of operating records as specified under (a) of this section shall be filed monthly with the regulatory agency.

(d) Any discharge of untreated or partially treated wastewater to the use area, and the cessation of same, shall be reported immediately by telephone to the regulatory agency, the State Department of Health, and the local health officer.

§60331. Bypass.

There shall be no bypassing of untreated or partially treated wastewater from the reclamation plant or any intermediate unit processes to the point of use.

Article 8. General Requirements of Design.

§60333. Flexibility of design.

The design of process piping, equipment arrangement, and unit structures in the reclamation plant must allow for efficiency and convenience in operation and maintenance and provide flexibility of operation to permit the highest possible degree of treatment to be obtained under varying circumstances.

§60335. Alarms.

(a) Alarm devices required for various unit processes as specified in other sections of these regulations shall be installed to provide warning of:

(1) Loss of power from the normal power supply.
(2) Failure of a biological treatment process.
(3) Failure of a disinfection process.
(4) Failure of a coagulation process.
(5) Failure of a filtration process.
(6) Any other specific process failure for which warning is required by the regulatory agency.

(b) All required alarm devices shall be independent of the normal power supply of the reclamation plant.

(c) The person to be warned shall be the plant operator, superintendent, or any other responsible person designated by the management of the reclamation plant and capable of taking prompt corrective action.

(d) Individual alarm devices may be connected to a master alarm to sound at a location where it can be conveniently observed by the attendant. In case the reclamation plant is not attended full time, the alarm(s) shall be connected to sound at a police station, fire station or other full time service unit with which arrangements have been made to alert the person in charge at times that the reclamation plant is unattended.

§60337. Power supply.

The power supply shall be provided with one of the following reliability features:

(a) Alarm and standby power source.

(b) Alarm and automatically actuated short-term retention or disposal provisions as specified in Section 60341.

(c) Automatically actuated long-term storage or disposal provisions as specified in Section 60341.

Article 9. Reliability Requirements for Primary Effluent.

§60339. Primary treatment.

Reclamation plants producing reclaimed water exclusively for uses for which primary effluent is permitted shall be provided with one of the following reliability features:

(a) Multiple primary treatment units capable of producing primary effluent with one unit not in operation.

(b) Long-term storage or disposal provisions as specified in Section 60341.

Article 10. Reliability Requirements for Full Treatment.

§60341. Emergency storage or disposal.

(a) Where short-term retention or disposal provisions are used as a reliability feature, these shall consist of facilities reserved for the purpose of storing or disposing of untreated or partially treated wastewater for at least a 24-hour period. The facilities shall include all the necessary diversion devices, provisions for odor control, conduits, and pumping and pump back equipment. All of the equipment other than the pump back equipment shall be either independent of the normal power supply or provided with a standby power source.

(b) Where long-term storage or disposal provisions are used as a reliability feature, these shall consist of ponds, reservoirs, percolation areas, downstream sewers leading to other treatment or disposal facilities or any other facilities reserved for the purpose of emergency storage or disposal of untreated or partially treated wastewater. These facilities shall be of sufficient capacity to provide disposal or storage of wastewater for at least 20 days, and shall include all the necessary diversion works, provisions for odor and nuisance control, conduits, and pumping and pump back equipment. All of the equipment other than the pump back equipment shall be either independent of the normal power supply or provided with a standby power source.

(c) Diversion to a less demanding reuse is an acceptable alternative to emergency disposal of partially treated wastewater provided that the quality of the partially treated wastewater is suitable for the less demanding reuse.

(d) Subject to prior approval by the regulatory agency, diversion to a discharge point which requires lesser quality of wastewater is an acceptable alternative to emergency disposal of partially treated wastewater.

(e) Automatically actuated short-term retention or disposal provisions and automatically actuated long-term storage or disposal provisions shall include, in addition to provisions of (a), (b), (c), or (d) of this section, all the necessary sensors, instruments, valves and other devices to enable fully automatic diversion of untreated or partially treated wastewater to approved emergency storage or disposal in the event of failure of a treatment process and a manual reset to prevent automatic restart until the failure is corrected.

§60343. Primary treatment.

All primary treatment unit processes shall be provided with one of the following reliability features:

(a) Multiple primary treatment units capable of producing primary effluent with one unit not in operation.

(b) Standby primary treatment unit process.

(c) Long-term storage or disposal provisions.

§60345. Biological treatment.

All biological treatment unit processes shall be provided with one of the following reliability features:

(a) Alarm and multiple biological treatment units capable of producing oxidized wastewater with one unit not in operation.

(b) Alarm, short-term retention or disposal provisions, and standby replacement equipment.

(c) Alarm and long-term storage or disposal provisions.

(d) Automatically actuated long-term storage or disposal provisions.

§60347. Secondary sedimentation.

All secondary sedimentation unit processes shall be provided with one of the following reliability features:

(a) Multiple sedimentation units capable of treating the entire flow with one unit not in operation.

(b) Standby sedimentation unit process.

(c) Long-term storage or disposal provisions.

§60349. Coagulation.

(a) All coagulation unit processes shall be provided with the following mandatory features for uninterrupted coagulant feed:

(1) Standby feeders,
(2) Adequate chemical stowage and conveyance facilities,
(3) Adequate reserve chemical supply, and
(4) Automatic dosage control.

(b) All coagulation unit processes shall be provided with one of the following reliability features:

(1) Alarm and multiple coagulation units capable of treating the entire flow with one unit not in operation;

(2) Alarm, short-term retention or disposal provisions, and standby replacement equipment;

(3) Alarm and long-term storage or disposal provisions;

(4) Automatically actuated long-term storage or disposal provisions, or

(5) Alarm and standby coagulation process.

§60351. Filtration.

All filtration unit processes shall be provided with one of the following reliability features:

(a) Alarm and multiple filter units capable of treating the entire flow with one unit not in operation.

(b) Alarm, short-term retention or disposal provisions and standby replacement equipment.

(c) Alarm and long-term storage or disposal provisions.

(d) Automatically actuated long-term storage or disposal provisions.

(e) Alarm and standby filtration unit process.

§60353. Disinfection.

(a) All disinfection unit processes where chlorine is used as the disinfectant shall be provided with the following features for uninterrupted chlorine feed:

(1) Standby chlorine supply,

(2) Manifold systems to connect chlorine cylinders,

(3) Chlorine scales, and

(4) Automatic devices for switching to full chlorine cylinders. Automatic residual control of chlorine dosage, automatic measuring and recording of chlorine residual, and hydraulic performance studies may also be required.

(b) All disinfection unit processes where chlorine is used as the disinfectant shall be provided with one of the following reliability features:

(1) Alarm and standby chlorinator;

(2) Alarm, short-term retention or disposal provisions, and standby replacement equipment;

(3) Alarm and long-term storage or disposal provisions;

(4) Automatically actuated long-term storage or disposal provisions; or

(5) Alarm and multiple point chlorination, each with independent power source, separate chlorinator, and separate chlorine supply.

§60355. Other alternatives to reliability requirements

Other alternatives to reliability requirements set forth in Articles 8 to 10 may be accepted if the applicant demonstrates to the satisfaction of the State Department of Health that the proposed alternative will assure an equal degree of reliability.

* * * * *

Conceptual Drainage Analysis

Existing vs. Proposed

El Toro 100-Acre Parcel Development

IRVINE, CA 90242

November 17, 2015

This Conceptual Drainage Analysis has been prepared by, and under the direction of, the undersigned, a duly Registered Civil Engineer in the State of California. Except as noted, the undersigned attests to the technical information contained herein, and has judged to be acceptable the qualifications of any technical specialists providing engineering data for this report, upon which findings, conclusions, and recommendations are based.

Todd Schmieder, P.E.
Registered Civil Engineer No. C37167
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Section 1 Purpose and Scope

This Conceptual Drainage Analysis study presents the potential hydrologic effects for the proposed County of Orange development of the El Toro 100-Acre Parcel Development in Irvine, California. The project site is located on the former Marine Corps Air Station (MCAS) El Toro and will be located south of and adjacent to the City of Irvine's Great Park.

This study addresses pre-construction and post construction stormwater runoff volumes from the project site and mitigation required by Santa Ana Regional Water Quality Control Board (SARWQCB). The study includes 25-year and 100-year storm runoff calculations for the existing condition and the assumed developed condition based on preliminary development concepts developed by the County of Orange for the project's environmental assessment. The study also details the general project characteristics, the design, criteria and methodology applied to the analysis of the project and a backbone underground storm drain system to convey the stormwater to three different receiving storm drain lines. A separate Conceptual Water Quality Management Plan (WQMP) has also been developed to conceptually address the project's Low Impact Development (LID) objectives and methods to treat stormwater runoff before it enter the backbone storm drain system as well as the downstream receiving drainage systems.

The information contained in this conceptual drainage study is to be used as a "Basis of Design" to establish project drainage guidelines for the eventual development of the thirty Planning Areas currently identified within the County's 100-Acre Parcel. It is not to be used for final design and construction purposes. The purpose is to solely provide an established basis for the project's overall stormwater runoff volumes and stormwater detention requirements for a post-development condition. As the project moves forward from its current conceptual site planning phase into a preliminary and final design phase additional detailed drainage analysis will be prepared to address the project's backbone storm drain system and the actual proposed site development improvements planned within each individual Planning Area. These more detailed drainage studies will then be compared back to this Conceptual Drainage Analysis to ensure consistency with the overall "Basis of Design" for stormwater runoff management.

2

Section 2 Project Information

2.1 Project Description

The project resides on County land located on the former El Toro Marine Corps Air Station (MCAS) military base located in Irvine, CA. The proposed project will involve developing a 108-acre site area with multiple uses while closely matching the properties existing drainage patterns. The current plan for the county property is to develop a mixed-use development consisting of multi-family residential, retail, commercial, parks and general open space areas within thirty (30) Planning Areas (PAs). The initial site development assumptions used to analysis the potential development have been used in this study to develop the hydrological analysis; however, the final requirements for each Planning Area will be determined at a later time. Current Site Planning for the 100-Acre Parcel' s 30 Pas includes 10 Planning Areas (PA-A to PA-J) identified to contain park/open space improvement and the remaining 20 Planning Areas (PA-01 to PA-20) will include mixed use development consisting of multi-family residential, retail, hotel and commercial office space uses. In addition, the project includes a series of backbone private streets that will provide access to each Planning Area as well as access to the future extension of Marine Way along the project's northern boundary.

This study addresses stormwater runoff from each of the 30 Planning Areas and backbone streets for the project based on the current land use and grading assumptions established for each Planning Area and the backbone private streets preliminary layout. This analysis also incorporates approximately 23 acres of off-site property located east of Bee Canyon Channel and immediately adjacent to and south of the County's 100-Acre Parcel.

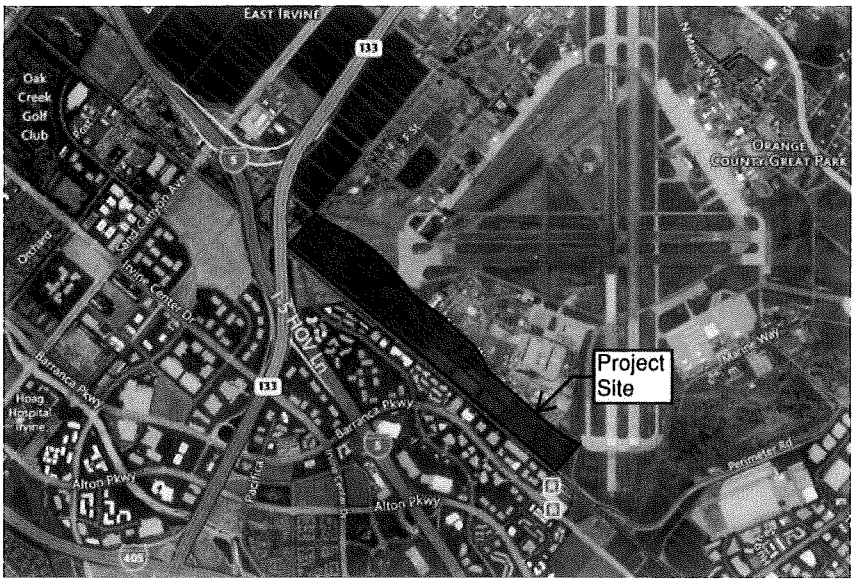


Figure 1 – Vicinity Map

2.2 Hydrologic Setting

This section summarizes the project's size and location (in the context of the larger watershed), existing topography and site improvements, soil and vegetation conditions, percent impervious area, natural and infrastructure drainage features, and other relevant hydrologic and environmental factors associated with the project area.

2.2.1 Watershed

The project site is located within the Santa Ana Region Hydrologic Unit as defined by the California Regional Water Quality Control Board, Region 8, and is tributary to the Newport Bay. Within the Newport Bay watershed, the project site's stormwater runoff will ultimately be discharged to three separate Orange County Flood Control District (OCFCD) facilities: Marshburn Channel (F16), Bee Canyon Channel (F17), and Agua Chinon Channel (F18), with only the proposed storm drain improvements within the Bee Canyon Channel watershed having direct connections with the County's existing flood control facility (Bee Canyon Channel Double-Box Culvert).

2.2.2 Existing Topography and Facilities

The site is located on land that was formally the El Toro MCAS Marine Base. The project's hydrological study area is a long linear area bounded by the future extension of Marine Way to the north and the existing OCTA rail lines right of way to the south. The study area covers approximately 136 acres, of which the County site includes approximately 108 acres, the existing 2nd harvest food Bank warehouse property covers 6.47 acres and the remaining 22 acres includes the 21.3-acre OCTA potential Metrolink Maintenance Yard and a small area of City of Irvine property that includes the Department of Navy's groundwater treatment facility.

The existing (and proposed) topography of the project site is relatively flat with a very gentle slope falling in a southwesterly direction, except for a small portion (approximately 5 acres in size) on the eastern edge of the County's 100-Acre Parcel Development that drains in a southeasterly direction towards an existing storm drain line that ultimately connects to Agua Chinon Channel). The existing ground surface elevations range from a high of +280 to a low of +218 feet above mean sea level.

The project area can be divided in half based on the location of the existing Bee canyon Channel double box culvert that crosses the county property. The westerly section of the project study area consists of a large open space area containing barren grassland and an existing paved 2-lane road. This area includes both the County's property and the OCTA and City properties. This area is located with the Marshburn Channel watershed. The existing land coverage in this westerly section is roughly 15% impervious.

The easterly section of the project study area consists of several large industrial buildings with abandoned railroad tracks spur lines, cracked and weathered asphalt parking lots, a 2-lane main access roadway, and several additional service access roadways. Also within this area near its western edge is an open space area also consisting of barren grassland. The existing 2nd Harvest Food Bank warehouse, with its newly improved building and site improvements, is also located within this easterly section within a separately owned 6.5-acre parcel. Except for a small 5-acre area that drains to the Agua Chinon Channel water shed the majority of the easterly section's stormwater runoff will drain into the Bee Canyon Channel watershed. The existing land coverage in the easterly section is roughly 50% impervious.

Currently storm water runoff from the 100-Acre Parcel is conveyed to downstream receiving drainage systems as both surface flow and through existing underground storm drain lines that were constructed as part of the former marine base site improvements or as part of the recent Bee Canyon Channel improvements.

2.2.3 Adjacent Land Use

Paved aircraft runways, open grassland, and facility building of the former El Toro Marine Base border the project study area to the north and east. Agricultural fields and the State Route-133 Freeway are located to the west. South of the project are the OCTA /SCRRA railway lines and light industrial/commercial office space. Existing and future development north of the project site will include the City of Irvine's Great Park, which when built-out will consist of multiple passive and active recreational uses. The extension of the ultimate 4- lane Marine Way will define the northern limits of the County's 100-Acre Parcel and the north limits of the project study area. The future Great Park Neighborhood District 6 Development is located immediately adjacent to and east of the project study area.

2.2.4 Soil Conditions

The project site location has been graphically shown on the Orange County Hydrology Manual Hydrologic Classification of Soils Map, which has been included in *Appendix C* of this report. The map shows the project to be in an area of hydrologic soil group B.

2.2.5 Existing Drainage Patterns

The existing topography within the 136-acre project study area can be separated into 3 main drainage areas, each discharging to existing underground drainage systems that ultimately drains into one of three separate Orange County Flood control District (OCFCD) drainage facilities (see the Existing Condition Hydrology Map in *Appendix A*). These OCFCD facilities are Marshburn Channel (F16), Bee Canyon Channel (F17) and Agua Chinon Channel (F18) and these facilities will be used to identify the three separate outfall drainage areas included in this conceptual drainage study.

The project's study area boundary is limited on the north by the proposed extension of Marine Way along the northern boundary of the project study area and the county's 100-Acre Parcel. The proposed Marine Way improvements including the public storm drain lines within Marine Way (including the Raceway Storm drain line) will cut off and eliminate any run-on from areas upstream of the project study area.

The southerly limit has been identified to be the OCTA/SCRRA right of way based on the currently drainage patterns and existing graded drainage swales that runs parallel to the railroad right of way for the majority of the project study area southern boundary.

The follow provided a description of each of the existing three drainage areas studied in this analysis.

Outfall 1 – Marshburn Channel
The drainage area studied as part of Outfall 1 consists of a 56.99-acre area that encompasses the County's 100-Acre Parcel west of Bee Canyon Channel and parcels that are owned by the City of Irvine and the Orange County Transportation Authority (COTA). The existing topography in this area directs stormwater runoff as overland flow in a northwest to southeast direction across the County's property onto and through the adjacent OCTA and City property to an existing earthen swale that is located along the southern boundary for the former Marine Base

(and running parallel to the OCTA/SCRRA railroad right of way). This existing graded swale along with other unlined flowlines collect and direct the stormwater runoff to the southwest corner of the former Marine Base where it is intercepted by an existing concrete trap channel that extends off-site to an existing 60-inch storm drain (OCFCD F16P01) that is located beneath the existing SR-133 bridge overcrossing of the railroad lines and interstate I-5 and runs parallel to the railroad right of way line. The existing 60-inch storm drain line is located within Caltrans right of way and is referred to herein as the "Caltrans Storm Drain". Downstream of the Caltrans Storm Drain and existing storm drain system eventually conveys the project area storm water runoff discharges to the Marshburn Channel (west of the project site and west of SR-133). This connect occurs north of the Marshburn Channel crossing of interstate I-5 and downstream of the existing Marine Way crossing of Marshburn Channel.

Note: The project's existing and proposed storm water discharge design volumes for Outfall 1 is based on the existing stormwater runoff flows to the Caltrans Storm Drain that will be further limited in volume due to the extension of Marine Way from Ridge Valley to its crossing of Bee Canyon Channel, which is currently under construction and the completion of the Raceway Storm drain line by the City of Irvine. These Marine Way improvements will reroute stormwater runoff for areas upstream of Marine way through the Raceways Strom Drain line which will connect up to the Marshburn Channel upstream of the I-5 / Marshburn Channel Crossing.

The drainage design for the County's project westerly section will be based on limiting stormwater flow volume and maintaining existing discharge velocities in to the Caltrans Storm Drain and will not require any downstream improvements between the outlet of the Caltrans Storm Drain and Marshburn Channel.

Outfall 2 – Bee Canyon Channel

73.98 acres of the project study area east of the existing Bee Canyon Channel directs runoff southwesterly to multiple discharge points into the existing Bee Canyon Channel Double Box Culvert that was recently constructed by Five Point Communities. Runoff in the vicinity of the existing site buildings is collected via existing underground storm drain systems and directed westerly to Bee Canyon Channel. Areas south and west of the site buildings convey runoff as overland flow in a southwesterly direction to an existing 60" storm drain lateral located at the southwest corner of the Bee Canyon Channel existing drainage area boundary.

Outfall 3 – Agua Chinon Channel

Stormwater runoff from a 5.24-acre portion of the project study area (and the County's 100-Acre Parcel property) at the project's eastern boundary is directed to an existing storm drain

line that connects to Agua Chinon Channel east of the project study area. Surface runoff is collected by several on-site drainage inlets and is conveyed through an existing on-site and off-site 36-inch storm drain system that runs along the eastern boundary of the 100-Acre Parcel and exits the project site at the southeastern corner of the project site running parallel to the OCTA/SCRRA railroad right of way and eventually discharges into the Agua Chinon Channel. The off-site existing storm drain line is located within the Great Park Neighborhood District 6 and the property is currently owned by Five Point Communities.

2.2.6 Proposed Drainage Conditions and Drainage Area Diversions

The proposed developed condition for the County's 100-Acre Parcel will include multi-family residential housing, retail and commercial office space mixed uses. The projected development areas east and west of bee Canyon Channel are assumed to become approximately 90% impervious (see Section 3.1.1 for exact land use and impervious values proposed for the various Planning Areas within the County's 100-Acre Parcel).

For the proposed condition the development of the County's 100-Acre Parcel is planned to essentially maintain the existing condition drainage patterns. However, due to site topography constraints, the planned grading for a several Planning Areas will result in two minor drainage area diversions to Bee Canyon Channel.

One area of diversion is a 7.5- acre area located west of and immediately adjacent to Bee Canyon Channel. This area is proposed to be diverted to Bee Canyon Channel since the underlying topography will create a low point at the southeast corner of Planning Area 20 (PA-20). This low point is done to address the existing drainage pattern that has stormwater runoff from the County's property sheet flowing into the OCTA property. To prevent this from occurring PA_05 and PA-20 are to be graded in a northwest to south east direction instead of the existing northeast to southwest direction. The estimated 100-year flow volume contribution from this 7.5-acre area is estimated to be 25.0 CFS, which is considered insignificant when compared to the estimated 1607.9 cfs for the 100-year storm flow volume estimated to be conveyed in Bee Canyon Channel just upstream of the existing double box culvert's outlet into the Bee Canyon Channel crossing of the OCTA/SCRRA railroad right of way (per the OCFCD approved July 2014 Bee Canyon Channel Improvement Plans prepared by RBF for the construction of the Bee Canyon Channel's Double Box Culvert through the County's 100-Acre Parcel). This diversion does not include any stormwater runoff diversion for the 21.3 acre OCTA property located west of Bee Canyon Channel.

The second area of diversion is on the project's easterly boundary. In this area the proposed site grading and projected building layout will impact the stormwater runoff drainage patterns within the county's project. In this area the proposed site improvements will result in reducing the stormwater runoff volume that reaches the downstream Agua Chinon Channel drainage system. And as a result there will be a slight diversion from the Agua Chinon Channel watershed to the Bee Canyon Channel watershed. The project site topography changes in this area will reduce the tributary drainage area to Agua Chinon Channel watershed by approximately 1.9 acres (or approximately 5.5 CFS for a Q-100 storm event). Again this diverted volume is insignificant to the estimated 100-year storm flow in Bee Cannel Channel.

This total projected diversion of approximately 9.4 acres along with the proposed changes in land uses results in an 28.12 CFS increase in stormwater runoff volume (for a 100-year storm event) when comparing the existing condition to the proposed developed condition for the 100-Acre Parcel. The estimated 28.12 CFS would be approximately a 1.7 percent increase to the projected Q-100 storm water flow in Bee Canyon Channel at the project's southern boundary (1607.9 CFS); however it is important to note that the OCFCD's 100-year storm volume in Bee Canyon Channel assumed a developed condition for the County's 100-Acre Parcel so a portion of this 28.12 CFS increase has already been included in the estimated Q-100 flow volume for the Flood control facility. Also the 28.12 CFS does not consider any on-site detention that might further reduce the peak storm flows from the County's property.

Based on the above projected for storm water flow diversion volume, the additional flow impact on Bee Canyon Channel could be consider insignificant and a detailed analysis of the impact of this diversion on the existing County flood control facility has not been provided in this study.

In addition to the two proposed diversions, for the proposed drainage condition each Planning Area will be required to detain a percentage of the storm water runoff contributed from within its individual Planning Area along with the required percentage of storm water runoff from the adjacent private streets to address the project's hydromodification storm water runoff management requirements. The project's required detention of the backbone private street's storm water flows will be accomplished by oversizing the detained flow contributed within each Planning Area the same amount that would be required for the private streets. The private streets will then not be required to detain any actual storm water runoff.

In addition to on-site stormwater detention, each Planning Area, as well as the backbone private streets, will be required to provide LID improvements to satisfy the County's Drainage Area Master Plan (DAMP) requirements for treatment of stormwater runoff.

2.2.7 Proposed Drainage Patterns

As stated previously, the proposed development within the county's 100-Acre Parcel and within the rest of the project study area has been developed for the proposed project to essentially maintained to closely match the existing drainage patterns (see the Proposed Condition Hydrology Map in *Appendix A*). The following provides a discussion on the proposed drainage for the three drainage areas associated with the project study.

Outfall 1 – Marshburn Channel

There are 2 main areas that discharge runoff to Marshburn channel, the El Toro 100-Acre Parcel Development (the project) and OCTA property south of the project, which is currently proposed to serve as a railroad maintenance yard for OCTA and SCRRA's Metrolink passenger rail line service.

Stormwater runoff from the 100-Acre Parcel's Planning Areas PA-01, PA-02, PA-03, PA-04, PA-C, PA- D, and a portion of PA-E (referred to herein as PA-E1) along with the project's backbone private streets serving these Planning Areas will be collected by a proposed storm drain system in the project's private street systems and will eventually discharge to a proposed storm drain line that will be constructed as part of the project's overall infrastructure improvements. This storm drain line (the "Off-site Storm Drain") will run in a north to south direction along the western boundary of the former marine base will extend outside of the County's 100-Acre Parcel into the City and OCTA property. The off-site Storm drain will also be used to collect storm water runoff from the City and OCTA property. At the downstream terminus of the off-site storm drain stormwater will be discharged into a proposed concrete drainage channel (which will be replacing the existing concrete lined drainage channel). This confluence will occur in the southwest corner of the former El Toro Marine Base on OCTA property. The project Study Areas Post Development storm water runoff will then be conveyed by the new concrete channel to the existing 60-inch Caltrans Storm Drain (OCFCD F16P01) located off site within Caltrans right of way.

The total proposed drainage tributary area that will discharge to the existing Caltrans Storm Drain line and ultimately into the Marshburn Channel is 49.58 acres, 27.58 acres from the El Toro Development and 22.00 acres from the combined OCTA and city properties, which is approximately 7.5 acres less than in the existing condition. However with the proposed change

in land use for open space grasslands to multi-family residential the resulting total discharge into the Caltrans Storm drain would show an increase from 101.75 CFS to 133.63 CFS (or a 31.88 CFS increase) without detention of storm water runoff.

The design concept for Outfall 1 stormwater runoff is to maintain the existing storm water runoff volume in the existing Marshburn Channel at the upstream end of the Marshburn Channel Crossing with Interstate I-5. To accomplish this, the combined runoff from the County's 100-Acre Parcel and the OCTA and City properties will have to be limited to the existing condition 100-year peak flow volume discharging to Marshburn Channel with an additional reduction due to storm water runoff that is being intercepted by the Raceway Storm drain system in Marine Way.

Using the Rational Method, runoff calculations are provided in *Appendix B* for Outfall 1's drainage area. In the proposed condition the calculation indicate that the area will produce an increased 100-year peak flow rate for Outfall 1. As a result, the County's proposed storm drain system, as well as the system for the OCTA parcel, will be required to provide stormwater detention to reduce the peak flow rate discharging to the Caltrans Storm Drain and ultimately into Marshburn Channel. The exact project discharge rate and detention requirements will be determined in the final design phase after stormwater Low Impact Development best management practices can be identified to serve each Planning Area. Any required reduction in flow to the Caltrans Storm drain line is assumed to be allocated based on the percentage each area contributes to the total stormwater runoff in the tributary area to Outfall 1 as well as any contribution for a developed OCTA Maintenance Yard for the Metrolink rail service.

Each Planning Area will treat its runoff for pollutants in accordance with current WQMP requirements and mitigate any increase in flow resulting from development. The proposed storm drain systems will discharge off-site at the same locations as in the existing site conditions.

Outfall 2 – Bee Canyon Channel

County 100-Acre Parcel's Planning Areas PA-05 thru PA-13, PA-B, PA-E2, and PA-F thru PA-J along with the project's private streets serving these Planning Areas will discharge storm runoff to a proposed storm drain system running east to west across the middle of the site where it will discharge to Bee Canyon Channel. Planning Areas PA-15 thru PA-20 and the 2nd Harvest property will discharge storm runoff to a second storm drain system that runs east to west

along the southern site boundary where it will discharge to Bee Canyon Channel. Each Planning Area will include a detention basin to reduce the peak flow rate of the stormdrain system.

The total proposed tributary area that will discharge to the Bee Canyon Channel is 83.30 acres, which is approximately a 13-acre increase over the existing condition. This increase is the result of the two previously identified diversions for storm water runoff that flows from Marshburn Channel (contributed from Planning Areas PA-05, PA-20 and a portion of PA-E2) and from Agua Chinon Channel (contributed from a portion of PA-13 and the private street serving PA-13 and PA-14).

Each Planning Area will treat its runoff for pollutants in accordance with current WQMP requirements and mitigate any increase in flow resulting from development. The proposed storm drain systems will discharge off-site at the same locations as in the existing site conditions.

Outfall 3 – Agua Chinon Channel

Storm runoff from Planning Area 14 will flow toward the southeastern corner of the project and discharge to an existing 36" storm drain tributary to the Agua Chinon Channel. The proposed tributary area that discharges to the Agua Chinon Channel is being reduced from 5.24 acres to 3.33 acres. Ration Method runoff calculations provided in *Appendix B* show that the proposed condition will produce a decreased 100-year peak flow rate at Outfall 3, therefore Planning Area 14 will not require stormwater detention before discharging to the Agua Chinon Channel.

Each Planning Area will treat its runoff for pollutants in accordance with current WQMP requirements and mitigate any increase in flow resulting from development. The proposed storm drain systems will discharge off-site at the same locations as in the existing site conditions.

2.2.8 Downstream Conditions

Marshburn Channel

At the time of this study, 2 existing drainage reports were on record pertaining to the El Toro Development drainage area tributary to the Marshburn Channel and the existing storm drain facility conveying those flows. These reports were reviewed to determine if the Marshburn Channel has adequate capacity to accept runoff from the proposed commercially developed

site and to establish the allowable site discharge rate that the existing stormdrain was designed to accept. These reports related to the Marshburn Channel are located in *Appendix D*.

A report titled "Amendment to PA51 Marshburn Watershed," was approved by the City of Irvine on September 8, 2011 that analyzed the flows within Marshburn Channel, see *Appendix D*. This report included the project area tributary to the Marshburn Channel within subarea "16E" of the "Exhibit A, PA 51 Marshburn Watershed Hydrology Map." AES rational method calculations for 16E show the planned land use assumed for the entire subarea to be "Commercial." The portion of the 100-Acre Parcel area that drains ultimately into the Marshburn Channel is planned as residential, but in a worst case could be commercial. Based on the hydrological analysis presented in this study as well in the 20011 study, it would appear that the existing Marshburn Channel has been designed to receive stormwater runoff from the County's 100-Acre Parcel. In addition, it appears that the existing Channel has adequate capacity to accept the proposed stormwater runoff from the developed portion of the County's 100-Acre Parcel that contributes storm water runoff to the Marshburn Channel without adversely affected the channel.

In addition to the 2011 Study, a second drainage report titled "Drainage Design Report on State Route 133," and dated March 21, 1997, addresses the direct runoff from the project area that was assumed to discharge into the Marshburn Channel. A copy of this study is also included in *Appendix D*. Included in that report were the interim and ultimate design conditions for Storm Drain System 24, the Caltrans 60-inch SSRP storm drain line (OCFCD F16P01), that conveys discharge downstream from the project area which ultimately get intercepted by Marshburn Channel. The 1997 report stated that in the existing condition, the project area (the former MCAS) produced a 100-year storm peak flow rate of 140 cfs that discharges to and confluences with the concrete trap channel leading to the Caltrans Storm Drain. Before receiving the 140 cfs from the project area, the trap channel carries a peak flow of 49 cfs generated from SR133 runoff, thereby producing a combined total of 189 cfs at the confluence point between the trap channel and the Caltrans Storm drain line. The report went on to state the existing concrete trap channel leading to the 60-inch storm drain line has a capacity of 100 cfs and flow exceeding the trap channel capacity (89 cfs) would overtop the channel flowing into the railway right of way south of the project. This 1997 report had also assumed that for the contributory area "*The ultimate land use for the remaining eastern area within the MCAS clear zone was assumed commercial. No overtopping from the MCAS will occur in the ultimate condition with Raceway Storm Drain*." Based on those findings, the trap channel leading up to 60-inch Caltrans Storm Drain was designed to receive 140 cfs of the runoff in the ultimate condition from the MCAS area [project area] with commercial land use with no stormwater overtopping into the railway. This 140 CFS flow volume was based on the Raceway Storm Drain that is

currently under construction as part of the Marine Way extension project, which reduces the tributary area to the Caltrans storm drain to be essentially runoff from a portion of the County's 100-Acre Parcel located west of bee Canyon Channel and from the adjacent Irvine Company property and from a portion of Caltrans right of way significant in place

To verify that the 60-inch line is capable of 189 cfs (140 cfs from the project + 49 cfs runoff from SR133/TIC property) a simple hydraulic analysis was performed using Hydraulic Toolbox 4.2 software created by the Federal Highway Administration and is included in *Appendix F*. The analysis shows that at 189 cfs, the depth of flow will be 3.87' within the existing 5' diameter storm drain. Based on this analysis, the existing Caltrans Storm Drain line SSRP has the capacity and was appropriately designed to accept 140 cfs from the project area.

The proposed project will have a maximum allowable 100-year storm discharge rate of 101.75 cfs (based on the existing condition Rational Method Analysis) to the Caltrans 60" SSRP tributary to the Marshburn Channel. The project also proposes to improve the existing trap channel leading to the Caltrans Storm Drain to fulfil runoff demands from the project study area (County's 100-Acre Parcel and the City and OCTA property).

Bee Canyon Channel

A report titled, "Bee Canyon Channel (F17) Improvements" was written by RBF Consulting on October 16, 2012 and is included in *Appendix E*. This report included improvements and storm analysis for Bee Canyon Channel. Runoff is shown contributing from a fully commercial proposed project site to Bee Canyon Channel. The report concluded Bee Canyon Channel at the crossing with OCTA/SCRRA railroad lines had been designed to adequately accommodate a 100-year storm event from a fully developed upstream area which included the portion of the County's 100-Acre Parcel that is located east of Bee Canyon Channel.

In the 2012 study none of the area within the County's 100-Acre Parcel east of Bee Canyon Channel was identified to be discharging into the Agua Chinon Channel watershed, however based on historical drainage patterns and the existing storm drain systems a small 5-acre area on the easterly edge of the 100-Acre Parcel does not discharge into the Bee Canyon Watershed and instead flows towards the Agua Chinon Channel. The current plan for the County's 100-acre Parcel Based on these findings, Bee Canyon Channel has previously been designed to accept runoff from the proposed developed project.

The current analysis for the 100-Acre parcel proposed two stormwater runoff diversions to Bee Canyon Channel. In addition to the two small diversions, the estimated difference between the Pre-Project and Post-Project storm water runoff flow volumes to Bee Canyon Channel is approximately 28.12 CFS. This difference represents a 1.7% increase to the projected buildout

100-year storm flow volume (1607.9 CFS) in Bee Canyon Channel Double Box Culvert and at the channel's railroad crossing bridge flows (per the 2012 Study). It is still important to note that the projected 28.12 flow increase is based on the difference between pre-project and post project flows while the 100-year design flow in Bee Canyon Channel was based on the fully built out 100-acre parcel as a commercial development so the actual amount of diversion flows and increase of flow to Bee Canyon Channel would be less than the 28.12 CFS.

Based on the analysis presented in this study and information obtain from drainage study prepared for the existing bee Canyon Channel the projected storm water runoff from the county's 100-Acre Parcel will not adversely impact storm water flow in the Bee Canyon Channel.

Agua Chinon Channel

Based on a review of the existing records and the existing storm drain systems for the former Marine Base, a 5.24 acre area within the existing project study area (and the county's 100-Acre Parcel) is currently draining through an off-site storm drain line to Aqua Chinon Channel. This existing storm drain system includes several inlets and pipe lines within the 100-Acre Parcel east of the most existing easterly warehouses and was constructed as part of the former Military Base storm drain system. The existing storm drain line that conveys storm water runoff off-site to Agua Chinon Channel is a 36" storm drain line and it extends from the project site and confluences with the Agua Chinon Channel upstream of the OCTA railroad right of way and channel crossing. The proposed project will continue to discharge runoff to the Agua Chinon Channel, but the tributary area and peak discharge will be decreased from 5.24 acres to 3.33 acres. Based on a reduced flow volume for stormwater runoff, the amount of flow from the small contributing area will not result in any impact to the downstream 36-inch existing storm drain line nor to the Agua Chinon Channel.

Section 3 Design Criteria and Methodology

This section summarizes the design criteria and methodology applied to support the drainage analysis of the project site as presented in this study. The project's hydrology was analyzed using The Rational Method as described in the Orange County Local Drainage Manual, dated January 1996.

3.1 Design Criteria

3.1.1 Runoff Calculation Method

A computer model was made using AES RATSCX software with built-in methodology following the 1986 Orange County Hydrology Criterion.

Design input criteria for the model were as follows:

Design Storm:	25-year and (100-year)
Antecedent Moisture Condition (AMC):	II and (III)
SCS Soil Group:	B
Existing Land Use:	West of Bee Canyon Channel – "Public Park" (15% impervious) East of Bee Canyon Channel – "5-7 Dwellings/Acre" (50% impervious) and "Commercial" (90% impervious)
Proposed Land Use:	All streets – "Commercial" (90% impervious) PA-A thru PA-J – "Public Park" (15% impervious) PA 01 thru 07, PA 19, PA 20 - "11+ Dwellings/Acre" (80% impervious) PA 08 thru 18, Second Harvest - "Commercial" (90% impervious) OCTA property – "Commercial" (90% impervious)

Full hydrologic calculations and values are included *Appendix B*.

3.1.2 Runoff and Detention

The peak 25-year and 100-year storm runoff was calculated for the existing and proposed condition of both the eastern and western sections of the project Study Area (which includes the County's 100-Acre Parcel, OCTA's 21.3 acre parcel, and the City of Irvine property located along the former western boundary of the Marine Base and accommodates the Department of Navy's groundwater treatment facility and several groundwater extraction and monitoring

wells as well as some existing and proposed public utilities and storm drain improvements). To comply with existing Water Quality Management Plan (WQMP) and Low Impact Development (LID) requirements, the proposed site runoff may not exceed the existing site runoff volume for the design storm event (100-year storm). To comply with this requirement, each Planning Area within the 100-Acre Parcel will include detention basins designed to store and discharge runoff at an allowable flow rate equal to the existing condition peak runoff.

For conceptual sizing and site planning purposes only, a detention basin for each Planning Area has been designed that will reduces the peak runoff rate from each Planning Area before entering the main stormdrain system. Detention requirements of Planning Area basin are based on distributing the total required detention (difference between Existing and Proposed Q_{100} at each Outfall) to each Planning Area proportionally by the ratio of its area to the total area, in addition each Planning Area will also be required to detain an additional flow volume equivalent to the estimated 100-year "detained" storm volume flow from the 100-Acre Parcel's backbone private streets located adjacent to each Planning Area.

For conceptual design purposes each Planning Areas' detention basin was designed using AES CH1 computational hydraulic software with built-in methodology following the 1986 Orange County Hydrology Criterion. The small area unit hydrograph method was used to produce a runoff hydrograph for each basin's tributary area. The runoff hydrograph was then routed through a flow-thru detention basin model which reduced the peak runoff by the designated rate. A summary and calculations for each of the Planning Areas' detention basins are included in *Appendix G*.

3.1.3 Water Quality

The proposed site must meet additional WQMP and LID requirements pertaining to storm water treatment as described in the Technical Guidance Document (TGD) for the Orange County WQMPs. The TGD requirements specify a Design Capture Volume (DCV) or a design runoff flow to be treated depending on whether a volume-based or flow-based Best Management Practices (BMPs) are used on site. The specific requirements and how they are implemented in each Planning Area will be addressed in the project's final design documents and in each Planning Area's Final WQMP. A Conceptual WQMP has been prepared to identify potential alternatives for addressing stormwater runoff treatments that will be developed to satisfy stormwater runoff for the County's 100-Acre Parcel for each Planning are and the backbone private streets.

Section 4 Hydrology and Drainage Analysis

This section summarizes the quantitative hydrologic analysis of the existing and proposed conditions of the site.

4.1 Drainage Delineation

Hydrology maps for the existing and developed conditions have been provided in *Appendix A* of this report. The hydrology maps depict subareas, flow paths, flow lengths, node elevations and outfall locations used in the AES Rational Method runoff calculations provided in *Appendix B.*

Although not specifically highlighted in the hydrology maps, the proposed area of storm water diversion from Marshburn Channel to Bee Canyon Channel are the development areas located west of Bee Canyon Channel (PA-05 and PA-20) comprising approximately seven acres of multi-family housing and a half-acre of designated open space area (a portion of PA-E2). The Agua Chinon watershed diversion to Bee Canyon Channel occurs on the eastern boundary of the County's 100-Acre Parcel in Planning Area 14 and is approximately 1.9 acres of commercial area.

4.2 Summary of Results[1]

This study has been developed as a conceptual analysis of the County's 100-Acre Parcel's storm water discharges and has been developed to conservatively show the existing and post development assumptions for storm water runoff for the "project study area". The proposed improvements were design to best maintain existing drainage runoff flow patterns when possible; however, the site topography for the County's 100-Acre Parcel and the proposed repurposing for the Marine Base property has resulted in two small drainage area diversions which do not have any significant or detrimental effect on the downstream receiving water bodies (Marshburn Channel, Bee Canyon Channel, and Agua Chinon Channel). During the final design for the County's El Toro 100-acre Parcel Development additional drainage analysis will be undertaken to determine maximum allowed discharge for the entire project area and for each individual Planning Area based on the proposed development plan for each Planning Area and the proposed backbone storm drain system.

A summary of the study results for each drainage area are presented in the below table.

Table 1 - Summary of Results

OUTFALL	RECEIVING WATER		TRIBUTARY AREA (AC)		Q25 (CFS)		Q100 (CFS)		PROP. REDUCTION OF OUTFLOW[2]
			EXIST.	PROP.	EXIST.	PROP.	EXIST.	PROP.	
1	MARSHBURN CHANNEL	PROJECT	56.99	27.58	75.25	57.03[1]	101.75	74.33[1]	31.88 CFS[2]
		CITY/OCTA		22.00		45.50[1]		59.30[1]	
2	BEE CANYON CHANNEL		73.98	83.30	130.87	153.80[1]	171.84	199.96[1]	28.12 CFS[2]
3	AGUA CHINON CHANNEL		5.24	3.33	14.83	10.82[1]	19.36	13.92[1]	0 CFS[2]
TOTAL			136.21	136.21	220.95	267.15[1]	292.95	347.51[1]	

[1] This analysis for the Post-Development Condition shall be considered to be a planning tool only to help guide the developer and the architect in creating a land use plan. Additional design analysis is required to determine the Post Development conditions and requirements pertaining to storm water detention and treatment.

[2] Each Planning Area shall be responsible to reduce runoff based on an overall permitted contribution to each outfall point. The final percentage reduction of proposed discharge to each outfall shall be based on the flow volumes for the existing condition to each outfall point.

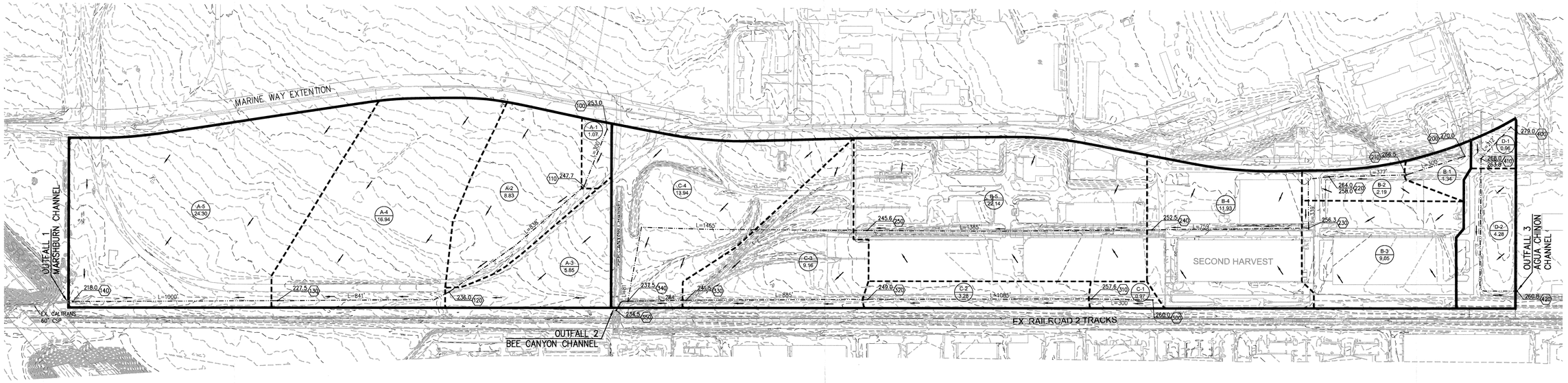
THIS STUDY SHALL NOT BE USED FOR FINAL DESIGN AND HAS BEEN DEVELOPED FOR INITIAL SITE PLANNING AND CONCEPTUAL DESIGN. ADDITIONAL DESTILED ANALYSIS WILL BE REQUIRED.

APPENDIX

A

Appendix A – Existing and Proposed Hydrology Maps

See Attached Maps



OUTFALL	RECEIVING WATER	TRIBUTARY AREA (AC)		Q25 (CFS)		Q100 (CFS)	
		EXISTING	PROPOSED	EXISTING	PROPOSED	EXISTING	PROPOSED
1	MARSHBURN CHANNEL	56.99	49.58	75.25	102.53	101.75	133.63
2	BEE CANYON CHANNEL	73.98	83.30	130.87	153.80	171.84	199.96
3	AGUA CHINON CHANNEL	5.24	3.33	14.83	10.82	19.36	13.92
TOTAL		136.21	136.21	220.95	267.15	292.95	347.51

N

0 200 300 400

(IN FEET)
1 INCH = 200 FEET

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NO	DESCRIPTION	BY	DATE	CHK

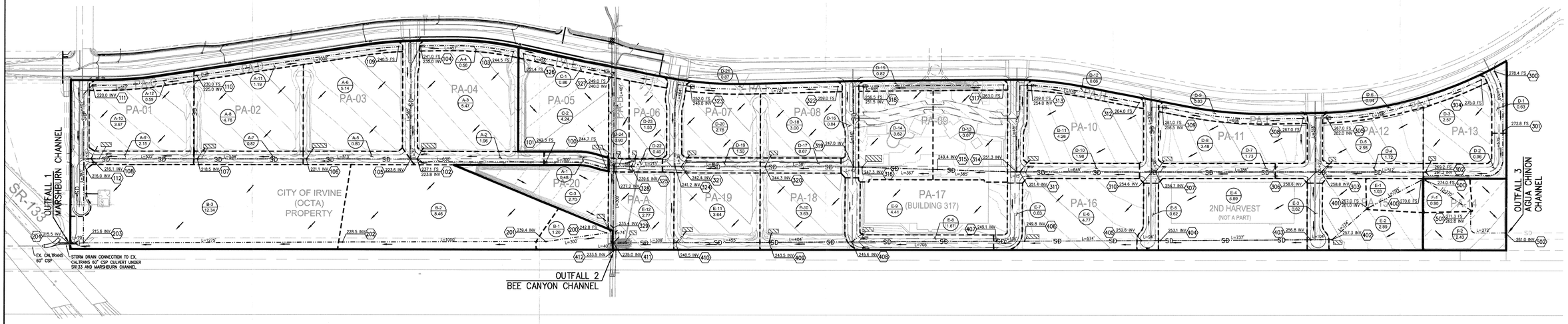
REVISIONS

PRELIMINARY HYDROLOGY MAP
EXISTING CONDITION

EL TORO DEVELOPMENT - ORANGE COUNTY
LOWE ENTERPRISES REAL ESTATE GROUP
UNINCORPORATED TERRITORY OF THE COUNTY OF ORANGE
IRVINE, CALIFORNIA

DRAWN: RH
DATE: 2015.11.16
CHECKED: --
DATE: --
REVISION #: --
DATE: --
JOB NO: SP7531

Nov 17, 2015 – 4:50pm by rhoskin K:\Drawings\SP\SP7531 Lowe El Toro\Eng\Hydrology\SP7531-HYD-PRE.dwg



OUTFALL	RECEIVING WATER	TRIBUTARY AREA (AC)		Q25 (CFS)		Q100 (CFS)	
		EXISTING	PROPOSED	EXISTING	PROPOSED	EXISTING	PROPOSED
1	MARSHBURN CHANNEL	56.99	49.58	75.25	102.53	101.75	133.63
2	BEE CANYON CHANNEL	73.98	83.30	130.87	153.80	171.84	199.96
3	AGUA CHINON CHANNEL	5.24	3.33	14.83	10.82	19.36	13.92
TOTAL		136.21	136.21	220.95	267.15	292.95	347.51

N

0 200 300 400

(IN FEET)
1 INCH = 200 FEET

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	REVISIONS			

PRELIMINARY HYDROLOGY MAP
PROPOSED CONDITION

EL TORO DEVELOPMENT - ORANGE COUNTY
LOWE ENTERPRISES REAL ESTATE GROUP
UNINCORPORATED TERRITORY OF THE COUNTY OF ORANGE
IRVINE, CALIFORNIA

DRAWN: RH
DATE: 2015.11.16
CHECKED: --
DATE: --
REVISION #: --
DATE: --
JOB NO: SP7531

Nov 17, 2015 - 5:07pm by rhaskin K:\Drawings\SP\SP7531 Lowe El Toro\Eng\Hydrology\SP7531-HYD-POST.dwg

B

Appendix B – Rational Method Calculations

See Attached Calculations

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
          (c) Copyright 1983-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
25 YEAR STORM - EXISTING CONDITION
STREAM A - MARSHBURN CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 25Y100X1.DAT
  TIME/DATE OF STUDY: 11:32 11/16/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   20.0     10.0    0.018/0.018/0.018   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
         DURATION     RAINFALL(INCH)
         5-MINUTES          0.40
```

```
        30-MINUTES          0.87
         1-HOUR             1.15
         3-HOUR             1.94
         6-HOUR             2.71
        24-HOUR             4.49
 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    253.00  DOWNSTREAM(FEET) =    247.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.601
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.152
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        1.07      0.30     0.850    56   10.60
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =       2.79
  TOTAL AREA(ACRES) =       1.07   PEAK FLOW RATE(CFS) =      2.79

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    120.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    247.70  DOWNSTREAM(FEET) =    236.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   838.00   CHANNEL SLOPE =  0.0140
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   2.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.331
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                 B        8.83      0.30     0.850    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.17
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.87
  AVERAGE FLOW DEPTH(FEET) =   0.55   TRAVEL TIME(MIN.) =   7.47
  Tc(MIN.) =   18.07
  SUBAREA AREA(ACRES) =     8.83       SUBAREA RUNOFF(CFS) =   16.50
  EFFECTIVE AREA(ACRES) =      9.90     AREA-AVERAGED Fm(INCH/HR) =   0.26
```

```
  AREA-AVERAGED Fp(INCH/HR) =    0.30  AREA-AVERAGED Ap =    0.85
  TOTAL AREA(ACRES) =          9.9          PEAK FLOW RATE(CFS) =       18.50

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.66   FLOW VELOCITY(FEET/SEC.) =   2.12
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    120.00 =    1138.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   18.07
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.331
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                 B        5.85      0.30      0.850    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA AREA(ACRES) =    5.85      SUBAREA RUNOFF(CFS) =   10.93
  EFFECTIVE AREA(ACRES) =     15.75   AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.85
  TOTAL AREA(ACRES) =       15.8       PEAK FLOW RATE(CFS) =       29.43

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    130.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    236.00  DOWNSTREAM(FEET) =    227.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   841.00   CHANNEL SLOPE =  0.0101
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   2.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.976
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                 B       16.94      0.30      0.850    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      42.58
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.29
  AVERAGE FLOW DEPTH(FEET) =   0.96   TRAVEL TIME(MIN.) =   6.12
  Tc(MIN.) =   24.19
  SUBAREA AREA(ACRES) =    16.94       SUBAREA RUNOFF(CFS) =   26.24
  EFFECTIVE AREA(ACRES) =     32.69     AREA-AVERAGED Fm(INCH/HR) =   0.25
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.85
  TOTAL AREA(ACRES) =       32.7         PEAK FLOW RATE(CFS) =       50.65

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
```

```
  DEPTH(FEET) =  1.03   FLOW VELOCITY(FEET/SEC.) =   2.40
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    130.00 =    1979.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    140.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    227.50  DOWNSTREAM(FEET) =    218.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1000.00   CHANNEL SLOPE =  0.0095
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   3.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.722
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                 B       24.30      0.30     0.850    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      66.71
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.50
  AVERAGE FLOW DEPTH(FEET) =   1.15   TRAVEL TIME(MIN.) =   6.66
  Tc(MIN.) =   30.85
  SUBAREA AREA(ACRES) =    24.30       SUBAREA RUNOFF(CFS) =   32.09
  EFFECTIVE AREA(ACRES) =     56.99     AREA-AVERAGED Fm(INCH/HR) =   0.25
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.85
  TOTAL AREA(ACRES) =       57.0         PEAK FLOW RATE(CFS) =      75.25

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.21   FLOW VELOCITY(FEET/SEC.) =   2.58
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    140.00 =    2979.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =       57.0  TC(MIN.) =     30.85
  EFFECTIVE AREA(ACRES) =     56.99  AREA-AVERAGED Fm(INCH/HR)=  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.850
  PEAK FLOW RATE(CFS)    =      75.25
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
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             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
25 YEAR STORM - EXISITNG CONDITION
STREAM B - BEE CANYON CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 25Y100X2.DAT
  TIME/DATE OF STUDY: 13:29 11/16/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   20.0     10.0    0.018/0.018/0.018   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
         DURATION     RAINFALL(INCH)
         5-MINUTES          0.40
```

```
        30-MINUTES          0.87
         1-HOUR             1.15
         3-HOUR             1.94
         6-HOUR             2.71
        24-HOUR             4.49
 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR UNIT HYDROGRAPH METHOD*

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    270.00  DOWNSTREAM(FEET) =    266.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.277
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.400
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"        B        1.34      0.30      0.500    56    9.28
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA RUNOFF(CFS) =       3.92
  TOTAL AREA(ACRES) =       1.34   PEAK FLOW RATE(CFS) =      3.92

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    220.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    266.50  DOWNSTREAM(FEET) =    264.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   377.00   CHANNEL SLOPE =  0.0066
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   8.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   2.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.763
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        2.19      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.63
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.53
  AVERAGE FLOW DEPTH(FEET) =   0.74   TRAVEL TIME(MIN.) =   4.10
  Tc(MIN.) =   13.38
  SUBAREA AREA(ACRES) =     2.19       SUBAREA RUNOFF(CFS) =    5.39
```

```
EFFECTIVE AREA(ACRES) =       3.53     AREA-AVERAGED Fm(INCH/HR) =    0.08
AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =    0.25
TOTAL AREA(ACRES) =         3.5          PEAK FLOW RATE(CFS) =        8.54

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) =  0.81   FLOW VELOCITY(FEET/SEC.) =   1.64
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    220.00 =     677.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    220.00 TO NODE    230.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   258.00  DOWNSTREAM(FEET) =   256.30
FLOW LENGTH(FEET) =   339.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.92
ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       8.54
PIPE TRAVEL TIME(MIN.) =   1.15    Tc(MIN.) =   14.53
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    230.00 =    1016.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   14.53
*  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.638
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        9.05      0.30     0.100    56
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    9.05      SUBAREA RUNOFF(CFS) =   21.24
EFFECTIVE AREA(ACRES) =     12.58   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.14
TOTAL AREA(ACRES) =       12.6       PEAK FLOW RATE(CFS) =      29.38

****************************************************************************
FLOW PROCESS FROM NODE    230.00 TO NODE    240.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   256.30  DOWNSTREAM(FEET) =   252.50
FLOW LENGTH(FEET) =   759.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.68
ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       29.38
  PIPE TRAVEL TIME(MIN.) =   1.89    Tc(MIN.) =    16.42
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    240.00 =    1775.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    240.00 TO NODE    240.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   16.42
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.461
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B       11.93      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =   11.93      SUBAREA RUNOFF(CFS) =   26.10
  EFFECTIVE AREA(ACRES) =     24.51   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.12
  TOTAL AREA(ACRES) =       24.5       PEAK FLOW RATE(CFS) =      53.48

****************************************************************************
  FLOW PROCESS FROM NODE    240.00 TO NODE    250.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   252.50  DOWNSTREAM(FEET) =   245.60
  FLOW LENGTH(FEET) =  1385.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  30.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.59
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       53.48
  PIPE TRAVEL TIME(MIN.) =   3.04    Tc(MIN.) =    19.46
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    250.00 =    3160.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    250.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   19.46
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.235
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"        B       22.14      0.30      0.500    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA AREA(ACRES) =   22.14      SUBAREA RUNOFF(CFS) =   41.55
```

```
  EFFECTIVE AREA(ACRES) =      46.65   AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.30
  TOTAL AREA(ACRES) =        46.7        PEAK FLOW RATE(CFS) =       90.05

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    340.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   245.60  DOWNSTREAM(FEET) =   237.50
  FLOW LENGTH(FEET) =  1465.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  35.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.11
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      90.05
  PIPE TRAVEL TIME(MIN.) =   2.68    Tc(MIN.) =   22.14
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    340.00 =    4625.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    340.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   22.14
  RAINFALL INTENSITY(INCH/HR) =   2.08
  AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.30
  EFFECTIVE STREAM AREA(ACRES) =      46.65
  TOTAL STREAM AREA(ACRES) =      46.65
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      90.05

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    310.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    260.00  DOWNSTREAM(FEET) =    257.60

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.004
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.258
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       B        0.97      0.30      0.500    56   10.00
```

```
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA RUNOFF(CFS) =       2.71
  TOTAL AREA(ACRES) =       0.97   PEAK FLOW RATE(CFS) =       2.71

****************************************************************************
  FLOW PROCESS FROM NODE    310.00 TO NODE    320.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    257.60  DOWNSTREAM(FEET) =    249.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1085.00   CHANNEL SLOPE =  0.0079
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   8.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.259
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"        B        3.28      0.30      0.500    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.87
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.99
  AVERAGE FLOW DEPTH(FEET) =   0.61   TRAVEL TIME(MIN.) =   9.09
  Tc(MIN.) =   19.10
  SUBAREA AREA(ACRES) =     3.28       SUBAREA RUNOFF(CFS) =    6.23
  EFFECTIVE AREA(ACRES) =      4.25     AREA-AVERAGED Fm(INCH/HR) =   0.15
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.50
  TOTAL AREA(ACRES) =        4.2          PEAK FLOW RATE(CFS) =       8.07

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.68   FLOW VELOCITY(FEET/SEC.) =   2.16
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    320.00 =    1385.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    320.00 TO NODE    330.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    249.00  DOWNSTREAM(FEET) =    241.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   885.00   CHANNEL SLOPE =  0.0085
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   8.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.949
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"        B        9.16      0.30      0.500    56
```

```
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      15.51
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.59
  AVERAGE FLOW DEPTH(FEET) =   0.86   TRAVEL TIME(MIN.) =   5.69
  Tc(MIN.) =   24.79
  SUBAREA AREA(ACRES) =     9.16       SUBAREA RUNOFF(CFS) =   14.83
  EFFECTIVE AREA(ACRES) =     13.41     AREA-AVERAGED Fm(INCH/HR) =   0.15
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.50
  TOTAL AREA(ACRES) =       13.4         PEAK FLOW RATE(CFS) =      21.71

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.98   FLOW VELOCITY(FEET/SEC.) =   2.82
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    330.00 =    2270.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    330.00 TO NODE    340.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    241.50  DOWNSTREAM(FEET) =    237.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   284.00   CHANNEL SLOPE =  0.0141
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   6.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.908
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       B       13.94      0.30      0.500    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      32.74
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.99
  AVERAGE FLOW DEPTH(FEET) =   1.21   TRAVEL TIME(MIN.) =   0.95
  Tc(MIN.) =   25.74
  SUBAREA AREA(ACRES) =    13.94       SUBAREA RUNOFF(CFS) =   22.06
  EFFECTIVE AREA(ACRES) =     27.35     AREA-AVERAGED Fm(INCH/HR) =   0.15
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.50
  TOTAL AREA(ACRES) =       27.3         PEAK FLOW RATE(CFS) =      43.27

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.39   FLOW VELOCITY(FEET/SEC.) =   5.37
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    340.00 =    2554.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    340.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
```

```
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   25.74
RAINFALL INTENSITY(INCH/HR) =   1.91
AREA-AVERAGED Fm(INCH/HR) =  0.15
AREA-AVERAGED Fp(INCH/HR) =  0.30
AREA-AVERAGED Ap =  0.50
EFFECTIVE STREAM AREA(ACRES) =      27.35
TOTAL STREAM AREA(ACRES) =      27.35
PEAK FLOW RATE(CFS) AT CONFLUENCE =      43.27

** CONFLUENCE DATA **
 STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1       90.05   22.14    2.078  0.30( 0.09) 0.30      46.7     200.00
    2       43.27   25.74    1.908  0.30( 0.15) 0.50      27.3     300.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
 STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1      130.87   22.14    2.078  0.30( 0.11) 0.37      70.2     200.00
    2      125.63   25.74    1.908  0.30( 0.11) 0.37      74.0     300.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     130.87    Tc(MIN.) =    22.14
EFFECTIVE AREA(ACRES) =      70.18   AREA-AVERAGED Fm(INCH/HR) =  0.11
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.37
TOTAL AREA(ACRES) =       74.0
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    340.00 =    4625.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    340.00 TO NODE    350.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   237.50  DOWNSTREAM(FEET) =   234.50
FLOW LENGTH(FEET) =    81.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  39.0 INCH PIPE IS  28.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  20.46
ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     130.87
PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =   22.21
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    350.00 =    4706.00 FEET.
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =       74.0  TC(MIN.) =     22.21
EFFECTIVE AREA(ACRES) =     70.18  AREA-AVERAGED Fm(INCH/HR)=  0.11
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.368
```

PEAK FLOW RATE(CFS) = 130.87

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	130.87	22.21	2.074	0.30(0.11)	0.37	70.2	200.00
2	125.63	25.81	1.905	0.30(0.11)	0.37	74.0	300.00

==========

==========

END OF RATIONAL METHOD ANALYSIS

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
25 YEAR STORM - EXISTING CONDITION
STREAM C - AGUA CHINON CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 25Y100X3.DAT
  TIME/DATE OF STUDY: 16:11 11/16/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ======  =====  =======
  1   20.0     10.0    0.018/0.018/0.018   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
         DURATION     RAINFALL(INCH)
         5-MINUTES          0.40
```

```
        30-MINUTES          0.87
         1-HOUR             1.15
         3-HOUR             1.94
         6-HOUR             2.71
        24-HOUR             4.49
 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR UNIT HYDROGRAPH METHOD*

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    410.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   212.00
  ELEVATION DATA: UPSTREAM(FEET) =    279.00  DOWNSTREAM(FEET) =    268.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.991
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.355
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"        B        0.96      0.30      0.500    56    5.99
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA RUNOFF(CFS) =       3.63
  TOTAL AREA(ACRES) =       0.96   PEAK FLOW RATE(CFS) =       3.63

****************************************************************************
  FLOW PROCESS FROM NODE    410.00 TO NODE    420.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   263.80  DOWNSTREAM(FEET) =   260.80
  FLOW LENGTH(FEET) =   819.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.57
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.63
  PIPE TRAVEL TIME(MIN.) =   3.82    Tc(MIN.) =    9.81
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    420.00 =    1031.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    420.00 TO NODE    420.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    9.81
```

```
*  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.294
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
RESIDENTIAL
"5-7 DWELLINGS/ACRE"        B        4.28      0.30      0.500    56
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
SUBAREA AREA(ACRES) =    4.28      SUBAREA RUNOFF(CFS) =   12.11
EFFECTIVE AREA(ACRES) =      5.24   AREA-AVERAGED Fm(INCH/HR) =  0.15
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.50
TOTAL AREA(ACRES) =         5.2       PEAK FLOW RATE(CFS) =      14.83
==============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =         5.2  TC(MIN.) =      9.81
EFFECTIVE AREA(ACRES) =      5.24  AREA-AVERAGED Fm(INCH/HR)=  0.15
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.500
PEAK FLOW RATE(CFS)    =      14.83
==============================================================================
==============================================================================
END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
          (c) Copyright 1983-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
25 YEAR STORM - PROPOSED CONDITION
STREAM A - MARSHBURN CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 25Y100Q1.DAT
  TIME/DATE OF STUDY: 15:57 11/16/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ====  ====  =======
  1   18.0     10.0    0.022/0.022/0.020   0.50    1.50 0.0313 0.125 0.0170
  2   18.0     10.0    0.022/0.022/0.020   0.50    1.50 0.0313 0.125 0.0170

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                          AREA-AVERAGED
         DURATION     RAINFALL(INCH)
```

```
        5-MINUTES          0.40
       30-MINUTES          0.87
        1-HOUR             1.15
        3-HOUR             1.94
        6-HOUR             2.71
       24-HOUR             4.49
 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    244.70  DOWNSTREAM(FEET) =    242.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.818
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.745
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        0.48      0.30     0.100    56    7.82
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      1.61
  TOTAL AREA(ACRES) =      0.48   PEAK FLOW RATE(CFS) =      1.61

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  63
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  242.30  DOWNSTREAM ELEVATION(FEET) =  237.10
  STREET LENGTH(FEET) =   638.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.022
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.022

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0170
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0170
  MAXIMUM ALLOWABLE STREET FLOW DEPTH(FEET) =   0.50

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.02
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
```

```
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =    9.45
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.83
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.61
  STREET FLOW TRAVEL TIME(MIN.) =   5.80   Tc(MIN.) =   13.62
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.735
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.96      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.96      SUBAREA RUNOFF(CFS) =    4.77
  EFFECTIVE AREA(ACRES) =      2.44    AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        2.4        PEAK FLOW RATE(CFS) =       5.94

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  11.16
  FLOW VELOCITY(FEET/SEC.) =  2.00   DEPTH*VELOCITY(FT*FT/SEC.) =   0.74
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     938.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   13.62
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.735
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        5.47      0.30      0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    5.47      SUBAREA RUNOFF(CFS) =   13.17
  EFFECTIVE AREA(ACRES) =      7.91   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =        7.9       PEAK FLOW RATE(CFS) =      19.11

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    105.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   223.80  DOWNSTREAM(FEET) =   223.60
  FLOW LENGTH(FEET) =    31.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.61
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       19.11
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =   13.70
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =     969.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.70
  RAINFALL INTENSITY(INCH/HR) =   2.73
  AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.17
  EFFECTIVE STREAM AREA(ACRES) =       7.91
  TOTAL STREAM AREA(ACRES) =       7.91
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      19.11

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   457.00
  ELEVATION DATA: UPSTREAM(FEET) =    244.50  DOWNSTREAM(FEET) =    241.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.828
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.607
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.56      0.30      0.850    56   14.83
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =       1.19
  TOTAL AREA(ACRES) =       0.56   PEAK FLOW RATE(CFS) =       1.19

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   235.00  DOWNSTREAM(FEET) =   223.60
  FLOW LENGTH(FEET) =   565.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.88
```

```
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        1.19
  PIPE TRAVEL TIME(MIN.) =   1.93    Tc(MIN.) =   16.76
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    105.00 =    1022.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   16.76
  RAINFALL INTENSITY(INCH/HR) =   2.43
  AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.85
  EFFECTIVE STREAM AREA(ACRES) =       0.56
  TOTAL STREAM AREA(ACRES) =       0.56
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.19

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1       19.11   13.70    2.727  0.30( 0.05) 0.17       7.9     100.00
      2        1.19   16.76    2.433  0.30( 0.25) 0.85       0.6     103.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1       20.21   13.70    2.727  0.30( 0.06) 0.21       8.4     100.00
      2       18.20   16.76    2.433  0.30( 0.06) 0.21       8.5     103.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      20.21    Tc(MIN.) =    13.70
  EFFECTIVE AREA(ACRES) =       8.37   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.21
  TOTAL AREA(ACRES) =        8.5
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    105.00 =    1022.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   223.60  DOWNSTREAM(FEET) =   221.10
  FLOW LENGTH(FEET) =   513.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  21.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.88
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      20.21
  PIPE TRAVEL TIME(MIN.) =   1.45    Tc(MIN.) =   15.15
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    106.00 =    1535.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   15.15
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.575
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.80      0.30     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.80      SUBAREA RUNOFF(CFS) =    1.83
  EFFECTIVE AREA(ACRES) =      9.17   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        9.3       PEAK FLOW RATE(CFS) =      20.76

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   15.15
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.575
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        5.14      0.30     0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    5.14      SUBAREA RUNOFF(CFS) =   11.64
  EFFECTIVE AREA(ACRES) =     14.31   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =       14.4       PEAK FLOW RATE(CFS) =      32.40

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   221.10  DOWNSTREAM(FEET) =   218.50
  FLOW LENGTH(FEET) =   538.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  25.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.67
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      32.40
  PIPE TRAVEL TIME(MIN.) =   1.34    Tc(MIN.) =   16.50
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    107.00 =    2073.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   16.50
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.454
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.82      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.82      SUBAREA RUNOFF(CFS) =    1.79
  EFFECTIVE AREA(ACRES) =     15.13   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.19
  TOTAL AREA(ACRES) =       15.2       PEAK FLOW RATE(CFS) =      32.63

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   16.50
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.454
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        4.76      0.30      0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    4.76      SUBAREA RUNOFF(CFS) =   10.26
  EFFECTIVE AREA(ACRES) =     19.89   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.19
  TOTAL AREA(ACRES) =       20.0       PEAK FLOW RATE(CFS) =      42.88

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    108.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   218.50  DOWNSTREAM(FEET) =   216.10
  FLOW LENGTH(FEET) =   522.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  29.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.92
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      42.88
  PIPE TRAVEL TIME(MIN.) =   1.26    Tc(MIN.) =   17.76
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    108.00 =    2595.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.76
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.354
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        2.15      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    2.15      SUBAREA RUNOFF(CFS) =    4.50
  EFFECTIVE AREA(ACRES) =     22.04   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.19
  TOTAL AREA(ACRES) =       22.1       PEAK FLOW RATE(CFS) =      45.59

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.76
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.354
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        3.67      0.30      0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    3.67      SUBAREA RUNOFF(CFS) =    7.58
  EFFECTIVE AREA(ACRES) =     25.71   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.19
  TOTAL AREA(ACRES) =       25.8       PEAK FLOW RATE(CFS) =      53.17

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    112.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   216.10  DOWNSTREAM(FEET) =   216.00
  FLOW LENGTH(FEET) =    53.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  35.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.33
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      53.17
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =   17.92
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    112.00 =    2648.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   17.92
  RAINFALL INTENSITY(INCH/HR) =   2.34
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.19
  EFFECTIVE STREAM AREA(ACRES) =      25.71
  TOTAL STREAM AREA(ACRES) =      25.81
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      53.17

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =    240.50  DOWNSTREAM(FEET) =    230.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   19.042
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.263
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        1.19      0.30     0.850    56   19.04
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =      2.15
  TOTAL AREA(ACRES) =      1.19   PEAK FLOW RATE(CFS) =      2.15

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   225.00  DOWNSTREAM(FEET) =   220.00
  FLOW LENGTH(FEET) =   517.00   MANNING'S N =  0.013
```

```
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.45
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.15
  PIPE TRAVEL TIME(MIN.) =   1.94    Tc(MIN.) =   20.98
  LONGEST FLOWPATH FROM NODE    109.00 TO NODE    111.00 =    1517.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    111.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   20.98
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.142
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                 B        0.59      0.30      0.850    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA AREA(ACRES) =    0.59      SUBAREA RUNOFF(CFS) =    1.00
  EFFECTIVE AREA(ACRES) =      1.78   AREA-AVERAGED Fm(INCH/HR) =  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.85
  TOTAL AREA(ACRES) =        1.8       PEAK FLOW RATE(CFS) =       3.02

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   220.00  DOWNSTREAM(FEET) =   216.00
  FLOW LENGTH(FEET) =   407.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.91
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.02
  PIPE TRAVEL TIME(MIN.) =   1.38    Tc(MIN.) =   22.36
  LONGEST FLOWPATH FROM NODE    109.00 TO NODE    112.00 =    1924.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   22.36
  RAINFALL INTENSITY(INCH/HR) =   2.07
```

```
AREA-AVERAGED Fm(INCH/HR) =  0.26
AREA-AVERAGED Fp(INCH/HR) =  0.30
AREA-AVERAGED Ap =  0.85
EFFECTIVE STREAM AREA(ACRES) =        1.78
TOTAL STREAM AREA(ACRES) =        1.78
PEAK FLOW RATE(CFS) AT CONFLUENCE =        3.02

** CONFLUENCE DATA **
 STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)     NODE
    1        53.17   17.92     2.342   0.30( 0.06) 0.19       25.7      100.00
    1        48.60   21.03     2.139   0.30( 0.06) 0.19       25.8      103.00
    2         3.02   22.36     2.066   0.30( 0.26) 0.85        1.8      109.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
 STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)     NODE
    1        55.96   17.92     2.342   0.30( 0.07) 0.22       27.1      100.00
    2        51.56   21.03     2.139   0.30( 0.07) 0.23       27.5      103.00
    3        49.92   22.36     2.066   0.30( 0.07) 0.23       27.6      109.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       55.96    Tc(MIN.) =     17.92
EFFECTIVE AREA(ACRES) =       27.13   AREA-AVERAGED Fm(INCH/HR) =  0.07
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.22
TOTAL AREA(ACRES) =        27.6
LONGEST FLOWPATH FROM NODE    103.00 TO NODE    112.00 =    2648.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    112.00 TO NODE    203.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   216.00  DOWNSTREAM(FEET) =   215.60
FLOW LENGTH(FEET) =   383.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  54.0 INCH PIPE IS  41.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.31
ESTIMATED PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       55.96
PIPE TRAVEL TIME(MIN.) =   1.48    Tc(MIN.) =   19.40
LONGEST FLOWPATH FROM NODE    103.00 TO NODE    203.00 =    3031.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
```

```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   19.40
  RAINFALL INTENSITY(INCH/HR) =   2.24
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.22
  EFFECTIVE STREAM AREA(ACRES) =      27.13
  TOTAL STREAM AREA(ACRES) =      27.59
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      55.96

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    242.80  DOWNSTREAM(FEET) =    239.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.292
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.896
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        1.20      0.30     0.100    56    7.29
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      4.18
  TOTAL AREA(ACRES) =      1.20   PEAK FLOW RATE(CFS) =      4.18

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   239.40  DOWNSTREAM(FEET) =   228.50
  FLOW LENGTH(FEET) =  1000.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.57
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.18
  PIPE TRAVEL TIME(MIN.) =   2.99    Tc(MIN.) =   10.29
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =    1300.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
 MAINLINE Tc(MIN.) =   10.29
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.207
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  B        8.46      0.30      0.100    56
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =    8.46      SUBAREA RUNOFF(CFS) =   24.19
 EFFECTIVE AREA(ACRES) =      9.66   AREA-AVERAGED Fm(INCH/HR) =  0.03
 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =        9.7       PEAK FLOW RATE(CFS) =      27.62

****************************************************************************
 FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   228.50  DOWNSTREAM(FEET) =   215.60
 FLOW LENGTH(FEET) =  1275.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.45
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      27.62
 PIPE TRAVEL TIME(MIN.) =   2.52    Tc(MIN.) =   12.80
 LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    2575.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =   12.80
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.833
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  B       12.34      0.30      0.100    56
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =   12.34      SUBAREA RUNOFF(CFS) =   31.13
 EFFECTIVE AREA(ACRES) =     22.00   AREA-AVERAGED Fm(INCH/HR) =  0.03
 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =       22.0       PEAK FLOW RATE(CFS) =      55.50

****************************************************************************
 FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
```

```
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   12.80
RAINFALL INTENSITY(INCH/HR) =   2.83
AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =      22.00
TOTAL STREAM AREA(ACRES) =      22.00
PEAK FLOW RATE(CFS) AT CONFLUENCE =      55.50

** CONFLUENCE DATA **
 STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)     NODE
    1        55.96   19.40     2.239   0.30( 0.07) 0.22      27.1      100.00
    1        51.56   22.56     2.056   0.30( 0.07) 0.23      27.5      103.00
    1        49.92   23.90     1.990   0.30( 0.07) 0.23      27.6      109.00
    2        55.50   12.80     2.833   0.30( 0.03) 0.10      22.0      200.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
 STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)     NODE
    1       102.53   12.80     2.833   0.30( 0.05) 0.15      39.9      200.00
    2        99.70   19.40     2.239   0.30( 0.05) 0.17      49.1      100.00
    3        91.67   22.56     2.056   0.30( 0.05) 0.17      49.5      103.00
    4        88.73   23.90     1.990   0.30( 0.05) 0.17      49.6      109.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     102.53    Tc(MIN.) =    12.80
EFFECTIVE AREA(ACRES) =      39.90   AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.15
TOTAL AREA(ACRES) =       49.6
LONGEST FLOWPATH FROM NODE    103.00 TO NODE    203.00 =    3031.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   215.60  DOWNSTREAM(FEET) =   215.50
FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  63.0 INCH PIPE IS  49.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.60
ESTIMATED PIPE DIAMETER(INCH) =  63.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     102.53
PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =   13.01
LONGEST FLOWPATH FROM NODE    103.00 TO NODE    204.00 =    3101.00 FEET.
============================================================================
```

```
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)        =        49.6  TC(MIN.) =      13.01
EFFECTIVE AREA(ACRES) =      39.90  AREA-AVERAGED Fm(INCH/HR)=  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.155
PEAK FLOW RATE(CFS)    =     102.53

** PEAK FLOW RATE TABLE **
 STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
 NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)           (ACRES)    NODE
    1       102.53   13.01    2.807  0.30( 0.05) 0.15      39.9     200.00
    2        99.70   19.61    2.225  0.30( 0.05) 0.17      49.1     100.00
    3        91.67   22.78    2.045  0.30( 0.05) 0.17      49.5     103.00
    4        88.73   24.11    1.980  0.30( 0.05) 0.17      49.6     109.00
==============================================================================
==============================================================================
END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
25 YEAR STORM - PROPOSED CONDITION
STREAM B - BEE CANYON CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 25Y100Q2.DAT
  TIME/DATE OF STUDY: 15:59 11/16/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   18.0     10.0    0.022/0.022/0.020   0.50    1.50 0.0312 0.125 0.0170

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
         DURATION     RAINFALL(INCH)
         5-MINUTES          0.40
```

```
        30-MINUTES          0.87
         1-HOUR             1.15
         3-HOUR             1.94
         6-HOUR             2.71
        24-HOUR             4.49
 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    278.40  DOWNSTREAM(FEET) =    272.80

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.599
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.122
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        0.63      0.30     0.100    56    6.60
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      2.32
  TOTAL AREA(ACRES) =      0.63   PEAK FLOW RATE(CFS) =      2.32

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  63
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  272.80  DOWNSTREAM ELEVATION(FEET) =  269.20
  STREET LENGTH(FEET) =   575.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.022
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.022

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0170
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0170
  MAXIMUM ALLOWABLE STREET FLOW DEPTH(FEET) =   0.50

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.56
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
```

```
    HALFSTREET FLOOD WIDTH(FEET) =     9.45
    AVERAGE FLOW VELOCITY(FEET/SEC.) =     1.62
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =     0.54
  STREET FLOW TRAVEL TIME(MIN.) =   5.92   Tc(MIN.) =   12.51
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.870
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.96      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     0.96      SUBAREA RUNOFF(CFS) =     2.45
  EFFECTIVE AREA(ACRES) =       1.59    AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =         1.6        PEAK FLOW RATE(CFS) =       4.06

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.07
  FLOW VELOCITY(FEET/SEC.) =  1.65   DEPTH*VELOCITY(FT*FT/SEC.) =   0.57
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     875.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   12.51
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.870
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        2.57      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     2.57      SUBAREA RUNOFF(CFS) =     6.57
  EFFECTIVE AREA(ACRES) =       4.16    AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =         4.2        PEAK FLOW RATE(CFS) =      10.63

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   261.30  DOWNSTREAM(FEET) =   258.80
  FLOW LENGTH(FEET) =   512.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  14.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.18
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.63
  PIPE TRAVEL TIME(MIN.) =   1.65    Tc(MIN.) =   14.16
```

```
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =    1387.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   14.16
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.676
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.72      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.72      SUBAREA RUNOFF(CFS) =    4.10
  EFFECTIVE AREA(ACRES) =      5.88   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        5.9       PEAK FLOW RATE(CFS) =      14.00

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   14.16
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.676
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        2.55      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    2.55      SUBAREA RUNOFF(CFS) =    6.07
  EFFECTIVE AREA(ACRES) =      8.43   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        8.4       PEAK FLOW RATE(CFS) =      20.07

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    306.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   258.80  DOWNSTREAM(FEET) =   258.60
  FLOW LENGTH(FEET) =    27.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.05
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      20.07
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =   14.23
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    306.00 =    1414.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    306.00 TO NODE    306.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.23
  RAINFALL INTENSITY(INCH/HR) =   2.67
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       8.43
  TOTAL STREAM AREA(ACRES) =       8.43
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      20.07

****************************************************************************
  FLOW PROCESS FROM NODE    304.00 TO NODE    305.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   788.00
  ELEVATION DATA: UPSTREAM(FEET) =    275.00  DOWNSTREAM(FEET) =    267.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   17.428
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.379
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.94      0.30     0.850    56   17.43
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =      1.80
  TOTAL AREA(ACRES) =      0.94   PEAK FLOW RATE(CFS) =      1.80

****************************************************************************
  FLOW PROCESS FROM NODE    305.00 TO NODE    306.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   262.00  DOWNSTREAM(FEET) =   258.60
  FLOW LENGTH(FEET) =   318.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.38
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.80
  PIPE TRAVEL TIME(MIN.) =   1.21    Tc(MIN.) =   18.64
```

```
  LONGEST FLOWPATH FROM NODE    304.00 TO NODE    306.00 =    1106.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    306.00 TO NODE    306.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   18.64
  RAINFALL INTENSITY(INCH/HR) =   2.29
  AREA-AVERAGED Fm(INCH/HR) =  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.85
  EFFECTIVE STREAM AREA(ACRES) =       0.94
  TOTAL STREAM AREA(ACRES) =       0.94
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.80

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1       20.07   14.23    2.669  0.30( 0.03) 0.10       8.4     300.00
      2        1.80   18.64    2.291  0.30( 0.26) 0.85       0.9     304.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1       21.70   14.23    2.669  0.30( 0.05) 0.16       9.1     300.00
      2       18.99   18.64    2.291  0.30( 0.05) 0.18       9.4     304.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      21.70    Tc(MIN.) =    14.23
  EFFECTIVE AREA(ACRES) =       9.15   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =        9.4
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    306.00 =    1414.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    306.00 TO NODE    307.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   258.60  DOWNSTREAM(FEET) =   254.70
  FLOW LENGTH(FEET) =   786.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.19
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       21.70
  PIPE TRAVEL TIME(MIN.) =   2.12    Tc(MIN.) =    16.34
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    307.00 =    2200.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    307.00 TO NODE    307.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   16.34
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.468
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.73      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     1.73      SUBAREA RUNOFF(CFS) =     3.80
  EFFECTIVE AREA(ACRES) =      10.88   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.15
  TOTAL AREA(ACRES) =        11.1       PEAK FLOW RATE(CFS) =       23.72

****************************************************************************
  FLOW PROCESS FROM NODE    307.00 TO NODE    307.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   16.34
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.468
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        3.48      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     3.48      SUBAREA RUNOFF(CFS) =     7.63
  EFFECTIVE AREA(ACRES) =      14.36   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.14
  TOTAL AREA(ACRES) =        14.6       PEAK FLOW RATE(CFS) =       31.35

****************************************************************************
  FLOW PROCESS FROM NODE    307.00 TO NODE    310.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   254.70  DOWNSTREAM(FEET) =   254.60
  FLOW LENGTH(FEET) =    18.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  23.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.05
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       31.35
```

```
  PIPE TRAVEL TIME(MIN.) =    0.04     Tc(MIN.) =    16.38
  LONGEST FLOWPATH FROM NODE     300.00 TO NODE     310.00 =     2218.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     310.00 TO NODE     310.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    16.38
  RAINFALL INTENSITY(INCH/HR) =    2.46
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.14
  EFFECTIVE STREAM AREA(ACRES) =       14.36
  TOTAL STREAM AREA(ACRES) =       14.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       31.35

****************************************************************************
  FLOW PROCESS FROM NODE     308.00 TO NODE     309.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    696.00
  ELEVATION DATA: UPSTREAM(FEET) =     267.00  DOWNSTREAM(FEET) =     261.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    17.135
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.402
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.83      0.30      0.850    56   17.13
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =       1.60
  TOTAL AREA(ACRES) =       0.83   PEAK FLOW RATE(CFS) =       1.60

****************************************************************************
  FLOW PROCESS FROM NODE     309.00 TO NODE     310.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    256.50  DOWNSTREAM(FEET) =    254.60
  FLOW LENGTH(FEET) =    370.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS    5.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    3.26
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =        1.60
  PIPE TRAVEL TIME(MIN.) =   1.89    Tc(MIN.) =    19.03
  LONGEST FLOWPATH FROM NODE    308.00 TO NODE    310.00 =    1066.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    310.00 TO NODE    310.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   19.03
  RAINFALL INTENSITY(INCH/HR) =   2.26
  AREA-AVERAGED Fm(INCH/HR) =  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.85
  EFFECTIVE STREAM AREA(ACRES) =        0.83
  TOTAL STREAM AREA(ACRES) =        0.83
  PEAK FLOW RATE(CFS) AT CONFLUENCE =        1.60

  ** CONFLUENCE DATA **
   STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)     NODE
      1        31.35   16.38     2.464   0.30( 0.04) 0.14       14.4      300.00
      1        27.62   20.90     2.147   0.30( 0.04) 0.15       14.6      304.00
      2         1.60   19.03     2.264   0.30( 0.26) 0.85        0.8      308.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)     NODE
      1        32.87   16.38     2.464   0.30( 0.05) 0.17       15.1      300.00
      2        30.77   19.03     2.264   0.30( 0.05) 0.18       15.3      308.00
      3        29.13   20.90     2.147   0.30( 0.06) 0.19       15.4      304.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       32.87    Tc(MIN.) =    16.38
  EFFECTIVE AREA(ACRES) =       15.07   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =        15.4
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    310.00 =    2218.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    310.00 TO NODE    311.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   254.60  DOWNSTREAM(FEET) =   251.40
```

```
  FLOW LENGTH(FEET) =   649.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  25.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.74
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      32.87
  PIPE TRAVEL TIME(MIN.) =   1.60    Tc(MIN.) =   17.99
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    311.00 =    2867.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    311.00 TO NODE    311.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.99
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.337
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.98      0.30     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.98      SUBAREA RUNOFF(CFS) =    4.11
  EFFECTIVE AREA(ACRES) =     17.05   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =       17.4       PEAK FLOW RATE(CFS) =      35.12

****************************************************************************
  FLOW PROCESS FROM NODE    311.00 TO NODE    311.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.99
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.337
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        4.26      0.30     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    4.26      SUBAREA RUNOFF(CFS) =    8.85
  EFFECTIVE AREA(ACRES) =     21.31   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.15
  TOTAL AREA(ACRES) =       21.6       PEAK FLOW RATE(CFS) =      43.96

****************************************************************************
  FLOW PROCESS FROM NODE    311.00 TO NODE    314.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   251.40  DOWNSTREAM(FEET) =   251.30
  FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.20
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      43.96
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =   18.02
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    314.00 =    2882.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    314.00 TO NODE    314.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   18.02
  RAINFALL INTENSITY(INCH/HR) =   2.33
  AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.15
  EFFECTIVE STREAM AREA(ACRES) =      21.31
  TOTAL STREAM AREA(ACRES) =      21.65
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      43.96

****************************************************************************
  FLOW PROCESS FROM NODE    312.00 TO NODE    313.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   539.00
  ELEVATION DATA: UPSTREAM(FEET) =    264.00  DOWNSTREAM(FEET) =    259.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.244
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.567
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.66      0.30      0.850    56   15.24
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =      1.37
  TOTAL AREA(ACRES) =      0.66   PEAK FLOW RATE(CFS) =      1.37

****************************************************************************
  FLOW PROCESS FROM NODE    313.00 TO NODE    314.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   254.00  DOWNSTREAM(FEET) =   251.30
  FLOW LENGTH(FEET) =   481.00   MANNING'S N =  0.013
```

```
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   3.22
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       1.37
PIPE TRAVEL TIME(MIN.) =   2.49    Tc(MIN.) =   17.74
LONGEST FLOWPATH FROM NODE    312.00 TO NODE    314.00 =    1020.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    314.00 TO NODE    314.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   17.74
RAINFALL INTENSITY(INCH/HR) =   2.36
AREA-AVERAGED Fm(INCH/HR) =  0.26
AREA-AVERAGED Fp(INCH/HR) =  0.30
AREA-AVERAGED Ap =  0.85
EFFECTIVE STREAM AREA(ACRES) =       0.66
TOTAL STREAM AREA(ACRES) =       0.66
PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.37

** CONFLUENCE DATA **
 STREAM       Q      Tc   Intensity   Fp(Fm)      Ap     Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1       43.96   18.02    2.335  0.30( 0.05) 0.15      21.3     300.00
    1       41.02   20.68    2.160  0.30( 0.05) 0.16      21.6     308.00
    1       39.14   22.57    2.056  0.30( 0.05) 0.16      21.6     304.00
    2        1.37   17.74    2.356  0.30( 0.26) 0.85       0.7     312.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
 STREAM       Q      Tc   Intensity   Fp(Fm)      Ap     Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1       45.04   17.74    2.356  0.30( 0.05) 0.17      21.6     312.00
    2       45.32   18.02    2.335  0.30( 0.05) 0.17      22.0     300.00
    3       42.27   20.68    2.160  0.30( 0.05) 0.18      22.2     308.00
    4       40.32   22.57    2.056  0.30( 0.05) 0.18      22.3     304.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      45.32    Tc(MIN.) =    18.02
EFFECTIVE AREA(ACRES) =      21.97   AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
TOTAL AREA(ACRES) =       22.3
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    314.00 =    2882.00 FEET.

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    314.00 TO NODE    315.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   251.30  DOWNSTREAM(FEET) =   249.40
  FLOW LENGTH(FEET) =   385.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  27.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.41
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      45.32
  PIPE TRAVEL TIME(MIN.) =   0.87    Tc(MIN.) =   18.89
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    315.00 =    3267.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    315.00 TO NODE    315.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   18.89
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.274
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        3.67      0.30     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     3.67      SUBAREA RUNOFF(CFS) =     7.41
  EFFECTIVE AREA(ACRES) =      25.64   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =        26.0       PEAK FLOW RATE(CFS) =       51.35

****************************************************************************
  FLOW PROCESS FROM NODE    315.00 TO NODE    316.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   249.40  DOWNSTREAM(FEET) =   247.30
  FLOW LENGTH(FEET) =   367.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  28.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.04
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      51.35
  PIPE TRAVEL TIME(MIN.) =   0.76    Tc(MIN.) =   19.65
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    316.00 =    3634.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    316.00 TO NODE    316.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
  MAINLINE Tc(MIN.) =   19.65
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.223
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        3.62      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    3.62      SUBAREA RUNOFF(CFS) =    7.15
  EFFECTIVE AREA(ACRES) =     29.26   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.15
  TOTAL AREA(ACRES) =       29.6       PEAK FLOW RATE(CFS) =      57.34

****************************************************************************
  FLOW PROCESS FROM NODE    316.00 TO NODE    319.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   247.30  DOWNSTREAM(FEET) =   247.00
  FLOW LENGTH(FEET) =    42.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  28.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.98
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      57.34
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =   19.72
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    319.00 =    3676.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    319.00 TO NODE    319.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   19.72
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.218
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.84      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.84      SUBAREA RUNOFF(CFS) =    1.65
  EFFECTIVE AREA(ACRES) =     30.10   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.15
  TOTAL AREA(ACRES) =       30.4       PEAK FLOW RATE(CFS) =      58.86

****************************************************************************
  FLOW PROCESS FROM NODE    319.00 TO NODE    319.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
```

```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    19.72
  RAINFALL INTENSITY(INCH/HR) =    2.22
  AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.15
  EFFECTIVE STREAM AREA(ACRES) =       30.10
  TOTAL STREAM AREA(ACRES) =       30.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       58.86

****************************************************************************
  FLOW PROCESS FROM NODE    317.00 TO NODE    318.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   684.00
  ELEVATION DATA: UPSTREAM(FEET) =    263.00  DOWNSTREAM(FEET) =    256.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   16.688
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.439
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.82      0.30     0.850    56   16.69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =      1.61
  TOTAL AREA(ACRES) =      0.82   PEAK FLOW RATE(CFS) =      1.61

****************************************************************************
  FLOW PROCESS FROM NODE    318.00 TO NODE    319.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   251.50  DOWNSTREAM(FEET) =   247.00
  FLOW LENGTH(FEET) =   441.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.17
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.61
  PIPE TRAVEL TIME(MIN.) =   1.76    Tc(MIN.) =   18.45
  LONGEST FLOWPATH FROM NODE    317.00 TO NODE    319.00 =    1125.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    319.00 TO NODE    319.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
```

```
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   18.45
  RAINFALL INTENSITY(INCH/HR) =   2.30
  AREA-AVERAGED Fm(INCH/HR) =  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.85
  EFFECTIVE STREAM AREA(ACRES) =        0.82
  TOTAL STREAM AREA(ACRES) =        0.82
  PEAK FLOW RATE(CFS) AT CONFLUENCE =        1.61

  ** CONFLUENCE DATA **
   STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)     NODE
      1        58.69   19.44     2.237   0.30( 0.05) 0.15      29.8      312.00
      1        58.86   19.72     2.218   0.30( 0.05) 0.15      30.1      300.00
      1        55.06   22.42     2.063   0.30( 0.05) 0.16      30.3      308.00
      1        52.64   24.34     1.969   0.30( 0.05) 0.16      30.4      304.00
      2         1.61   18.45     2.304   0.30( 0.26) 0.85       0.8      317.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)     NODE
      1        59.02   18.45     2.304   0.30( 0.05) 0.17      29.1      317.00
      2        60.25   19.44     2.237   0.30( 0.05) 0.17      30.6      312.00
      3        60.41   19.72     2.218   0.30( 0.05) 0.17      30.9      300.00
      4        56.48   22.42     2.063   0.30( 0.05) 0.18      31.2      308.00
      5        53.99   24.34     1.969   0.30( 0.05) 0.18      31.3      304.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       60.41    Tc(MIN.) =     19.72
  EFFECTIVE AREA(ACRES) =       30.92   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =        31.3
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    319.00 =    3676.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    319.00 TO NODE    320.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   247.00  DOWNSTREAM(FEET) =   244.30
  FLOW LENGTH(FEET) =   381.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  29.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.01
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       60.41
```

```
  PIPE TRAVEL TIME(MIN.) =    0.70     Tc(MIN.) =    20.43
  LONGEST FLOWPATH FROM NODE     300.00 TO NODE     320.00 =     4057.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     320.00 TO NODE     320.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    20.43
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.175
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)   CN
  COMMERCIAL                  B        0.67      0.30      0.100     56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     0.67      SUBAREA RUNOFF(CFS) =     1.29
  EFFECTIVE AREA(ACRES) =      31.59   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =        31.9       PEAK FLOW RATE(CFS) =       60.41
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE     320.00 TO NODE     320.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    20.43
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.175
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)   CN
  COMMERCIAL                  B        3.00      0.30      0.100     56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     3.00      SUBAREA RUNOFF(CFS) =     5.79
  EFFECTIVE AREA(ACRES) =      34.59   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =        34.9       PEAK FLOW RATE(CFS) =       66.18

****************************************************************************
  FLOW PROCESS FROM NODE     320.00 TO NODE     321.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    244.30  DOWNSTREAM(FEET) =    242.40
  FLOW LENGTH(FEET) =    410.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  31.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    7.93
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =    1
  PIPE-FLOW(CFS) =       66.18
```

```
  PIPE TRAVEL TIME(MIN.) =    0.86     Tc(MIN.) =    21.29
  LONGEST FLOWPATH FROM NODE     300.00 TO NODE     321.00 =     4467.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     321.00 TO NODE     321.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    21.29
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.124
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.53      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     1.53      SUBAREA RUNOFF(CFS) =     2.88
  EFFECTIVE AREA(ACRES) =      36.12   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =        36.5       PEAK FLOW RATE(CFS) =       67.50

****************************************************************************
  FLOW PROCESS FROM NODE     321.00 TO NODE     321.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    21.29
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.124
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        2.76      0.30      0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =     2.76      SUBAREA RUNOFF(CFS) =     5.13
  EFFECTIVE AREA(ACRES) =      38.88   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =        39.2       PEAK FLOW RATE(CFS) =       72.63

****************************************************************************
  FLOW PROCESS FROM NODE     321.00 TO NODE     324.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    242.40  DOWNSTREAM(FEET) =    241.20
  FLOW LENGTH(FEET) =     30.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  23.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.01
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =    1
  PIPE-FLOW(CFS) =       72.63
```

```
  PIPE TRAVEL TIME(MIN.) =    0.03     Tc(MIN.) =    21.32
  LONGEST FLOWPATH FROM NODE     300.00 TO NODE     324.00 =     4497.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     324.00 TO NODE     324.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    21.32
  RAINFALL INTENSITY(INCH/HR) =    2.12
  AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.16
  EFFECTIVE STREAM AREA(ACRES) =       38.88
  TOTAL STREAM AREA(ACRES) =       39.22
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       72.63

****************************************************************************
  FLOW PROCESS FROM NODE     322.00 TO NODE     323.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    724.00
  ELEVATION DATA: UPSTREAM(FEET) =     259.00  DOWNSTREAM(FEET) =     252.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    17.013
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.412
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.87      0.30      0.850    56   17.01
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =       1.69
  TOTAL AREA(ACRES) =       0.87   PEAK FLOW RATE(CFS) =       1.69

****************************************************************************
  FLOW PROCESS FROM NODE     323.00 TO NODE     324.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    246.00  DOWNSTREAM(FEET) =    241.20
  FLOW LENGTH(FEET) =    464.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS    5.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    4.26
  ESTIMATED PIPE DIAMETER(INCH) =  18.00     NUMBER OF PIPES =    1
```

```
  PIPE-FLOW(CFS) =        1.69
  PIPE TRAVEL TIME(MIN.) =   1.82    Tc(MIN.) =   18.83
  LONGEST FLOWPATH FROM NODE    322.00 TO NODE    324.00 =    1188.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    324.00 TO NODE    324.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   18.83
  RAINFALL INTENSITY(INCH/HR) =   2.28
  AREA-AVERAGED Fm(INCH/HR) =  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.85
  EFFECTIVE STREAM AREA(ACRES) =       0.87
  TOTAL STREAM AREA(ACRES) =       0.87
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.69

  ** CONFLUENCE DATA **
   STREAM       Q       Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER     (CFS)   (MIN.) (INCH/HR) (INCH/HR)           (ACRES)    NODE
      1       71.67   20.05    2.198  0.30( 0.05) 0.16      37.0     317.00
      1       72.56   21.04    2.139  0.30( 0.05) 0.16      38.5     312.00
      1       72.63   21.32    2.123  0.30( 0.05) 0.16      38.9     300.00
      1       68.10   24.05    1.983  0.30( 0.05) 0.17      39.1     308.00
      1       65.25   25.98    1.898  0.30( 0.05) 0.17      39.2     304.00
      2        1.69   18.83    2.278  0.30( 0.26) 0.85       0.9     322.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q       Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER     (CFS)   (MIN.) (INCH/HR) (INCH/HR)           (ACRES)    NODE
      1       71.48   18.83    2.278  0.30( 0.05) 0.18      35.6     322.00
      2       73.29   20.05    2.198  0.30( 0.05) 0.18      37.9     317.00
      3       74.13   21.04    2.139  0.30( 0.05) 0.18      39.4     312.00
      4       74.19   21.32    2.123  0.30( 0.05) 0.18      39.8     300.00
      5       69.55   24.05    1.983  0.30( 0.05) 0.18      40.0     308.00
      6       66.62   25.98    1.898  0.30( 0.06) 0.18      40.1     304.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       74.19    Tc(MIN.) =    21.32
  EFFECTIVE AREA(ACRES) =       39.75   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.18
  TOTAL AREA(ACRES) =       40.1
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    324.00 =    4497.00 FEET.

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    324.00 TO NODE    325.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   241.20  DOWNSTREAM(FEET) =   239.60
  FLOW LENGTH(FEET) =   215.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  31.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.69
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      74.19
  PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =   21.69
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    325.00 =    4712.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    325.00 TO NODE    325.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   21.69
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.102
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        1.53      0.30      0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    1.53      SUBAREA RUNOFF(CFS) =    2.81
  EFFECTIVE AREA(ACRES) =     41.28   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.18
  TOTAL AREA(ACRES) =       41.6       PEAK FLOW RATE(CFS) =      76.11

****************************************************************************
  FLOW PROCESS FROM NODE    325.00 TO NODE    328.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   239.60  DOWNSTREAM(FEET) =   237.20
  FLOW LENGTH(FEET) =    86.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  24.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.99
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      76.11
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =   21.78
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    328.00 =    4798.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    328.00 TO NODE    328.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

```
==============================================================================
  MAINLINE Tc(MIN.) =   21.78
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.097
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.40      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.40      SUBAREA RUNOFF(CFS) =    0.74
  EFFECTIVE AREA(ACRES) =     41.68   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.18
  TOTAL AREA(ACRES) =       42.0       PEAK FLOW RATE(CFS) =      76.68

******************************************************************************
  FLOW PROCESS FROM NODE    328.00 TO NODE    328.00 IS CODE =  81
------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
  MAINLINE Tc(MIN.) =   21.78
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.097
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                 B        0.90      0.30      0.850    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA AREA(ACRES) =    0.90      SUBAREA RUNOFF(CFS) =    1.49
  EFFECTIVE AREA(ACRES) =     42.58   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.19
  TOTAL AREA(ACRES) =       42.9       PEAK FLOW RATE(CFS) =      78.17

******************************************************************************
  FLOW PROCESS FROM NODE    328.00 TO NODE    328.00 IS CODE =   1
------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   21.78
  RAINFALL INTENSITY(INCH/HR) =   2.10
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.19
  EFFECTIVE STREAM AREA(ACRES) =      42.58
  TOTAL STREAM AREA(ACRES) =      42.92
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      78.17

******************************************************************************
  FLOW PROCESS FROM NODE    326.00 TO NODE    327.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   455.00
  ELEVATION DATA: UPSTREAM(FEET) =    251.40  DOWNSTREAM(FEET) =    249.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.948
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.502
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.86      0.30      0.850    56   15.95
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =       1.74
  TOTAL AREA(ACRES) =       0.86   PEAK FLOW RATE(CFS) =       1.74

****************************************************************************
  FLOW PROCESS FROM NODE    327.00 TO NODE    328.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   240.00  DOWNSTREAM(FEET) =   237.20
  FLOW LENGTH(FEET) =   461.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.55
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.74
  PIPE TRAVEL TIME(MIN.) =   2.17    Tc(MIN.) =   18.11
  LONGEST FLOWPATH FROM NODE    326.00 TO NODE    328.00 =     916.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    328.00 TO NODE    328.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   18.11
  RAINFALL INTENSITY(INCH/HR) =   2.33
  AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.85
  EFFECTIVE STREAM AREA(ACRES) =       0.86
  TOTAL STREAM AREA(ACRES) =       0.86
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.74

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
```

NUMBER	(CFS)	(MIN.)	(INCH/HR)	(INCH/HR)		(ACRES)	NODE
1	75.75	19.29	2.247	0.30(0.06)	0.20	38.5	322.00
1	77.40	20.51	2.170	0.30(0.06)	0.19	40.7	317.00
1	78.14	21.50	2.113	0.30(0.06)	0.19	42.2	312.00
1	78.17	21.78	2.097	0.30(0.06)	0.19	42.6	300.00
1	73.34	24.51	1.962	0.30(0.06)	0.20	42.8	308.00
1	70.28	26.46	1.879	0.30(0.06)	0.20	42.9	304.00
2	1.74	18.11	2.328	0.30(0.25)	0.85	0.9	326.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	75.52	18.11	2.328	0.30(0.06)	0.21	37.0	326.00
2	77.42	19.29	2.247	0.30(0.06)	0.21	39.3	322.00
3	79.01	20.51	2.170	0.30(0.06)	0.21	41.6	317.00
4	79.70	21.50	2.113	0.30(0.06)	0.21	43.1	312.00
5	79.71	21.78	2.097	0.30(0.06)	0.21	43.4	300.00
6	74.77	24.51	1.962	0.30(0.06)	0.21	43.7	308.00
7	71.64	26.46	1.879	0.30(0.06)	0.21	43.8	304.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 79.71 Tc(MIN.) = 21.78
EFFECTIVE AREA(ACRES) = 43.44 AREA-AVERAGED Fm(INCH/HR) = 0.06
AREA-AVERAGED Fp(INCH/HR) = 0.30 AREA-AVERAGED Ap = 0.21
TOTAL AREA(ACRES) = 43.8
LONGEST FLOWPATH FROM NODE 300.00 TO NODE 328.00 = 4798.00 FEET.

****
FLOW PROCESS FROM NODE 328.00 TO NODE 328.00 IS CODE = 81

>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========
MAINLINE Tc(MIN.) = 21.78
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 2.097
SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
RESIDENTIAL "11+ DWELLINGS/ACRE"	B	4.24	0.30	0.200	56

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
SUBAREA AREA(ACRES) = 4.24 SUBAREA RUNOFF(CFS) = 7.77
EFFECTIVE AREA(ACRES) = 47.68 AREA-AVERAGED Fm(INCH/HR) = 0.06
AREA-AVERAGED Fp(INCH/HR) = 0.30 AREA-AVERAGED Ap = 0.21
TOTAL AREA(ACRES) = 48.0 PEAK FLOW RATE(CFS) = 87.37

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE

```
     1        84.04    18.11     2.328  0.30( 0.06) 0.21       41.2      326.00
     2        85.63    19.29     2.247  0.30( 0.06) 0.21       43.6      322.00
     3        86.94    20.51     2.170  0.30( 0.06) 0.21       45.8      317.00
     4        87.41    21.50     2.113  0.30( 0.06) 0.21       47.3      312.00
     5        87.37    21.78     2.097  0.30( 0.06) 0.21       47.7      300.00
     6        81.92    24.51     1.962  0.30( 0.06) 0.21       47.9      308.00
     7        78.48    26.46     1.879  0.30( 0.06) 0.21       48.0      304.00
  NEW PEAK FLOW DATA ARE:
  PEAK FLOW RATE(CFS) =       87.41  Tc(MIN.) =   21.50
  AREA-AVERAGED Fm(INCH/HR) =  0.06  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.21  EFFECTIVE AREA(ACRES) =      47.35

****************************************************************************
  FLOW PROCESS FROM NODE    328.00 TO NODE    329.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   237.20  DOWNSTREAM(FEET) =   235.40
  FLOW LENGTH(FEET) =   300.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  36.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.17
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       87.41
  PIPE TRAVEL TIME(MIN.) =   0.55    Tc(MIN.) =   22.04
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    329.00 =    5098.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    329.00 TO NODE    329.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   22.04
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.083
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        2.70      0.30      0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    2.70      SUBAREA RUNOFF(CFS) =    4.92
  EFFECTIVE AREA(ACRES) =     50.05   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.21
  TOTAL AREA(ACRES) =       50.7       PEAK FLOW RATE(CFS) =      91.06

****************************************************************************
  FLOW PROCESS FROM NODE    329.00 TO NODE    411.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =   235.40  DOWNSTREAM(FEET) =   235.00
  FLOW LENGTH(FEET) =    74.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  35.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.03
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      91.06
  PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =   22.18
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    411.00 =    5172.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    411.00 TO NODE    411.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   22.18
  RAINFALL INTENSITY(INCH/HR) =   2.08
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.21
  EFFECTIVE STREAM AREA(ACRES) =      50.05
  TOTAL STREAM AREA(ACRES) =      50.72
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      91.06

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   295.00
  ELEVATION DATA: UPSTREAM(FEET) =    270.00  DOWNSTREAM(FEET) =    267.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.402
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.863
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        1.03      0.30     0.100    56    7.40
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      3.55
  TOTAL AREA(ACRES) =      1.03   PEAK FLOW RATE(CFS) =      3.55

****************************************************************************
  FLOW PROCESS FROM NODE    401.00 TO NODE    402.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =   261.00  DOWNSTREAM(FEET) =   257.30
  FLOW LENGTH(FEET) =   234.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.11
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.55
  PIPE TRAVEL TIME(MIN.) =   0.64    Tc(MIN.) =    8.04
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    402.00 =     529.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.04
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.686
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        2.89      0.30     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    2.89      SUBAREA RUNOFF(CFS) =    9.51
  EFFECTIVE AREA(ACRES) =      3.92   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        3.9       PEAK FLOW RATE(CFS) =      12.90

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    403.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   257.30  DOWNSTREAM(FEET) =   256.80
  FLOW LENGTH(FEET) =   104.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.33
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.90
  PIPE TRAVEL TIME(MIN.) =   0.32    Tc(MIN.) =    8.37
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    403.00 =     633.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    403.00 TO NODE    403.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.37
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.605
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
```

```
     LAND USE              GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.62      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.62      SUBAREA RUNOFF(CFS) =    1.99
  EFFECTIVE AREA(ACRES) =      4.54   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        4.5       PEAK FLOW RATE(CFS) =      14.61

****************************************************************************
  FLOW PROCESS FROM NODE    403.00 TO NODE    404.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   256.80  DOWNSTREAM(FEET) =   253.10
  FLOW LENGTH(FEET) =   737.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.51
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      14.61
  PIPE TRAVEL TIME(MIN.) =   2.23    Tc(MIN.) =   10.59
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    404.00 =    1370.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    404.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   10.59
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.154
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE              GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        5.89      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    5.89      SUBAREA RUNOFF(CFS) =   16.56
  EFFECTIVE AREA(ACRES) =     10.43   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       10.4       PEAK FLOW RATE(CFS) =      29.32

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    405.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   253.10  DOWNSTREAM(FEET) =   252.60
  FLOW LENGTH(FEET) =    94.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.85
```

```
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       29.32
  PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =   10.82
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    405.00 =    1464.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    405.00 TO NODE    405.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   10.82
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.116
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.62      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.62      SUBAREA RUNOFF(CFS) =    1.72
  EFFECTIVE AREA(ACRES) =     11.05   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       11.1       PEAK FLOW RATE(CFS) =      30.69

****************************************************************************
  FLOW PROCESS FROM NODE    405.00 TO NODE    406.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   252.60  DOWNSTREAM(FEET) =   249.80
  FLOW LENGTH(FEET) =   574.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  23.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.65
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       30.69
  PIPE TRAVEL TIME(MIN.) =   1.44    Tc(MIN.) =   12.26
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    406.00 =    2038.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    406.00 TO NODE    406.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   12.26
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.903
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        4.77      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    4.77      SUBAREA RUNOFF(CFS) =   12.34
```

```
  EFFECTIVE AREA(ACRES) =      15.82   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        15.8        PEAK FLOW RATE(CFS) =       40.91

****************************************************************************
  FLOW PROCESS FROM NODE    406.00 TO NODE    407.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   249.80  DOWNSTREAM(FEET) =   249.10
  FLOW LENGTH(FEET) =   136.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  26.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.27
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      40.91
  PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =   12.57
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    407.00 =    2174.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    407.00 TO NODE    407.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   12.57
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.862
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.63      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.63      SUBAREA RUNOFF(CFS) =    1.61
  EFFECTIVE AREA(ACRES) =     16.45   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        16.4        PEAK FLOW RATE(CFS) =       41.93

****************************************************************************
  FLOW PROCESS FROM NODE    407.00 TO NODE    408.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   249.10  DOWNSTREAM(FEET) =   245.60
  FLOW LENGTH(FEET) =   705.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  27.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.17
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      41.93
  PIPE TRAVEL TIME(MIN.) =   1.64    Tc(MIN.) =   14.21
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    408.00 =    2879.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    408.00 TO NODE    408.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   14.21
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.671
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.67      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.67      SUBAREA RUNOFF(CFS) =    3.97
  EFFECTIVE AREA(ACRES) =     18.12   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       18.1       PEAK FLOW RATE(CFS) =      43.06

****************************************************************************
  FLOW PROCESS FROM NODE    408.00 TO NODE    408.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   14.21
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.671
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        4.41      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    4.41      SUBAREA RUNOFF(CFS) =   10.48
  EFFECTIVE AREA(ACRES) =     22.53   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       22.5       PEAK FLOW RATE(CFS) =      53.54

****************************************************************************
  FLOW PROCESS FROM NODE    408.00 TO NODE    409.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   245.60  DOWNSTREAM(FEET) =   243.50
  FLOW LENGTH(FEET) =   404.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  30.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.75
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      53.54
  PIPE TRAVEL TIME(MIN.) =   0.87    Tc(MIN.) =   15.08
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    409.00 =    3283.00 FEET.

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    409.00 TO NODE    409.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   15.08
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.582
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        3.63      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     3.63      SUBAREA RUNOFF(CFS) =     8.34
  EFFECTIVE AREA(ACRES) =      26.16   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        26.2       PEAK FLOW RATE(CFS) =       60.09

****************************************************************************
  FLOW PROCESS FROM NODE    409.00 TO NODE    410.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   243.50  DOWNSTREAM(FEET) =   240.50
  FLOW LENGTH(FEET) =   455.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  30.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.72
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      60.09
  PIPE TRAVEL TIME(MIN.) =   0.87    Tc(MIN.) =   15.95
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    410.00 =    3738.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    410.00 TO NODE    410.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   15.95
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.502
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        3.64      0.30      0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =     3.64      SUBAREA RUNOFF(CFS) =     8.00
  EFFECTIVE AREA(ACRES) =      29.80   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.11
  TOTAL AREA(ACRES) =        29.8       PEAK FLOW RATE(CFS) =       66.19

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    410.00 TO NODE    411.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   240.50  DOWNSTREAM(FEET) =   235.00
  FLOW LENGTH(FEET) =   308.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  26.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.87
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      66.19
  PIPE TRAVEL TIME(MIN.) =   0.40    Tc(MIN.) =   16.35
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    411.00 =    4046.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    411.00 TO NODE    411.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   16.35
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.467
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                B        2.77      0.30     0.850    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA AREA(ACRES) =    2.77      SUBAREA RUNOFF(CFS) =    5.51
  EFFECTIVE AREA(ACRES) =     32.57   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =       32.6       PEAK FLOW RATE(CFS) =      70.78

****************************************************************************
  FLOW PROCESS FROM NODE    411.00 TO NODE    411.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   16.35
  RAINFALL INTENSITY(INCH/HR) =   2.47
  AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.17
  EFFECTIVE STREAM AREA(ACRES) =      32.57
  TOTAL STREAM AREA(ACRES) =      32.57
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      70.78

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
```

```
    1        88.01   18.80    2.280  0.30( 0.06) 0.21       43.9      326.00
    1        89.48   19.97    2.203  0.30( 0.06) 0.21       46.3      322.00
    1        90.67   21.19    2.130  0.30( 0.06) 0.21       48.5      317.00
    1        91.06   22.18    2.076  0.30( 0.06) 0.21       50.0      312.00
    1        91.00   22.46    2.061  0.30( 0.06) 0.20       50.4      300.00
    1        85.43   25.20    1.931  0.30( 0.06) 0.21       50.6      308.00
    1        81.90   27.15    1.851  0.30( 0.06) 0.21       50.7      304.00
    2        70.78   16.35    2.467  0.30( 0.05) 0.17       32.6      400.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)           (ACRES)    NODE
      1       153.80   16.35    2.467  0.30( 0.06) 0.19       70.8      400.00
      2       153.30   18.80    2.280  0.30( 0.06) 0.19       76.5      326.00
      3       152.51   19.97    2.203  0.30( 0.06) 0.19       78.8      322.00
      4       151.57   21.19    2.130  0.30( 0.06) 0.19       81.1      317.00
      5       150.37   22.18    2.076  0.30( 0.06) 0.19       82.6      312.00
      6       149.88   22.46    2.061  0.30( 0.06) 0.19       83.0      300.00
      7       140.50   25.20    1.931  0.30( 0.06) 0.20       83.2      308.00
      8       134.63   27.15    1.851  0.30( 0.06) 0.20       83.3      304.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      153.80    Tc(MIN.) =     16.35
  EFFECTIVE AREA(ACRES) =       70.78   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.19
  TOTAL AREA(ACRES) =        83.3
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    411.00 =    5172.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    411.00 TO NODE    412.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   235.00  DOWNSTREAM(FEET) =   233.50
  FLOW LENGTH(FEET) =    40.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  29.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  21.49
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      153.80
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =   16.38
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    412.00 =    5212.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =        83.3  TC(MIN.) =      16.38
  EFFECTIVE AREA(ACRES) =      70.78  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.194
  PEAK FLOW RATE(CFS)    =     153.80
```

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	153.80	16.38	2.464	0.30(0.06)	0.19	70.8	400.00
2	153.30	18.83	2.278	0.30(0.06)	0.19	76.5	326.00
3	152.51	20.00	2.201	0.30(0.06)	0.19	78.8	322.00
4	151.57	21.22	2.128	0.30(0.06)	0.19	81.1	317.00
5	150.37	22.21	2.074	0.30(0.06)	0.19	82.6	312.00
6	149.88	22.49	2.059	0.30(0.06)	0.19	83.0	300.00
7	140.50	25.23	1.930	0.30(0.06)	0.20	83.2	308.00
8	134.63	27.18	1.850	0.30(0.06)	0.20	83.3	304.00

==========

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END OF RATIONAL METHOD ANALYSIS

```
****************************************************************************
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                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
25 YEAR STORM - PROPOSED CONDITION
STREAM C - AGUA CHINON CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 25Y100Q3.DAT
  TIME/DATE OF STUDY: 16:00 11/16/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ======  =====  =======
  1   20.0     10.0    0.022/0.022/0.020   0.50    1.50 0.0312 0.125 0.0170

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
         DURATION     RAINFALL(INCH)
         5-MINUTES          0.40
```

```
        30-MINUTES          0.87
         1-HOUR             1.15
         3-HOUR             1.94
         6-HOUR             2.71
        24-HOUR             4.49
 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR UNIT HYDROGRAPH METHOD*

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   270.00
  ELEVATION DATA: UPSTREAM(FEET) =    274.00  DOWNSTREAM(FEET) =    271.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.168
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.934
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        0.90      0.30     0.100    56    7.17
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      3.16
  TOTAL AREA(ACRES) =      0.90   PEAK FLOW RATE(CFS) =      3.16

****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   262.80  DOWNSTREAM(FEET) =   261.00
  FLOW LENGTH(FEET) =   272.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.31
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.16
  PIPE TRAVEL TIME(MIN.) =   1.05    Tc(MIN.) =    8.22
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =     542.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.22
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.640
```

```
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B       2.43      0.30      0.100    56
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    2.43      SUBAREA RUNOFF(CFS) =    7.90
EFFECTIVE AREA(ACRES) =      3.33   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =        3.3       PEAK FLOW RATE(CFS) =      10.82
==============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =        3.3  TC(MIN.) =      8.22
EFFECTIVE AREA(ACRES) =      3.33  AREA-AVERAGED Fm(INCH/HR)=  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.100
PEAK FLOW RATE(CFS)    =      10.82
==============================================================================
==============================================================================
END OF RATIONAL METHOD ANALYSIS
```

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****************************************************************************
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                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
100 YEAR STORM - EXISTING CONDITION
STREAM A - MARSHBURN CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 100100X1.DAT
  TIME/DATE OF STUDY: 10:29 11/16/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ======  =====  =======
  1   20.0     10.0    0.018/0.018/0.018   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
         DURATION     RAINFALL(INCH)
         5-MINUTES          0.52
```

```
        30-MINUTES          1.09
         1-HOUR             1.45
         3-HOUR             2.43
         6-HOUR             3.36
        24-HOUR             5.63
*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    253.00  DOWNSTREAM(FEET) =    247.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.601
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.022
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        1.07      0.30     0.850    76   10.60
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =      3.63
  TOTAL AREA(ACRES) =      1.07   PEAK FLOW RATE(CFS) =      3.63

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    120.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    247.70  DOWNSTREAM(FEET) =    236.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   838.00   CHANNEL SLOPE =  0.0140
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   2.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.007
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                 B        8.83      0.30     0.850    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      14.70
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.99
  AVERAGE FLOW DEPTH(FEET) =   0.61   TRAVEL TIME(MIN.) =   7.01
  Tc(MIN.) =   17.62
  SUBAREA AREA(ACRES) =     8.83       SUBAREA RUNOFF(CFS) =   21.87
  EFFECTIVE AREA(ACRES) =      9.90     AREA-AVERAGED Fm(INCH/HR) =   0.26
```

```
  AREA-AVERAGED Fp(INCH/HR) =    0.30  AREA-AVERAGED Ap =    0.85
  TOTAL AREA(ACRES) =          9.9          PEAK FLOW RATE(CFS) =       24.52

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.74   FLOW VELOCITY(FEET/SEC.) =   2.26
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    120.00 =    1138.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.62
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.007
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                 B        5.85      0.30      0.850    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA AREA(ACRES) =    5.85      SUBAREA RUNOFF(CFS) =   14.49
  EFFECTIVE AREA(ACRES) =     15.75   AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.85
  TOTAL AREA(ACRES) =       15.8       PEAK FLOW RATE(CFS) =      39.01

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    130.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    236.00  DOWNSTREAM(FEET) =    227.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   841.00   CHANNEL SLOPE =  0.0101
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   2.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.561
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                 B       16.94      0.30      0.850    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      56.63
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.46
  AVERAGE FLOW DEPTH(FEET) =   1.07   TRAVEL TIME(MIN.) =   5.70
  Tc(MIN.) =   23.31
  SUBAREA AREA(ACRES) =    16.94       SUBAREA RUNOFF(CFS) =   35.15
  EFFECTIVE AREA(ACRES) =     32.69     AREA-AVERAGED Fm(INCH/HR) =   0.25
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.85
  TOTAL AREA(ACRES) =       32.7         PEAK FLOW RATE(CFS) =      67.84

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
```

```
  DEPTH(FEET) =  1.15   FLOW VELOCITY(FEET/SEC.) =   2.58
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    130.00 =    1979.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    140.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    227.50  DOWNSTREAM(FEET) =    218.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1000.00   CHANNEL SLOPE =  0.0095
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   3.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.239
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                 B       24.30      0.30     0.850    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      89.55
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.71
  AVERAGE FLOW DEPTH(FEET) =   1.29   TRAVEL TIME(MIN.) =   6.16
  Tc(MIN.) =   29.48
  SUBAREA AREA(ACRES) =    24.30       SUBAREA RUNOFF(CFS) =   43.38
  EFFECTIVE AREA(ACRES) =     56.99     AREA-AVERAGED Fm(INCH/HR) =   0.25
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.85
  TOTAL AREA(ACRES) =       57.0         PEAK FLOW RATE(CFS) =     101.75

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.35   FLOW VELOCITY(FEET/SEC.) =   2.78
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    140.00 =    2979.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =       57.0  TC(MIN.) =     29.48
  EFFECTIVE AREA(ACRES) =     56.99  AREA-AVERAGED Fm(INCH/HR)=  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.850
  PEAK FLOW RATE(CFS)    =     101.75
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
100 YEAR STORM - EXISTING CONDITION
STREAM B - BEE CANYON CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 100100X2.DAT
  TIME/DATE OF STUDY: 11:39 11/16/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   20.0     10.0    0.018/0.018/0.018   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
         DURATION     RAINFALL(INCH)
         5-MINUTES          0.52
```

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        30-MINUTES          1.09
         1-HOUR             1.45
         3-HOUR             2.43
         6-HOUR             3.36
        24-HOUR             5.63
*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    270.00  DOWNSTREAM(FEET) =    266.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.277
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.342
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"        B        1.34      0.30      0.500    76    9.28
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA RUNOFF(CFS) =       5.06
  TOTAL AREA(ACRES) =       1.34   PEAK FLOW RATE(CFS) =       5.06

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    220.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    266.50  DOWNSTREAM(FEET) =    264.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   377.00   CHANNEL SLOPE =  0.0066
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   8.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   2.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.564
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        2.19      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.55
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.65
  AVERAGE FLOW DEPTH(FEET) =   0.81   TRAVEL TIME(MIN.) =   3.82
  Tc(MIN.) =   13.10
  SUBAREA AREA(ACRES) =     2.19       SUBAREA RUNOFF(CFS) =    6.96
```

```
  EFFECTIVE AREA(ACRES) =       3.53     AREA-AVERAGED Fm(INCH/HR) =    0.08
  AREA-AVERAGED Fp(INCH/HR) =    0.30  AREA-AVERAGED Ap =    0.25
  TOTAL AREA(ACRES) =         3.5          PEAK FLOW RATE(CFS) =       11.08

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.89   FLOW VELOCITY(FEET/SEC.) =   1.75
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    220.00 =     677.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    230.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   258.00  DOWNSTREAM(FEET) =   256.30
  FLOW LENGTH(FEET) =   339.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.28
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.08
  PIPE TRAVEL TIME(MIN.) =   1.07    Tc(MIN.) =   14.17
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    230.00 =    1016.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   14.17
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.407
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        9.05      0.30     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    9.05      SUBAREA RUNOFF(CFS) =   27.50
  EFFECTIVE AREA(ACRES) =     12.58   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.14
  TOTAL AREA(ACRES) =       12.6       PEAK FLOW RATE(CFS) =      38.09

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    240.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   256.30  DOWNSTREAM(FEET) =   252.50
  FLOW LENGTH(FEET) =   759.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.11
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       38.09
  PIPE TRAVEL TIME(MIN.) =   1.78    Tc(MIN.) =   15.95
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    240.00 =    1775.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    240.00 TO NODE    240.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   15.95
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.183
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B       11.93      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =   11.93      SUBAREA RUNOFF(CFS) =   33.86
  EFFECTIVE AREA(ACRES) =     24.51   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.12
  TOTAL AREA(ACRES) =       24.5       PEAK FLOW RATE(CFS) =      69.42

****************************************************************************
  FLOW PROCESS FROM NODE    240.00 TO NODE    250.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   252.50  DOWNSTREAM(FEET) =   245.60
  FLOW LENGTH(FEET) =  1385.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  32.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.24
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       69.42
  PIPE TRAVEL TIME(MIN.) =   2.80    Tc(MIN.) =   18.75
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    250.00 =    3160.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    250.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   18.75
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.902
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"        B       22.14      0.30      0.500    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA AREA(ACRES) =   22.14      SUBAREA RUNOFF(CFS) =   54.83
```

```
  EFFECTIVE AREA(ACRES) =      46.65   AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.30
  TOTAL AREA(ACRES) =        46.7        PEAK FLOW RATE(CFS) =     118.03

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    340.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   245.60  DOWNSTREAM(FEET) =   237.50
  FLOW LENGTH(FEET) =  1465.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  51.0 INCH PIPE IS  41.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.57
  ESTIMATED PIPE DIAMETER(INCH) =  51.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     118.03
  PIPE TRAVEL TIME(MIN.) =   2.55    Tc(MIN.) =   21.30
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    340.00 =    4625.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    340.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   21.30
  RAINFALL INTENSITY(INCH/HR) =   2.70
  AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.30
  EFFECTIVE STREAM AREA(ACRES) =      46.65
  TOTAL STREAM AREA(ACRES) =      46.65
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     118.03

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    310.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    260.00  DOWNSTREAM(FEET) =    257.60

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.004
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.158
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"        B        0.97      0.30      0.500    76   10.00
```

```
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA RUNOFF(CFS) =       3.50
  TOTAL AREA(ACRES) =       0.97   PEAK FLOW RATE(CFS) =       3.50

****************************************************************************
  FLOW PROCESS FROM NODE    310.00 TO NODE    320.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    257.60  DOWNSTREAM(FEET) =    249.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1085.00   CHANNEL SLOPE =  0.0079
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   8.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.914
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"        B        3.28      0.30      0.500    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.64
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.10
  AVERAGE FLOW DEPTH(FEET) =   0.67   TRAVEL TIME(MIN.) =   8.61
  Tc(MIN.) =   18.61
  SUBAREA AREA(ACRES) =     3.28       SUBAREA RUNOFF(CFS) =    8.16
  EFFECTIVE AREA(ACRES) =      4.25     AREA-AVERAGED Fm(INCH/HR) =   0.15
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.50
  TOTAL AREA(ACRES) =        4.2          PEAK FLOW RATE(CFS) =      10.57

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.76   FLOW VELOCITY(FEET/SEC.) =   2.30
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    320.00 =    1385.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    320.00 TO NODE    330.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    249.00  DOWNSTREAM(FEET) =    241.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   885.00   CHANNEL SLOPE =  0.0085
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   8.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.523
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"        B        9.16      0.30      0.500    76
```

```
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      20.37
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.77
  AVERAGE FLOW DEPTH(FEET) =   0.96   TRAVEL TIME(MIN.) =   5.32
  Tc(MIN.) =   23.93
  SUBAREA AREA(ACRES) =     9.16       SUBAREA RUNOFF(CFS) =   19.56
  EFFECTIVE AREA(ACRES) =     13.41     AREA-AVERAGED Fm(INCH/HR) =   0.15
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.50
  TOTAL AREA(ACRES) =       13.4         PEAK FLOW RATE(CFS) =      28.64

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.09   FLOW VELOCITY(FEET/SEC.) =   3.02
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    330.00 =    2270.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    330.00 TO NODE    340.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    241.50  DOWNSTREAM(FEET) =    237.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   284.00   CHANNEL SLOPE =  0.0141
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   6.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.471
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       B       13.94      0.30      0.500    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      43.20
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.37
  AVERAGE FLOW DEPTH(FEET) =   1.39   TRAVEL TIME(MIN.) =   0.88
  Tc(MIN.) =   24.81
  SUBAREA AREA(ACRES) =    13.94       SUBAREA RUNOFF(CFS) =   29.12
  EFFECTIVE AREA(ACRES) =     27.35     AREA-AVERAGED Fm(INCH/HR) =   0.15
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.50
  TOTAL AREA(ACRES) =       27.3         PEAK FLOW RATE(CFS) =      57.13

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.60   FLOW VELOCITY(FEET/SEC.) =   5.77
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    340.00 =    2554.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    340.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
```

```
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   24.81
RAINFALL INTENSITY(INCH/HR) =   2.47
AREA-AVERAGED Fm(INCH/HR) =  0.15
AREA-AVERAGED Fp(INCH/HR) =  0.30
AREA-AVERAGED Ap =  0.50
EFFECTIVE STREAM AREA(ACRES) =      27.35
TOTAL STREAM AREA(ACRES) =      27.35
PEAK FLOW RATE(CFS) AT CONFLUENCE =      57.13

** CONFLUENCE DATA **
 STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
    1       118.03   21.30    2.697  0.30( 0.09) 0.30      46.7      200.00
    2        57.13   24.81    2.471  0.30( 0.15) 0.50      27.3      300.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
 STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
    1       171.84   21.30    2.697  0.30( 0.11) 0.37      70.1      200.00
    2       164.92   24.81    2.471  0.30( 0.11) 0.37      74.0      300.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     171.84    Tc(MIN.) =    21.30
EFFECTIVE AREA(ACRES) =      70.13   AREA-AVERAGED Fm(INCH/HR) =  0.11
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.37
TOTAL AREA(ACRES) =       74.0
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    340.00 =    4625.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    340.00 TO NODE    350.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   237.50  DOWNSTREAM(FEET) =   234.50
FLOW LENGTH(FEET) =    81.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  42.0 INCH PIPE IS  32.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  21.70
ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     171.84
PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =   21.36
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    350.00 =    4706.00 FEET.
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =       74.0  TC(MIN.) =     21.36
EFFECTIVE AREA(ACRES) =     70.13  AREA-AVERAGED Fm(INCH/HR)=  0.11
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.368
```

PEAK FLOW RATE(CFS) = 171.84

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	171.84	21.36	2.692	0.30(0.11)	0.37	70.1	200.00
2	164.92	24.88	2.467	0.30(0.11)	0.37	74.0	300.00

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END OF RATIONAL METHOD ANALYSIS

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****************************************************************************
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                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
100 YEAR STORM - EXISTING CONDITION
STREAM C - AGUA CHINON CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 100100X3.DAT
  TIME/DATE OF STUDY: 16:12 11/16/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ====== =====  =======
  1   20.0     10.0    0.018/0.018/0.018   0.50    1.50 0.0312 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.52
```

```
        30-MINUTES          1.09
         1-HOUR             1.45
         3-HOUR             2.43
         6-HOUR             3.36
        24-HOUR             5.63
*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    410.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   212.00
  ELEVATION DATA: UPSTREAM(FEET) =    279.00  DOWNSTREAM(FEET) =    268.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.991
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.579
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"        B        0.96      0.30      0.500    76    5.99
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA RUNOFF(CFS) =       4.69
  TOTAL AREA(ACRES) =       0.96   PEAK FLOW RATE(CFS) =       4.69

****************************************************************************
  FLOW PROCESS FROM NODE    410.00 TO NODE    420.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   263.80  DOWNSTREAM(FEET) =   260.80
  FLOW LENGTH(FEET) =   819.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.77
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.69
  PIPE TRAVEL TIME(MIN.) =   3.62    Tc(MIN.) =    9.61
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    420.00 =    1031.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    420.00 TO NODE    420.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    9.61
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.256
```

```
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)   CN
RESIDENTIAL
"5-7 DWELLINGS/ACRE"        B        4.28      0.30      0.500    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
SUBAREA AREA(ACRES) =     4.28      SUBAREA RUNOFF(CFS) =    15.82
EFFECTIVE AREA(ACRES) =       5.24   AREA-AVERAGED Fm(INCH/HR) =  0.15
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.50
TOTAL AREA(ACRES) =         5.2       PEAK FLOW RATE(CFS) =       19.36
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =         5.2  TC(MIN.) =       9.61
EFFECTIVE AREA(ACRES) =       5.24  AREA-AVERAGED Fm(INCH/HR)=  0.15
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.500
PEAK FLOW RATE(CFS)    =      19.36
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

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****************************************************************************
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                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
STREAM A - MARSHBURN CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 100100Q1.DAT
  TIME/DATE OF STUDY: 14:54 11/16/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ====  ====  =======
  1   18.0     10.0    0.022/0.022/0.020   0.50    1.50 0.0313 0.125 0.0170
  2   18.0     10.0    0.022/0.022/0.020   0.50    1.50 0.0313 0.125 0.0170

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                         AREA-AVERAGED
         DURATION     RAINFALL(INCH)
```

```
        5-MINUTES          0.52
       30-MINUTES          1.09
        1-HOUR             1.45
        3-HOUR             2.43
        6-HOUR             3.36
       24-HOUR             5.63
*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    244.70  DOWNSTREAM(FEET) =    242.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.818
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.789
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        0.48      0.30     0.100    76    7.82
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      2.06
  TOTAL AREA(ACRES) =      0.48   PEAK FLOW RATE(CFS) =      2.06

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  63
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  242.30  DOWNSTREAM ELEVATION(FEET) =  237.10
  STREET LENGTH(FEET) =   638.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.022
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.022

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0170
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0170
  MAXIMUM ALLOWABLE STREET FLOW DEPTH(FEET) =   0.50

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.18
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
```

```
    STREET FLOW DEPTH(FEET) =  0.36
    HALFSTREET FLOOD WIDTH(FEET) =   10.54
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.93
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.69
  STREET FLOW TRAVEL TIME(MIN.) =   5.50   Tc(MIN.) =   13.31
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.530
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.96      0.30     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.96      SUBAREA RUNOFF(CFS) =    6.17
  EFFECTIVE AREA(ACRES) =      2.44    AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        2.4        PEAK FLOW RATE(CFS) =       7.69

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.40   HALFSTREET FLOOD WIDTH(FEET) =  12.41
  FLOW VELOCITY(FEET/SEC.) =  2.12   DEPTH*VELOCITY(FT*FT/SEC.) =   0.84
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     938.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   13.31
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.530
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        5.47      0.30     0.200    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    5.47      SUBAREA RUNOFF(CFS) =   17.08
  EFFECTIVE AREA(ACRES) =      7.91   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =        7.9       PEAK FLOW RATE(CFS) =      24.77

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    105.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   223.80  DOWNSTREAM(FEET) =   223.60
  FLOW LENGTH(FEET) =    31.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.06
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       24.77
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =   13.39
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =     969.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.39
  RAINFALL INTENSITY(INCH/HR) =   3.52
  AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.17
  EFFECTIVE STREAM AREA(ACRES) =       7.91
  TOTAL STREAM AREA(ACRES) =       7.91
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      24.77

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   457.00
  ELEVATION DATA: UPSTREAM(FEET) =    244.50  DOWNSTREAM(FEET) =    241.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.828
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.319
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.56      0.30      0.850    76   14.83
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =       1.54
  TOTAL AREA(ACRES) =       0.56   PEAK FLOW RATE(CFS) =       1.54

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   235.00  DOWNSTREAM(FEET) =   223.60
  FLOW LENGTH(FEET) =   565.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.25
```

```
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        1.54
  PIPE TRAVEL TIME(MIN.) =   1.79    Tc(MIN.) =   16.62
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    105.00 =    1022.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   16.62
  RAINFALL INTENSITY(INCH/HR) =   3.11
  AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.85
  EFFECTIVE STREAM AREA(ACRES) =       0.56
  TOTAL STREAM AREA(ACRES) =       0.56
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.54

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)      Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1       24.77   13.39    3.519  0.30( 0.05) 0.17       7.9     100.00
      2        1.54   16.62    3.109  0.30( 0.25) 0.85       0.6     103.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)      Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1       26.19   13.39    3.519  0.30( 0.06) 0.21       8.4     100.00
      2       23.38   16.62    3.109  0.30( 0.06) 0.21       8.5     103.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      26.19    Tc(MIN.) =    13.39
  EFFECTIVE AREA(ACRES) =       8.36   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.21
  TOTAL AREA(ACRES) =        8.5
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    105.00 =    1022.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   223.60  DOWNSTREAM(FEET) =   221.10
  FLOW LENGTH(FEET) =   513.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  23.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.30
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      26.19
  PIPE TRAVEL TIME(MIN.) =   1.36    Tc(MIN.) =   14.74
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    106.00 =    1535.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   14.74
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.330
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.80      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.80      SUBAREA RUNOFF(CFS) =    2.38
  EFFECTIVE AREA(ACRES) =      9.16   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        9.3       PEAK FLOW RATE(CFS) =      26.97

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   14.74
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.330
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        5.14      0.30      0.200    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    5.14      SUBAREA RUNOFF(CFS) =   15.13
  EFFECTIVE AREA(ACRES) =     14.30   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =       14.4       PEAK FLOW RATE(CFS) =      42.09

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   221.10  DOWNSTREAM(FEET) =   218.50
  FLOW LENGTH(FEET) =   538.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  28.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.08
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      42.09
  PIPE TRAVEL TIME(MIN.) =   1.27    Tc(MIN.) =   16.01
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    107.00 =    2073.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   16.01
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.176
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.82      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.82      SUBAREA RUNOFF(CFS) =    2.32
  EFFECTIVE AREA(ACRES) =     15.12   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.19
  TOTAL AREA(ACRES) =       15.2       PEAK FLOW RATE(CFS) =      42.44

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   16.01
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.176
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        4.76      0.30      0.200    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    4.76      SUBAREA RUNOFF(CFS) =   13.35
  EFFECTIVE AREA(ACRES) =     19.88   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.19
  TOTAL AREA(ACRES) =       20.0       PEAK FLOW RATE(CFS) =      55.79

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    108.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   218.50  DOWNSTREAM(FEET) =   216.10
  FLOW LENGTH(FEET) =   522.00   MANNING'S N =  0.013
```

```
DEPTH OF FLOW IN  42.0 INCH PIPE IS  30.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   7.57
ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      55.79
PIPE TRAVEL TIME(MIN.) =   1.15    Tc(MIN.) =   17.16
LONGEST FLOWPATH FROM NODE    103.00 TO NODE    108.00 =    2595.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   17.16
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.052
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        2.15      0.30      0.100    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    2.15      SUBAREA RUNOFF(CFS) =    5.85
EFFECTIVE AREA(ACRES) =     22.03   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.19
TOTAL AREA(ACRES) =       22.1       PEAK FLOW RATE(CFS) =      59.42

****************************************************************************
FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   17.16
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.052
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
RESIDENTIAL
"11+ DWELLINGS/ACRE"        B        3.67      0.30      0.200    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
SUBAREA AREA(ACRES) =    3.67      SUBAREA RUNOFF(CFS) =    9.88
EFFECTIVE AREA(ACRES) =     25.70   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.19
TOTAL AREA(ACRES) =       25.8       PEAK FLOW RATE(CFS) =      69.31

****************************************************************************
FLOW PROCESS FROM NODE    108.00 TO NODE    112.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   216.10  DOWNSTREAM(FEET) =   216.00
FLOW LENGTH(FEET) =    53.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  51.0 INCH PIPE IS  41.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.59
  ESTIMATED PIPE DIAMETER(INCH) =  51.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      69.31
  PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =   17.32
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    112.00 =    2648.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   17.32
  RAINFALL INTENSITY(INCH/HR) =   3.04
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.19
  EFFECTIVE STREAM AREA(ACRES) =      25.70
  TOTAL STREAM AREA(ACRES) =      25.81
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      69.31

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =    240.50  DOWNSTREAM(FEET) =    230.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   19.042
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.876
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                B        1.19      0.30     0.850    76   19.04
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =      2.81
  TOTAL AREA(ACRES) =      1.19   PEAK FLOW RATE(CFS) =      2.81

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   225.00  DOWNSTREAM(FEET) =   220.00
  FLOW LENGTH(FEET) =   517.00   MANNING'S N =  0.013
```

```
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.79
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.81
  PIPE TRAVEL TIME(MIN.) =   1.80    Tc(MIN.) =   20.84
  LONGEST FLOWPATH FROM NODE    109.00 TO NODE    111.00 =    1517.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    111.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   20.84
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.731
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                 B        0.59      0.30      0.850    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA AREA(ACRES) =    0.59      SUBAREA RUNOFF(CFS) =    1.31
  EFFECTIVE AREA(ACRES) =      1.78   AREA-AVERAGED Fm(INCH/HR) =  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.85
  TOTAL AREA(ACRES) =        1.8       PEAK FLOW RATE(CFS) =       3.97

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   220.00  DOWNSTREAM(FEET) =   216.00
  FLOW LENGTH(FEET) =   407.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.29
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.97
  PIPE TRAVEL TIME(MIN.) =   1.28    Tc(MIN.) =   22.13
  LONGEST FLOWPATH FROM NODE    109.00 TO NODE    112.00 =    1924.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   22.13
  RAINFALL INTENSITY(INCH/HR) =   2.64
```

```
AREA-AVERAGED Fm(INCH/HR) =  0.26
AREA-AVERAGED Fp(INCH/HR) =  0.30
AREA-AVERAGED Ap =  0.85
EFFECTIVE STREAM AREA(ACRES) =        1.78
TOTAL STREAM AREA(ACRES) =        1.78
PEAK FLOW RATE(CFS) AT CONFLUENCE =        3.97

** CONFLUENCE DATA **
 STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)     NODE
    1        69.31   17.32     3.036   0.30( 0.06) 0.19       25.7      100.00
    1        62.76   20.63     2.747   0.30( 0.06) 0.19       25.8      103.00
    2         3.97   22.13     2.639   0.30( 0.26) 0.85        1.8      109.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
 STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)     NODE
    1        72.93   17.32     3.036   0.30( 0.07) 0.22       27.1      100.00
    2        66.62   20.63     2.747   0.30( 0.07) 0.23       27.5      103.00
    3        64.21   22.13     2.639   0.30( 0.07) 0.23       27.6      109.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       72.93    Tc(MIN.) =     17.32
EFFECTIVE AREA(ACRES) =       27.09   AREA-AVERAGED Fm(INCH/HR) =  0.07
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.22
TOTAL AREA(ACRES) =        27.6
LONGEST FLOWPATH FROM NODE    103.00 TO NODE    112.00 =    2648.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    112.00 TO NODE    203.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   216.00  DOWNSTREAM(FEET) =   215.60
FLOW LENGTH(FEET) =   383.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  60.0 INCH PIPE IS  45.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.61
ESTIMATED PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       72.93
PIPE TRAVEL TIME(MIN.) =   1.38    Tc(MIN.) =   18.70
LONGEST FLOWPATH FROM NODE    103.00 TO NODE    203.00 =    3031.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
```

```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    18.70
  RAINFALL INTENSITY(INCH/HR) =    2.91
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.22
  EFFECTIVE STREAM AREA(ACRES) =       27.09
  TOTAL STREAM AREA(ACRES) =       27.59
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       72.93

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    300.00
  ELEVATION DATA: UPSTREAM(FEET) =    242.80  DOWNSTREAM(FEET) =    239.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.292
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.984
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        1.20      0.30     0.100    76    7.29
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =       5.35
  TOTAL AREA(ACRES) =       1.20   PEAK FLOW RATE(CFS) =       5.35

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   239.40  DOWNSTREAM(FEET) =   228.50
  FLOW LENGTH(FEET) =  1000.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.93
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.35
  PIPE TRAVEL TIME(MIN.) =   2.81    Tc(MIN.) =   10.10
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =    1300.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
 MAINLINE Tc(MIN.) =   10.10
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.135
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  B        8.46      0.30      0.100    76
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =    8.46      SUBAREA RUNOFF(CFS) =   31.25
 EFFECTIVE AREA(ACRES) =      9.66   AREA-AVERAGED Fm(INCH/HR) =  0.03
 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =        9.7       PEAK FLOW RATE(CFS) =      35.69

****************************************************************************
 FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   228.50  DOWNSTREAM(FEET) =   215.60
 FLOW LENGTH(FEET) =  1275.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.04
 ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      35.69
 PIPE TRAVEL TIME(MIN.) =   2.35    Tc(MIN.) =   12.45
 LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    2575.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =   12.45
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.668
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  B       12.34      0.30      0.100    76
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =   12.34      SUBAREA RUNOFF(CFS) =   40.40
 EFFECTIVE AREA(ACRES) =     22.00   AREA-AVERAGED Fm(INCH/HR) =  0.03
 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =       22.0       PEAK FLOW RATE(CFS) =      72.02

****************************************************************************
 FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
```

```
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   12.45
RAINFALL INTENSITY(INCH/HR) =   3.67
AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =      22.00
TOTAL STREAM AREA(ACRES) =      22.00
PEAK FLOW RATE(CFS) AT CONFLUENCE =      72.02

** CONFLUENCE DATA **
 STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)     NODE
    1        72.93   18.70     2.905   0.30( 0.07) 0.22      27.1      100.00
    1        66.62   22.06     2.643   0.30( 0.07) 0.23      27.5      103.00
    1        64.21   23.56     2.546   0.30( 0.07) 0.23      27.6      109.00
    2        72.02   12.45     3.668   0.30( 0.03) 0.10      22.0      200.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
 STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)     NODE
    1       133.63   12.45     3.668   0.30( 0.05) 0.15      40.0      200.00
    2       129.86   18.70     2.905   0.30( 0.05) 0.17      49.1      100.00
    3       118.37   22.06     2.643   0.30( 0.05) 0.17      49.5      103.00
    4       114.02   23.56     2.546   0.30( 0.05) 0.17      49.6      109.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      133.63    Tc(MIN.) =    12.45
EFFECTIVE AREA(ACRES) =      40.04   AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.15
TOTAL AREA(ACRES) =       49.6
LONGEST FLOWPATH FROM NODE    103.00 TO NODE    203.00 =    3031.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   215.60  DOWNSTREAM(FEET) =   215.50
FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  69.0 INCH PIPE IS  55.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.95
ESTIMATED PIPE DIAMETER(INCH) =  69.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     133.63
PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =   12.65
LONGEST FLOWPATH FROM NODE    103.00 TO NODE    204.00 =    3101.00 FEET.
============================================================================
```

```
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)        =        49.6  TC(MIN.) =      12.65
EFFECTIVE AREA(ACRES) =      40.04  AREA-AVERAGED Fm(INCH/HR)=  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.155
PEAK FLOW RATE(CFS)    =     133.63

** PEAK FLOW RATE TABLE **
 STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
 NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)           (ACRES)    NODE
    1       133.63   12.65    3.635  0.30( 0.05) 0.15       40.0     200.00
    2       129.86   18.90    2.888  0.30( 0.05) 0.17       49.1     100.00
    3       118.37   22.26    2.630  0.30( 0.05) 0.17       49.5     103.00
    4       114.02   23.76    2.533  0.30( 0.05) 0.17       49.6     109.00
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
STREAM B - BEE CANYON CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 100100Q2.DAT
  TIME/DATE OF STUDY: 14:56 11/16/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ====  ====  =======
  1   18.0     10.0    0.022/0.022/0.020   0.50    1.50 0.0312 0.125 0.0170

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
         DURATION     RAINFALL(INCH)
         5-MINUTES          0.52
```

```
        30-MINUTES          1.09
         1-HOUR             1.45
         3-HOUR             2.43
         6-HOUR             3.36
        24-HOUR             5.63
*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    278.40  DOWNSTREAM(FEET) =    272.80

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.599
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.278
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        0.63      0.30     0.100    76    6.60
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =       2.98
  TOTAL AREA(ACRES) =       0.63   PEAK FLOW RATE(CFS) =       2.98

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  63
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  272.80  DOWNSTREAM ELEVATION(FEET) =  269.20
  STREET LENGTH(FEET) =   575.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.022
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.022

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0170
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0170
  MAXIMUM ALLOWABLE STREET FLOW DEPTH(FEET) =   0.50

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.58
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.36
```

```
    HALFSTREET FLOOD WIDTH(FEET) =   10.54
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.71
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.61
  STREET FLOW TRAVEL TIME(MIN.) =   5.60   Tc(MIN.) =   12.20
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.711
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.96      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.96      SUBAREA RUNOFF(CFS) =    3.18
  EFFECTIVE AREA(ACRES) =      1.59    AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        1.6        PEAK FLOW RATE(CFS) =       5.27

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  11.16
  FLOW VELOCITY(FEET/SEC.) =  1.77   DEPTH*VELOCITY(FT*FT/SEC.) =   0.65
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     875.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   12.20
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.711
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        2.57      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    2.57      SUBAREA RUNOFF(CFS) =    8.52
  EFFECTIVE AREA(ACRES) =      4.16   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        4.2        PEAK FLOW RATE(CFS) =      13.78

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   261.30  DOWNSTREAM(FEET) =   258.80
  FLOW LENGTH(FEET) =   512.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.42
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.78
  PIPE TRAVEL TIME(MIN.) =   1.58    Tc(MIN.) =   13.78
```

```
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =    1387.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   13.78
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.462
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.72      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.72      SUBAREA RUNOFF(CFS) =    5.31
  EFFECTIVE AREA(ACRES) =      5.88   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        5.9       PEAK FLOW RATE(CFS) =      18.16

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   13.78
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.462
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        2.55      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    2.55      SUBAREA RUNOFF(CFS) =    7.88
  EFFECTIVE AREA(ACRES) =      8.43   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        8.4       PEAK FLOW RATE(CFS) =      26.04

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    306.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   258.80  DOWNSTREAM(FEET) =   258.60
  FLOW LENGTH(FEET) =    27.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  19.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.54
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      26.04
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =   13.83
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    306.00 =    1414.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    306.00 TO NODE    306.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.83
  RAINFALL INTENSITY(INCH/HR) =   3.45
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       8.43
  TOTAL STREAM AREA(ACRES) =       8.43
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      26.04

****************************************************************************
  FLOW PROCESS FROM NODE    304.00 TO NODE    305.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   788.00
  ELEVATION DATA: UPSTREAM(FEET) =    275.00  DOWNSTREAM(FEET) =    267.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   17.428
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.025
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.94      0.30     0.850    76   17.43
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =      2.34
  TOTAL AREA(ACRES) =      0.94   PEAK FLOW RATE(CFS) =      2.34

****************************************************************************
  FLOW PROCESS FROM NODE    305.00 TO NODE    306.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   262.00  DOWNSTREAM(FEET) =   258.60
  FLOW LENGTH(FEET) =   318.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.72
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.34
  PIPE TRAVEL TIME(MIN.) =   1.12    Tc(MIN.) =   18.55
```

```
  LONGEST FLOWPATH FROM NODE    304.00 TO NODE    306.00 =    1106.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    306.00 TO NODE    306.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   18.55
  RAINFALL INTENSITY(INCH/HR) =   2.92
  AREA-AVERAGED Fm(INCH/HR) =  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.85
  EFFECTIVE STREAM AREA(ACRES) =       0.94
  TOTAL STREAM AREA(ACRES) =       0.94
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.34

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1       26.04   13.83    3.453  0.30( 0.03) 0.10       8.4     300.00
      2        2.34   18.55    2.919  0.30( 0.26) 0.85       0.9     304.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1       28.14   13.83    3.453  0.30( 0.05) 0.16       9.1     300.00
      2       24.32   18.55    2.919  0.30( 0.05) 0.18       9.4     304.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      28.14    Tc(MIN.) =    13.83
  EFFECTIVE AREA(ACRES) =       9.13   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =        9.4
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    306.00 =    1414.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    306.00 TO NODE    307.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   258.60  DOWNSTREAM(FEET) =   254.70
  FLOW LENGTH(FEET) =   786.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.60
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       28.14
  PIPE TRAVEL TIME(MIN.) =   1.98    Tc(MIN.) =    15.82
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    307.00 =    2200.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    307.00 TO NODE    307.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   15.82
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.198
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.73      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.73      SUBAREA RUNOFF(CFS) =    4.93
  EFFECTIVE AREA(ACRES) =     10.86   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.15
  TOTAL AREA(ACRES) =       11.1       PEAK FLOW RATE(CFS) =      30.83

****************************************************************************
  FLOW PROCESS FROM NODE    307.00 TO NODE    307.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   15.82
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.198
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        3.48      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    3.48      SUBAREA RUNOFF(CFS) =    9.92
  EFFECTIVE AREA(ACRES) =     14.34   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.14
  TOTAL AREA(ACRES) =       14.6       PEAK FLOW RATE(CFS) =      40.75

****************************************************************************
  FLOW PROCESS FROM NODE    307.00 TO NODE    310.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   254.70  DOWNSTREAM(FEET) =   254.60
  FLOW LENGTH(FEET) =    18.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.51
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       40.75
```

```
  PIPE TRAVEL TIME(MIN.) =    0.04     Tc(MIN.) =    15.86
  LONGEST FLOWPATH FROM NODE     300.00 TO NODE     310.00 =     2218.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     310.00 TO NODE     310.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    15.86
  RAINFALL INTENSITY(INCH/HR) =    3.19
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.14
  EFFECTIVE STREAM AREA(ACRES) =       14.34
  TOTAL STREAM AREA(ACRES) =       14.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       40.75

****************************************************************************
  FLOW PROCESS FROM NODE     308.00 TO NODE     309.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    696.00
  ELEVATION DATA: UPSTREAM(FEET) =     267.00  DOWNSTREAM(FEET) =     261.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   17.135
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.055
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.83      0.30      0.850    76   17.13
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =       2.09
  TOTAL AREA(ACRES) =       0.83   PEAK FLOW RATE(CFS) =       2.09

****************************************************************************
  FLOW PROCESS FROM NODE     309.00 TO NODE     310.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    256.50  DOWNSTREAM(FEET) =    254.60
  FLOW LENGTH(FEET) =    370.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS    6.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    3.51
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =    1
```

```
  PIPE-FLOW(CFS) =        2.09
  PIPE TRAVEL TIME(MIN.) =   1.76    Tc(MIN.) =    18.89
  LONGEST FLOWPATH FROM NODE    308.00 TO NODE    310.00 =    1066.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    310.00 TO NODE    310.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   18.89
  RAINFALL INTENSITY(INCH/HR) =   2.89
  AREA-AVERAGED Fm(INCH/HR) =  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.85
  EFFECTIVE STREAM AREA(ACRES) =        0.83
  TOTAL STREAM AREA(ACRES) =        0.83
  PEAK FLOW RATE(CFS) AT CONFLUENCE =        2.09

  ** CONFLUENCE DATA **
   STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
      1        40.75   15.86    3.193  0.30( 0.04) 0.14      14.3      300.00
      1        35.46   20.67    2.744  0.30( 0.04) 0.15      14.6      304.00
      2         2.09   18.89    2.889  0.30( 0.26) 0.85       0.8      308.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
      1        42.71   15.86    3.193  0.30( 0.05) 0.17      15.0      300.00
      2        39.51   18.89    2.889  0.30( 0.05) 0.18      15.3      308.00
      3        37.44   20.67    2.744  0.30( 0.06) 0.19      15.4      304.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       42.71    Tc(MIN.) =    15.86
  EFFECTIVE AREA(ACRES) =       15.04   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =        15.4
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    310.00 =    2218.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    310.00 TO NODE    311.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   254.60  DOWNSTREAM(FEET) =   251.40
```

```
  FLOW LENGTH(FEET) =   649.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  28.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.16
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      42.71
  PIPE TRAVEL TIME(MIN.) =   1.51    Tc(MIN.) =   17.37
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    311.00 =    2867.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    311.00 TO NODE    311.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.37
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.031
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.98      0.30     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.98      SUBAREA RUNOFF(CFS) =    5.35
  EFFECTIVE AREA(ACRES) =     17.02   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =       17.4       PEAK FLOW RATE(CFS) =      45.68

****************************************************************************
  FLOW PROCESS FROM NODE    311.00 TO NODE    311.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.37
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.031
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        4.26      0.30     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    4.26      SUBAREA RUNOFF(CFS) =   11.51
  EFFECTIVE AREA(ACRES) =     21.28   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.15
  TOTAL AREA(ACRES) =       21.6       PEAK FLOW RATE(CFS) =      57.19

****************************************************************************
  FLOW PROCESS FROM NODE    311.00 TO NODE    314.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   251.40  DOWNSTREAM(FEET) =   251.30
  FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  28.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.72
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      57.19
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =   17.40
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    314.00 =    2882.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    314.00 TO NODE    314.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   17.40
  RAINFALL INTENSITY(INCH/HR) =   3.03
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.15
  EFFECTIVE STREAM AREA(ACRES) =      21.28
  TOTAL STREAM AREA(ACRES) =      21.65
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      57.19

****************************************************************************
  FLOW PROCESS FROM NODE    312.00 TO NODE    313.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   539.00
  ELEVATION DATA: UPSTREAM(FEET) =    264.00  DOWNSTREAM(FEET) =    259.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.244
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.267
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.66      0.30      0.850    76   15.24
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =      1.79
  TOTAL AREA(ACRES) =      0.66   PEAK FLOW RATE(CFS) =      1.79

****************************************************************************
  FLOW PROCESS FROM NODE    313.00 TO NODE    314.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   254.00  DOWNSTREAM(FEET) =   251.30
  FLOW LENGTH(FEET) =   481.00   MANNING'S N =  0.013
```

```
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   3.46
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       1.79
PIPE TRAVEL TIME(MIN.) =   2.31    Tc(MIN.) =   17.56
LONGEST FLOWPATH FROM NODE    312.00 TO NODE    314.00 =    1020.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    314.00 TO NODE    314.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   17.56
RAINFALL INTENSITY(INCH/HR) =   3.01
AREA-AVERAGED Fm(INCH/HR) =  0.26
AREA-AVERAGED Fp(INCH/HR) =  0.30
AREA-AVERAGED Ap =  0.85
EFFECTIVE STREAM AREA(ACRES) =       0.66
TOTAL STREAM AREA(ACRES) =       0.66
PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.79

** CONFLUENCE DATA **
 STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
 NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
    1        57.19   17.40    3.028  0.30( 0.04) 0.15      21.3     300.00
    1        52.70   20.44    2.761  0.30( 0.05) 0.16      21.6     308.00
    1        50.37   22.24    2.631  0.30( 0.05) 0.16      21.6     304.00
    2         1.79   17.56    3.012  0.30( 0.26) 0.85       0.7     312.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
 STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
 NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
    1        58.97   17.40    3.028  0.30( 0.05) 0.17      21.9     300.00
    2        58.74   17.56    3.012  0.30( 0.05) 0.17      22.0     312.00
    3        54.32   20.44    2.761  0.30( 0.05) 0.18      22.2     308.00
    4        51.91   22.24    2.631  0.30( 0.05) 0.18      22.3     304.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       58.97    Tc(MIN.) =    17.40
EFFECTIVE AREA(ACRES) =       21.93   AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
TOTAL AREA(ACRES) =       22.3
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    314.00 =    2882.00 FEET.

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    314.00 TO NODE    315.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   251.30  DOWNSTREAM(FEET) =   249.40
  FLOW LENGTH(FEET) =   385.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  30.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.86
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      58.97
  PIPE TRAVEL TIME(MIN.) =   0.82    Tc(MIN.) =   18.21
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    315.00 =    3267.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    315.00 TO NODE    315.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   18.21
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.950
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        3.67      0.30     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    3.67      SUBAREA RUNOFF(CFS) =    9.64
  EFFECTIVE AREA(ACRES) =     25.60   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =       26.0       PEAK FLOW RATE(CFS) =      66.86

****************************************************************************
  FLOW PROCESS FROM NODE    315.00 TO NODE    316.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   249.40  DOWNSTREAM(FEET) =   247.30
  FLOW LENGTH(FEET) =   367.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  31.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.52
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      66.86
  PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =   18.93
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    316.00 =    3634.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    316.00 TO NODE    316.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
  MAINLINE Tc(MIN.) =   18.93
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.885
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        3.62      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     3.62      SUBAREA RUNOFF(CFS) =     9.30
  EFFECTIVE AREA(ACRES) =     29.22   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.15
  TOTAL AREA(ACRES) =       29.6       PEAK FLOW RATE(CFS) =      74.67

****************************************************************************
  FLOW PROCESS FROM NODE    316.00 TO NODE    319.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   247.30  DOWNSTREAM(FEET) =   247.00
  FLOW LENGTH(FEET) =    42.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  31.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.52
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      74.67
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =   19.01
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    319.00 =    3676.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    319.00 TO NODE    319.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   19.01
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.879
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.84      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     0.84      SUBAREA RUNOFF(CFS) =     2.15
  EFFECTIVE AREA(ACRES) =     30.06   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.15
  TOTAL AREA(ACRES) =       30.4       PEAK FLOW RATE(CFS) =      76.66

****************************************************************************
  FLOW PROCESS FROM NODE    319.00 TO NODE    319.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
```

```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    19.01
  RAINFALL INTENSITY(INCH/HR) =    2.88
  AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.15
  EFFECTIVE STREAM AREA(ACRES) =       30.06
  TOTAL STREAM AREA(ACRES) =       30.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       76.66

****************************************************************************
  FLOW PROCESS FROM NODE    317.00 TO NODE    318.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    684.00
  ELEVATION DATA: UPSTREAM(FEET) =    263.00  DOWNSTREAM(FEET) =    256.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   16.688
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.102
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.82      0.30     0.850    76   16.69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =       2.10
  TOTAL AREA(ACRES) =       0.82   PEAK FLOW RATE(CFS) =       2.10

****************************************************************************
  FLOW PROCESS FROM NODE    318.00 TO NODE    319.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   251.50  DOWNSTREAM(FEET) =   247.00
  FLOW LENGTH(FEET) =   441.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.50
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.10
  PIPE TRAVEL TIME(MIN.) =   1.63    Tc(MIN.) =   18.32
  LONGEST FLOWPATH FROM NODE    317.00 TO NODE    319.00 =    1125.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    319.00 TO NODE    319.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
```

```
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   18.32
  RAINFALL INTENSITY(INCH/HR) =   2.94
  AREA-AVERAGED Fm(INCH/HR) =  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.85
  EFFECTIVE STREAM AREA(ACRES) =        0.82
  TOTAL STREAM AREA(ACRES) =        0.82
  PEAK FLOW RATE(CFS) AT CONFLUENCE =        2.10

  ** CONFLUENCE DATA **
   STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)     NODE
      1        76.66   19.01     2.879   0.30( 0.05) 0.15      30.1      300.00
      1        76.33   19.17     2.865   0.30( 0.05) 0.15      30.1      312.00
      1        70.85   22.09     2.641   0.30( 0.05) 0.16      30.4      308.00
      1        67.83   23.91     2.524   0.30( 0.05) 0.16      30.4      304.00
      2         2.10   18.32     2.940   0.30( 0.26) 0.85       0.8      317.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)     NODE
      1        77.59   18.32     2.940   0.30( 0.05) 0.17      29.8      317.00
      2        78.71   19.01     2.879   0.30( 0.05) 0.17      30.9      300.00
      3        78.38   19.17     2.865   0.30( 0.05) 0.17      30.9      312.00
      4        72.72   22.09     2.641   0.30( 0.05) 0.18      31.2      308.00
      5        69.60   23.91     2.524   0.30( 0.05) 0.18      31.3      304.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       78.71    Tc(MIN.) =     19.01
  EFFECTIVE AREA(ACRES) =       30.88   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =        31.3
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    319.00 =    3676.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    319.00 TO NODE    320.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   247.00  DOWNSTREAM(FEET) =   244.30
  FLOW LENGTH(FEET) =   381.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  33.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.52
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       78.71
```

```
  PIPE TRAVEL TIME(MIN.) =    0.67     Tc(MIN.) =    19.67
  LONGEST FLOWPATH FROM NODE     300.00 TO NODE     320.00 =     4057.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     320.00 TO NODE     320.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    19.67
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.822
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.67      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     0.67      SUBAREA RUNOFF(CFS) =     1.68
  EFFECTIVE AREA(ACRES) =      31.55   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =        31.9       PEAK FLOW RATE(CFS) =       78.71

****************************************************************************
  FLOW PROCESS FROM NODE     320.00 TO NODE     320.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    19.67
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.822
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        3.00      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     3.00      SUBAREA RUNOFF(CFS) =     7.54
  EFFECTIVE AREA(ACRES) =      34.55   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =        34.9       PEAK FLOW RATE(CFS) =       86.25

****************************************************************************
  FLOW PROCESS FROM NODE     320.00 TO NODE     321.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    244.30  DOWNSTREAM(FEET) =    242.40
  FLOW LENGTH(FEET) =    410.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  36.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    8.38
  ESTIMATED PIPE DIAMETER(INCH) =  48.00     NUMBER OF PIPES =    1
  PIPE-FLOW(CFS) =       86.25
  PIPE TRAVEL TIME(MIN.) =    0.81     Tc(MIN.) =    20.49
```

```
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    321.00 =    4467.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    321.00 TO NODE    321.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   20.49
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.758
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.53      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.53      SUBAREA RUNOFF(CFS) =    3.76
  EFFECTIVE AREA(ACRES) =     36.08   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =       36.5       PEAK FLOW RATE(CFS) =      87.99

****************************************************************************
  FLOW PROCESS FROM NODE    321.00 TO NODE    321.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   20.49
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.758
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        2.76      0.30      0.200    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    2.76      SUBAREA RUNOFF(CFS) =    6.70
  EFFECTIVE AREA(ACRES) =     38.84   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =       39.2       PEAK FLOW RATE(CFS) =      94.69

****************************************************************************
  FLOW PROCESS FROM NODE    321.00 TO NODE    324.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   242.40  DOWNSTREAM(FEET) =   241.20
  FLOW LENGTH(FEET) =    30.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  25.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  19.21
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      94.69
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =   20.51
```

```
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    324.00 =    4497.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    324.00 TO NODE    324.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   20.51
  RAINFALL INTENSITY(INCH/HR) =   2.76
  AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.16
  EFFECTIVE STREAM AREA(ACRES) =      38.84
  TOTAL STREAM AREA(ACRES) =      39.22
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      94.69

****************************************************************************
  FLOW PROCESS FROM NODE    322.00 TO NODE    323.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   724.00
  ELEVATION DATA: UPSTREAM(FEET) =    259.00  DOWNSTREAM(FEET) =    252.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   17.013
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.067
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                B        0.87      0.30     0.850    76   17.01
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =      2.20
  TOTAL AREA(ACRES) =      0.87   PEAK FLOW RATE(CFS) =      2.20

****************************************************************************
  FLOW PROCESS FROM NODE    323.00 TO NODE    324.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   246.00  DOWNSTREAM(FEET) =   241.20
  FLOW LENGTH(FEET) =   464.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.58
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.20
```

```
  PIPE TRAVEL TIME(MIN.) =    1.69     Tc(MIN.) =    18.70
  LONGEST FLOWPATH FROM NODE     322.00 TO NODE     324.00 =     1188.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     324.00 TO NODE     324.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    18.70
  RAINFALL INTENSITY(INCH/HR) =    2.91
  AREA-AVERAGED Fm(INCH/HR) =  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.85
  EFFECTIVE STREAM AREA(ACRES) =        0.87
  TOTAL STREAM AREA(ACRES) =        0.87
  PEAK FLOW RATE(CFS) AT CONFLUENCE =        2.20

  ** CONFLUENCE DATA **
   STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)     NODE
      1        93.89   19.83     2.810   0.30( 0.05) 0.16      37.8      317.00
      1        94.69   20.51     2.756   0.30( 0.05) 0.16      38.8      300.00
      1        94.31   20.68     2.743   0.30( 0.05) 0.16      38.9      312.00
      1        87.82   23.61     2.542   0.30( 0.05) 0.17      39.1      308.00
      1        84.19   25.46     2.435   0.30( 0.05) 0.17      39.2      304.00
      2         2.20   18.70     2.906   0.30( 0.26) 0.85       0.9      322.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM        Q       Tc    Intensity    Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)     NODE
      1        93.82   18.70     2.906   0.30( 0.05) 0.18      36.5      322.00
      2        96.01   19.83     2.810   0.30( 0.05) 0.18      38.6      317.00
      3        96.77   20.51     2.756   0.30( 0.05) 0.18      39.7      300.00
      4        96.37   20.68     2.743   0.30( 0.05) 0.18      39.7      312.00
      5        89.72   23.61     2.542   0.30( 0.05) 0.18      40.0      308.00
      6        86.00   25.46     2.435   0.30( 0.06) 0.18      40.1      304.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       96.77     Tc(MIN.) =     20.51
  EFFECTIVE AREA(ACRES) =       39.71    AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.18
  TOTAL AREA(ACRES) =        40.1
  LONGEST FLOWPATH FROM NODE     300.00 TO NODE     324.00 =     4497.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     324.00 TO NODE     325.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   241.20  DOWNSTREAM(FEET) =   239.60
  FLOW LENGTH(FEET) =   215.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  36.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.21
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      96.77
  PIPE TRAVEL TIME(MIN.) =   0.35    Tc(MIN.) =   20.86
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    325.00 =    4712.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    325.00 TO NODE    325.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   20.86
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.729
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        1.53      0.30      0.200    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    1.53      SUBAREA RUNOFF(CFS) =    3.68
  EFFECTIVE AREA(ACRES) =     41.24   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.18
  TOTAL AREA(ACRES) =       41.6       PEAK FLOW RATE(CFS) =      99.30

****************************************************************************
  FLOW PROCESS FROM NODE    325.00 TO NODE    328.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   239.60  DOWNSTREAM(FEET) =   237.20
  FLOW LENGTH(FEET) =    86.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  27.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.00
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      99.30
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =   20.95
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    328.00 =    4798.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    328.00 TO NODE    328.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
  MAINLINE Tc(MIN.) =   20.95
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.723
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.40      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.40      SUBAREA RUNOFF(CFS) =    0.97
  EFFECTIVE AREA(ACRES) =     41.64   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.18
  TOTAL AREA(ACRES) =       42.0       PEAK FLOW RATE(CFS) =     100.04

****************************************************************************
  FLOW PROCESS FROM NODE    328.00 TO NODE    328.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   20.95
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.723
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                 B        0.90      0.30      0.850    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA AREA(ACRES) =    0.90      SUBAREA RUNOFF(CFS) =    2.00
  EFFECTIVE AREA(ACRES) =     42.54   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.19
  TOTAL AREA(ACRES) =       42.9       PEAK FLOW RATE(CFS) =     102.04

****************************************************************************
  FLOW PROCESS FROM NODE    328.00 TO NODE    328.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   20.95
  RAINFALL INTENSITY(INCH/HR) =   2.72
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.19
  EFFECTIVE STREAM AREA(ACRES) =      42.54
  TOTAL STREAM AREA(ACRES) =      42.92
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     102.04

****************************************************************************
  FLOW PROCESS FROM NODE    326.00 TO NODE    327.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
```

```
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    455.00
  ELEVATION DATA: UPSTREAM(FEET) =    251.40  DOWNSTREAM(FEET) =    249.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.948
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.183
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 B        0.86      0.30      0.850    76   15.95
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =       2.27
  TOTAL AREA(ACRES) =       0.86   PEAK FLOW RATE(CFS) =       2.27

******************************************************************************
  FLOW PROCESS FROM NODE    327.00 TO NODE    328.00 IS CODE =  31
------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   240.00  DOWNSTREAM(FEET) =   237.20
  FLOW LENGTH(FEET) =   461.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.81
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.27
  PIPE TRAVEL TIME(MIN.) =   2.02    Tc(MIN.) =   17.96
  LONGEST FLOWPATH FROM NODE    326.00 TO NODE    328.00 =     916.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    328.00 TO NODE    328.00 IS CODE =   1
------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   17.96
  RAINFALL INTENSITY(INCH/HR) =   2.97
  AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.85
  EFFECTIVE STREAM AREA(ACRES) =       0.86
  TOTAL STREAM AREA(ACRES) =       0.86
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.27

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
```

```
     1        99.38   19.14    2.868  0.30( 0.06) 0.19       39.3      322.00
     1       101.38   20.26    2.775  0.30( 0.06) 0.19       41.5      317.00
     1       102.04   20.95    2.723  0.30( 0.06) 0.19       42.5      300.00
     1       101.63   21.11    2.711  0.30( 0.06) 0.19       42.6      312.00
     1        94.70   24.05    2.515  0.30( 0.06) 0.20       42.8      308.00
     1        90.83   25.90    2.411  0.30( 0.06) 0.20       42.9      304.00
     2         2.27   17.96    2.973  0.30( 0.25) 0.85        0.9      326.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)           (ACRES)    NODE
     1        99.07   17.96    2.973  0.30( 0.06) 0.21       37.8      326.00
     2       101.55   19.14    2.868  0.30( 0.06) 0.21       40.2      322.00
     3       103.48   20.26    2.775  0.30( 0.06) 0.21       42.3      317.00
     4       104.09   20.95    2.723  0.30( 0.06) 0.20       43.4      300.00
     5       103.67   21.11    2.711  0.30( 0.06) 0.21       43.4      312.00
     6        96.58   24.05    2.515  0.30( 0.06) 0.21       43.7      308.00
     7        92.63   25.90    2.411  0.30( 0.06) 0.21       43.8      304.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      104.09    Tc(MIN.) =     20.95
  EFFECTIVE AREA(ACRES) =       43.40   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        43.8
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    328.00 =    4798.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    328.00 TO NODE    328.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   20.95
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.723
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        4.24      0.30      0.200    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    4.24      SUBAREA RUNOFF(CFS) =   10.16
  EFFECTIVE AREA(ACRES) =      47.64   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        48.0       PEAK FLOW RATE(CFS) =     114.11

****************************************************************************
  FLOW PROCESS FROM NODE    328.00 TO NODE    329.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   237.20  DOWNSTREAM(FEET) =   235.40
  FLOW LENGTH(FEET) =   300.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  51.0 INCH PIPE IS  38.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.92
  ESTIMATED PIPE DIAMETER(INCH) =  51.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     114.11
  PIPE TRAVEL TIME(MIN.) =   0.50    Tc(MIN.) =   21.45
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    329.00 =    5098.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    329.00 TO NODE    329.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
  MAINLINE Tc(MIN.) =   21.45
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.686
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        2.70      0.30      0.200    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    2.70      SUBAREA RUNOFF(CFS) =    6.38
  EFFECTIVE AREA(ACRES) =     50.34   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =       50.7       PEAK FLOW RATE(CFS) =     118.91

****************************************************************************
  FLOW PROCESS FROM NODE    329.00 TO NODE    411.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   235.40  DOWNSTREAM(FEET) =   235.00
  FLOW LENGTH(FEET) =    74.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  54.0 INCH PIPE IS  38.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.71
  ESTIMATED PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     118.91
  PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =   21.58
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    411.00 =    5172.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    411.00 TO NODE    411.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
```

```
  TIME OF CONCENTRATION(MIN.) =    21.58
  RAINFALL INTENSITY(INCH/HR) =    2.68
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       50.34
  TOTAL STREAM AREA(ACRES) =       50.72
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      118.91

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    295.00
  ELEVATION DATA: UPSTREAM(FEET) =    270.00  DOWNSTREAM(FEET) =    267.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.402
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.942
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        1.03      0.30     0.100    76    7.40
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =       4.55
  TOTAL AREA(ACRES) =       1.03   PEAK FLOW RATE(CFS) =       4.55

****************************************************************************
  FLOW PROCESS FROM NODE    401.00 TO NODE    402.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   261.00  DOWNSTREAM(FEET) =   257.30
  FLOW LENGTH(FEET) =   234.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.52
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.55
  PIPE TRAVEL TIME(MIN.) =   0.60    Tc(MIN.) =    8.00
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    402.00 =     529.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.00
```

```
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.727
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        2.89      0.30      0.100    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =     2.89      SUBAREA RUNOFF(CFS) =    12.22
EFFECTIVE AREA(ACRES) =       3.92   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =         3.9       PEAK FLOW RATE(CFS) =       16.57

****************************************************************************
FLOW PROCESS FROM NODE    402.00 TO NODE    403.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   257.30  DOWNSTREAM(FEET) =   256.80
FLOW LENGTH(FEET) =   104.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.71
ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      16.57
PIPE TRAVEL TIME(MIN.) =   0.30    Tc(MIN.) =    8.30
LONGEST FLOWPATH FROM NODE    400.00 TO NODE    403.00 =     633.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    403.00 TO NODE    403.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =    8.30
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.627
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        0.62      0.30      0.100    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =     0.62      SUBAREA RUNOFF(CFS) =     2.57
EFFECTIVE AREA(ACRES) =       4.54   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =         4.5       PEAK FLOW RATE(CFS) =       18.78

****************************************************************************
FLOW PROCESS FROM NODE    403.00 TO NODE    404.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   256.80  DOWNSTREAM(FEET) =   253.10
```

```
  FLOW LENGTH(FEET) =   737.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.93
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      18.78
  PIPE TRAVEL TIME(MIN.) =   2.07    Tc(MIN.) =   10.38
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    404.00 =    1370.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    404.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   10.38
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.072
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        5.89      0.30     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     5.89      SUBAREA RUNOFF(CFS) =   21.43
  EFFECTIVE AREA(ACRES) =      10.43   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        10.4       PEAK FLOW RATE(CFS) =      37.94

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    405.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   253.10  DOWNSTREAM(FEET) =   252.60
  FLOW LENGTH(FEET) =    94.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  24.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.29
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      37.94
  PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =   10.59
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    405.00 =    1464.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    405.00 TO NODE    405.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   10.59
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.025
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.62      0.30     0.100    76
```

```
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     0.62       SUBAREA RUNOFF(CFS) =     2.23
  EFFECTIVE AREA(ACRES) =      11.05   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        11.1        PEAK FLOW RATE(CFS) =       39.73

****************************************************************************
  FLOW PROCESS FROM NODE    405.00 TO NODE    406.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   252.60  DOWNSTREAM(FEET) =   249.80
  FLOW LENGTH(FEET) =   574.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  26.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.07
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      39.73
  PIPE TRAVEL TIME(MIN.) =   1.35    Tc(MIN.) =   11.94
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    406.00 =    2038.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    406.00 TO NODE    406.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   11.94
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.757
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        4.77      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     4.77       SUBAREA RUNOFF(CFS) =    16.00
  EFFECTIVE AREA(ACRES) =      15.82   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        15.8        PEAK FLOW RATE(CFS) =       53.06

****************************************************************************
  FLOW PROCESS FROM NODE    406.00 TO NODE    407.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   249.80  DOWNSTREAM(FEET) =   249.10
  FLOW LENGTH(FEET) =   136.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  30.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.71
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      53.06
```

```
  PIPE TRAVEL TIME(MIN.) =    0.29     Tc(MIN.) =    12.24
  LONGEST FLOWPATH FROM NODE     400.00 TO NODE     407.00 =     2174.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     407.00 TO NODE     407.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    12.24
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.705
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.63       0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     0.63       SUBAREA RUNOFF(CFS) =     2.08
  EFFECTIVE AREA(ACRES) =      16.45   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        16.4        PEAK FLOW RATE(CFS) =       54.41

****************************************************************************
  FLOW PROCESS FROM NODE     407.00 TO NODE     408.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    249.10  DOWNSTREAM(FEET) =    245.60
  FLOW LENGTH(FEET) =    705.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  31.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    7.58
  ESTIMATED PIPE DIAMETER(INCH) =  39.00     NUMBER OF PIPES =    1
  PIPE-FLOW(CFS) =       54.41
  PIPE TRAVEL TIME(MIN.) =    1.55     Tc(MIN.) =    13.79
  LONGEST FLOWPATH FROM NODE     400.00 TO NODE     408.00 =     2879.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     408.00 TO NODE     408.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    13.79
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.460
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.67       0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     1.67       SUBAREA RUNOFF(CFS) =     5.16
  EFFECTIVE AREA(ACRES) =      18.12   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
```

```
  TOTAL AREA(ACRES) =        18.1        PEAK FLOW RATE(CFS) =       55.94

****************************************************************************
  FLOW PROCESS FROM NODE    408.00 TO NODE    408.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   13.79
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.460
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        4.41      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    4.41      SUBAREA RUNOFF(CFS) =   13.61
  EFFECTIVE AREA(ACRES) =     22.53   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        22.5        PEAK FLOW RATE(CFS) =       69.56

****************************************************************************
  FLOW PROCESS FROM NODE    408.00 TO NODE    409.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   245.60  DOWNSTREAM(FEET) =   243.50
  FLOW LENGTH(FEET) =   404.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  31.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.39
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      69.56
  PIPE TRAVEL TIME(MIN.) =   0.80    Tc(MIN.) =   14.59
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    409.00 =    3283.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    409.00 TO NODE    409.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   14.59
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.350
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        3.63      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    3.63      SUBAREA RUNOFF(CFS) =   10.85
  EFFECTIVE AREA(ACRES) =     26.16   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        26.2        PEAK FLOW RATE(CFS) =       78.16
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    409.00 TO NODE    410.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   243.50  DOWNSTREAM(FEET) =   240.50
  FLOW LENGTH(FEET) =   455.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  31.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.45
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       78.16
  PIPE TRAVEL TIME(MIN.) =   0.80    Tc(MIN.) =   15.39
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    410.00 =    3738.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    410.00 TO NODE    410.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   15.39
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.249
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        3.64      0.30      0.200    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    3.64      SUBAREA RUNOFF(CFS) =   10.45
  EFFECTIVE AREA(ACRES) =     29.80   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.11
  TOTAL AREA(ACRES) =       29.8       PEAK FLOW RATE(CFS) =      86.23

****************************************************************************
  FLOW PROCESS FROM NODE    410.00 TO NODE    411.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   240.50  DOWNSTREAM(FEET) =   235.00
  FLOW LENGTH(FEET) =   308.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  27.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.09
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       86.23
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =   15.76
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    411.00 =    4046.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    411.00 TO NODE    411.00 IS CODE =  81
```

```
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   15.76
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.205
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)   CN
  PUBLIC PARK                 B        2.77      0.30      0.850    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA AREA(ACRES) =     2.77      SUBAREA RUNOFF(CFS) =     7.36
  EFFECTIVE AREA(ACRES) =     32.57   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =       32.6       PEAK FLOW RATE(CFS) =      92.42

****************************************************************************
  FLOW PROCESS FROM NODE    411.00 TO NODE    411.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.76
  RAINFALL INTENSITY(INCH/HR) =   3.21
  AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.17
  EFFECTIVE STREAM AREA(ACRES) =      32.57
  TOTAL STREAM AREA(ACRES) =      32.57
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      92.42

  ** CONFLUENCE DATA **
   STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)           (ACRES)    NODE
      1       115.21   18.60    2.915  0.30( 0.06) 0.21      44.7     326.00
      1       117.13   19.77    2.814  0.30( 0.06) 0.21      47.1     322.00
      1       118.56   20.90    2.727  0.30( 0.06) 0.21      49.3     317.00
      1       118.91   21.58    2.677  0.30( 0.06) 0.20      50.3     300.00
      1       118.43   21.74    2.665  0.30( 0.06) 0.20      50.4     312.00
      1       110.42   24.69    2.478  0.30( 0.06) 0.21      50.6     308.00
      1       105.93   26.56    2.377  0.30( 0.06) 0.21      50.7     304.00
      2        92.42   15.76    3.205  0.30( 0.05) 0.17      32.6     400.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)           (ACRES)    NODE
      1       199.96   15.76    3.205  0.30( 0.06) 0.19      70.4     400.00
```

```
    2      199.11   18.60    2.915  0.30( 0.06) 0.19      77.3     326.00
    3      198.09   19.77    2.814  0.30( 0.06) 0.19      79.7     322.00
    4      196.95   20.90    2.727  0.30( 0.06) 0.19      81.8     317.00
    5      195.83   21.58    2.677  0.30( 0.06) 0.19      82.9     300.00
    6      195.02   21.74    2.665  0.30( 0.06) 0.19      82.9     312.00
    7      181.51   24.69    2.478  0.30( 0.06) 0.20      83.2     308.00
    8      174.05   26.56    2.377  0.30( 0.06) 0.20      83.3     304.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     199.96    Tc(MIN.) =    15.76
  EFFECTIVE AREA(ACRES) =      70.43   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.19
  TOTAL AREA(ACRES) =       83.3
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    411.00 =    5172.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    411.00 TO NODE    412.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   235.00  DOWNSTREAM(FEET) =   233.50
  FLOW LENGTH(FEET) =    40.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  33.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  22.76
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     199.96
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =   15.78
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    412.00 =    5212.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =       83.3  TC(MIN.) =     15.78
  EFFECTIVE AREA(ACRES) =     70.43  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.193
  PEAK FLOW RATE(CFS)    =     199.96

  ** PEAK FLOW RATE TABLE **
   STREAM       Q       Tc    Intensity   Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER     (CFS)   (MIN.)  (INCH/HR)  (INCH/HR)           (ACRES)    NODE
      1      199.96   15.78    3.202  0.30( 0.06) 0.19      70.4     400.00
      2      199.11   18.63    2.912  0.30( 0.06) 0.19      77.3     326.00
      3      198.09   19.80    2.812  0.30( 0.06) 0.19      79.7     322.00
      4      196.95   20.93    2.724  0.30( 0.06) 0.19      81.8     317.00
      5      195.83   21.61    2.675  0.30( 0.06) 0.19      82.9     300.00
      6      195.02   21.77    2.663  0.30( 0.06) 0.19      82.9     312.00
      7      181.51   24.72    2.476  0.30( 0.06) 0.20      83.2     308.00
      8      174.05   26.59    2.375  0.30( 0.06) 0.20      83.3     304.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
          (c) Copyright 1983-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                          Analysis prepared by:

TAIT & ASSOCIATES, INC.
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
STREAM C - AGUA CHINON CHANNEL

----------------------------------------------------------------------------
  FILE NAME: 100100Q3.DAT
  TIME/DATE OF STUDY: 14:58 11/16/2015
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   20.0     10.0    0.022/0.022/0.020   0.50    1.50 0.0312 0.125 0.0170

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
         DURATION     RAINFALL(INCH)
         5-MINUTES          0.52
```

```
        30-MINUTES          1.09
         1-HOUR             1.45
         3-HOUR             2.43
         6-HOUR             3.36
        24-HOUR             5.63
*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   270.00
  ELEVATION DATA: UPSTREAM(FEET) =    274.00  DOWNSTREAM(FEET) =    271.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.168
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.033
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        0.90      0.30     0.100    76    7.17
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =       4.05
  TOTAL AREA(ACRES) =       0.90   PEAK FLOW RATE(CFS) =       4.05

****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   262.80  DOWNSTREAM(FEET) =   261.00
  FLOW LENGTH(FEET) =   272.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.59
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.05
  PIPE TRAVEL TIME(MIN.) =   0.99    Tc(MIN.) =    8.16
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =     542.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.16
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.675
```

```
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B       2.43      0.30      0.100    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    2.43      SUBAREA RUNOFF(CFS) =   10.16
EFFECTIVE AREA(ACRES) =      3.33   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =        3.3       PEAK FLOW RATE(CFS) =      13.92
==============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =        3.3  TC(MIN.) =      8.16
EFFECTIVE AREA(ACRES) =      3.33  AREA-AVERAGED Fm(INCH/HR)=  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.100
PEAK FLOW RATE(CFS)    =      13.92
==============================================================================
==============================================================================
END OF RATIONAL METHOD ANALYSIS
```

C

Appendix C – Orange County Hydrologic Soil Group Map

See Attached Exhibit

ORANGE COUNTY
HYDROLOGY MANUAL

HYDROLOGIC CLASSIFICATION OF SOILS
ORANGE COUNTY, CALIFORNIA

PLATE B

D

Appendix D – Marshburn Channel Reports

See Attached Exhibits

DIST	COUNTY	ROUTE	POST MILE TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	133/5	8.8-10.9/22.5-24.8	1	913

TRANSPORTATION CORRIDOR AGENCIES

PROJECT PLANS FOR CONSTRUCTION ON

EASTERN TRANSPORTATION CORRIDOR
STATE ROUTE 133

IN ORANGE COUNTY

IN AND NEAR IRVINE ON ROUTE 133 FROM ALTON PARKWAY TO TRABUCO ROAD AND ON INTERSTATE 5 FROM 0.1 MILE EAST OF BARRANCA PARKWAY TO 0.8 MILE WEST OF SAND CANYON AVENUE

To be supplemented by Standard Plans dated July, 1992

NO AS BUILT CORRECTIONS

AS BUILT

CORRECTIONS BY For D. SPARKS

CONTRACT NO. 12-111000-06

DATE 12-23-98

INDEX OF SHEETS

SHEET NO	TYPE
1	TITLE
2-10	TYPICAL CROSS SECTION
11-12	STANDARD PLANS LIST
13-16	CONSTRUCTION STAKING SURVEY
17	KEY MAP
18-35	LAYOUT
36-57	PROFILE AND SUPERELEVATION DIAGRAMS
58-87	CONSTRUCTION DETAIL
88-114	CONTOUR GRADING
115-132	DRAINAGE PLAN
133-155	DRAINAGE PROFILE
156-181	DRAINAGE DETAIL
182-195	DRAINAGE QUANTITIES
196-212	EDGE DRAIN PLAN
213-215	EDGE DRAIN QUANTITIES
216-221	OCTA/CRMF STORM DRAIN
221A-221B	MARSHBURN CHNL
222-241	UTILITY PLAN
242-327	STAGE CONSTRUCTION
328-339	CONSTRUCTION AREA SIGN
340-363	PAVEMENT DELINIATION PLAN
364-372	SUMMARY OF QUANTITIES
373-415	SIGN PLAN
416-502	MSE & RETAINING WALL PLAN (WALL NO 5104A, 5104B, 318, 529, 7102, 1200, 1800, R4043, R4069, 7110, 7111)
503-534	LIGHTING AND SIGNAL PLAN
535-552	CORRIDOR OPERATING SYSTEM PLAN
553-913	BRIDGE PLAN (SEE INDEX BELOW)

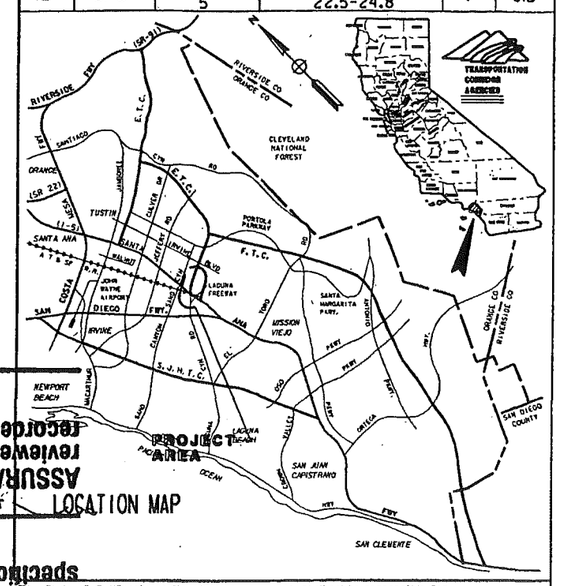
AS BUILT

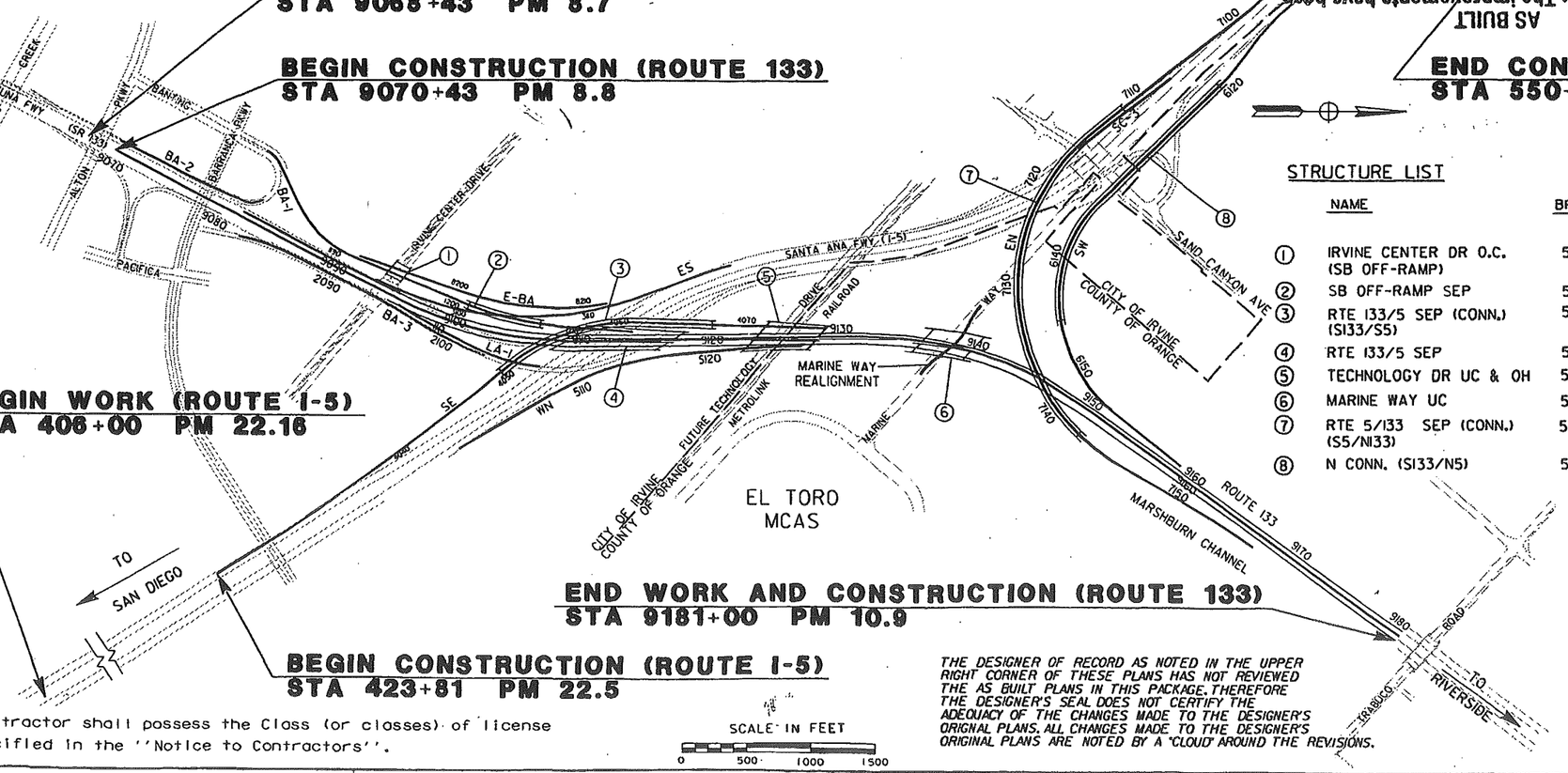
CERTIFICATION: The improvements have been installed in substantial compliance with the lines and grades shown on these As-Built plans and with the quality criteria set forth in the project specifications.

QC Manager 9/30/00 Date

ASSURANCE: The improvements have been reviewed and found to be accurately recorded by the As-Built plans.

CEM RE 5/19/01 Date





SECTION 06 PROJECT PLANS

STRUCTURE LIST

	NAME	BRIDGE NO	SHEET NO
1	IRVINE CENTER DR O.C. (SB OFF-RAMP)	55-769 K	553-572
2	SB OFF-RAMP SEP	55-770 F	573-599
3	RTE 133/5 SEP (CONN.) (S133/S5)	55-771 F	600-656
4	RTE 133/5 SEP	55-772 R/L	657-709
5	TECHNOLOGY DR UC & OH	55-773 R/L	710-748
6	MARINE WAY UC	55-774 R/L	749-781
7	RTE 5/133 SEP (CONN.) (S5/N133)	55-775 F	782-857
8	N CONN. (S133/N5)	55-776 F	858-913

17 SEPT 9
PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER JOHNNIE FREEMAN No. 18335 Exp. 6-30-01 CIVIL STATE OF CALIFORNIA

9-15-97
PLANS APPROVAL DATE

PREPARED FOR:
SILVERADO CONSTRUCTORS

PREPARED BY:
CH2M HILL
3 HUTTON CENTRE DR., #200
SANTA ANA, CA 92707

The Contractor shall possess the Class (or classes) of license as specified in the "Notice to Contractors".

SCALE IN FEET
0 500 1000 1500

THE DESIGNER OF RECORD AS NOTED IN THE UPPER RIGHT CORNER OF THESE PLANS HAS NOT REVIEWED THE AS BUILT PLANS IN THIS PACKAGE. THEREFORE THE DESIGNER'S SEAL DOES NOT CERTIFY THE ADEQUACY OF THE CHANGES MADE TO THE DESIGNER'S ORIGINAL PLANS. ALL CHANGES MADE TO THE DESIGNER'S ORIGINAL PLANS ARE NOTED BY A "CLOUD" AROUND THE REVISIONS.

PROJECT ENGINEER	DATE	CHIEF ENGINEER	DATE	CALTRANS DESIGN OVERSIGHT APPROVAL		REGISTRATION NO.	DATE
FRANK JENES	9-15-97	MIKE ENDRES	9-15-97	PRINTED NAME AGNES VILLANUEVA	SIGNATURE	44996	9-15-97

Approved as to impact on State facilities and conformance with applicable State standards and practices contained in the Caltrans Oversight Manual. Oversight was performed as described in the California Department of Transportation A & E Consultant Services Manual.

FOR REDUCED PLANS 0 1 2 3

Contract No.	12-111000-06
CU 00000	EA 111000

LAST REVISION

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	133/5	8.8-10.9/22.5-24.8	119	913

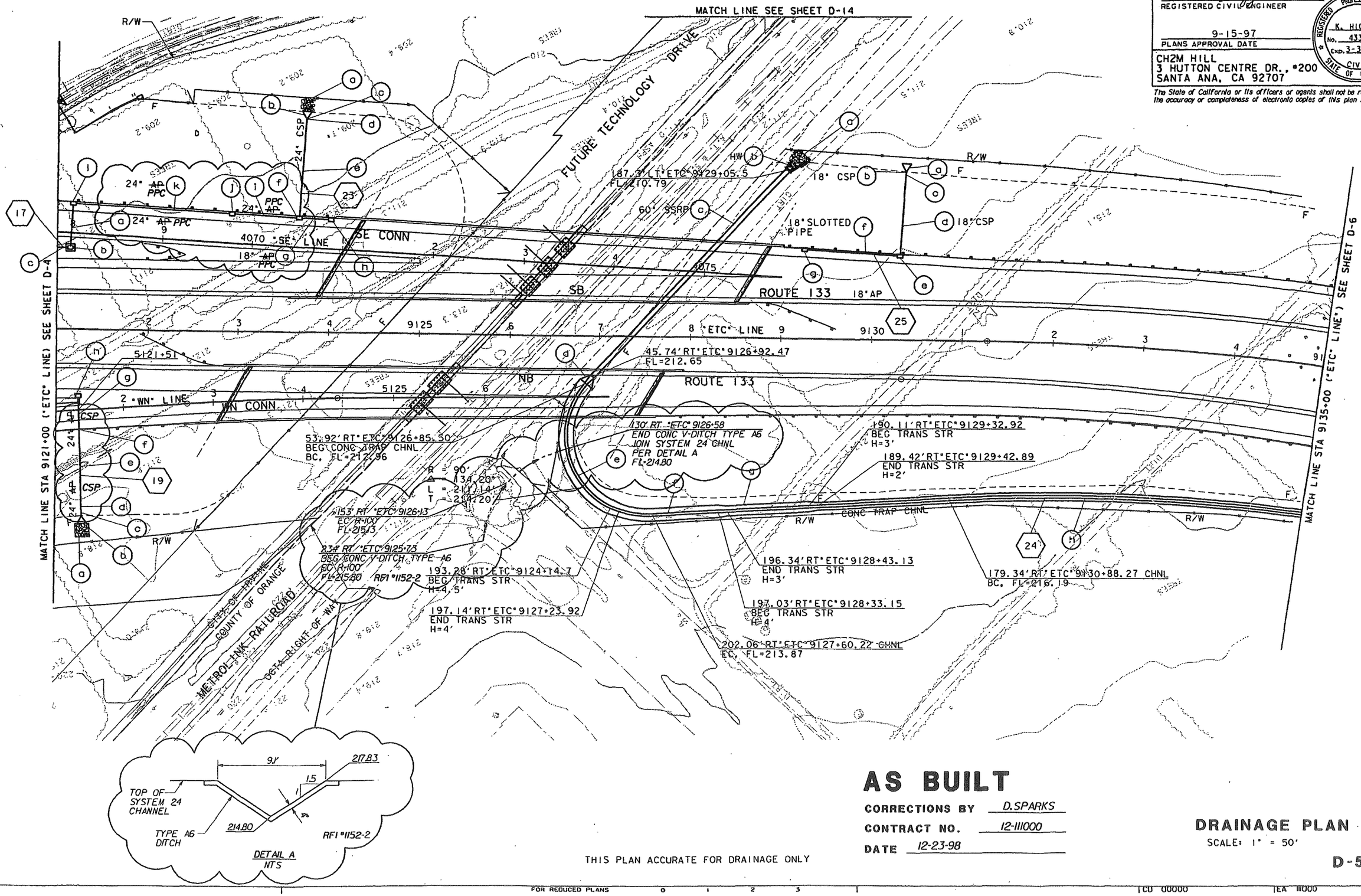
Kathleen Higgins
REGISTERED CIVIL ENGINEER

9-15-97
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
K. HIGGINS
No. 43323
EXP. 3-31-00
CIVIL
STATE OF CALIFORNIA

CH2M HILL
3 HUTTON CENTRE DR., #200
SANTA ANA, CA 92707

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.



AS BUILT

CORRECTIONS BY D.SPARKS
CONTRACT NO. 12-111000
DATE 12-23-98

THIS PLAN ACCURATE FOR DRAINAGE ONLY

DRAINAGE PLAN

SCALE: 1" = 50'

D-5

08-JAN-1997	08:41:52	06d05.div	
TRANSPORTATION CORRIDOR AGENCIES	TOLL ROAD OVERSIGHT	TCA PROJECT MANAGER	
	AGNES VILLANUEVA	MIKE ENDRES	
	CALCULATED/DESIGNED BY	CHECKED BY	KH
	DATE	REVISED BY	DATE REVISED

FOR REDUCED PLANS 0 1 2 3

TCD 00000 TEA 11000

DIST	COUNTY	ROUTE	TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	133/5	8.8-10.9/22.5-24.8	120	913

Kathleen Higgins
REGISTERED CIVIL ENGINEER

9-15-97
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
K. HIGGINS
No. 43323
Exp. 3-31-
CIVIL
STATE OF CALIFORNIA

CH2M HILL
3 HUTTON CENTRE DR., #200
SANTA ANA, CA 92707

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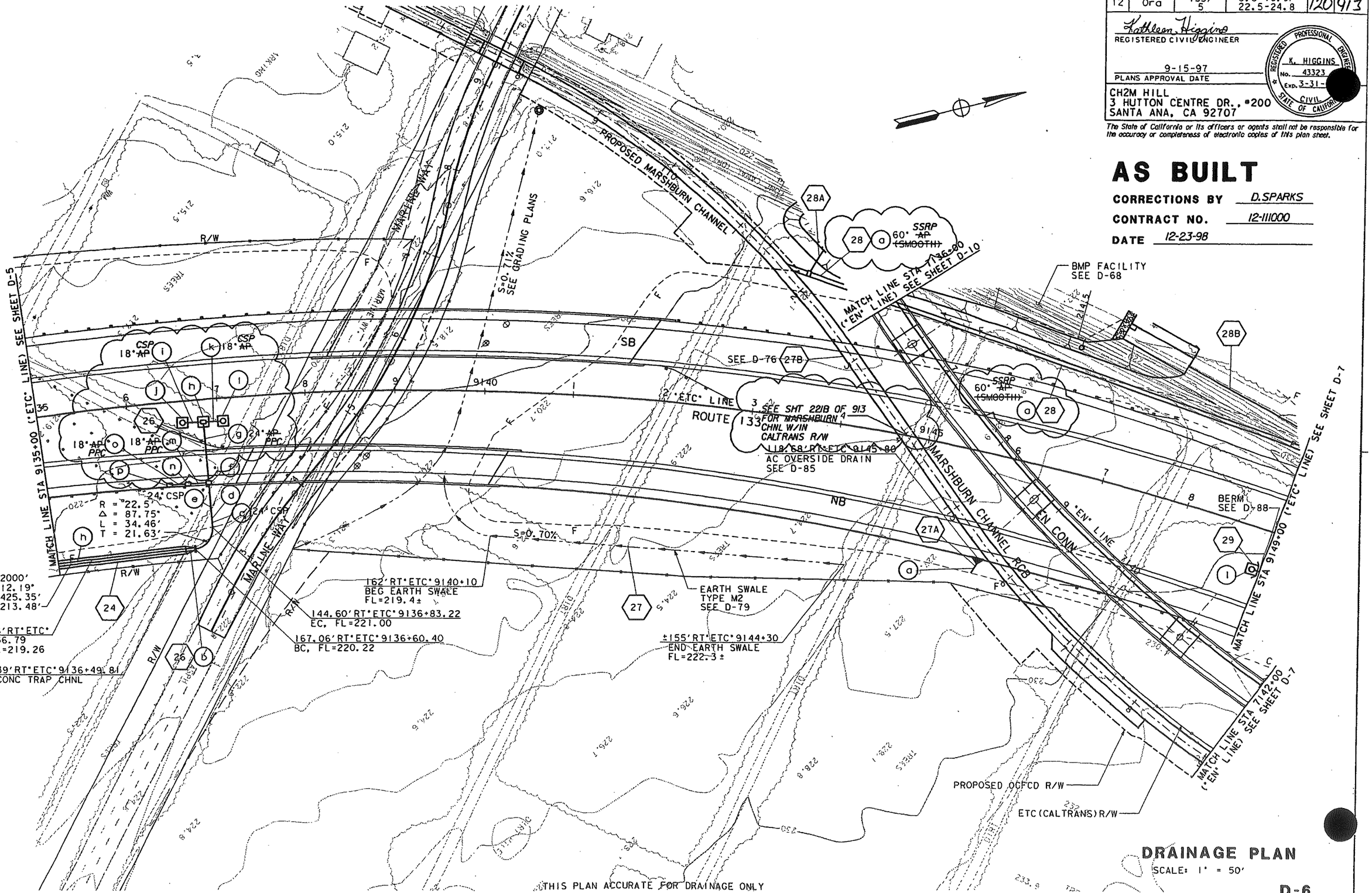
CORRECTIONS BY D.SPARKS
CONTRACT NO. 12-111000
DATE 12-23-98



DRAINAGE PLAN

SCALE: 1" = 50'

D-6

CALCULATED/DESIGNED BY		DATE	REVISED BY
CHECKED BY	KH		DATE REVISED

TCA PROJECT MANAGER: MIKE ENDRES
TOLL ROAD OVERSIGHT: AGNES VILLANUEVA
TRANSPORTATION CORRIDOR AGENCIES

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FOR REDUCED PLANS 0 1 2 3

TCD 00000 TEA 11000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	133/5	8.8-10.9/22.5-24.8	142	913

Kathleen Higgins
REGISTERED CIVIL ENGINEER

9-15-97
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER K. HIGGINS No. 43323 Exp. 3-31 CIVIL STATE OF CALIFORNIA

CH2M HILL
3 HUTTON CENTRE DR., #200
SANTA ANA, CA 92707

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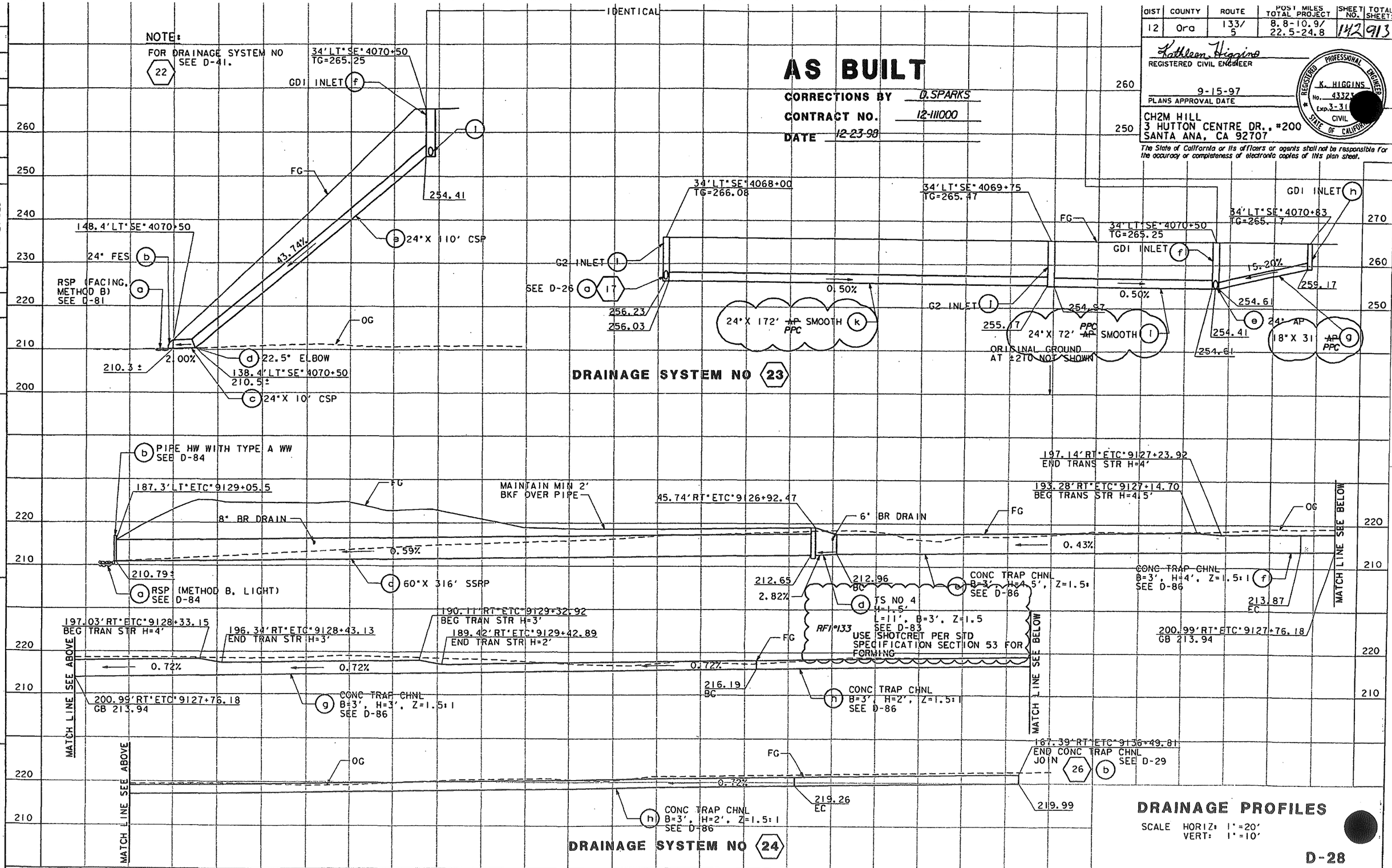
AS BUILT

CORRECTIONS BY D. SPARKS
CONTRACT NO. 12-111000
DATE 12-23-98

NOTE:
FOR DRAINAGE SYSTEM NO (22) SEE D-41.



DRAINAGE PROFILES

SCALE HORIZ: 1"=20'
VERT: 1"=10'

D-28

Station	
Cu.	
Yds.	Exc.
	Emb.

FOR REDUCED PLANS 0 1 2 3

TCU 00000 TEA 111000

REVISED BY | DATE REVISED | DATE | KH
CALCULATED/DESIGNED BY | CHECKED BY
TCA PROJECT MANAGER: MIKE ENDRES
TOLL ROAD OVERSIGHT: AGNES VILLANUEVA
TRANSPORTATION CORRIDOR AGENCIES
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Final (Resubmittal)

Drainage Design Report on State Route 133

Volume 1 of 2

March 21, 1997

Design Section 06

Design Submittal Number E06DXXD-01

Submitted to

Transportation Corridor Agencies

Submitted by

Silverado
CONSTRUCTORS
A JOINT VENTURE OF FCI CONSTRUCTORS, SUKUT CONSTRUCTION, INC.
WAYSS & FREYTAG AND OBAYASHI CORPORATION, SUPPORTED BY CH2M HILL

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Camber

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This Hydrology and Drainage Report has been prepared by CH2M HILL Engineers under the direction of the following Registered Civil Engineer. The undersigned attests to the technical information contained herein and the qualifications of any technical specialist providing engineering data upon which recommendations, conclusions, and decisions are based:

Kathleen Higgins
Registered Civil Engineer

3/21/97
Date

SECTION 1

INTRODUCTION

1.1 GENERAL

This report documents the final onsite and offsite drainage study for the Eastern Transportation Corridor (ETC), Section 90-06. This report examines all of the onsite and offsite drainage systems outside the boundaries of the Fast Track project. The Fast Track systems which includes 7 through 20, 24, and 27 have been approved for construction. Drainage Systems 9 and 20 have been slightly modified based on the findings during construction. As a complete document, this report also combines the Fast Track systems with the associated supporting calculations. Complete bridge deck drainage computations conducted by the bridge design engineers are included in the bridge drawing submittals. Miscellaneous structural calculations for the drainage systems are combined with all others in Section 06 and are submitted in a separate volume.

1.2 OBJECTIVE

This study is performed to provide drainage alignments and sizes for new drainage systems necessary to adequately drain and protect this section from storm water runoff from onsite and offsite areas.

Specific objectives of this report are as follows:

1. Define watershed boundaries, characteristics, and design conditions for the existing and proposed drainage facilities.
2. Compute design discharges for proposed and existing storm drain systems to be constructed or impacted by the project.
3. Provide street flow and inlet hydraulic calculations for new and existing roadway areas to be constructed or impacted by the project.
4. Provide a hydraulic analysis of the new and existing storm drain facilities to be constructed or impacted by the project.
5. Provide recommendations and design to mitigate adverse impacts to existing facilities from the project.

1.3 PROJECT LOCATION

Figure 1-1 shows the location of Section 06 of the ETC Project. Section 06 extends the existing Route 133 over Route 5 and continues in the northerly direction. Just south of Trabuco Road Section 06 connects to Section 07. Widening of Route 5 to accommodate connectors from Route 133 will also be done north and south of existing SR 133. Refer to the design drawings for more specific details on the proposed construction.

SECTION 2

EXISTING DRAINAGE CONDITIONS AND FACILITIES

The existing drainage systems in Section 06 consist of several onsite drainage systems along Route 5 and SR 133, three offsite systems, and minor systems on Route 5, SR 133, and Sand Canyon Avenue. The three offsite systems are: 1) Bee Canyon Wash, 2) a concrete trap channel along Route 5 between Sand Canyon Avenue and Jeffrey Road, 3) 3-27" RCPs under Route 5. Drainage Plans show the existing drainage systems. All existing inlets are standard Caltrans inlets, Types G1, G2, GDO, and GD1. Type 50W water carrying barrier is located on Route 5 in superelevated areas.

Under current conditions, no flooding occurs along SR 133. Areas in the vicinity have been improved and drain away from the highway. Flooding also does not occur in the areas of consideration along Route 5. However, temporary ponding has been observed adjacent to Route 5 in the vicinity of the 3-27" RCP culvert inlet. This ponding is primarily associated with offsite flows. Ponding depths of 1 to 2 feet are believed to have occurred during past rainfall events.

SECTION 3

PROPOSED DRAINAGE CONDITIONS AND FACILITIES

3.1 PROPOSED DRAINAGE SYSTEMS FOR PROJECT PHASE

The attached Drainage Plans show the proposed drainage systems in the entire Section 06. Because the ultimate highway alignment will be constructed in phases, the drainage systems are designed for the worst case runoff between the project and ultimate conditions. Ultimate condition is not considered in the north end of Route 5 where the EN and SW connectors connect to Route 5. This area will differ significantly in the ultimate phase due to the HOV connectors in the center of Route 5. In general, the runoff conditions during the project and ultimate phase are the same for systems on ramps and connectors. Proposed drainage systems on SR 133 are usually controlled by runoff conditions during the ultimate phase.

3.2 ACCOMMODATION OF ULTIMATE PHASE WITH PROPOSED SYSTEMS

In all cases, the accommodation of the ultimate highway alignment was made when designing the drainage systems. All inlets spaced on the outside shoulders of SR 133 and on all ramps are spaced and designed to carry worst case flows. For SR 133 these flows generally occur in the ultimate phase.

The difference between the ultimate and project phases is that the median of SR 133 will be paved in the ultimate phase. In the project phase the median is an earth swale. Also, as stated above, an HOV connector will connect the northerly end of SR 133 to the northerly end of Route 5. When the ultimate phase is constructed, additional inlets or water carrying barriers will have to be built in the median in superelevated sections of SR 133. The culverts and receiving facilities are designed to carry flows for the worst case runoff and will accommodate changes stemming from ultimate phase inlet addition. The proposed drainage systems are also designed as not to interfere with the proposed Corridor Operating System that runs along the northbound shoulder.

3.3 IMPACTS TO EXISTING DRAINAGE FACILITIES AND CONDITIONS

The existing onsite drainage systems on SR 133 will be impacted. A majority of the systems will be modified, removed, or abandoned. The hydraulic capacities of modified systems will not be affected. Existing systems on SR 133 that do not have the necessary hydraulic capacity and are impacted will be upgraded, removed, or abandoned. Existing drainage patterns along SR 133 will not be modified. The flow from the proposed highway is conveyed to an earth swale that parallels Irvine Center Drive. This swale also conveyed runoff from existing facilities.

The drainage systems for Route 5 and LA-1 will be impacted. Elements of the existing drainage systems will be modified, replaced, or removed. These impacts will primarily involve the elements of the existing drainage systems that collect offsite flow from the north.

In specific locations, the existing drainage systems that collect offsite flows have been identified as being undersized; hence, ponding and inundation of areas adjacent to Route 5 may occur under existing conditions. However, the hydraulic capacities of the existing drainage systems are not negatively impacted by this project. Detailed discussion on the impacts can be found in the summary section of Sections 5.4, 6.4 and 7.4.

SECTION 4

HYDROLOGIC CHARACTERISTICS

4.1 RAINFALL CHARACTERISTICS

The project site has a Mediterranean type climate characterized by long, dry summers and mild winters. The average annual precipitation is approximately 13 inches. Most of the precipitation occurs during the period from November through March, with little or no rainfall from May through October.

Three types of storms that produce precipitation in the area are: general winter storms, thunderstorms, and tropical cyclones. Flooding is most often caused by high intensity rainfall associated with general winter storms. Flood flow stages can rise from nearly dry streams beds to extreme flood peaks in a matter of hours.

4.2 SOIL TYPES AND INFILTRATION

Based on US Soil Conservation Services criteria, soils are classified into four hydrological soil groups: A, B, C, and D, where A is the most pervious with low runoff potential (such as sand or gravel) and D is the least pervious with high runoff potential (such as clay soils). The soil types for this project were taken from the Orange County Hydrology Manual (OCEMA, 1986). The soil type for Section 6 was identified as Type B. Appendix C2 contains the soil map for Section 6.

4.3 LAND USE

Future land use was used for the drainage study. The offsite land adjacent to SR 133 was assumed to be Commercial in the ultimate condition.

Recommended values for impervious cover were obtained from Figure C-4 of OCEMA Hydrology Manual (OCEMA, 1986).

4.4 RUNOFF COEFFICIENT

The Rational Method runoff coefficients used in this project are taken from the Caltrans Highway Design Manual (HDM). The coefficient of runoff (C) for impervious materials such as concrete or asphalt is 1.0. For vegetated or earth slopes (cut/fill) that are 2:1 or steeper the runoff coefficient is 0.80. Cut or fill slopes with less than 2:1 side slopes have a runoff coefficient of 0.65. For median areas a runoff coefficient of 0.65 is also used. Refer to Table 819.2B of the HDM for estimating "C" values.

4.5 DEBRIS PRODUCTION POTENTIAL

The proposed roadway is in a flat area. A majority of the land in this area consists roadway and commercial uses. The potential for debris generation from the vicinity of the roadway is low. With the proposed Marshburn Retarding Basin, the debris production from upstream watersheds is also limited.

4.6 UNUSUAL OR SPECIAL CONDITIONS

Between Bee Canyon Wash and Marshburn Channel, the sheetflow from MCAS is intercepted by the railroad. The railroad is about 3 feet above the surrounding ground. During a major storm event, the flood flow could overtop the railroad and be partially intercepted by the Bee Canyon Collector channel south of the railroad (SLA, 1989). The overtopping flow in the collector channel will drain into the MCAS clear zone area near I-5. A small ponding situation may occur within the clear zone under the existing condition. In the case of excess overflow in the clear zone, the major flood water will escape to the west through the I-5/railroad crossing and drain into Marshburn Channel immediately downstream of I-5. The ponding water will eventually drain through the existing triple 27-inch reinforced concrete pipe (RCP) under I-5 (Drainage System 16). The roadside earthen ditch downstream of the triple 27-inch RCP will eventually carry the flow to Marshburn Channel near Irvine Center Drive.

each watershed and any contributing bridge decks is shown in Table 5-1. Specific conclusions and results of the hydrologic computations are discussed in Section 6.4.

5.4.2 OFFSITE HYDROLOGY

Detailed hydrology modeling was conducted to estimate the overland flow at the railroad from the MCAS. The effect of offsite flow from MCAS to System 16 was determined by using the weir-flow analysis over the railroad. This analysis was performed by using the Split Flow Option in the HEC-2 computer program (COE, 1991) and considering the Raceway 100-year discharge (490 cfs) from the Master Plan. The HEC-2 Split Flow Option provides for the automatic determination of channel discharges and profiles in situations where the flow is lost from the main channel. The HEC-2 analysis indicated that the typical flow capacity of the north swale is greater than 300 cfs except at the sections near Gate No. 6. The partial blockage of the MCAS berm forces about 160 cfs over the railroad during a 100-year flood.

Further investigation indicated that about 40 cfs of the overtopping flow would drain along the existing railroad and access road to the west. The rest of the 120 cfs will be intercepted by the Bee Canyon Collector Channel and drain to the triple 27-inch RCP. The existing land use of the MCAS clear zone was assumed to be *Pubic Park* as it has been used as a nursery. By adding the nearby onsite and offsite runoff, the existing hydrology of System 16 was obtained. The resulting 100-year flow is 169 cfs at outlet of the existing triple 27-inch RCP. To assess the existing condition of the roadway inlet, the 25-year flow at the onsite 27-inch RCP lateral was also found to be 17 cfs.

By applying the same overflow condition from the railroad, the interim and ultimate hydrology were also derived. The ultimate land use for the remaining eastern area within the MCAS clear zone was assumed *Commercial*. No overtopping from MCAS will occur in the ultimate condition with Raceway Storm Drain. The resulting interim and ultimate 100-year flows at the outlet of System 16 are 173 and 114 cfs, respectively. The impact due to the proposed project within the clear zone is insignificant. See Appendix C for details.

Two other drainage systems, Systems 38 and 42, involve offsite runoffs. System 38 is the Bee Canyon Wash immediately downstream of Route 5. The channel discharge is conservatively based on the discharge at San Diego Creek. The OCEMA Master Plan indicates the 100-year discharge is about 2,494 cfs at that location. Detailed discussion is presented with the hydraulic calculations in Appendix D.

The existing and ultimate hydrology for System 42 were conducted by Caltrans (Caltrans, 1987) and JMTA (JMTA, 1995), respectively. This ditch, also collecting roadway runoff, is mainly to intercept the overland flow from the north. The increase of onsite runoff to the system is negligible because of the small area added by the proposed connectors. No further study will be needed for this project. Listed below are the discharges for both conditions based on Caltrans' and JMTA's studies:

7.4.18 DRAINAGE SYSTEM 24

System 24 collects and conveys offsite stormwater runoff from area east of Route 133 between Technology Drive and Marine Way. This system was evaluated based on the existing ditch capacity and the 100-year flows. The existing ditch capacity was estimated by recent survey cross-section data. The system is composed of:

- RSP outlet with concrete headwall and Type A wingwalls,
- 60-inch SSRP,
- concrete trap channel along Route 133 fill.

Hydraulic analysis shows that for the 100-year event the flow is contained in the channel and is below the crown of the pipe.

7.4.19 DRAINAGE SYSTEM 25

This system is placed upstream of a superelevation reversal. It contains a G1 and a SCSP cleanout inlets, an 18" CSP pipe, and a slotted pipe to collect small amount of water off the bridge deck. Due to the additional runoff from the ultimate condition, the cleanout inlet and the slotted pipe need to extend 30 feet toward the bridge. The system empties onto a field. The outlet flow velocity is below erodible velocity and RSP is not necessary. Hydraulic analysis of the system is in Appendix D.

7.4.20 DRAINAGE SYSTEM 26

This system is placed upstream of a bridge. It picks up flows from the median and the shoulder. An additional inlet is placed on the NB shoulder for the ultimate condition. This systems outlets at the toe of the slope. The flow then continues on into a proposed concrete trapezoidal channel. Rock slope protection is placed at the outlet for erosion control. Hydraulic analysis of the system is in Appendix D. The hydraulics were performed with slightly higher flows than are actually estimated. Also, the hydraulic analysis was not performed for the two side inlets in the median since they act as back-up only.

7.4.21 DRAINAGE SYSTEM 27

System 27 is an earth trapezoidal swale that carries offsite flows from areas east of Route 133. In the project condition, the swale is graded to drain along the interim Marine Way and terminated at the inlet of Marshburn Channel. This will allow the water to flow to Marshburn channel as it does in the existing condition. The analysis for this channel was done with normal depth calculations and are found in Appendix D.

7.4.22 DRAINAGE SYSTEMS 28 THROUGH 33

These systems are a network that begins in Section 07. The network drains the portion of section 06 that is in cut. System 28 is the mainline. Systems 29 through 33 are laterals. To minimize the depth of excavation for this system, the Corridor Operating System will be placed below Systems 29, 30, 32, and 33. The hydraulics for System 28 were based on AES RATSC5 hydrology. This was done in order to better represent the actual time of

7.4.36 DRAINAGE SYSTEM 47

This system includes two inlets that drain the gore area of the SW Connector and Route 5. It connects to System 42. Hydraulic analysis of the system is in Appendix D.

7.4.37 DRAINAGE SYSTEM 48

This system replaces two existing inlets due to the auxiliary lane of the SW Connector. The system drains both northbound and southbound areas of Route 5. It connects to System 42. Hydraulic analysis of the system is in Appendix D.

7.4.38 DRAINAGE SYSTEM 49

This system is required due to the interference of the 50E barrier associated with the EN Connector Bent 6 footing. The system includes:

- replacing the existing modified GD1 inlet with a new G1 inlet at the edge of 50E barrier,
- connecting the existing 50W 18-inch pipe at the begin of barrier taper with a modified G2 inlet,
- connecting these two inlets with an 18" slotted pipe.
- reconnecting the new G1 inlet and the existing downstream 18" CSP with an 18" AP.

As the new downstream pipe is steeper and the discharge is small, no hydraulic problem is expected for this system. Hydraulic analysis of the system is in Appendix D.

7.4.39 DRAINAGE SYSTEM 50

This system reconnects the existing 50W due to the interference of the 50E barrier associated with the sign post on the median. The system includes:

- installing 2 modified G2 inlets at begin and end of 50E taper,
- installing a SCSP cleanout in the middle of system,
- connecting these 3 inlets with 15" slotted pipe with 3" high slots.

The use of 15" instead of 18" slotted pipe is to provide a smoother transition and positive drainage between the 50W 18" pipes at both ends. Hydraulic analysis of the system is in Appendix D.

7.5 UNUSUAL OR SPECIAL CONDITIONS

Post-construction settlement curves have been developed for drainage systems having more than 20 feet of fill. The settlement prediction is less than 6.0 and 2.5 inches for System 17 (24-inch CSP) and System 18 (42-inch SSRP), respectively. Two pipelines of System 16 (unit J is 42-inch RCP and unit N is 24-inch CSP), on the other hand, may experience settlement of up to 15.2 inches over the total length. The settlements of Systems 17 and 18 are less than those of System 16 because they are under the slope with less loading.

Although the settlement would not adversely impact the pipe, Silverado has included camber in the pipeline installation to minimize the potential deviation from the design gradient. We are recommending a camber equal to 100% of the estimated settlement at all points along the settlement curves for the pipelines J and N in System 16.

The calculation for settlement and camber analyses are presented in Appendix E. We have found that the maximum pipe joint rotation angle would be 0.43 degree with cambering for System 16 pipelines and 0.42 degree for settlement of Systems 17 and 18. We assume CSP joint spacing is 20 feet while RCP joint spacing is 8 feet. The manufacturer's recommendations indicate that the allowable joint rotation angle is 1.2 degrees for 42-inch RCP and 2.3 degrees for 24-inch CSP; therefore, the calculated joint rotations are well within the allowable.

The suggested camber elevations are presented on profile sheet D-25. For the simplicity of plan presentation and construction, the camber elevations for unit J RCP are shown for every 16 feet. The spacing for the camber elevations of unit N CSP remains 20 feet.

Regarding bulking factor, the RMP report suggest that 1.2 factor be used for the San Diego Creek watershed. However, no bulking factors were applied to these offsite system in Section 6 for the following site specific reasons:

The sheetflow overflow from the MCAS will pond on the north side of the railroad berm before it overtops the berm to System 16. Most sediment in the flow will be deposited upstream of the railroad as the flow will be in a ponded condition. Also, the drainage area is an airport with the majority of the area paved. Very little sediment generation is expected from the area. Therefore, a bulking factor is not necessary as relatively clear flow will be coming over the railroad.

The System 24 hydrology estimated about 49 cfs for the 100-year peak flow. We designed the system with a 60" SSRP to carry 100 cfs, based on the existing ditch capacity. The 100 cfs design discharge is equal to a bulking factor of 2.0.

The design discharges of System 42, an open channel, were based on OCFCD Master Plan and Caltrans' design values for the recently constructed channel and should have included any bulking requirements. This is not a new system. We are only realigning part of the existing system parallel to I-5.

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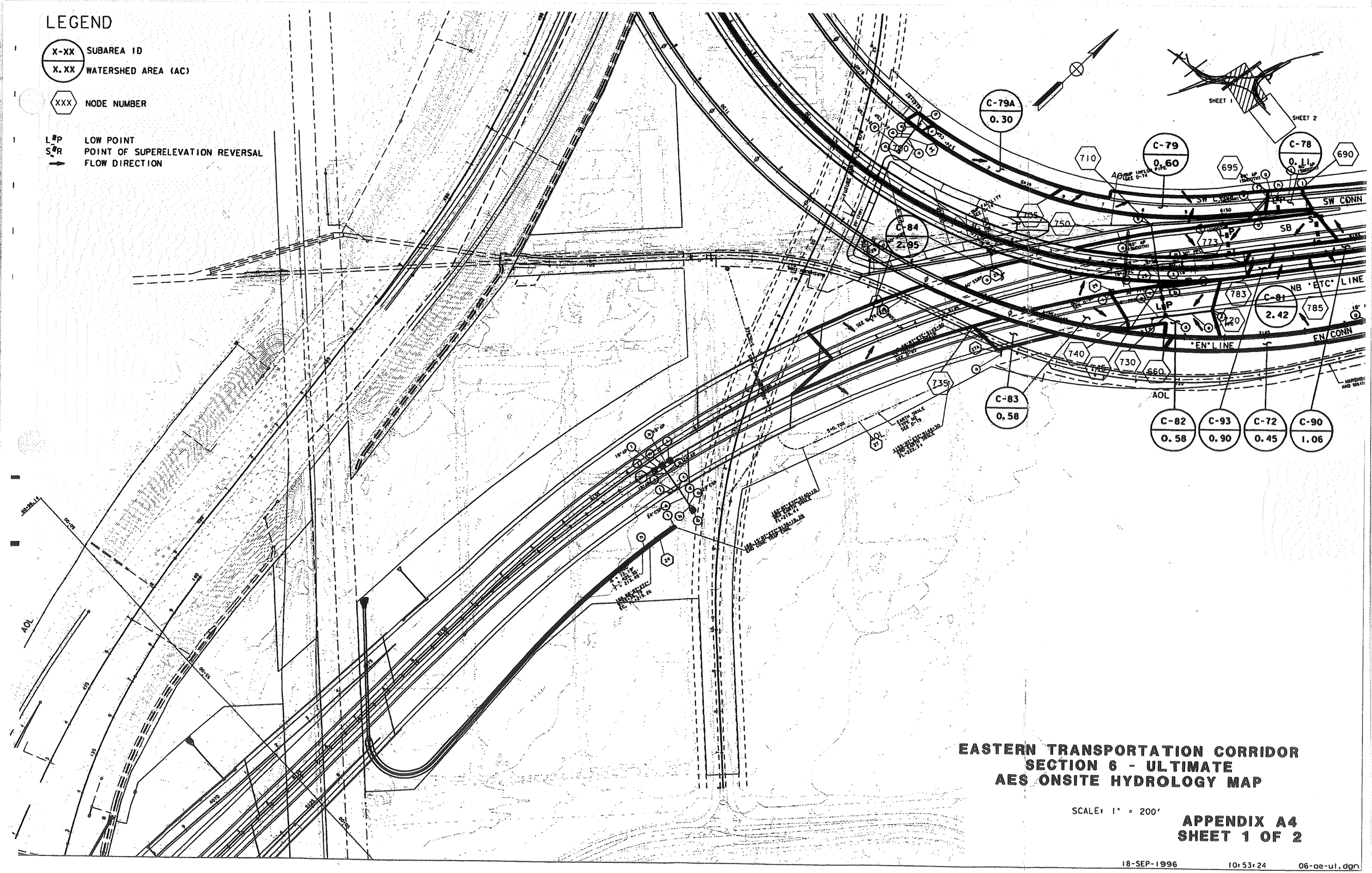
APPENDIX A4

ONSITE AES PROJECT & ULTIMATE CONDITIONS


LEGEND
X-XX
X.XX
SUBAREA ID
WATERSHED AREA (AC)
XXX
NODE NUMBER
LP
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SR
POINT OF SUPERELEVATION REVERSAL
FLOW DIRECTION
C-79A
0.30
C-79
0.60
C-78
0.11
C-84
2.95
C-81
2.42
C-83
0.58
C-82
0.58
C-93
0.90
C-72
0.45
C-90
1.06
SHEET 1
SHEET 2
SW CONN
SB
NB "ETC" LINE
"EN" LINE
EN CONN
AOL
690
695
710
730
735
740
750
773
783
785
EASTERN TRANSPORTATION CORRIDOR
SECTION 6 - ULTIMATE
AES ONSITE HYDROLOGY MAP
SCALE: 1" = 200'
APPENDIX A4
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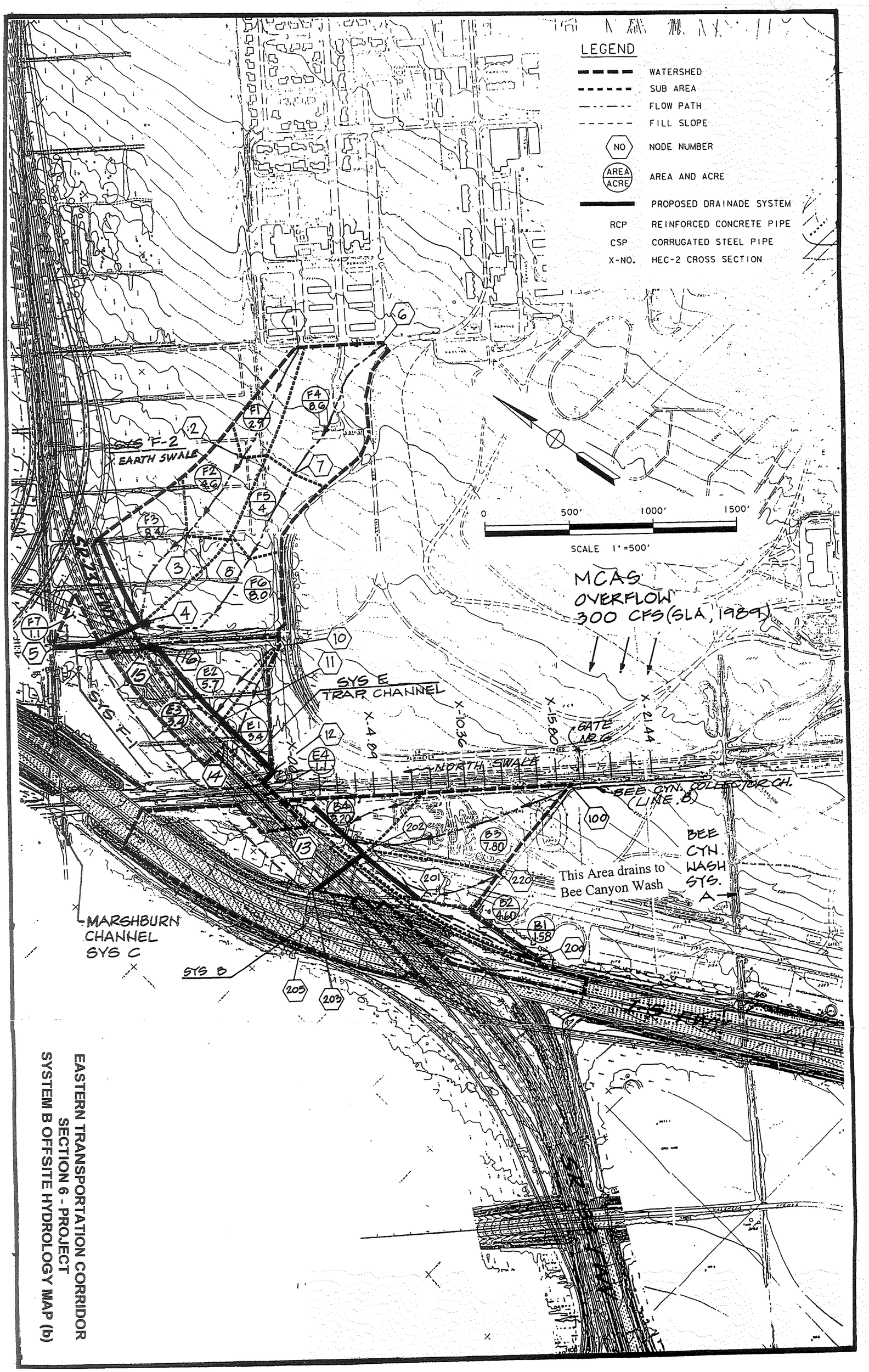
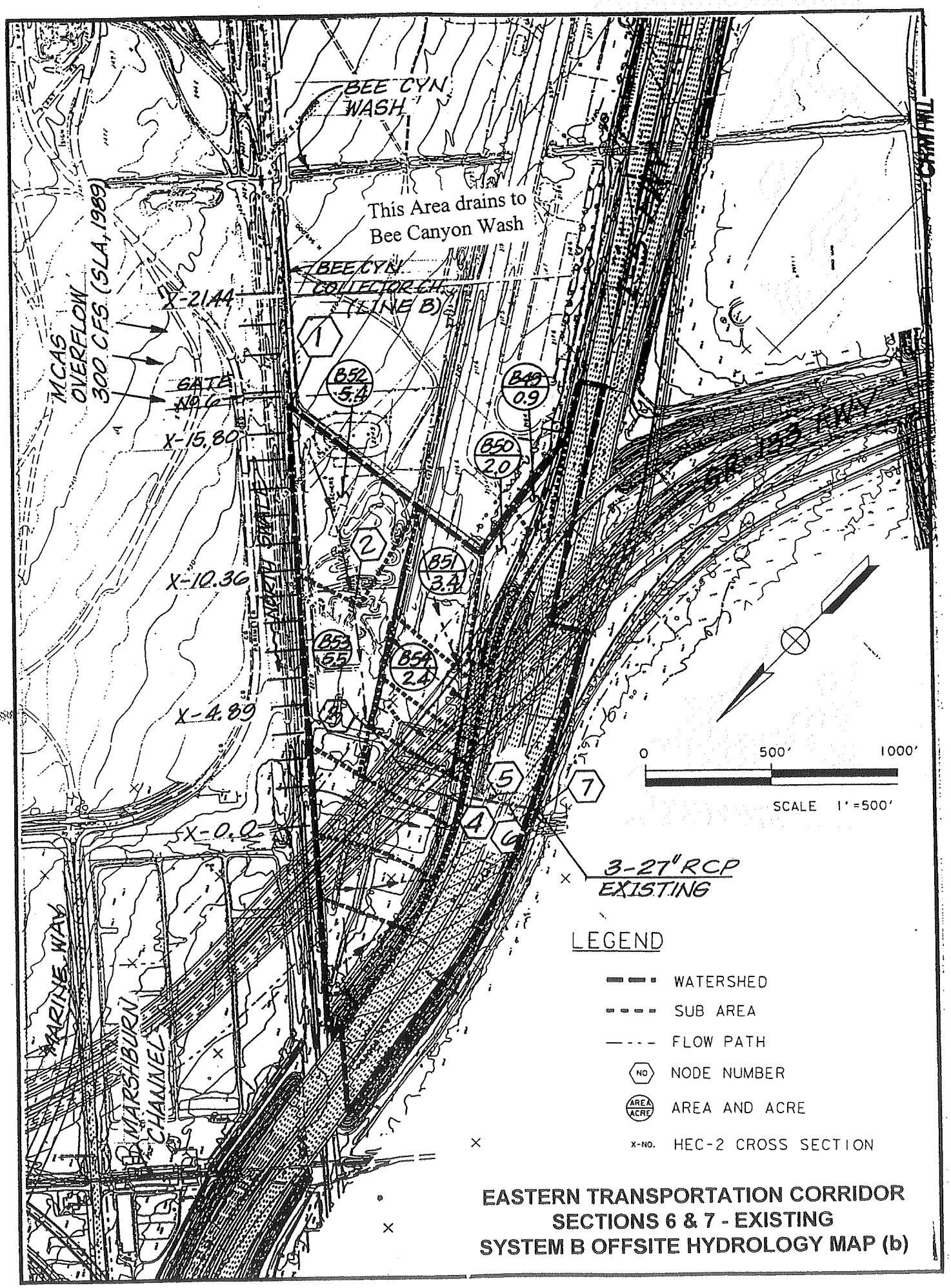
18-SEP-1996
10:53:24
06-ae-ul.dgn

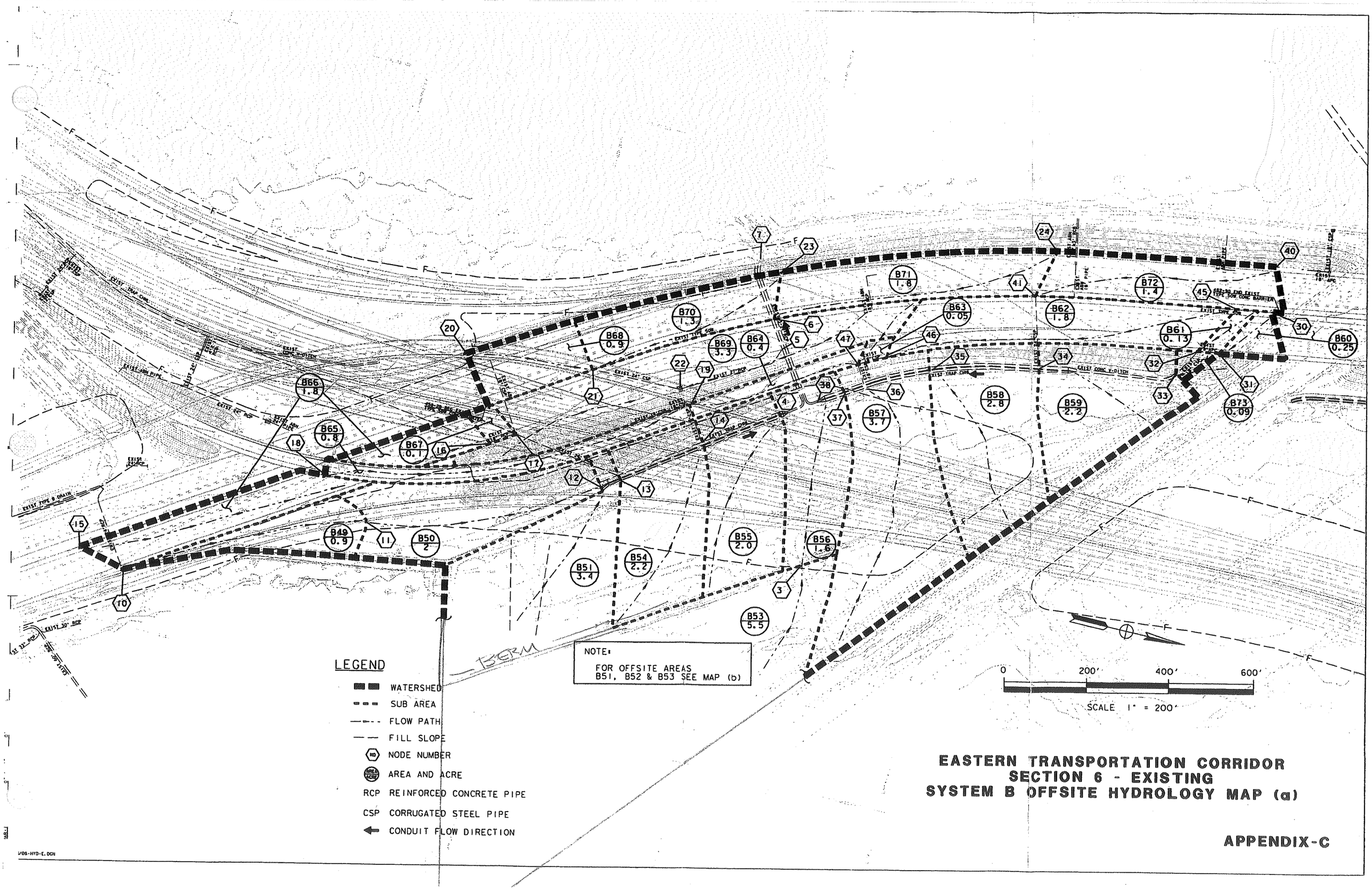
APPENDIX C3
OFFSITE HYDROLOGY MAPS



EASTERN TRANSPORTATION CORRIDOR
SECTION 6 - PROJECT
SYSTEM B OFFSITE HYDROLOGY MAP (b)

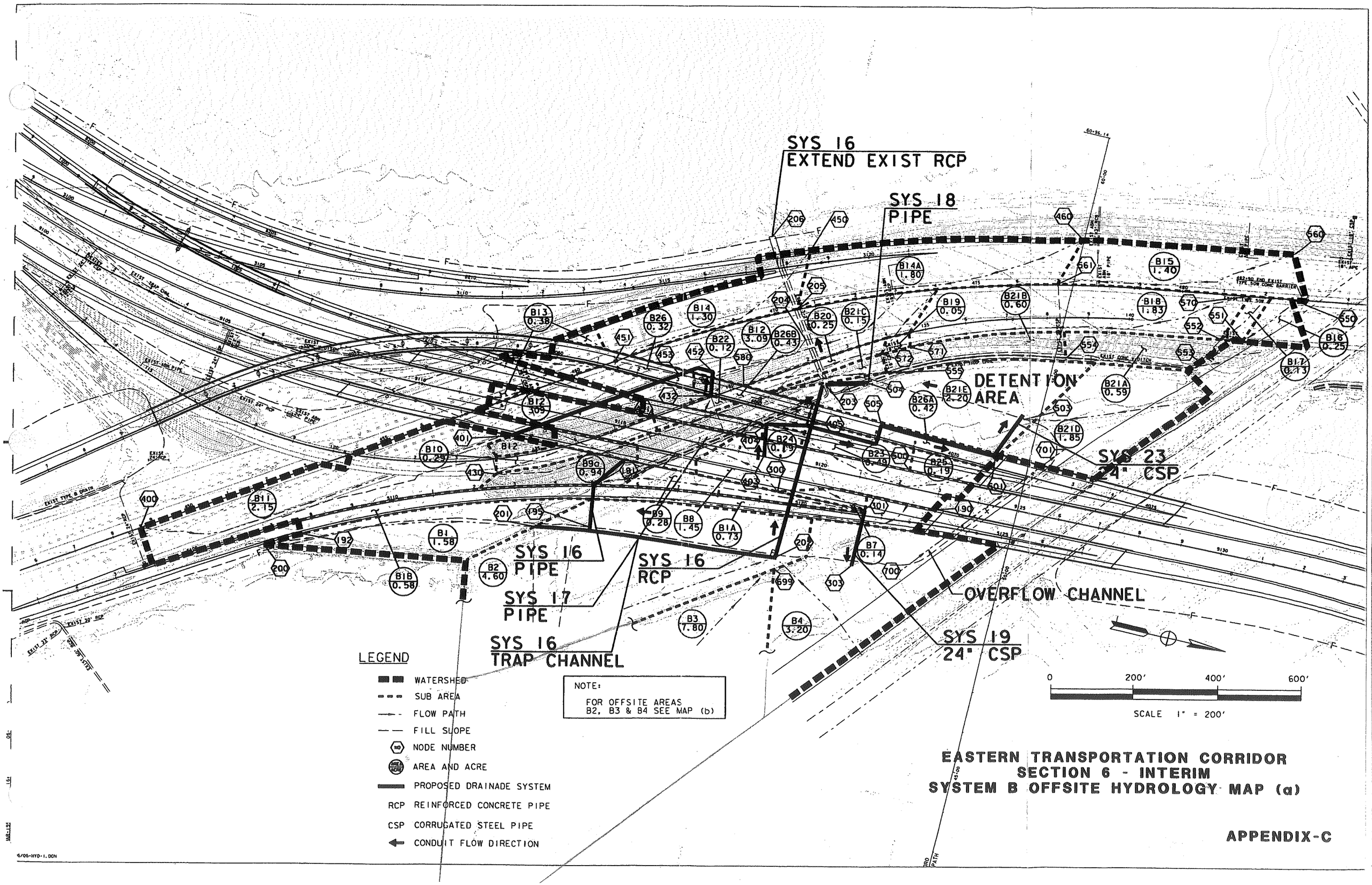


EASTERN TRANSPORTATION CORRIDOR
SECTIONS 6 & 7 - EXISTING
SYSTEM B OFFSITE HYDROLOGY MAP (b)



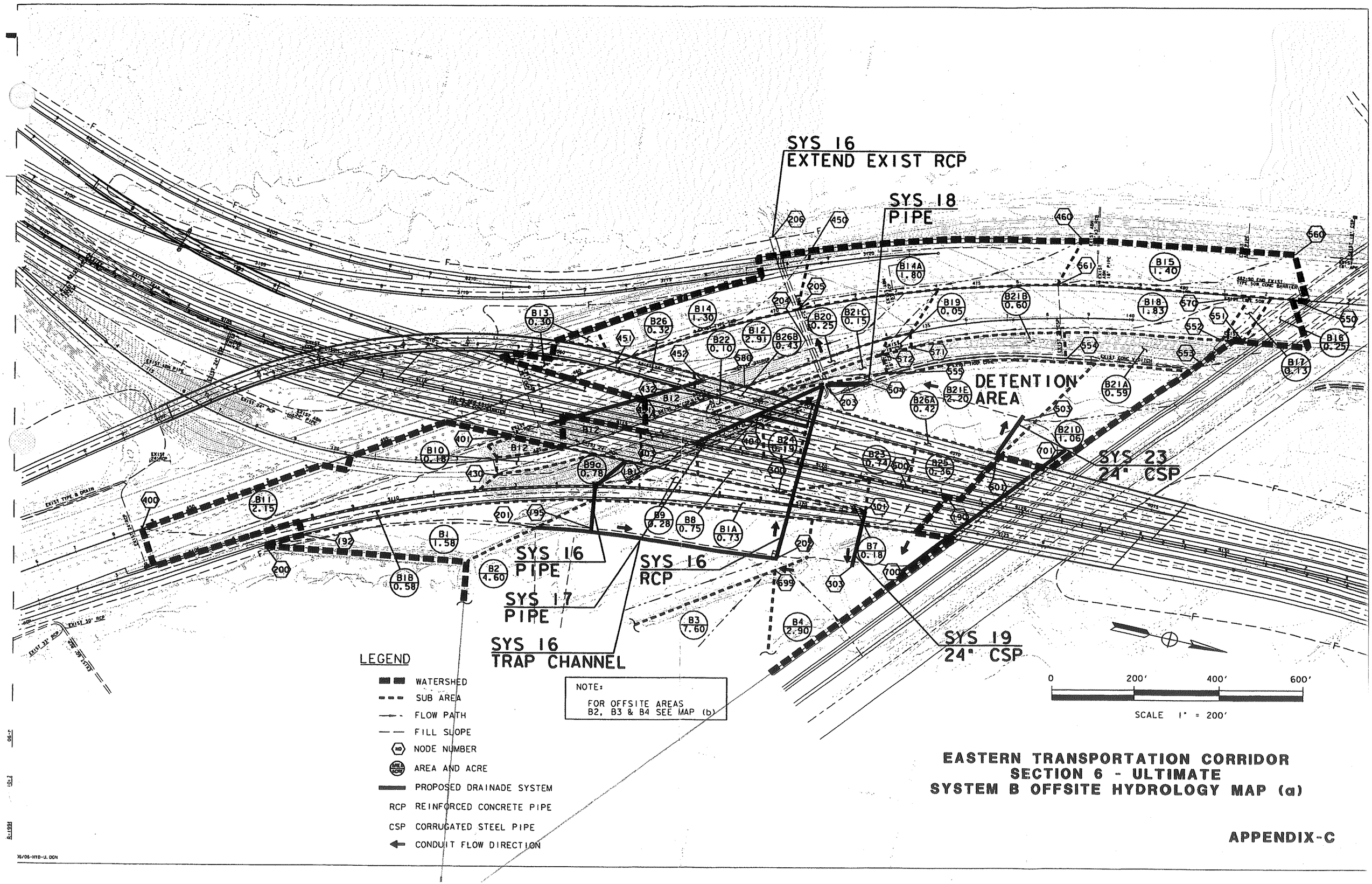
EASTERN TRANSPORTATION CORRIDOR
SECTION 6 - EXISTING
SYSTEM B OFFSITE HYDROLOGY MAP (a)

APPENDIX-C



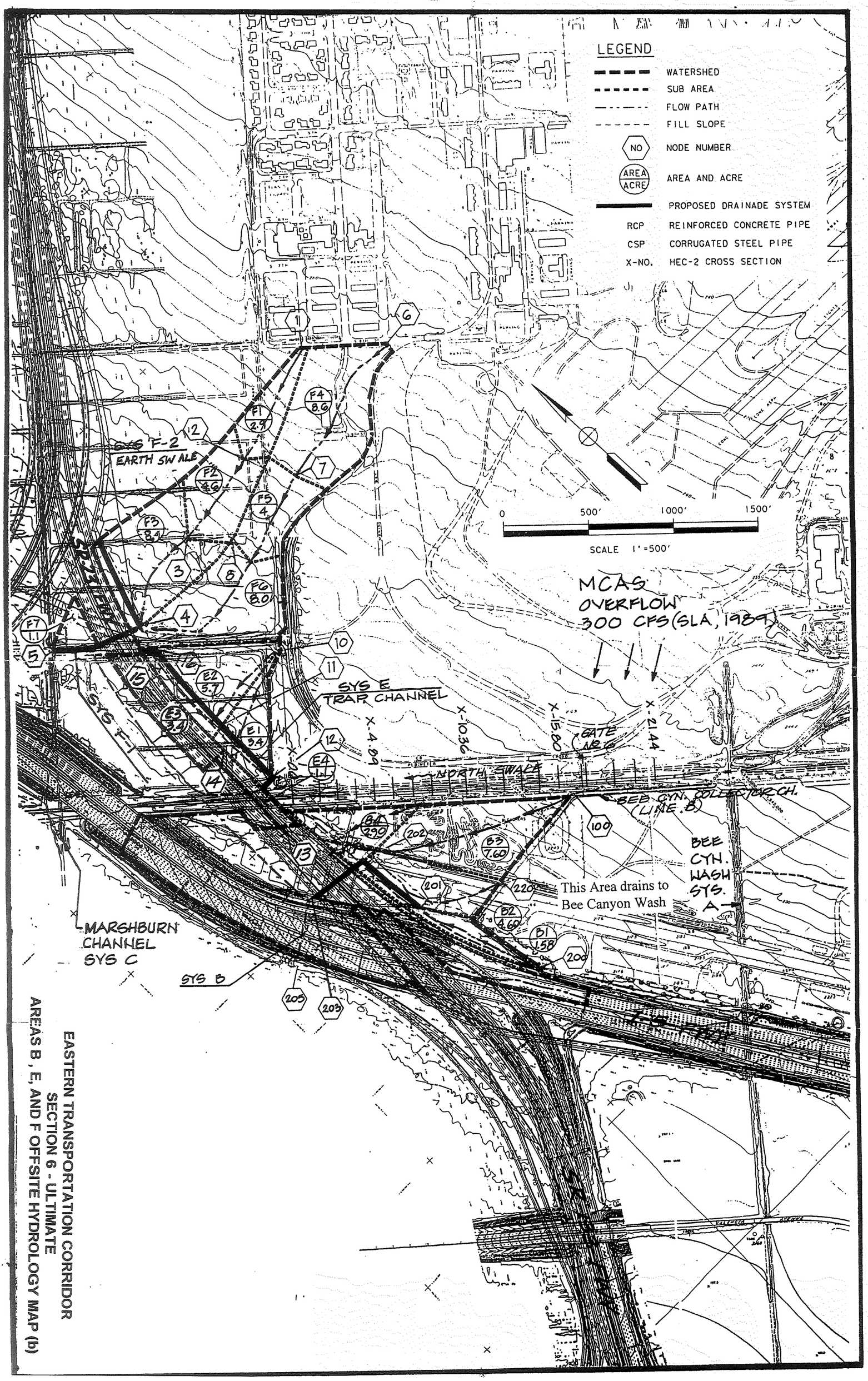
EASTERN TRANSPORTATION CORRIDOR
SECTION 6 - INTERIM
SYSTEM B OFFSITE HYDROLOGY MAP (a)

APPENDIX-C



EASTERN TRANSPORTATION CORRIDOR
SECTION 6 - ULTIMATE
SYSTEM B OFFSITE HYDROLOGY MAP (a)

APPENDIX-C



EASTERN TRANSPORTATION CORRIDOR
SECTION 6 - ULTIMATE
AREAS B, E, AND F OFFSITE HYDROLOGY MAP (b)

Eastern Transportation Corridor • Orange County, CA

Final (Resubmittal)

Drainage Design Report on State Route 133

Volume 2 of 2

March 21, 1997

Design Section 06

Design Submittal Number E06DXXD-01

Submitted to

Transportation Corridor Agencies

Submitted by

Silverado CONSTRUCTORS

A JOINT VENTURE OF FCI CONSTRUCTORS, SUKLT CONSTRUCTION, INC., WAYSS & FREYTAG AND OBAYASHI CORPORATION, SUPPORTED BY CH2M HILL

Prepared by

CH2M HILL

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Santa Ana, CA 92707
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APPENDIX D

HYDRAULIC COMPUTATIONS FOR ONSITE & OFFSITE DRAINAGE SYSTEMS

DRAINAGE SYSTEM 24

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

SECTION 6, SYSTEM 24

HEADING LINE NO 2 IS -

100 - YEAR STORM 6/11/96

HEADING LINE NO 3 IS -

FILE NAME S6S24V3.INP DESIGED BY: EVA PLAJZER CHECKED BY: GH

DATE: 7/10/1996
TIME: 19:45

F0515P

WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	1	0	0.DD	4.00	4.00	2.00	2.00	0.00										
CD	3	1	0	0.00	4.00	3.00	1.50	1.50	0.00										
CD	48	4			4.00														
CD	60	4			5.00														
CD	5	5	0	0.00															

System 24 - Hydraulic Summary & Channel Depth Requirements

STA.	INV. ELEV ft	DEPTH OF FLOW ft	W.S. ELEV ft	Q cfs	VEL ft/s	VEL HEAD ft	ENERGY GRD. EL. ft	SUPER ELEV. ft	CRTL DEPTH ft	HGT ft	BASE ft	ZL NO	Flow Regime	Freeboard 0.2He or 0.25d	Required Depth ft	Channel Type
9+93.00	210.64	2.55	213.19	100	4.31	0.29	213.48	0	1.95	4	4	2	sub	0.57	3.12	RSP
10+03.49	210.70	2.58	213.28	100	4.24	0.28	213.56	0	1.95	4	4	2	sub	0.57	3.15	RSP
HYDRAULIC JUMP																
10+03.49	210.70	1.42	212.13	100	10.25	1.63	213.76	0	1.95	4	4	2	super	0.36	1.78	RSP
10+03.79	210.71	1.41	212.12	100	10.36	1.67	213.78	0	1.95	4	4	2	super	0.35	1.77	RSP
10+05.19	210.71	1.37	212.08	100	10.86	1.83	213.91	0	1.95	4	4	2	super	0.34	1.71	RSP
10+06.60	210.72	1.32	212.04	100	11.39	2.02	214.06	0	1.95	4	4	2	super	0.33	1.65	RSP
10+08.00	210.73	1.28	212.01	100	11.95	2.22	214.22	0	1.95	4	4	2	super	0.32	1.60	RSP
10+08.00	210.73	2.50	213.23	100	10.17	1.61	214.84	0	2.85	5	0	0				PIPE
10+80.42	211.16	2.50	213.66	100	10.17	1.61	215.26	0	2.85	5	0	0				PIPE
12+37.10	212.07	2.54	214.61	100	10.00	1.55	216.16	0	2.85	5	0	0				PIPE
13+09.20	212.50	2.64	215.13	100	9.53	1.41	216.54	0	2.85	5	0	0				PIPE
13+30.67	212.62	2.74	215.36	100	9.09	1.28	216.64	0	2.85	5	0	0				PIPE
13+35.00	212.65	2.85	215.50	100	8.66	1.17	216.66	0	2.85	5	0	0				PIPE
13+35.00	212.65	3.05	215.70	100	7.91	0.97	216.68		2.86		5					PIPE
13+45.00	212.96	3.66	216.62	100	3.22	0.16	216.78	0	2.27	4	3	1.5	sub	0.76	4.42	CONC
13+66.97	213.06	3.55	216.61	100	3.38	0.18	216.79	0	2.27	4	3	1.5	sub	0.75	4.30	CONC
13+85.00	213.14	3.47	216.61	100	3.52	0.19	216.80	0	2.27	4	3	1.5	sub	0.73	4.20	CONC
13+95.00	213.18	3.72	216.90	49	1.54	0.04	216.93	0.02	1.56	4	3	1.5	sub	0.75	4.49	CONC
14+19.61	213.28	3.61	216.89	49	1.61	0.04	216.93	0.02	1.56	4	3	1.5	sub	0.73	4.36	CONC
14+43.60	213.39	3.51	216.89	49	1.69	0.04	216.94	0.02	1.56	4	3	1.5	sub	0.71	4.24	CONC
14+66.96	213.49	3.41	216.89	49	1.78	0.05	216.94	0.02	1.56	4	3	1.5	sub	0.69	4.12	CONC
14+89.71	213.58	3.31	216.89	49	1.86	0.05	216.95	0.02	1.56	4	3	1.5	sub	0.67	4.00	CONC
15+11.86	213.68	3.21	216.89	49	1.95	0.06	216.95	0.02	1.56	4	3	1.5	sub	0.65	3.89	CONC
15+33.42	213.77	3.12	216.89	49	2.05	0.07	216.95	0.02	1.56	4	3	1.5	sub	0.64	3.77	CONC
15+54.41	213.86	3.03	216.89	49	2.15	0.07	216.96	0.02	1.56	4	3	1.5	sub	0.62	3.67	CONC
15+56.89	213.87	3.02	216.89	49	2.16	0.07	216.96	0	1.56	4	3	1.5	sub	0.62	3.63	CONC
15+72.00	213.94	2.94	216.88	49	2.24	0.08	216.96	0	1.56	4	3	1.5	sub	0.60	3.55	CONC
15+83.48	214.02	2.86	216.88	49	2.35	0.09	216.97	0	1.56	4	3	1.5	sub	0.59	3.45	CONC

CHN L DESIGN DEPTH

4.5'

4'

System 24 - Hydraulic Summary & Channel Depth Requirements

STA.	INV. ELEV ft	DEPTH OF FLOW ft	W.S. ELEV ft	Q cfs	VEL ft/s	VEL HEAD ft	ENERGY GRD. EL. ft	SUPER ELEV. ft	CRTL DEPTH ft	HGT ft	BASE ft	ZL NO	Flow Regime	Freeboard 0.2He or 0.25d	Required Depth ft	Channel Type
15+94.60	214.10	2.77	216.87	49	2.47	0.10	216.97	0	1.56	4	3	1.5	sub	0.57	3.35	CONC
16+05.35	214.18	2.69	216.87	49	2.59	0.10	216.97	0	1.56	4	3	1.5	sub	0.56	3.25	CONC
16+15.73	214.25	2.61	216.86	49	2.72	0.12	216.98	0	1.56	4	3	1.5	sub	0.54	3.15	CONC
16+25.74	214.32	2.53	216.86	49	2.85	0.13	216.98	0	1.56	4	3	1.5	sub	0.53	3.06	CONC
16+35.38	214.40	2.45	216.85	49	2.99	0.14	216.99	0	1.56	4	3	1.5	sub	0.52	2.97	CONC
16+44.64	214.46	2.38	216.84	49	3.13	0.15	216.99	0	1.56	4	3	1.5	sub	0.51	2.89	CONC
16+53.52	214.53	2.31	216.83	49	3.29	0.17	217.00	0	1.56	4	3	1.5	sub	0.50	2.80	CONC
16+62.00	214.59	2.24	216.82	49	3.45	0.19	217.01	0	1.56	4	3	1.5	sub	0.48	2.72	CONC
16+70.07	214.64	2.17	216.81	49	3.62	0.20	217.01	0	1.56	4	3	1.5	sub	0.47	2.64	CONC
16+77.71	214.70	2.10	216.80	49	3.79	0.22	217.02	0	1.56	4	3	1.5	sub	0.46	2.57	CONC
16+84.91	214.75	2.04	216.79	49	3.98	0.25	217.03	0	1.56	4	3	1.5	sub	0.46	2.49	CONC
16+91.64	214.80	1.97	216.77	49	4.17	0.27	217.04	0	1.56	4	3	1.5	sub	0.45	2.42	CONC
16+97.86	214.84	1.91	216.75	49	4.37	0.30	217.05	0	1.56	4	3	1.5	sub	0.44	2.35	CONC
17+03.52	214.88	1.85	216.73	49	4.59	0.33	217.06	0	1.56	4	3	1.5	sub	0.44	2.29	CONC
17+06.15	214.90	1.82	216.72	49	4.70	0.34	217.07	0	1.56	4	3	1.5	sub	0.43	2.25	CONC
HYDRAULIC JUMP																
17+06.15	214.90	1.32	216.22	49	7.49	0.87	217.09	0	1.56	4	3	1.5	super	0.33	1.64	CONC
17+85.43	215.47	1.32	216.79	49	7.49	0.87	217.66	0	1.56	4	3	1.5	super	0.33	1.64	CONC
18+85.73	216.19	1.31	217.50	49	7.52	0.88	218.38	0.01	1.56	4	3	1.5	super	0.33	1.65	CONC
21+95.70	218.43	1.31	219.74	49	7.52	0.88	220.62	0.01	1.56	4	3	1.5	super	0.33	1.65	CONC
23+11.09	219.26	1.32	220.58	49	7.49	0.87	221.45	0	1.56	4	3	1.5	super	0.33	1.65	CONC
23+88.00	219.81	1.31	221.12	49	7.53	0.88	222.00	0	1.56	4	3	1.5	super	0.33	1.64	CONC

4'

3'

2'

DATE: 7/10/1996
TIME: 19:45

F0515P

WATER SURFACE PROFILE - CROSS SECTION POINT LISTING

CARD CODE	SECT NO	NO OF POINTS	X(1) , Y(1) X(8) , Y(8)	X(2) , Y(2) X(9) , Y(9)	X(3) , Y(3) X(10) ,Y(10)	X(4) , Y(4) X(11) ,Y(11)	X(5) , Y(5) X(N) , Y(N)	X(6) , Y(6) X(N+1),Y(N+1)	X(7) , Y(7) X(99) ,Y(99)
PTS	5	11	0.00 217.65	0.00 215.15	0.19 214.19	0.73 213.38	1.54 212.84	2.55 212.65	3.56 212.84
PTS			4.37 213.38	4.91 214.19	5.10 215.15	5.10 217.65			

WATER SURFACE PROFILE - ELEMENT CARD LISTING

```
ELEMENT NO   1 IS A SYSTEM OUTLET      *         *     *
                U/S DATA   STATION    INVERT  SECT                                W S ELEV
                            993.00    210.64    1                                  213.19

ELEMENT NO   2 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                           1019.00    210.79    1           0.040                          0.00   0.00    0.00     0

ELEMENT NO   3 IS A  WALL  EXIT                        *
                U/S DATA   STATION    INVERT  SECT
                           1019.00    210.79   60

ELEMENT NO   4 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                           1335.00    212.65   60           0.013                          0.00   0.00    0.00     0

ELEMENT NO   5 IS A  WALL  ENTRANCE                    *
                U/S DATA   STATION    INVERT  SECT           FP
                           1335.00    212.65    5           0.200

ELEMENT NO   6 IS A TRANSITION         *         *     *
                U/S DATA   STATION    INVERT  SECT            N
                           1345.00    212.96    3           0.015

ELEMENT NO   7 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                           1385.00    213.14    3           0.015                         90.00   0.00    0.00     0

ELEMENT NO   8 IS A JUNCTION           *         *     *     *                *                *                *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3      Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                           1395.00    213.18    3     3     0  0.015    51.0     0.0   217.00     0.00   0.50    0.00

ELEMENT NO   9 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                           1556.89    213.87    3           0.015                         90.00   0.00    0.00     0

ELEMENT NO  10 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                           1572.00    213.94    3           0.015                          0.00   0.00    0.00     0

ELEMENT NO  11 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                           1885.73    216.19    3           0.015                          0.00   0.00    0.00     0

ELEMENT NO  12 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                           2311.09    219.26    3           0.015                       2000.00   0.00    0.00     0
```

WATER SURFACE PROFILE - ELEMENT CARD LISTING

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ELEMENT NO  13 IS A REACH            *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                 2388.00  219.81    3             0.015                                 0.00   0.00    0.00      0

ELEMENT NO  14 IS A SYSTEM HEADWORKS                 *                      *
                    U/S DATA   STATION    INVERT  SECT                                     W S ELEV
                                 2388.00  219.81    3                                       221.12
NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING
```

WATER SURFACE PROFILE LISTING

SECTION 6, SYSTEM 24
100 - YEAR STORM 6/11/96
FILE NAME S6S24V3.INP DESIGED BY: EVA PLAJZER CHECKED BY: GH

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
993.00	210.64	2.550	213.190	100.0	4.31	0.288	213.478	0.00	1.952		4.00	4.00	2.00	0	0.00
22.08	0.00577					.007442	0.16			2.737			2.00		
1015.08	210.77	2.608	213.375	100.0	4.16	0.269	213.644	0.00	1.952		4.00	4.00	2.00	0	0.00
HYDRAULIC JUMP													2.00		
1015.08	210.77	1.404	212.171	100.0	10.47	1.701	213.872	0.00	1.952		4.00	4.00	2.00	0	0.00
1.12	0.00577					.092328	0.10			2.737			2.00		
1016.20	210.77	1.366	212.140	100.0	10.87	1.836	213.976	0.00	1.952		4.00	4.00	2.00	0	0.00
1.40	0.00577					.104022	0.15			2.737			2.00		
1017.60	210.78	1.320	212.102	100.0	11.40	2.019	214.121	0.00	1.952		4.00	4.00	2.00	0	0.00
1.40	0.00577					.118672	0.17			2.737			2.00		
1019.00	210.79	1.276	212.066	100.0	11.96	2.221	214.287	0.00	1.952		4.00	4.00	2.00	0	0.00
WALL EXIT													2.00		
1019.00	210.79	2.501	213.291	100.0	10.18	1.610	214.901	0.00	2.847		5.00	0.00	0.00	0	0.00
60.96	0.00589					.005889	0.36			2.501			0.00		
1079.96	211.15	2.501	213.650	100.0	10.18	1.610	215.260	0.00	2.847		5.00	0.00	0.00	0	0.00
159.07	0.00589					.005749	0.91			2.501			0.00		
1239.03	212.09	2.537	214.622	100.0	10.00	1.552	216.174	0.00	2.847		5.00	0.00	0.00	0	0.00
70.45	0.00589					.005275	0.37			2.501			0.00		
1309.48	212.50	2.635	215.135	100.0	9.53	1.410	216.545	0.00	2.847		5.00	0.00	0.00	0	0.00
21.22	0.00589					.004651	0.10			2.501			0.00		
1330.70	212.62	2.737	215.362	100.0	9.09	1.282	216.644	0.00	2.847		5.00	0.00	0.00	0	0.00
4.30	0.00589					.004102	0.02			2.501			0.00		

WATER SURFACE PROFILE LISTING

SECTION 6, SYSTEM 24
100 - YEAR STORM 6/11/96
FILE NAME S6S24V3.INP DESIGED BY: EVA PLAJZER CHECKED BY: GH

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
1335.00	212.65	2.847	215.497	100.0	8.66	1.165	216.662	0.00	2.847		5.00	0.00	0.00	0	0.00
WALL ENTRANCE													0.00		
1335.00	212.65	3.053	215.703	100.0	7.91	0.972	216.675		2.861			5		0	0.00
TRANS STR	0.03100					.002253	0.02								
1345.00	212.96	3.658	216.618	100.0	3.22	0.161	216.779	0.07	2.265		4.00	3.00	1.50	0	0.00
21.97	0.00450					.000474	0.01			2.120			1.50		
1366.97	213.06	3.553	216.612	100.0	3.38	0.177	216.789	0.07	2.265		4.00	3.00	1.50	0	0.00
18.03	0.00450					.000532	0.01			2.120			1.50		
1385.00	213.14	3.467	216.607	100.0	3.52	0.192	216.799	0.00	2.265		4.00	3.00	1.50	0	0.00
JUNCT STR	0.00400					.000331	0.00						1.50		
1395.00	213.18	3.715	216.895	49.0	1.54	0.037	216.932	0.02	1.556		4.00	3.00	1.50	0	0.00
24.61	0.00426					.000106	0.00			1.504			1.50		
1419.61	213.28	3.609	216.894	49.0	1.61	0.040	216.934	0.02	1.556		4.00	3.00	1.50	0	0.00
23.99	0.00426					.000121	0.00			1.504			1.50		
1443.60	213.39	3.506	216.893	49.0	1.69	0.044	216.937	0.02	1.556		4.00	3.00	1.50	0	0.00
23.36	0.00426					.000137	0.00			1.504			1.50		
1466.96	213.49	3.405	216.892	49.0	1.78	0.049	216.941	0.02	1.556		4.00	3.00	1.50	0	0.00
22.75	0.00426					.000156	0.00			1.504			1.50		
1489.71	213.58	3.307	216.891	49.0	1.86	0.054	216.945	0.02	1.556		4.00	3.00	1.50	0	0.00
22.15	0.00426					.000177	0.00			1.504			1.50		
1511.86	213.68	3.211	216.889	49.0	1.95	0.059	216.948	0.02	1.556		4.00	3.00	1.50	0	0.00
21.56	0.00426					.000201	0.00			1.504			1.50		

WATER SURFACE PROFILE LISTING

SECTION 6, SYSTEM 24
100 - YEAR STORM 6/11/96
FILE NAME S6S24V3.INP DESIGED BY: EVA PLAJZER CHECKED BY: GH

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA / ZR	BASE/ ID NO.	ZL	NO PIER	AVBPR
1533.42	213.77	3.117	216.887	49.0	2.05	0.065	216.952	0.02	1.556	4.00	3.00	1.50	0	0.00
20.99	0.00426					.000228	0.00		1.504			1.50		
1554.41	213.86	3.026	216.885	49.0	2.15	0.072	216.957	0.02	1.556	4.00	3.00	1.50	0	0.00
2.48	0.00426					.000245	0.00		1.504			1.50		
1556.89	213.87	3.015	216.885	49.0	2.16	0.072	216.957	0.00	1.556	4.00	3.00	1.50	0	0.00
15.11	0.00463					.000260	0.00		1.472			1.50		
1572.00	213.94	2.944	216.884	49.0	2.24	0.078	216.962	0.00	1.556	4.00	3.00	1.50	0	0.00
11.48	0.00717					.000293	0.00		1.315			1.50		
1583.48	214.02	2.857	216.879	49.0	2.35	0.086	216.965	0.00	1.556	4.00	3.00	1.50	0	0.00
11.12	0.00717					.000332	0.00		1.315			1.50		
1594.60	214.10	2.772	216.874	49.0	2.47	0.095	216.969	0.00	1.556	4.00	3.00	1.50	0	0.00
10.75	0.00717					.000378	0.00		1.315			1.50		
1605.35	214.18	2.690	216.869	49.0	2.59	0.104	216.973	0.00	1.556	4.00	3.00	1.50	0	0.00
10.38	0.00717					.000429	0.00		1.315			1.50		
1615.73	214.25	2.609	216.863	49.0	2.72	0.115	216.978	0.00	1.556	4.00	3.00	1.50	0	0.00
10.01	0.00717					.000488	0.00		1.315			1.50		
1625.74	214.32	2.531	216.856	49.0	2.85	0.126	216.982	0.00	1.556	4.00	3.00	1.50	0	0.00
9.64	0.00717					.000555	0.01		1.315			1.50		
1635.38	214.40	2.454	216.849	49.0	2.99	0.139	216.988	0.00	1.556	4.00	3.00	1.50	0	0.00
9.26	0.00717					.000630	0.01		1.315			1.50		
1644.64	214.46	2.380	216.841	49.0	3.13	0.152	216.993	0.00	1.556	4.00	3.00	1.50	0	0.00
8.88	0.00717					.000717	0.01		1.315			1.50		

WATER SURFACE PROFILE LISTING

SECTION 6, SYSTEM 24
100 - YEAR STORM 6/11/96
FILE NAME S6S24V3.INP DESIGED BY: EVA PLAJZER CHECKED BY: GH

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRO.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
1653.52	214.53	2.307	216.832	49.0	3.29	0.168	217.000	0.00	1.556		4.00	3.00	1.50	0	0.00
8.48	0.00717					.000815	0.01			1.315			1.50		
1662.00	214.59	2.237	216.822	49.0	3.45	0.185	217.007	0.00	1.556		4.00	3.00	1.50	0	0.00
8.07	0.00717					.000927	0.01			1.315			1.50		
1670.07	214.64	2.168	216.811	49.0	3.62	0.203	217.014	0.00	1.556		4.00	3.00	1.50	0	0.00
7.64	0.00717					.001053	0.01			1.315			1.50		
1677.71	214.70	2.101	216.799	49.0	3.79	0.223	217.022	0.00	1.556		4.00	3.00	1.50	0	0.00
7.20	0.00717					.001198	0.01			1.315			1.50		
1684.91	214.75	2.035	216.785	49.0	3.98	0.246	217.031	0.00	1.556		4.00	3.00	1.50	0	0.00
6.73	0.00717					.001364	0.01			1.315			1.50		
1691.64	214.80	1.972	216.770	49.0	4.17	0.270	217.040	0.00	1.556		4.00	3.00	1.50	0	0.00
6.22	0.00717					.001551	0.01			1.315			1.50		
1697.86	214.84	1.910	216.753	49.0	4.37	0.297	217.050	0.00	1.556		4.00	3.00	1.50	0	0.00
5.66	0.00717					.001765	0.01			1.315			1.50		
1703.52	214.88	1.850	216.733	49.0	4.59	0.327	217.060	0.00	1.556		4.00	3.00	1.50	0	0.00
2.63	0.00717					.001940	0.01			1.315			1.50		
1706.15	214.90	1.821	216.723	49.0	4.70	0.343	217.066	0.00	1.556		4.00	3.00	1.50	0	0.00
HYDRAULIC JUMP													1.50		
1706.15	214.90	1.315	216.217	49.0	7.49	0.872	217.089	0.00	1.556		4.00	3.00	1.50	0	0.00
79.28	0.00717					.007166	0.57			1.315			1.50		
1785.43	215.47	1.315	216.786	49.0	7.49	0.872	217.658	0.00	1.556		4.00	3.00	1.50	0	0.00
100.30	0.00717					.007197	0.72			1.315			1.50		

WATER SURFACE PROFILE LISTING

SECTION 6, SYSTEM 24
100 - YEAR STORM 6/11/96
FILE NAME S6S24V3.INP DESIGED BY: EVA PLAJZER CHECKED BY: GH

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
1885.73	216.19	1.312	217.502	49.0	7.52	0.878	218.380	0.01	1.556		4.00	3.00	1.50	0	0.00
309.97	0.00722					.007229	2.24			1.312			1.50		
2195.70	218.43	1.312	219.739	49.0	7.52	0.878	220.617	0.01	1.556		4.00	3.00	1.50	0	0.00
115.39	0.00722					.007187	0.83			1.312			1.50		
2311.09	219.26	1.316	220.576	49.0	7.49	0.870	221.446	0.00	1.556		4.00	3.00	1.50	0	0.00
76.91	0.00715					.007208	0.55			1.316			1.50		
2388.00	219.81	1.310	221.120	49.0	7.53	0.881	222.001	0.00	1.556		4.00	3.00	1.50	0	0.00

6/8/96

Evaluation of existing capacity for unlined ditch north of Metrolink RR & parallel to it.

An exist ditch carries flows to an exist lined channel parallel to the RR. This ditch will be covered by ETC. A culvert under ETC will be provided to carry equivalent flow capacity. (At a certain depth water will start spilling over into the RR area & will be carried to Marshburn).

Survey data of the exist ditch provided crosssechons & flow line profile.

Based on this information water from the exist swale will start spilling into RR swale when the flow is approximately 100 cfs. (This occurs at cross-section number 3).

The proposed pipe will be designed for 100 year flows.

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD

IM-005-2(803)05

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON STATE HIGHWAY

IN ORANGE COUNTY IN IRVINE AT IRVINE OVERHEAD

To be supplemented by Standard Plans dated January, 1988

INDEX OF SHEETS

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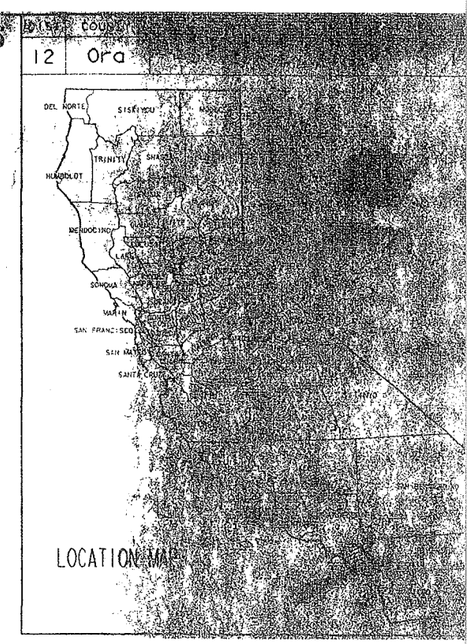
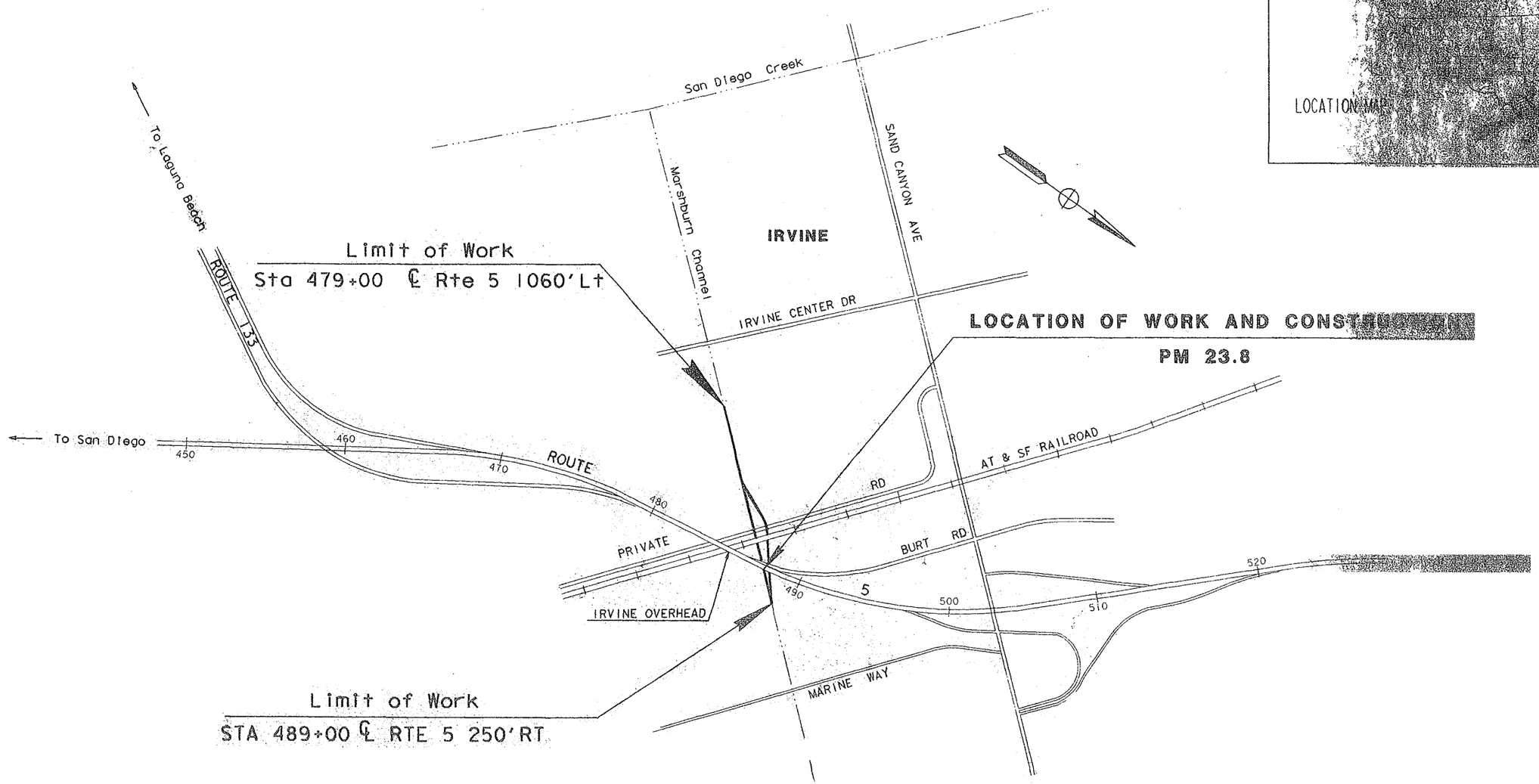
" "	2	Standard Plans List
" "	3	Layout
" "	4	Drainage Plan
" "	5-7	Drainage Profiles
" "	8-12	Drainage Details
" "	13	Utility Plan
" "	14	Construction Area Signs
" "	15	Summary of Quantities
" "	16	Revised Standard Plan

STRUCTURE PLANS

" "	17-26	Marshburn Channel





NO SCALE

The Contractor shall possess the Class or Classes of license

F16-701-L

38

3

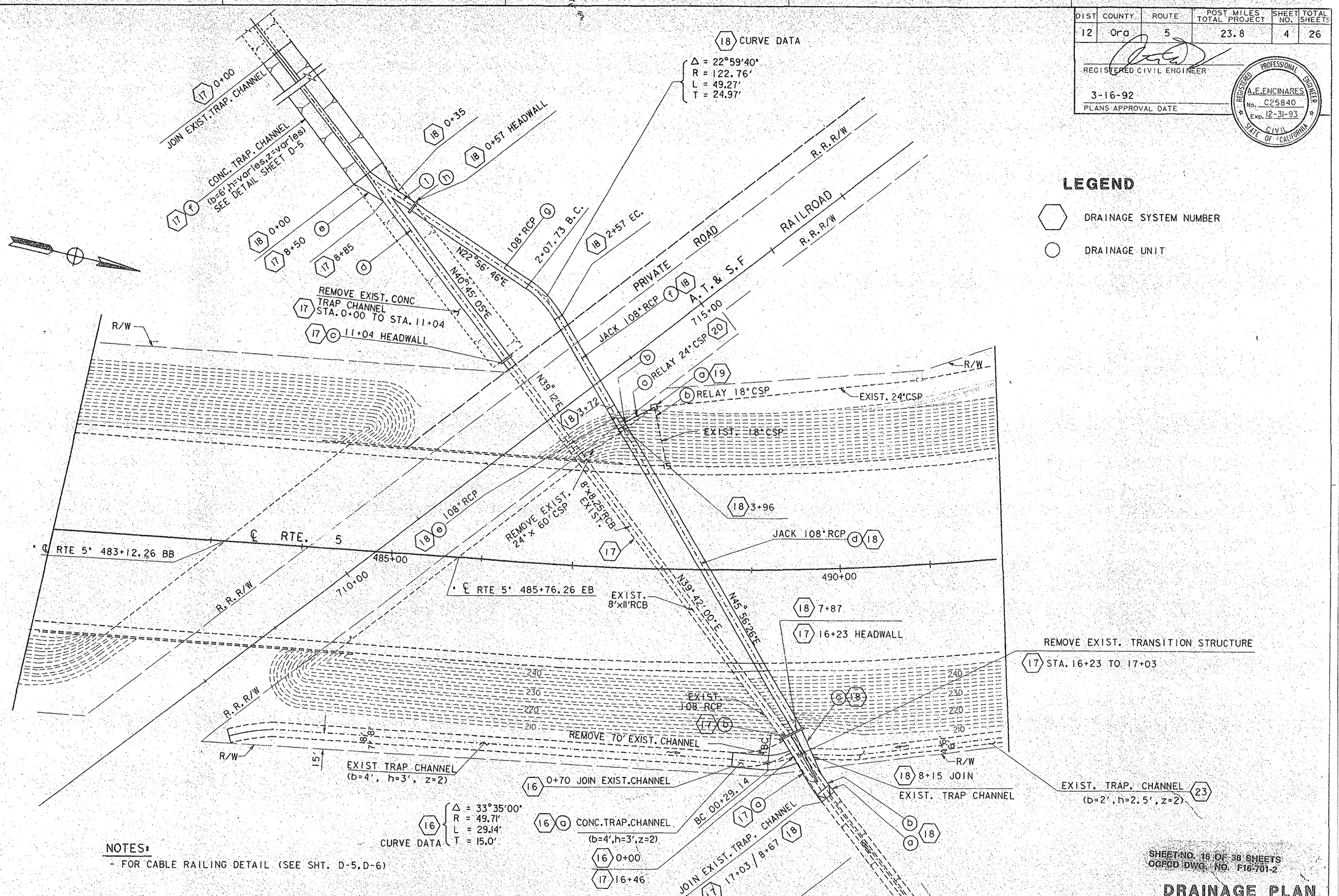
DESIGNED	CHECKED	DATE	DESIGN ENGINEER	DATE	APPROVAL RECOMMENDED BY
PRINCIPAL ENGINEER			B. RABBITT		

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	5	23.8	4	26

REGISTERED CIVIL ENGINEER

3-16-92
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
A.E. ENCINARES
No. C25840
Exp. 12-31-93
CIVIL
STATE OF CALIFORNIA



LEGEND

- DRAINAGE SYSTEM NUMBER
- DRAINAGE UNIT

NOTES:
- FOR CABLE RAILING DETAIL (SEE SHT. D-5, D-6)

SHEET NO. 16 OF 38 SHEETS
OCFCD DWG. NO. F16-701-2

DRAINAGE PLAN

SCALE: 1" = 50'

D-1

THIS PLAN ACCURATE FOR DRAINAGE ONLY.

DATE	REVISED BY	DATE REVISED

CALCULATED/DESIGNED BY
CHECKED BY

PROJECT ENGINEER A.E. ENCINARES

STATE OF CALIFORNIA / DEPARTMENT OF TRANSPORTATION
HYDRAULICS

Caltrans

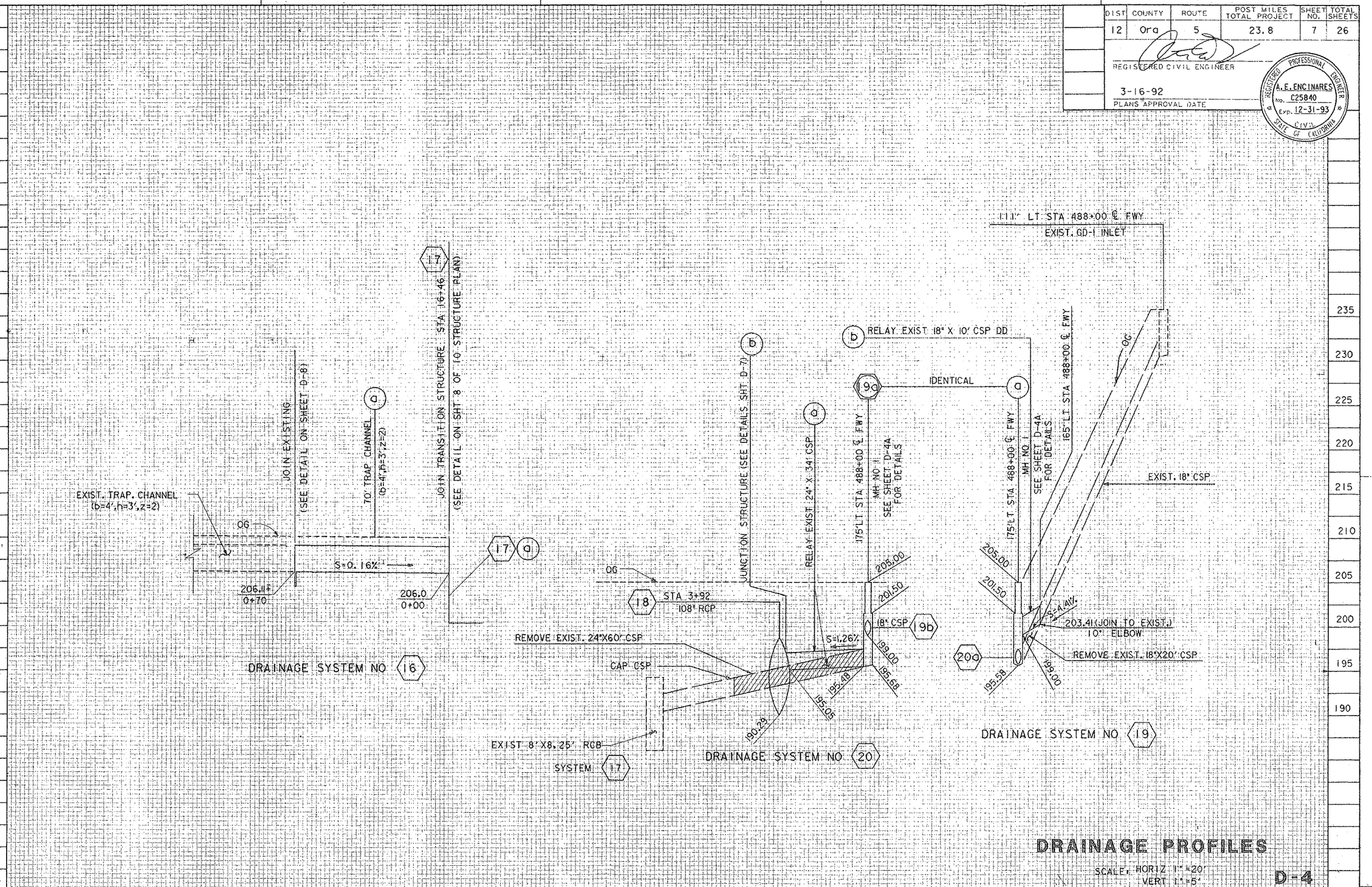
26 - 38 F16-701-2

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	5	23.8	7	26

REGISTERED CIVIL ENGINEER

3-16-92
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
A.E. ENCINARES
No. C25840
Exp. 12-31-93
CIVIL
STATE OF CALIFORNIA



DRAINAGE PROFILES

SCALE: HORIZ 1" = 20'
VERT 1" = 5'

D-4

SHEET NO. 19 OF 38 SHEETS
OCFCD DWG. NO. F16-701-2

DATE	REVISED BY	DATE REVISED

CALCULATED/DESIGNED BY
CHECKED BY

PROJECT ENGINEER, A. E. ANCINARES

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
HYDRAULIC

29 38 F16-701

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3

CU 2209 | EA 016101

LAST REVISION

SAN DIEGO CREEK
FLOOD CONTROL
MASTER PLAN

Amendment to
PA 51

Amendment to Marshburn Watershed

PREPARED BY:
RBF Consulting

PREPARED FOR:
Heritage Fields El Toro, LLC
Orange County Great Park Corporation

SAN DIEGO CREEK
FLOOD CONTROL MASTER PLAN

AMENDMENT TO PA 51 MARSHBURN WATERSHED
Orange County, California

Prepared For:

HERITAGE FIELDS EL TORO, LLC
25 Enterprise
Aliso Viejo, CA 92656

CITY OF IRVINE
ORANGE COUNTY GREAT PARK CORPORATION
1 Civic Center Plaza
Irvine, CA 92623

APPROVED
CITY OF IRVINE
SEP 08 2011
ALL REVISIONS MUST RECEIVE CITY APPROVAL PRIOR TO CONSTRUCTION

Consultants:

RBF CONSULTING
14725 Alton Parkway
Irvine, California 92618

RBF CONSULTING

Contact: John McCarthy, P.E.,
Rebecca Kinney, P.E., Lindsey Woehlk, P.E.

Approved: November, 2008
Amendment submitted August 4, 2011
JN 10-105697

FLOOD CONTROL MASTER PLAN
SAN DIEGO CREEK

PA 51
AMENDMENT TO MARSHBURN WATERSHED

Prepared by:

RBF CONSULTING
14725 Alton Parkway
Irvine, California 92618

Project Manager: _____
John McCarthy, PE

Project Engineer: _____
Rebecca Kinney, PE

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Exhibit C. Original Flood Control Master Plan for San Diego Creek Hydrology Map
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Exhibit E Approved Marshburn Retarding Basin Hydrology Map
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B Marshburn Retarding Basin Update- Loss Rates and Basin Rating Tables

C Marshburn Retarding Basin Update - Unit Hydrograph Analysis

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M Drainage Report for Marshburn Wash Channel, Upstream of Irvine Center Drive, Downstream of I-5, by David Evans and Associates

N Marshburn Channel As-Built Plans

O "Preliminary Hydrology Report Supporting the EIR and Zone Change for Planning Area 40", by Stantec, dated August 2007 Land Use Map

P Marshburn Retarding Basin Interim Condition, Assuming Cascading of Subareas13A and 14A Bypassing Marshburn Retarding Basin

Q WSPG Hydraulic Analysis for Marshburn Channel with Updated Design Discharges.

R Southern California Association of Governments- Land Use Plan

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1.0 INTRODUCTION

This study investigates the impacts of the ultimate condition improvements to the City of Irvine Planning Area 51 (PA 51) within the Marshburn Channel Watershed on the "Flood Control Master Plan for San Diego Creek" (FCMPSDC). See Figure 1-1 for the regional location map. The FCMPSDC was prepared in April 1989 by John M. Tettemer & Associates, Ltd. The purpose of this report is to:

1. Update design discharges for the Marshburn Watershed area with the highest potential land use.
2. Identify potential impacts and mitigation with the site development
3. Establish ultimate condition drainage patterns
4. Recommend backbone infrastructure improvements
5. Identify future ownership of the backbone facilities.

An Update to PA 51 Marshburn Channel was approved by the County of Orange and City of Irvine, on November 2008. This report is intended to update that approval.

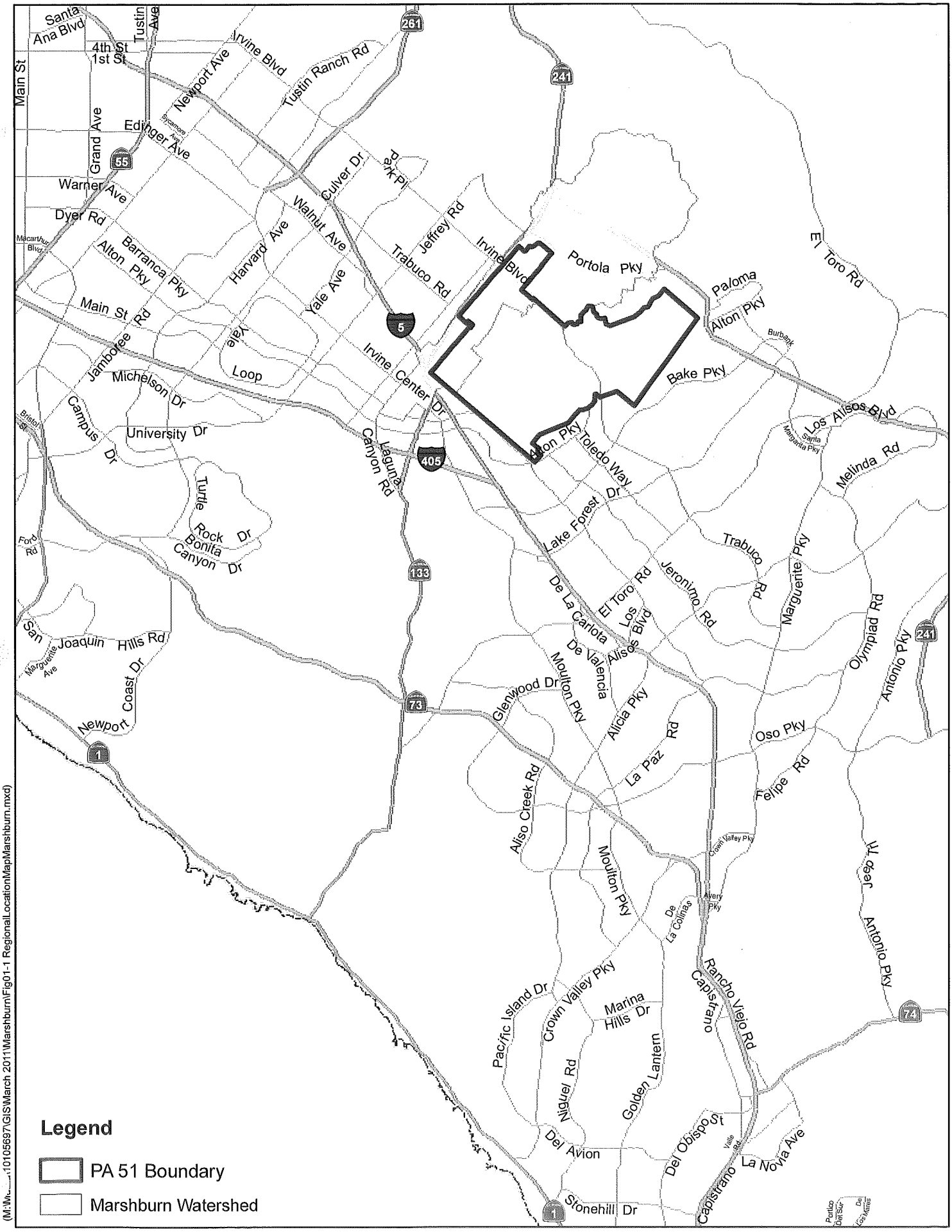
As part of the update to that approval, this report was reviewed by both the County of Orange and the City of Irvine. The City is the lead agency in the environmental documentation for the project. This report has been prepared to satisfy the *Final Program Environmental Impact Report (FPIER) for the Orange County Great Park SCH # 2002101020 certified on May 27, 2003 by Irvine City Council Resolution No. 03-60* Mitigation Measure H/WQ 3 which states:

> Prior to approval of the first tentative tract or parcel map in the project area, detailed hydrology studies and hydraulic analysis shall be conducted. Studies and analysis shall be prepared in accordance with OCFCD methodologies and standards and the Flood Control Master Plan for San Diego Creek, as well as any additional guidelines in effect at the time of the project design. Recommendations contained in the hydrology studies and/or hydraulic analysis to address drainage/flooding issues related to proposed development shall be implemented. Compliance with this measure shall be verified by the Community Development Department.

The City, as the lead agency, shall be responsible for ensuring that other EIR requirements, including, but not limited to, local drainage hydrology, hydraulics, and mitigation related analyses, water quality ordinance compliance, and other regulatory conditions are satisfied. This shall include verification of compliance for each hydrology and water quality related mitigation measure during each applicable phase of development.

1.1 Background

The former El Toro property encompasses approximately 4,600 acres within the City of Irvine. The former base will be redeveloped by two separate entities. Heritage Fields El Toro, LLC will be developing Great Park Neighborhoods, which consists of separate districts surrounding the Orange County Great Park (OCGP). District 1 North, 1 South and District 4, formerly the Life Long Learning District (LLD), District 7, formerly the Park District (PD), and District 6 formerly the Transit Oriented Development District (TOD) include residential, commercial, and mixed land uses, and encompass approximately 2,260 acres. The Orange County Great Park Corporation/City of Irvine will be developing the central portion of the site known as The Orange County Great Park encompassing approximately 1,120 acres. In addition, approximately 900 acres of the northeastern portion of the El Toro property will remain undeveloped as part of the Natural Community Conservation Planning



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RBF CONSULTING GIS

0 2 4 Miles

PA 51

Regional Location Map

Figure 1-1

(NCCP) reserve, and approximately 100 acres in the southern portion will be developed by the County of Orange. Figure 1-2: District Plan shows the approximate locations of the different development areas. Figure 1-3 shows the land use plan, which is the basis of the hydrology impact analysis.

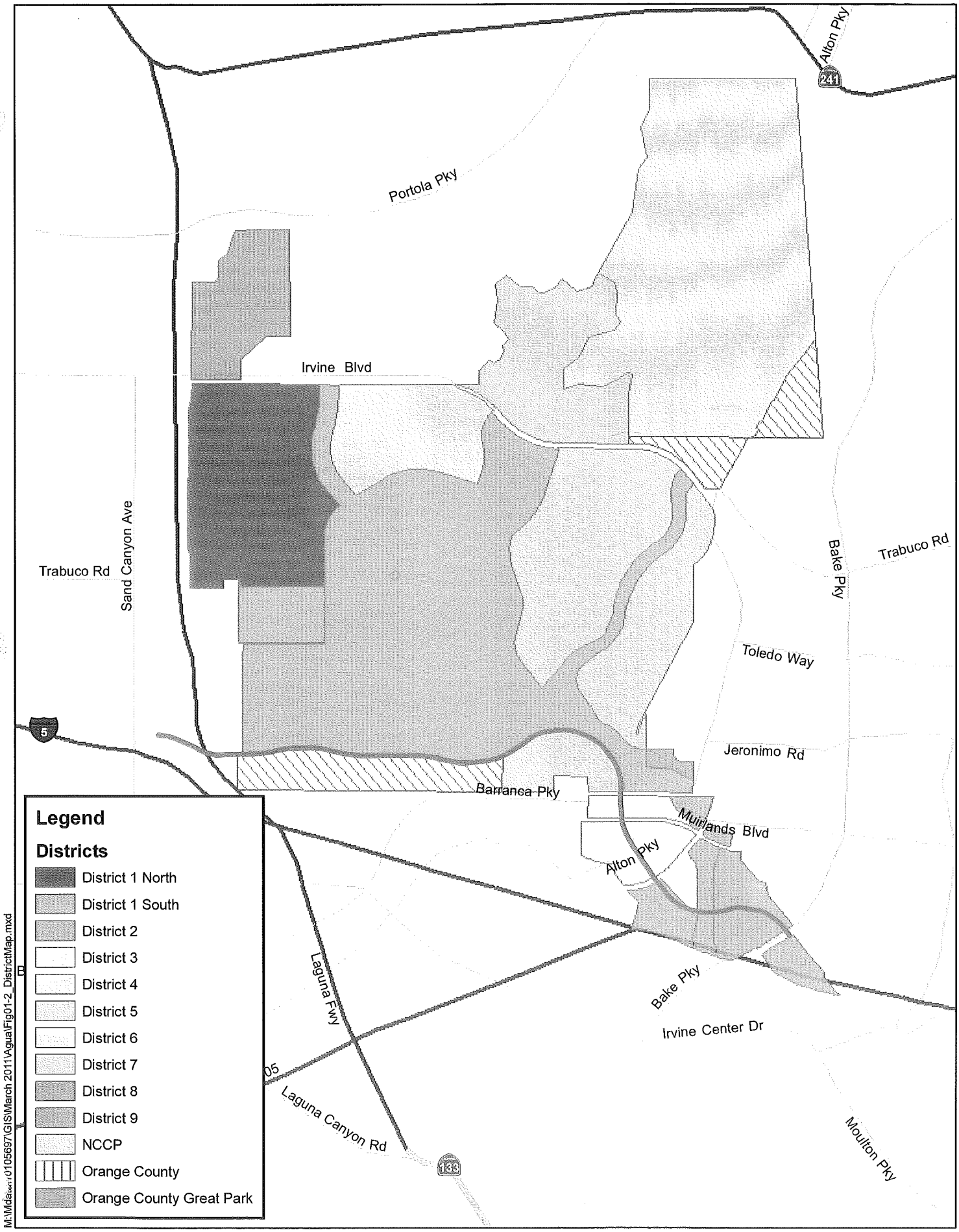
1.2 Description of Study Area

The Marshburn Retarding Basin and Channel receive a significant amount of off-site runoff. The majority of the off-site runoff originates in the foothills of the Santiago Mountains, which drain south and southwest toward PA 51. The foothills of the Santiago Mountains consist of several canyon regions that concentrate runoff and drain directly into the Marshburn Retarding Basin and outlet into the Marshburn Channel. Within the Marshburn Watershed there are three debris and detention basins, Bee Canyon, Round Canyon and Marshburn. The discharge from Bee and Round Canyons contribute flows to the Marshburn Retarding Basin, located east of State Route (SR) 133 and north of Irvine Boulevard. The Marshburn Retarding Basin hydrology upstream of the basin has been revised since the 1989 FCMPSDC was adopted. The most recent revision was prepared as part of the "Basis of Design to Marshburn Retarding Basin", by RBF Consulting, dated August 12, 2005.

This report presents the revisions to the drainage patterns and land uses resulting from the proposed PA 51 (Subareas 13A and 14A) development within the Marshburn Watershed. Approximately 155 acres of PA 51 drains directly into Marshburn Retarding Basin north of Irvine Boulevard. Land use within subareas 13A and 14A were revised from 5-7 dwelling units per acre (Approved Basis of Design to Marshburn Retarding Basin", by RBF Consulting, dated August 12, 2005) to 8-10 dwelling units per acre to reflect the highest potential density land use. Additionally, the proposed tentative tract map for District 8 and supporting hydrology create a storm drain system that conveys 100-yr flows from this subarea to the existing pipe tributary to Marshburn Basin. Discharge from Marshburn Retarding Basin is conveyed via Marshburn Channel adjacent to the western portion of the Heritage Fields development. The flows from Marshburn Channel are ultimately conveyed to San Diego Creek. The existing San Diego Creek storm drain facilities have been constructed for the ultimate watershed build out condition based on both the approved FCMPSDC and the Marshburn Retarding Basin Update.

Runoff from a 83 acre area was redirected from the Marshburn Channel Watershed to the Bee Canyon Watershed. The areas involved were taken from the original FCMPSDC subareas 30B, 31A and 31B (District 1 North and South) and conveyed into 24A of the Bee Canyon Watershed (Drainage Area L), Exhibit C. The diversion became possible due to the closure of the existing diversion structure at Irvine Boulevard that conveys the upper reaches of the Bee Canyon Watershed to Marshburn Retarding Basin resulting in an under utilized facility at Bee Canyon. Approximately 282 acres from subarea 24A, and its runoff, was then redirected from Bee Canyon Watershed towards Agua Chinon. The OCGP area is now tributary to the Agua Chinon Watershed at its downstream connection point along Agua Chinon Channel.

As a result of these boundary adjustments, the report evaluates impacts to the Marshburn Watershed, the downstream San Diego Creek Channel and evaluates changes at specific nodes within the FCMPSDC. Intermediate nodes were established to verify discharges with the flow rates on the "As-Built Plans", Appendix N. Table 1-1 describes the nodes.



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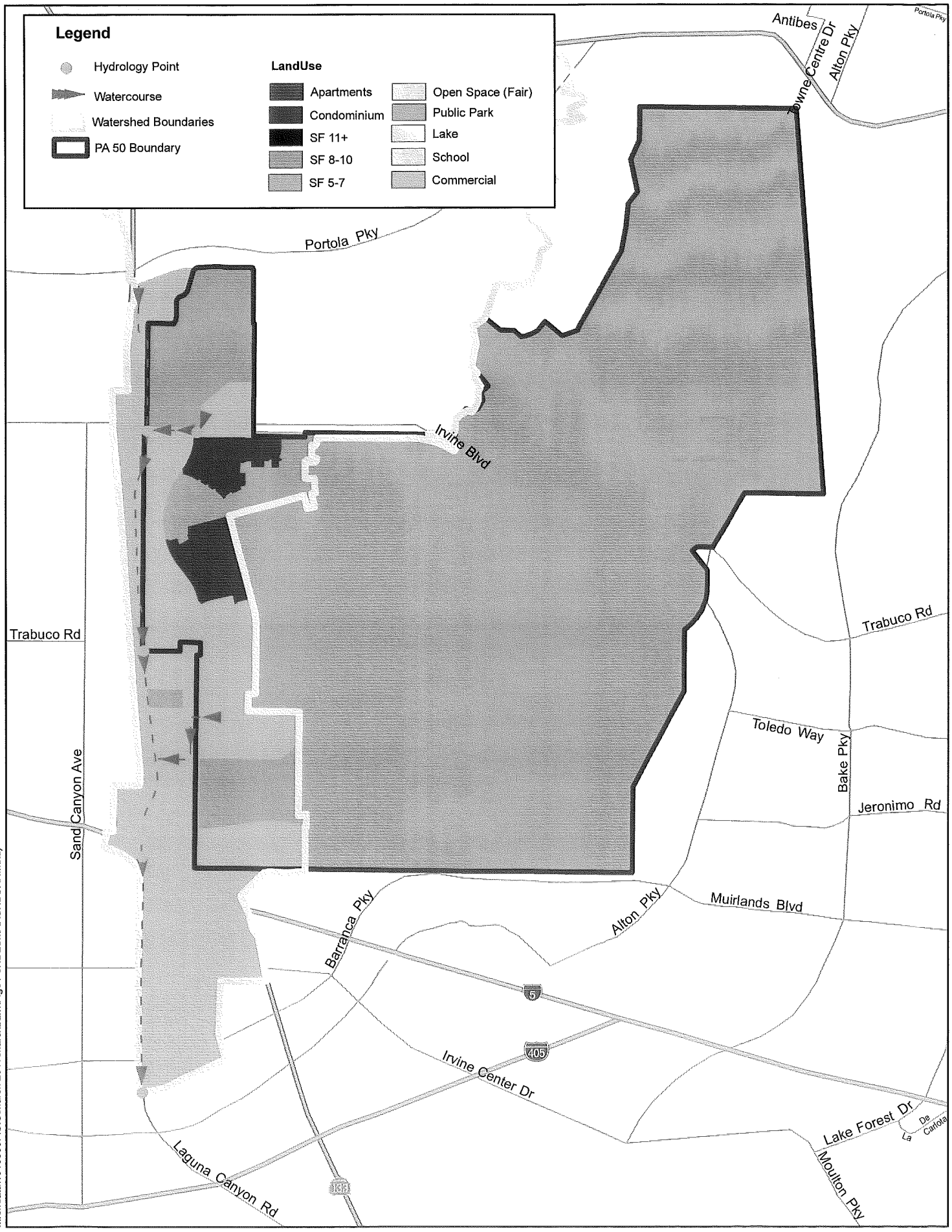
PA 51
FLOOD CONTROL MASTER PLAN UPDATE
District Plan

Figure 1-2



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0 3,000 6,000 Feet

PA 50

Flood Control Master Plan Update

Land Use Plan

Figure 1-3

Table 1-1: Hydrology Nodes		
Node (Exhibits A & B)	**FCMPSDC Sub-Watershed**	**Location**
78	C	Marshburn Retarding Basin Outlet
93/ CP 4C	C	Irvine Boulevard and Marshburn Channel
95	C	Trabuco Road and Marshburn Channel
96	C	Marine Way and Marshburn Channel
97	C	I-5 and Marshburn Channel
100/ CP 5C	C	Upstream of confluence with San Diego Creek
5D	A, B, C, D, L, M	Downstream of Confluence with San Diego Creek

1.3 Previous Studies and Agreements

Several previous studies and agreements have been prepared for the study area. They include:

1. PA 51 Marshburn Watershed Update by RBF Consulting Approved November, 2008
2. San Diego Creek Flood Control Master Plan by John M. Tettemer & Associates dated 1989.
3. Agreement No. D04-017 between the OCFCD, the City of Irvine and The Irvine Company dated March 8, 2005.
4. Basis of Design for Marshburn Channel by RBF Consulting dated August 12, 2005.
5. "Drainage Design Report for the Construction of The Marshburn Channel 100-Year Improvements Upstream of Irvine Center Drive, Downstream of I-5 Freeway (Sta. 73+33 to Sta. 95+05), January 12, 1998, David Evans and Associates, Inc.

2.0 HYDROLOGY METHODOLOGY

The Marshburn Watershed is divided into an upper and lower watershed. The upper watershed contains the upper reaches of Marshburn Channel, PA 51 (Subarea 30A, FCMPSDC), Bee Canyon and Round Canyon and drains into the Marshburn Retarding Basin. The Marshburn Retarding Basin discharges into Marshburn Channel. The lower watershed begins just downstream of the Marshburn Retarding Basin at Marshburn Channel and terminates at San Diego Creek. This report focuses on using the highest potential density land use revision for subareas 13A and 14A, tributary to the Marshburn Retarding Basin, and the lower watershed which is tributary to the Marshburn Channel. Flowrates for concentration points from the Marshburn Retarding Basin Update and FCMPSDC were evaluated by updating the watershed hydrology.

All FCMPSDC computations have been updated to a 5-minute time interval, in accordance with the current guidelines of the 1986 Orange County Hydrology Manual. Figure 2-1 shows the location of the watersheds on an aerial photograph of the area.

The methods and analysis used in the hydrology calculations are in conformance with the procedures outlined in the Orange County Hydrology Manual, and are summarized below.

2.1 Times of Concentration

The rational method was used to compute Time of Concentration (Tc) for each of the subareas in accordance with the Hydrology Manual. The 2004 Advanced Engineering Software (AES) computer program RATSCx was used for the rational method calculations. Subarea boundaries and flow paths are illustrated on the Marshburn Ultimate Condition Topographic Hydrology Map, *Exhibit A* and Marshburn Ultimate Condition Aerial Hydrology Map, *Exhibit B.* Please refer to Rational Method which can be found in Appendix A for Marshburn Retarding Basin, and Appendices D & E for Marshburn Channel.

The existing Marshburn Retarding Basin was coded into the lower Marshburn Channel Rational Method as a user defined input (code 7). The time of concentration for the basin (code 7) was manually input into the Rational Method to match the downstream time of concentration.

A sensitivity analysis was performed for the watershed below the Marshburn Basin to ensure that the initial area used in the analysis would produce the highest flow. Two separate analyses were performed; one starting at node 90.1, and the other 95.1. The times of concentration were taken from the complex rational method, below the Marshburn Retarding Basin. The peak flow at Node 95.6 was 1,167 cfs using a lag time strictly for Node 90.1, compared to a flow rate of 1,164 cfs starting at Node 95.1. Therefore, the lag times starting at Node 90.1 were used for the development of the downstream hydrographs. This detailed analysis can be found in Appendix L.

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FIGURE 2-1

PA 51
FLOOD CONTROL MASTER PLAN UPDATE
Marshburn Channel Watershed
Aerial Map

0 750 1,500
Feet

Source: Eagle Aerial 2007

Legend

- Hydrology Node
- Watercourse
- Watershed Boundary
- PA 51 Boundary
- PA 40 (TIC)

2.2 Loss Rates

The maximum loss rate (Fm) and the low loss rate fraction (Y-bar) were computed for each subarea using watershed data and the formulas from the Hydrology Manual. The watershed data consists of the hydrologic soil type maps from the Hydrology Manual along with the highest potential density land use plan. The PA 40 development adjacent to the Marshburn Channel is part of The Irvine Company's (TIC) future development. The assumed land use was taken from the "Preliminary Hydrology Report Supporting the EIR and Zone Change for Planning Area 40", by Stantec, dated August 2007, which can be found in Appendix O. This report assumes a majority of the site to be commercial with an area of park. The areas north of Irvine Boulevard were taken from the "Basis of Design to Marshburn Retarding Basin", dated August 12, 2005, by RBF Consulting. Subareas 13A and 14A land use has been revised to reflect 8-10 dwelling units per acre (highest potential density land use), rather than the 5-7 dwelling units per acre density (approved Basis of Design to Marshburn Retarding Basin", by RBF Consulting, dated August 12, 2005) used in the previous reports. Land uses for Districts 1 North, 1 South, and District 4 were based on detailed rational hydrology maps provided for the proposed Vesting Tentative Maps. For this updated analysis, large subareas were assigned a land use based on approximating the area average pervious area (Ap) from the detailed analysis. The generalized land use resulted in a slightly lower Ap (more impervious surface) value to conservatively approximate the detailed proposed design. Land uses below Irvine Boulevard have been revised to reflect 5-7 dwelling units per acre, commercial, and condominium (highest potential density land use) rather than mostly 8-10 dwelling units per acre density. Figures 2-2 and 2-3 show the focused area soil types and land uses used in the hydrology analysis. Detailed loss rates calculations can be found in Appendix B and F for Marshburn Retarding Basin and Channel, respectively. The offsite land use was taken from "Southern California Association of Governments", Appendix R.

2.3 S-Graph

The Orange County Valley developed S-graph was used in computing hydrographs for the subareas in the AES Floodx model.

2.4 Hydrograph Generation

The unit hydrograph analysis for the Marshburn Watershed was prepared with the above design parameters: time of concentration, loss rate and S-Graph. This information was input into the AES Floodx computer program. This is consistent with the previously approved "Basis of Design to Marshburn Retarding Basin", by RBF Consulting, dated August 12, 2005. The 100-year high confidence flow rates for the various concentration points along the Marshburn Channel were computed based on the depth area factors for the watershed area contributing to the concentration point. These user generated concentration points were used to compare with "As-Built" plans and the original FCMPSDC to ensure that flows do not exceed the capacity of the existing storm drain systems. A schematic to help describe the AES Floodx modeling procedure is shown in Figure 2-4.

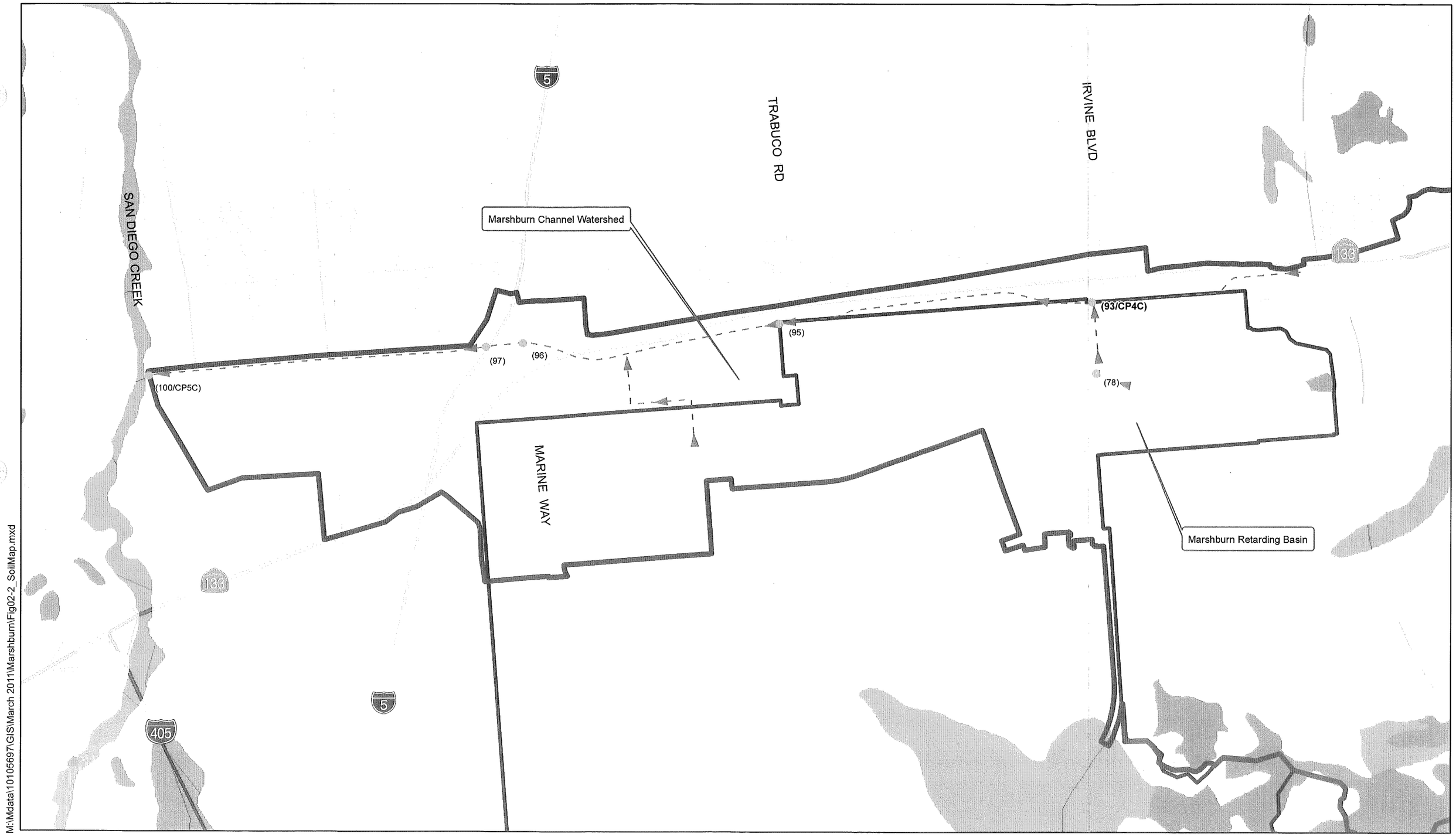

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FIGURE 2-2

PA 51
FLOOD CONTROL MASTER PLAN UPDATE
Marshburn Channel Watershed: Hydrologic Soils Types
Soils Map

0 750 1,500
Feet

Source: Eagle Aerial 2007

Legend
- Hydrology Node
- Watercourse
- Watershed Boundary
- PA 51 Boundary

Soil Type
- A
- B
- C
- D

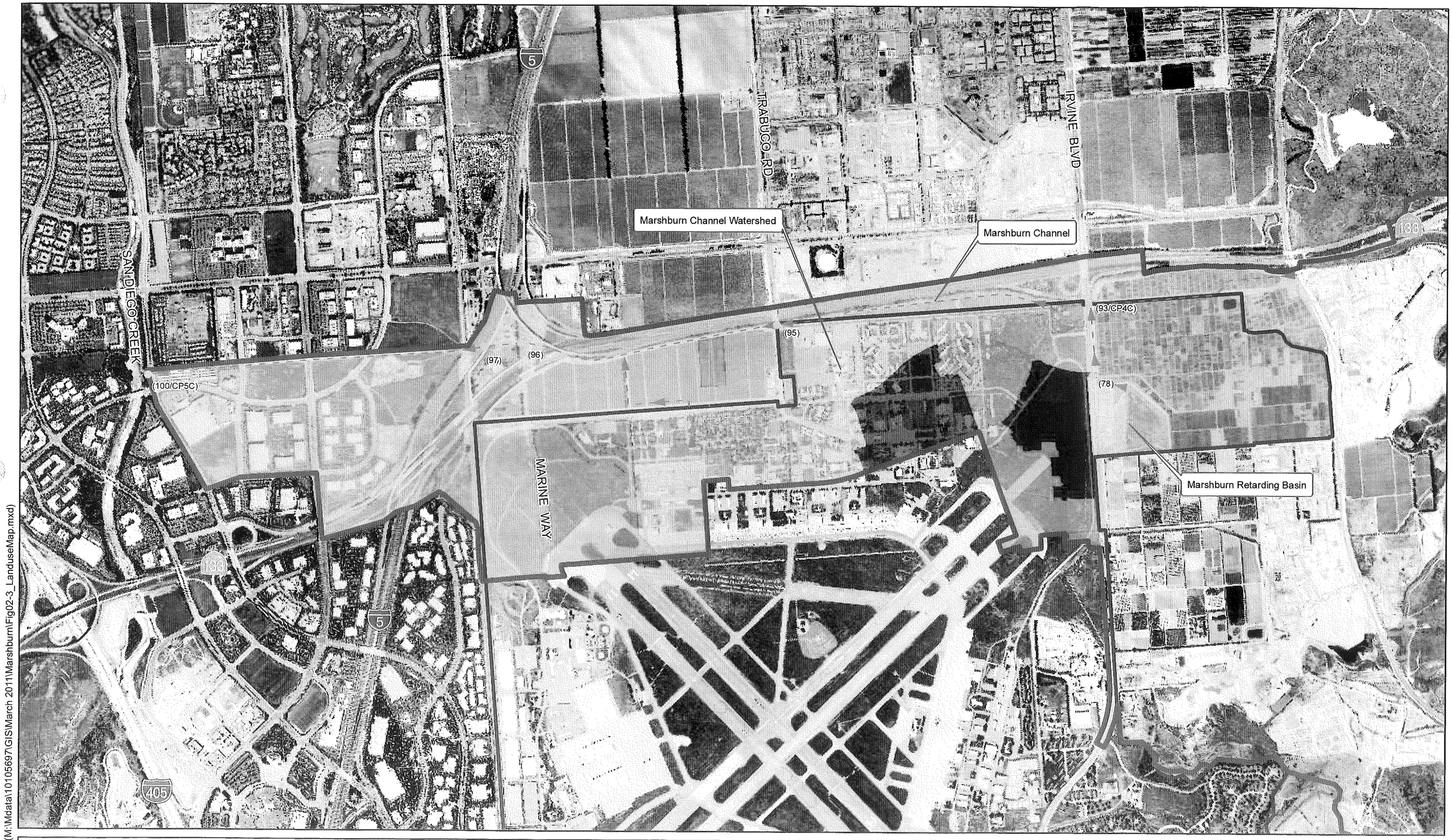

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FIGURE 2-3

PA 51
FLOOD CONTROL MASTER PLAN UPDATE
Marshburn Channel Watershed
Land Use Map

0 800 1,600
Feet

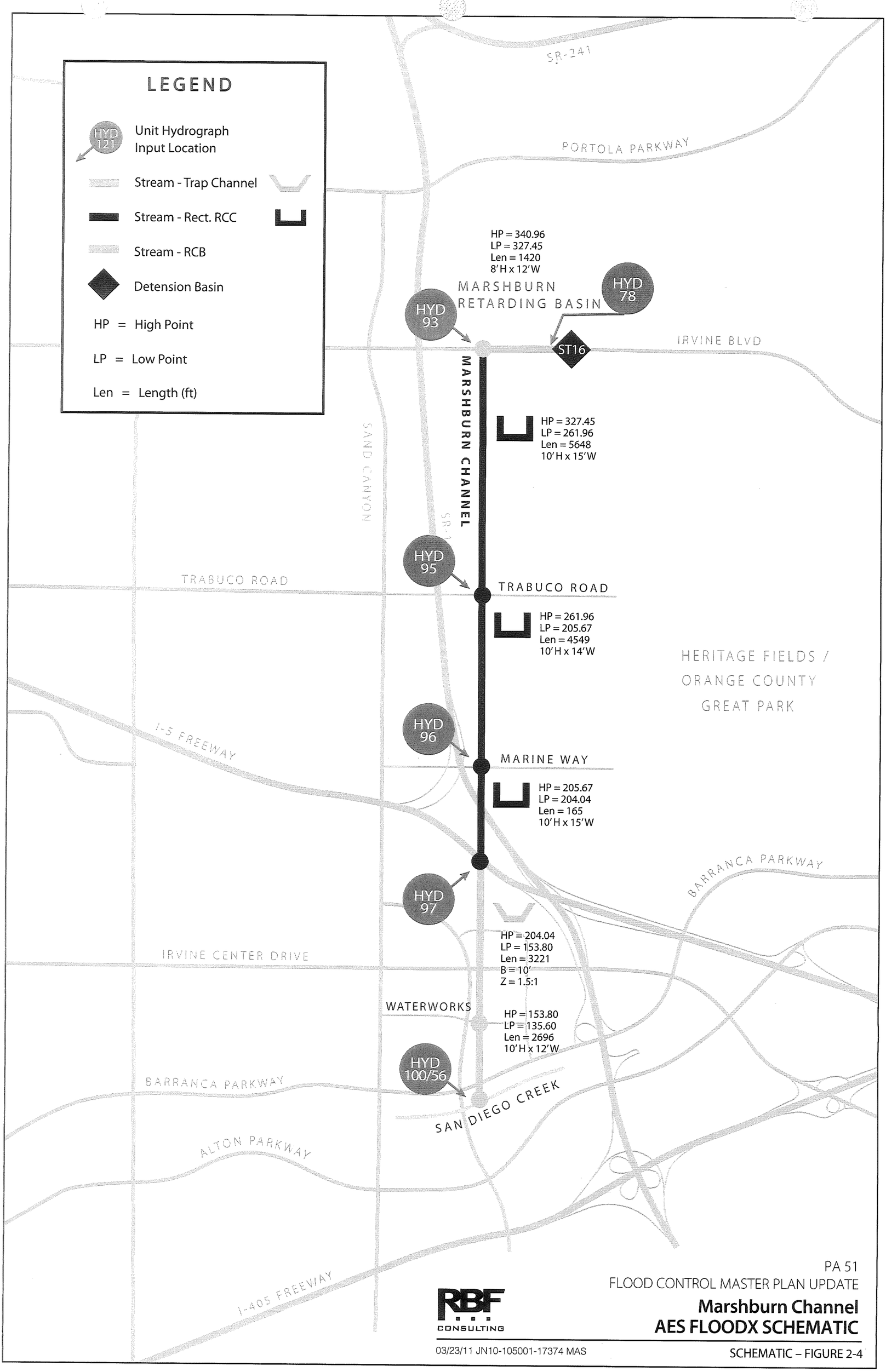
Source: Eagle Aerial 2007

Legend

- Hydrology Node
- Watercourse
- Watershed Boundary
- PA 51 Boundary
- PA 40 (TIC)

LandUse

- Apartments
- Condominium
- SF 11+
- SF 8-10
- SF 5-7
- Open Space (Fair)
- Public Park
- Lake
- School
- Commercial



PA 51
FLOOD CONTROL MASTER PLAN UPDATE

Marshburn Channel
AES FLOODX SCHEMATIC

RBF CONSULTING

03/23/11 JN10-105001-17374 MAS

SCHEMATIC – FIGURE 2-4

2.5 Depth-Area Reduction Factors

Average storm rainfall intensity tends to decrease as the size of the tributary watershed increases. Depth-area factors were used to reduce the rainfall to account for this in accordance with the OC Hydrology Manual procedures. Since the tributary area is different at each of the concentration points, the AES Floodx models were analyzed for each concentration point adjusting the depth-area factors for the particular concentration point. The hydrograph and peak discharge are accurate only for the particular point for which the model was processed. Table 2-1 show the total tributary area for each concentration point, which was used to calculate the depth-area reduction factors in the AES Floodx models.

Table 2-1: Total Tributary Area for Depth Area Reduction Factors

Location	Concentration Point	Total Tributary Area (Ac.)
Marshburn Retarding Basin	78	3,627
Marshburn/ Irvine Blvd.	93	3,711
Marshburn/ Trabuco Rd.	95	4,100
Marshburn/ Marine Way	96	4,526
Marshburn/ I-5	97	4,620
Marshburn/ San Diego Creek.	100/ 5C	4,908
San Diego Creek, downstream of Marshburn Channel Watershed	5D	27,046*

*Note that this was run with the DAR at CP 6D (upstream of Peters Canyon Channel) to compare with results in the Original Master Plan

2.6 Channel Routing Procedure

The AES Floodx computer program uses the convex method for channel routing recommended in the Hydrology Manual. Parameters for the convex method were established in the previously approved "Basis of Design to Marshburn Retarding Basin", by RBF Consulting, dated August 12, 2005. This study is based on the same AES Floodx models from the update, and therefore, prepared using the convex routing parameters. This is to maintain consistency with the previously approved studies. The results of the analysis were reviewed to ensure that the routing provided reasonable results. Table 2-2 describes the routing parameters used in the AES Floodx analysis. Copies of the As-Built plans for Marshburn Channel can be found in Appendix N.

Table 2-2: AES Floodx Convex Routing Parameters					
Reach	Upstream Elev.	Downstream Elev.	Length (ft.)	Manning's n	Channel Description
78 to 93	340.96	327.45	1,420	0.014	8' x 12' RCB
93 to 95	327.45	261.96	5,648	0.014	10' x 15' Rect. Channel
95 to 96	261.96	205.69	4,549	0.014	10' x 14' Rect. Channel
96 to 97	205.69	204.04	165	0.014	10' x 15' Rect. Channel
97 to 98	204.04	166.69	2,146	0.015	Trap Channel, B= 10, Z= 1.5:1
98 to 99	166.69	153.80	1,075	0.015	Trap Channel, B= 10, Z= 1.5:1
99 to 100	153.80	135.60	2,696	0.014	10' x 12' RCB

2.7 *Hydrology Discussion*

The assumptions used for this update of the Marshburn Watershed generally use the same assumptions and methodology in the FCMPSDC and the "Basis of Design to Marshburn Retarding Basin", by RBF Consulting, dated August 12, 2005. Where the most current or detailed data was available, it was used in developing subarea parameters. The modifications to the previous master plans are summarized below.

1. The "Basis of Design to Marshburn Retarding Basin", by RBF Consulting, dated August 12, 2005 has a higher tributary area than the original FCMPSDC. The original FCMPSDC has a tributary area of 5.57 sq. mi. and the approved update has a 5.66 sq. mi. This difference was attributed to the detailed topographic mapping provided for the Marshburn Retarding Basin Update.
2. Subareas 13A and 14A from the "Basis of Design to Marshburn Retarding Basin", by RBF Consulting, dated August 12, 2005 has been revised to reflect a highest potential land use of 8-10 dwelling units per acre.
3. Subareas 6E-16E land uses have been modified to reflect the highest potential land use based on proposed Vesting Tentative Maps for Districts 1 North, 1 South, and District 4.
4. The PA 51 land use has been revised to reflect the highest potential density land use for the area.
5. The watershed boundary with PA 51 south of Irvine Boulevard has been revised to balance the runoff between Bee Canyon and the Marshburn Channel.
6. The total tributary area for FCMPSDC subareas 31A and 31B is higher than the original FCMPSDC, even though 83 acres has been directed over to the Bee Canyon watershed. This can be attributed to the more detailed topography and boundary mapping, and additional tributary area from SR 133. SR 133 was constructed after the original FCMPSDC and much of this area just north of Irvine Boulevard is designed to drain into Marshburn Channel at I-5.
7. The tributary area and impervious values have been compared between the original FCMPSDC and the updated Marshburn Channel. A weighted percent impervious has been calculated for the four major confluence points.

Table 2-3: Percent Impervious Comparison for Marshburn Channel		
	Original FCMPSDC	Updated Marshburn

				Channel	
FCMPSDC Subarea	**Marshburn Channel Confluence with:**	**Area (sq. mi.)**	**Weighted % IMP**	**Area (sq. mi.)**	**Weighted % IMP (1)**
30C	Irvine Blvd.	0.10	45/ 65 (2)	0.13	72
30B	Trabuco Rd.	0.75	52	0.61	74
31A & 31B	I-5	0.75	67	0.81	76
31C & 32A	San Diego Creek	0.44	55	0.45	90

Note (1) Weighted % IMP taken from Rational Method, Ap.
Note (2) 45 % taken from Original FCMPSDC and 65% taken from "Basis of Design to Marshburn Retarding Basin", by RBF Consulting, dated August 12, 2005 for 5- 7 dwelling per acre.

At Irvine Boulevard the change in the percent impervious from 65% (5- 7 dwellings per acre) from the "Basis of Design to Marshburn Retarding Basin", by RBF Consulting, dated August 12, 2005 to 72%, can be attributed to the development of the PA 51 and the highest potential density land use of 8-10 dwellings per acre.

At Trabuco Road within Districts 1 North and South and its higher potential density of single family homes (5-7 dwellings per acre), commercial and condos resulted in a 74% impervious value, compared to the 52% of the original FCMPSDC.

The I-5 concentration point which incorporates the Great Park Neighborhoods, PA 40 (from The Irvine Company) and the PA 51 development land uses, provided a 76% impervious value. This is higher than the original master plan of 67% impervious.

San Diego Creek incorporates the existing development downstream of the project and provides a 90% impervious value compared to the 55% from the original FCMPSDC. The combined impervious value is higher at the CP 5C, but this is due to the existing development downstream of PA 51, which is predominately commercial, compared to the estimated land use in the original master plan.

Single area, Free-draining and Complex Unit Hydrograph models were developed per the Orange County Hydrology Manual. A complex free draining model was also developed downstream of the Marshburn Retarding Basin.

Single area, free-draining and complex unit hydrograph models were necessary to assess the impacts that the Marshburn Retarding Basin will have on the peak discharges in the Marshburn Channel. The free draining models were compared with the single area models to assess the need for calibration as required in the Orange County Hydrology Manual, and calibrations were not necessary. The complex free draining models had a larger discharge than the single area models.

3.0 HYDROLOGY RESULTS

3.1 *Marshburn Retarding Basin*

The results of the revised land use in subareas 13A and 14A to 8-10 dwelling units per acre (per the highest potential density land use plan) has increased the Marshburn Retarding Basin inflow, outflow and water surface elevation. These revised subareas are adjacent to the basin and had a minor effect on the overall hydraulics of the basin. The following table compares the approved "Basis of Design to Marshburn Retarding Basin", by RBF Consulting, dated August 12, 2005 with the proposed update.

Table 3-1: Marshburn Retarding Basin Revision Summary Table

	Approved Marshburn Retarding Basin Report, August 12, 2005		Marshburn Retarding Basin Land Use Revised	
	Unplugged Outlet	**Plugged Outlet**	**Unplugged Outlet**	**Plugged Outlet**
Inflow (cfs)	4,261	4,261	4,267	4,267
Outflow (cfs)	843	799	846	793
Max WSEL (ft.)	365.9	367.4	366.1	367.6
Freeboard (ft.)	3.0	1.5	2.8	1.3

The land use revision for subareas 13A and 14A resulted in a minor change to the hydrology and the effects to the basin are considered minimal. The total inflow and outflow has increased by 6 cfs and 3 cfs, or less than 1 percent, by using the highest potential density land use. The basin still provides the regional freeboard with the proposed revisions.

3.2 *Marshburn Watershed*

A complex flood routing model was necessary for the Marshburn Watershed due to the presence of three basins. Comparison of the watershed models tributary to the Marshburn Retarding Basin was analyzed as part of the previous updated study. This report includes a comparison of the watershed models for the Marshburn Retarding Basin to the San Diego Creek confluence. Single area hydrographs were developed to compare with the complex-free draining analysis to make sure the complex-free draining model correctly estimates the design flow rates. The complex-free draining model should have an equal or greater flow than the single area model. For the Marshburn watershed, the complex-free draining model is higher than the single area model for each concentration point. Therefore, no calibration is required for these models. A summary of the comparison is provided in Table 3-2.

Table 3-2: Unit Hydrograph Analysis for Marshburn Watershed						
Concentration Points	**Marshburn Channel Confluence with:**	**Tributary Area (Ac.)**	**Complex Model Free Draining Lag Time (hr.)**	**Complex Model Free Draining Q_{100} (cfs)**	**Single Area Lag Time (hr.)**	**Single Area Q_{100} (cfs)**
78	Marshburn Retarding Basin Outlet	3,627	0.23	7,027	0.34	6,594
93	Irvine Blvd.	3,711	0.214	7,093	0.353	6,613
95	Trabuco Road	4,100	0.252	7,361	0.390	6,660
96	Marine Way	4,526	0.282	7,885	0.420	6,994
97	I-5	4,620	0.283	8,023	0.421	7,119
100/ CP 5C	San Diego Creek	4,908	0.326	7,970	0.461	7,178

The complex model with the basins includes the basin routing for Bee and Round Canyon before routing into the Marshburn Retarding Basin. The following table provides a summary of the Marshburn Channel watershed and comparisons with the original FCMPSDC and the design discharge from the "As-Built" plans.

Table 3-3: Unit Hydrograph Summary					
	Original FCMPSDC		**Updated 100-Year Value**		**As-Built Plans**
Marshburn Channel Concentration Point	**Tributary Area (sq.mi.)**	**Discharge (cfs)**	**Tributary Area (sq.mi.)**	**Discharge (cfs)**	**Discharge (cfs)**
Marshburn Retarding Basin (78)	5.57	---	5.67	846	---
Irvine Blvd. (93/ CP4C)	5.67	1,004	5.80	951/ 1,082 (1)	1,121
Trabuco Road (95)	6.42	1,856 (3)	6.41	1,704 (2)	1,860
Marine Way (96)	---	2,282 (3)	7.07	2,361	2,660
I-5 (97)	---	2,604 (3)	7.22	2,529	2,660
San Diego Creek (100/ CP5C)	7.61	3,031	7.67	2,865	3,232

Note (1) *The UH analysis is 951 cfs, and the other flow rate of 1,082 cfs is based on rational method and the peak discharge from the basin. This design discharge is used to design the Marshburn Channel at Irvine Blvd.*

Note (2) *Design discharge taken from UH analysis, this concentration point downstream of the basin is 473 Ac., less than the 640 Ac. This method was adopted in the previously approved "Basis of Design to Marshburn Retarding Basin", by RBF Consulting, dated August 12, 2005.*

Note (3) *Discharges taken from Original FCMPSDC, Internodal Flow Rate*

The updated flowrates for Marshburn Channel at Irvine Boulevard and Trabuco Road are less than the Original FCMPSDC and the as-built plans. The updated flow rate at Marine Way is higher than the

internodal flow from the original FCMPSDC and less than the As-Built plans. This internodal point was interpolated from the unit hydrographs calculated at CP 4C and CP 5C.

Marshburn Channel at the I-5 and at the San Diego Creek confluence with Marshburn Channel (CP 5C) have lower flows than the original FCMPSDC and As-Built plans. With the proposed update, approximately 83 acres has been directed from the Marshburn Watershed to the Bee Canyon Watershed. The 83 acres were directed from subareas 30B, 31A and 31B into 24A of the Bee Canyon Watershed from the FCMPSDC. The tributary area at Marshburn Retarding Basin and the inclusion of SR 133 has increased the total tributary area, even though 83 acres were directed to the Bee Canyon watershed. The total tributary area from the update and the original FCMPSDC are equal, 7.67 square miles. The updated hydrology for the Bee Canyon Watershed is included in the report titled, "PA 51 and PA 30 Bee Canyon, Agua Chinon, Borrego, Serrano and Upper San Diego Creek" Report, dated October 2, 2008"

A separate AES Floodx analysis was done for the subareas downstream of Marshburn Retarding Basin for an depth area reduction factor without the total tributary area of 5.67 sq. mi. from the basin. The Marshburn Channel with its total tributary area of 2.0 sq. mi. was analyzed and compared with the overall Marshburn Watershed. This resulted in a flow at San Diego Creek to be less than the complex model of the entire watershed. The results of the lower discharge for the Marshburn Channel shows that Marshburn Watershed depth area reduction factor will not greatly effect the Marshburn Channel flows. A detailed depth area reduction factor analysis can be found in Appendix H.

Table 3-4: Depth Area Reduction Comparison

Location	Tributary Area (sq. mi.)	Flow (cfs)
Marshburn Watershed @ Irvine Blvd.	5.80	951
Marshburn Channel Watershed @ Irvine Blvd. (no basin watershed)	0.13	238
Marshburn Watershed @ Trabuco Road	6.41	1,704
Marshburn Channel Watershed @ Trabuco Road (no basin watershed)	0.74	1,177
Marshburn Watershed @ Marine Way Road	7.07	2,361
Marshburn Channel Watershed @ Marine Way (no basin watershed)	1.41	1,982
Marshburn Watershed @ I- 5	7.22	2,529
Marshburn Channel Watershed @ I- 5 (no basin watershed)	1.55	2,173
Marshburn Watershed @ San Diego Creek	7.67	2,865
Marshburn Channel Watershed @ San Diego Creek (no basin watershed)	2.00	2,594

An updated multi-day routing analysis was performed for Marshburn Retarding Basin due to the modifications in land use upstream of the basin. The results of the single day analysis show that the basin did not drain completely in 24 hours. This required a second day analysis, per Orange County Flood Control requirements. The second day analysis results showed a need for a third day analysis. The third day analysis resulted in no change in the water surface depth from the second day event. The following table is a summary of the Marshburn Retarding Basin multi-day storm event analysis and the discharges at the downstream concentration points to San Diego Creek.

Table 3-5: Marshburn Retarding Basin Multi-Day Analysis Summary Table			
	1- Day Storm Event	**2- Day Storm Event**	**3- Day Storm Event**
Un-Plugged			
Discharge (cfs)	846	848	848
Max Height (ft.)	31.09	31.2	31.2
Plugged			
Discharge (cfs)	793	805	805
Max Height (ft.)	32.57	32.6	32.6

Table 3-6: Multi-Day Storm Event Summary			
Location	**1- Day Storm Event (cfs)**	**2- Day Storm Event (cfs)**	**3- Day Storm Event (cfs)**
Marshburn Retarding Basin Outlet (Unplugged)	846	848	848
Marshburn Retarding Basin Outlet (Plugged)	793	805	805
Irvine Blvd.	952	956	956
Trabuco Road	1,704	1,708	1,708
Marine Way	2,361	2,364	2,364
I- 5	2,529	2,532	2,532
San Diego Creek	2,865	2,868	2,868

3.3 San Diego Creek Master Plan

The impacts of the PA 51 redevelopment on San Diego Creek were analyzed at concentration point CP 5D along the San Diego Creek upstream of the confluence at Jeffrey Road. Exhibit C shows the FCMPSDC hydrology map and concentration points. Unit hydrographs from the updated hydrology and detention basin analysis for Bee, Agua Chinon and Borrego watersheds, prepared using AES FloodSCx computer application, were hand-coded into the FCMPSDC HEC-1 model for node 5D. Table 3-7 shows the results of the HEC-1hydrology analysis.

Table 3-7: San Diego Creek Hydrology Comparison		
Concentration Point	**Drainage Area (sq mi)**	**Flowrate (cfs)**

	Updated Model	FCMPSDC Model	Updated Complex Basin Model[1]	FCMPSDC Model
Jeffrey Rd CP 5D	41.50	41.47	17,165[2]	17,275 [2]

[1] Includes Agua Chinon Retarding Basin
[2] Depth Area used from CP 5D was from node CP 6D

The result of the HEC-1 analysis in San Diego Creek downstream of CP 5D with the updated flow rate is less than the FCMPSDC. The HEC-1 model can be found in Appendix K for CP 5D.

4.0 MASTER PLAN OF DRAINAGE FACILITIES

4.1 Proposed Facilities

The proposed onsite storm drain facilities will convey flows from the PA 51 development in accordance with the proposed drainage boundaries, and the drainage patterns in Agreement D04-017 between Irvine Company, City of Irvine and County of Orange. The existing Marshburn Channel is constructed to its ultimate condition. No further improvements are planned for the Marshburn Channel from the Marshburn Retarding Basin to the San Diego Creek confluence. A hydraulic analysis of the existing channel system with the updated flows was prepared to confirm the channel capacity, and establish hydraulic controls for use in sizing the onsite storm drain system. A proposed Marshburn Channel Storm Drain Facility Map is shown on Exhibit F.

4.2 Ownership

A composite location and proposed ownership map of the facilities is shown on Exhibit D. This map has been updated based on meetings held on February 14, 2008 and February 20, 2008 between all parties to resolve the ownership responsibilities for the proposed improvements. Approval of this master plan shall include adoption of the ownership responsibilities shown on Exhibit D.

5.0 SUMMARY AND CONCLUSIONS

The project will result in the conversion of the former MCAS El Toro base property into parks, open space, drainage and riparian corridors, a wildlife corridor, residential, commercial and educational uses. Developed condition on-site surface runoff will generally follow the existing drainage pattern of the site from northeast to southwest and will be collected and conveyed by local drainage facilities. Local drainage facilities will be designed to accommodate changes in land use and surface runoff within the proposed development and include natural surface drainage conveyance systems and underground conduit facilities. The Master Plan of Drainage system, Marshburn Channel (F16) is classified as "regional facility", with tributary areas greater than 1,000 acres or "sub-regional", with tributary areas between 640 and 1,000 acres. Marshburn Channel is an existing channel and built to its ultimate flows, per the Original FCMPSDC and the Marshburn Retarding Basin Update. No additional regional facilities will be constructed.

Local storm drains will be constructed with the developments of PA 51 and the PA 40 (TIC) Property to convey flows into the Marshburn Channel at intermediate points. For the purpose of this report the concentration points at Trabuco Road, I-5 and San Diego Creek were compared to the Original FCMPSDC.

The land use for subareas 13A and 14A, tributary to Marshburn Retarding Basin were updated to reflect a higher density of 8-10 dwellings per acre. This revision resulted in an insignificant increase in the inflow, outflow and water surface elevation in the basin. This increase is minor (less than 1%) and flows at the concentration points along the Marshburn Channel were determined to be lower than the original FCMPSDC and the As-Built plan design flow rates.

Land uses within Districts 1 North, 1 South, and District 4 were updated from proposed Vested Tentative Maps for the above Districts to reflect a higher density. This increase was minor and flows were lower than the original FCMPSDC and the As-Built plan design flow rates.

Approximately 83 acres, from the Marshburn Watershed (south of Irvine Boulevard) has been directed over to the Bee Canyon Watershed, and the land use for PA 51 has been updated to reflect the highest potential density land use. The upper reaches of the Bee Canyon Watershed north of Irvine Boulevard have been conveyed to Marshburn Retarding Basin. Secondly, the 282-acre diversion (see Exhibit C for graphical comparison of FCMPSDC drainage boundaries with the updated study boundaries) from the Bee Canyon to Agua Chinon is necessary because drainage paths from the area east of the Canyon have been severed due to canyon grading, requiring the flow from this area to be directed to Agua Chinon rather than Bee Canyon. This has left an excess capacity in Bee Canyon, therefore to balance the watersheds, a portion (approximately 83 acres) of the Marshburn Watershed has been planned to drain to Bee Canyon. The Bee Canyon Watersheds has the ability to accept the balancing of the flows and not exceed the capacities of the existing downstream facilities. Table 5.1 summarizes the recommended design discharges for the Marshburn Channel.

On-site backbone infrastructure improvements shall follow the watershed boundaries and facility alignments shown on Exhibits A and D, respectively.

The Marshburn Channel WSPG hydraulics have been prepared to analyze the updated design discharges at Irvine Boulevard, Trabuco Road, Maine Way, I-5 and San Diego Creek. This analysis shows the updated design flows are less than the As-Built plans, at all comparison pointsThese ultimate channel design discharges were taken from a letter dated June 19, 1997. Please see attached Appendix M.

A detailed WSPG analysis with the updated flows can be found in Appendix Q. The bifurcation underneath I-5 was originally designed for Foothill/ Eastern Transportation Corridor Agency. A detailed bifurcation analysis with the updated flows has been included in Appendix S.

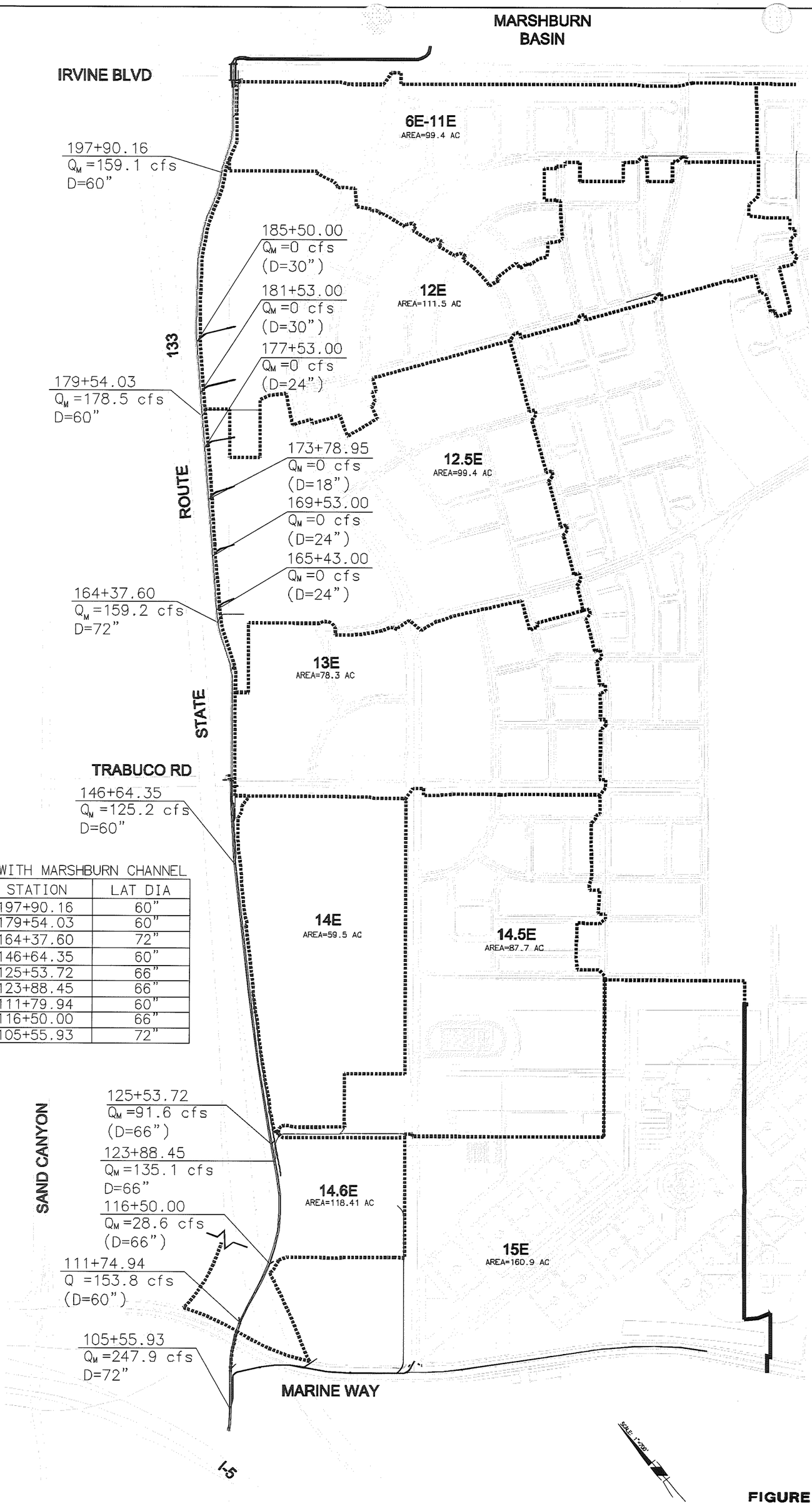
Table 5-1: Design Discharge Summary Table

Marshburn Channel Concentration Point	Original FCMPSDC Discharge (cfs)	Updated 100-Year Design Discharge with Multi-Day Storm (cfs)	As-Built Plans Discharge (cfs)
Marshburn Retarding Basin- Unplugged (78)	---	**846**	---
Irvine Blvd. (93/ CP4C)	1,004	**956/ 1,082** (1)	1,121
Trabuco Road (95)	1,856	**1,708** (2)	1,860
Marine Way (96)	2,282 (3)	**2,364**	2,660
I-5 (97)	2,604 (3)	**2,532**	2,660
San Diego Creek (100/ CP5C)	3,031	**2,868**	3,232

Note (1) *The UH analysis is 951 cfs and 1,082 cfs is based on rational method and the peak discharge from the basin. This design discharge is used to design the Marshburn Channel at Irvine Blvd.*

Note (2) *Design discharge taken from UH analysis, this concentration point downstream of the basin is 473 Ac., less than the 640 Ac. This method was adopted in the previously approved "Basis of Design to Marshburn Retarding Basin", by RBF Consulting, dated August 12, 2005.*

Note (3) *Discharges taken from Original FCMPSDC, Internodal Flow Rate*



CONFLUENCE WITH MARSHBURN CHANNEL

SUBAREA	STATION	LAT DIA
6E-11E	197+90.16	60"
12E	179+54.03	60"
12.5E	164+37.60	72"
13E	146+64.35	60"
14E	125+53.72	66"
14.5E	123+88.45	66"
14.6E	111+79.94	60"
	116+50.00	66"
15E	105+55.93	72"

Q_M INDICATES LATERAL 100 YEAR FLOW (INCREMENTAL INCREASE TO MARSHBURN CHANNEL)

RBF CONSULTING
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IRVINE, CALIFORNIA 92618-2027
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FIGURE 5-1
MARSHBURN CHANNEL WSPG EXHIBIT
SHEET 1 OF 1
7/1/11

H:\PDATA\1D100203\CADD\LAND\EXHIBITS\DRAINAGE\MARSHBURN\MARSHBURN ALTERNATIVES\MARSHBURN WSPG-FIGURE 5-1.DWG LWOEHLK 8/12/11 8:05 am

5.1 Final Drainage Design Requirements and Guidelines

Due to the preliminary nature of the site planning used for the development of the Master Plan, numerous issues related to the design of the regional and master planned drainage facilities have been deferred until the final design phase. The following paragraphs summarize the deferred issues identified during the master plan development. This list is not intended to be all-inclusive, as additional items may be identified by reviewing agencies during final design.

For the design and construction of all regional master plan facilities, agreements between the County, the City, the Great Park Neighborhoods Corporation, and Heritage Fields El Toro LLC will be required.

- The City of Irvine will ensure that permit requirements for any activities that may have potential impacts on the waters of the United States are satisfied.
- The City of Irvine will ensure the development upstream of Marshburn Retarding Basin is managed to limit Marshburn Channel discharges to not exceed committed ultimate design discharges for the channel.
- Drainage boundary devices must be in place along the NW Inlet into Marshburn Basin. The storm drain devices will be designed to capture the 100-year storm event and prevent flows from cascading over and bypassing the Marshburn Retarding Basin (Subareas 13A and 14A).
- The tract level plans for the development of PA 40 have not yet been developed, the location of the storm drain (Line C.1 in Exhibit D) that would convey flows from the tributary areas within the Life Long Learning District and OC Great Park to the Marshburn Channel is still subject to change. This local drainage issue would be settled between the City and the developer. The City of Irvine shall ensure that any change to this storm drain alignment would not result in worsening the condition of Marshburn Channel. Appropriate analyses will be provided to OCFCD for review and approval if any change to the alignment occurs.
- If watershed conditions (land uses, subarea boundaries, etc.) turn out to be different from the assumptions made in this update, new hydrologic analyses could be needed to demonstrate that discharges along Marshburn Channel do not exceed committed ultimate design discharges for the channel. Therefore, the City should ensure that the assumed watershed conditions are accurate and development within the watershed will conform to the approved report. Additionally, if deviations from the final approved report are proposed in the future, the City needs to ensure that impacts of any proposed changes are analyzed and mitigated to prevent adverse impacts to downstream areas.

5.2 Design Standards

The final design of regional drainage improvements shall be completed in accordance with the requirements of the County of Orange and OCFCD. Master plan and local storm drain systems shall be designed in accordance with the City of Irvine Standards.

6.0 REFERENCES

- Fuscoe Engineering. *Master Plan of Drainage for Heritage Fields.* Prepared for Heritage Fields El Toro, LLC. February 23, 2007

- Fuscoe Engineering. *Master Plan of Drainage The Orange County Great Park Neighborhoods.* Prepared for The City of Irvine Orange County Great Park Neighborhoods Corporation. April25, 2007

- JMTA. *Flood Control Master Plan for San Diego Creek.* Prepared for the Cities of Irvine and Tustin, and The Irvine Company. April 1989.

- Orange County Resources and Development Management Department (RDMD). *Orange County Hydrology Manual.* Santa Ana, California. October 1986.

- Orange County Master Plan of Flood Control and Drainage: Facilities Map

- RBF Consulting. Heritage Fields and Orange County Great Park Neighborhoods Update for Bee Canyon, Agua Chinon, Borrego, Serrano and Upper San Diego Creek" Report, dated May 21, 2008

- RBF Consulting. "Basis of Design to Marshburn Retarding Basin", dated August 12, 2005.

- "Drainage Design Report for the Construction of the Marshburn Wash Channel 100-Year Improvements Upstream of Irvine Center Drive Downstream of I-5", by David Evans and Associates, Inc, January 12, 1998.

- "Preliminary Hydrology Report Supporting the EIR and Zone Change for Planning Area 40", by Stantec, August 2007

- "Drainage Design Report for the Construction of The Marshburn Channel 100-Year Improvements Upstream of Irvine Center Drive, Downstream of I-5 Freeway (Sta. 73+33 to Sta. 95+05), January 12, 1998, David Evans and Associates, Inc.

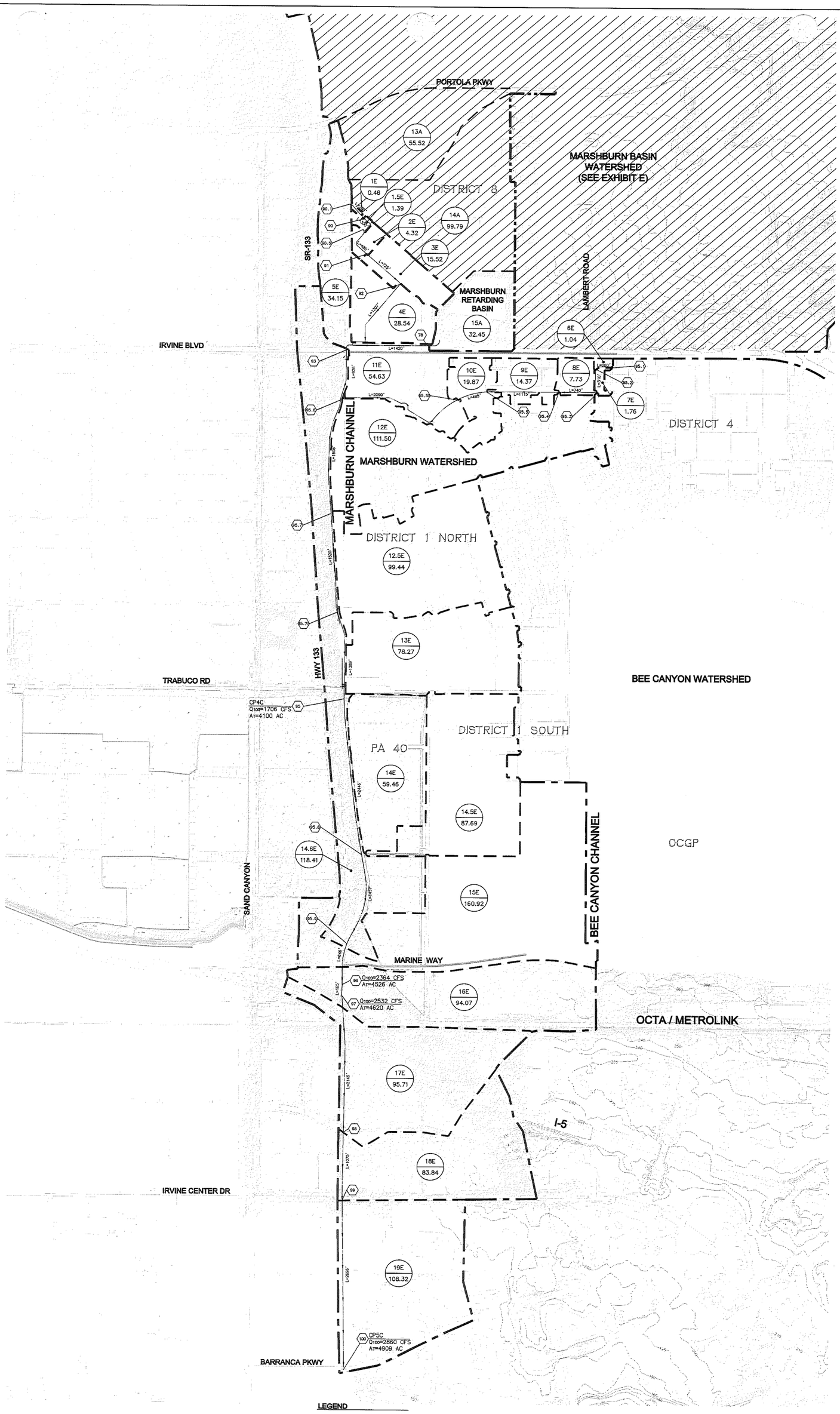

EXHIBIT A

PA 51 MARSHBURN WATERSHED HYDROLOGY MAP

SHEET 1 OF 1

FLOOD CONTROL MASTER PLAN SAN DIEGO CREEK

PA 51 MARSHBURN WATERSHED UPDATE

Marshburn Channel Update (Downstream of Marshburn Basin)

Rational Method Ultimate Condition

RBF

TECHNICAL APPENDIX D

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****************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
        (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
      (c) Copyright 1983-2004 Advanced Engineering Software (aes)
          Ver. 10.0  Release Date: 01/01/2004  License ID 1264

                        Analysis prepared by:

                          RBF Consulting
                        14725 Alton Parkway
                      Irvine, California  92618


----------------------------------------------------------------------------
  FILE NAME: G:\AES2004\MAR100.DAT
  TIME/DATE OF STUDY: 17:22 08/01/2011
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  =====  ====  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2   18.0     13.0    0.018/0.018/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE     90.10 TO NODE     90.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    378.00  DOWNSTREAM(FEET) =    375.10

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.261
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.346
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "8-10 DWELLINGS/ACRE"       B        0.46      0.30       0.40    76    9.26
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.40
  SUBAREA RUNOFF(CFS) =       1.75
```

1E


```
  TOTAL AREA(ACRES) =       0.46   PEAK FLOW RATE(CFS) =       1.75

****************************************************************************
  FLOW PROCESS FROM NODE     90.00 TO NODE     90.50 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  375.10  DOWNSTREAM ELEVATION(FEET) =  373.50
  STREET LENGTH(FEET) =   300.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  13.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.05
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.40
    HALFSTREET FLOOD WIDTH(FEET) =   14.80
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.94
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.77
  STREET FLOW TRAVEL TIME(MIN.) =   2.58   Tc(MIN.) =  11.84
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.791
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "8-10 DWELLINGS/ACRE"       B        1.39      0.30       0.40    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.40
  SUBAREA AREA(ACRES) =    1.39      SUBAREA RUNOFF(CFS) =    4.59
  EFFECTIVE AREA(ACRES) =       1.85    AREA-AVERAGED Fm(INCH/HR) =  0.12
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.40
  TOTAL AREA(ACRES) =       1.85        PEAK FLOW RATE(CFS) =       6.11

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.44   HALFSTREET FLOOD WIDTH(FEET) =  17.44
  FLOW VELOCITY(FEET/SEC.) =  2.14   DEPTH*VELOCITY(FT*FT/SEC.) =   0.95
  LONGEST FLOWPATH FROM NODE     90.10 TO NODE     90.50 =   600.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     90.50 TO NODE     91.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   373.50  DOWNSTREAM(FEET) =   367.80
  FLOW LENGTH(FEET) =   485.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.30
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.11
  PIPE TRAVEL TIME(MIN.) =   1.28   Tc(MIN.) =  13.12
  LONGEST FLOWPATH FROM NODE     90.10 TO NODE     91.00 =  1085.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     91.00 TO NODE     91.00 IS CODE =  81
```

1.5E

```
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) = 13.12
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.570
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "8-10 DWELLINGS/ACRE"      B        4.32      0.30       0.40    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40
  SUBAREA AREA(ACRES) =    4.32      SUBAREA RUNOFF(CFS) =   13.41
  EFFECTIVE AREA(ACRES) =      6.17   AREA-AVERAGED Fm(INCH/HR) = 0.12
  AREA-AVERAGED Fp(INCH/HR) = 0.30  AREA-AVERAGED Ap = 0.40
  TOTAL AREA(ACRES) =      6.17       PEAK FLOW RATE(CFS) =      19.16

****************************************************************************
  FLOW PROCESS FROM NODE     91.00 TO NODE     92.00 IS CODE = 31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   367.80  DOWNSTREAM(FEET) =   359.00
  FLOW LENGTH(FEET) =   725.00   MANNING'S N = 0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.38
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     19.16
  PIPE TRAVEL TIME(MIN.) =   1.44    Tc(MIN.) =  14.57
  LONGEST FLOWPATH FROM NODE     90.10 TO NODE     92.00 =  1810.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     92.00 TO NODE     92.00 IS CODE = 81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINEINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) = 14.57
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.362
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "8-10 DWELLINGS/ACRE"      B       15.52      0.30       0.40    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40
  SUBAREA AREA(ACHES) =   15.52      SUBAREA RUNOFF(CFS) =   45.29
  EFFECTIVE AREA(ACRES) =     21.69   AREA-AVERAGED Fm(INCH/HR) = 0.12
  AREA-AVERAGED Fp(INCH/HR) = 0.30  AREA-AVERAGED Ap = 0.40
  TOTAL AREA(ACRES) =     21.69       PEAK FLOW RATE(CFS) =      63.29

****************************************************************************
  FLOW PROCESS FROM NODE     92.00 TO NODE     93.00 IS CODE = 31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   359.00  DOWNSTREAM(FEET) =   327.45
  FLOW LENGTH(FEET) =  1307.00   MANNING'S N = 0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.62
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     63.29
  PIPE TRAVEL TIME(MIN.) =   1.49    Tc(MIN.) =  16.06
```

2E

3E


```
  LONGEST FLOWPATH FROM NODE     90.10 TO NODE     93.00 =  3117.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     93.00 TO NODE     93.00 IS CODE = 81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINEINE Tc(MIN) = 16.06
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.182
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "8-10 DWELLINGS/ACRE"      B       28.54      0.30       0.40    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40
  SUBAREA AREA(ACRES) =   28.54      SUBAREA RUNOFF(CFS) =   78.64
  EFFECTIVE AREA(ACRES) =     50.23   AREA-AVERAGED Fm(INCH/HR) = 0.12
  AREA-AVERAGED Fp(INCH/HR) = 0.30  AREA-AVERAGED Ap = 0.40
  TOTAL AREA(ACRES) =     50.23       PEAK FLOW RATE(CFS) =     138.41

****************************************************************************
  FLOW PROCESS FROM NODE     93.00 TO NODE     93.00 IS CODE = 81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) = 16.06
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.182
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B       34.15      0.30       0.10    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10
  SUBAREA AREA(ACRES) =   34.15      SUBAREA RUNOFF(CFS) =   96.87
  EFFECTIVE AREA(ACRES) =     84.38   AREA-AVERAGED Fm(INCH/HR) = 0.08
  AREA-AVERAGED Fp(INCH/HR) = 0.30  AREA-AVERAGED Ap = 0.28
  TOTAL AREA(ACRES) =     84.38       PEAK FLOW RATE(CFS) =     235.27

****************************************************************************
  FLOW PROCESS FROM NODE     93.00 TO NODE     93.00 IS CODE =  1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS = 2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  16.06
  RAINFALL INTENSITY(INCH/HR) =   3.18
  AREA-AVERAGED Fm(INCH/HR) =  0.08
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.28
  EFFECTIVE STREAM AREA(ACRES) =    84.38
  TOTAL STREAM AREA(ACRES) =    84.38
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    235.27

****************************************************************************
  FLOW PROCESS FROM NODE     93.00 TO NODE     93.00 IS CODE =  7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN.) =  16.06   RAINFALL INTENSITY(INCH/HR) =  3.18
  EFFECTIVE AREA(ACRES) =   312.66
  TOTAL AREA(ACRES) =  3626.84        PEAK FLOW RATE(CFS) =    847.00
```

4E

5E

MARSHBURN BASIN

$Q = .9(I - F_m)A_E$

$847 = .9(3.18 - .17)A_E$

$A_E = 312.66\ Ac$

```
AREA-AVERAGED Fm(INCH/HR) =   0.17  AREA-AVERAGED Fp(INCH/HR) =   0.22
AREA-AVERAGED Ap =  0.79
NOTE: EFFECTIVE AREA IS USED AS THE TOTAL CONTRIBUTING AREA FOR ALL
      CONFLUENCE ANALYSES.

****************************************************************************
FLOW PROCESS FROM NODE     93.00 TO NODE     93.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =  16.06
RAINFALL INTENSITY(INCH/HR) =   3.18
AREA-AVERAGED Fm(INCH/HR) =  0.17
AREA-AVERAGED Fp(INCH/HR) =  0.22
AREA-AVERAGED Ap =  0.79
EFFECTIVE STREAM AREA(ACRES) =   312.66
TOTAL STREAM AREA(ACRES) =  3626.84
PEAK FLOW RATE(CFS) AT CONFLUENCE =    847.00

** CONFLUENCE DATA **
 STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)        (ACRES)    NODE
    1     235.27  16.06    3.182  0.30( 0.08) 0.28    84.4       90.10
    2     847.00  16.06    3.181  0.22( 0.17) 0.79   312.7       93.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
 STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)        (ACRES)    NODE
    1    1082.20  16.06    3.182  0.23( 0.15) 0.68   397.0       90.10
    2    1082.25  16.06    3.181  0.23( 0.15) 0.68   397.0       93.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =   1082.25    Tc(MIN.) =    16.06
EFFECTIVE AREA(ACRES) =   397.04   AREA-AVERAGED Fm(INCH/HR) =  0.15
AREA-AVERAGED Fp(INCH/HR) =  0.23  AREA-AVERAGED Ap =  0.68
TOTAL AREA(ACRES) =   3711.22
LONGEST FLOWPATH FROM NODE     90.10 TO NODE     93.00 =  3117.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     93.00 TO NODE     95.60 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    327.45  DOWNSTREAM(FEET) =    314.13
CHANNEL LENGTH THRU SUBAREA(FEET) =   926.00   CHANNEL SLOPE =  0.0144
CHANNEL BASE(FEET) =   15.00   "Z" FACTOR =   0.000
MANNING'S FACTOR = 0.014   MAXIMUM DEPTH(FEET) =  10.00
CHANNEL FLOW THRU SUBAREA(CFS) =   1082.25
FLOW VELOCITY(FEET/SEC.) =  22.06   FLOW DEPTH(FEET) =   3.27
TRAVEL TIME(MIN.) =   0.70   Tc(MIN.) =  16.76
LONGEST FLOWPATH FROM NODE     90.10 TO NODE     95.60 =  4043.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     95.60 TO NODE     95.60 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
```



```
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =  16.76
RAINFALL INTENSITY(INCH/HR) =   3.10
AREA-AVERAGED Fm(INCH/HR) =  0.15
AREA-AVERAGED Fp(INCH/HR) =  0.23
AREA-AVERAGED Ap =  0.68
EFFECTIVE STREAM AREA(ACRES) =   397.04
TOTAL STREAM AREA(ACRES) =  3711.22
PEAK FLOW RATE(CFS) AT CONFLUENCE =   1082.25

****************************************************************************
FLOW PROCESS FROM NODE     95.10 TO NODE     95.20 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
INITIAL SUBAREA FLOW-LENGTH(FEET) =   260.00
ELEVATION DATA: UPSTREAM(FEET) =    388.80  DOWNSTREAM(FEET) =    384.50

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.855
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.795
SUBAREA Tc AND LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
RESIDENTIAL
"8-10 DWELLINGS/ACRE"       B        1.04      0.30       0.40    76    7.86
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.40
SUBAREA RUNOFF(CFS) =       4.38
TOTAL AREA(ACRES) =       1.04   PEAK FLOW RATE(CFS) =       4.38

****************************************************************************
FLOW PROCESS FROM NODE     95.20 TO NODE     95.30 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) =  384.50  DOWNSTREAM ELEVATION(FEET) =  379.50
STREET LENGTH(FEET) =   310.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 30.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  25.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.67
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.34
  HALFSTREET FLOOD WIDTH(FEET) =   10.81
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.98
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.02
STREET FLOW TRAVEL TIME(MIN.) =   1.73   Tc(MIN.) =   9.59
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.282
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
RESIDENTIAL
```

6E

7E

```
"8-10 DWELLINGS/ACRE"      B        1.76      0.30      0.40     76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.40
SUBAREA AREA(ACRES) =     1.76      SUBAREA RUNOFF(CFS) =     6.59
EFFECTIVE AREA(ACRES) =       2.80    AREA-AVERAGED Fm(INCH/HR) =  0.12
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.40
TOTAL AREA(ACRES) =       2.80        PEAK FLOW RATE(CFS) =       10.49

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.28
FLOW VELOCITY(FEET/SEC.) =  3.23   DEPTH*VELOCITY(FT*FT/SEC.) =   1.20
LONGEST FLOWPATH FROM NODE     95.10 TO NODE     95.30 =   570.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     95.30 TO NODE     95.40 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   379.50  DOWNSTREAM(FEET) =   369.60
FLOW LENGTH(FEET) =   740.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   7.39
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     10.49
PIPE TRAVEL TIME(MIN.) =   1.67    Tc(MIN.) =  11.26
LONGEST FLOWPATH FROM NODE     95.10 TO NODE     95.40 =  1310.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     95.40 TO NODE     95.40 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  11.26
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.908
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
PUBLIC PARK                 B        7.73      0.30      0.85     76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.85
SUBAREA AREA(ACRES) =     7.73      SUBAREA RUNOFF(CFS) =   25.42
EFFECTIVE AREA(ACRES) =      10.53   AREA-AVERAGED Fm(INCH/HR) =  0.22
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.73
TOTAL AREA(ACRES) =      10.53       PEAK FLOW RATE(CFS) =       34.96

****************************************************************************
FLOW PROCESS FROM NODE     95.40 TO NODE     95.50 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   369.60  DOWNSTREAM(FEET) =   350.50
FLOW LENGTH(FEET) =  1115.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  10.96
ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     34.96
PIPE TRAVEL TIME(MIN.) =   1.70    Tc(MIN.) =  12.95
LONGEST FLOWPATH FROM NODE     95.10 TO NODE     95.50 =  2425.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     95.50 TO NODE     95.50 IS CODE =  81
----------------------------------------------------------------------------
```

8E


```
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  12.95
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.595
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
CONDOMINIUMS                B       14.37      0.30      0.35     76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.35
SUBAREA AREA(ACRES) =    14.37      SUBAREA RUNOFF(CFS) =   45.13
EFFECTIVE AREA(ACRES) =      24.90   AREA-AVERAGED Fm(INCH/HR) =  0.15
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.51
TOTAL AREA(ACRES) =      24.90       PEAK FLOW RATE(CFS) =       77.12

****************************************************************************
FLOW PROCESS FROM NODE     95.50 TO NODE     95.55 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   350.50  DOWNSTREAM(FEET) =   344.00
FLOW LENGTH(FEET) =   485.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  39.0 INCH PIPE IS  27.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  12.27
ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     77.12
PIPE TRAVEL TIME(MIN.) =   0.66    Tc(MIN.) =  13.61
LONGEST FLOWPATH FROM NODE     95.10 TO NODE     95.55 =  2910.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     95.55 TO NODE     95.55 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  13.61
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.500
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
CONDOMINIUMS                B       19.87      0.30      0.35     76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.35
SUBAREA AREA(ACRES) =    19.87      SUBAREA RUNOFF(CFS) =   60.71
EFFECTIVE AREA(ACRES) =      44.77   AREA-AVERAGED Fm(INCH/HR) =  0.13
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.44
TOTAL AREA(ACRES) =      44.77       PEAK FLOW RATE(CFS) =      135.71

****************************************************************************
FLOW PROCESS FROM NODE     95.55 TO NODE     95.60 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   344.00  DOWNSTREAM(FEET) =   314.13
FLOW LENGTH(FEET) =  2090.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  45.0 INCH PIPE IS  36.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  14.16
ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =    135.71
PIPE TRAVEL TIME(MIN.) =   2.46    Tc(MIN.) =  16.07
LONGEST FLOWPATH FROM NODE     95.10 TO NODE     95.60 =  5000.00 FEET.

****************************************************************************
```

9E

10E

```
  FLOW PROCESS FROM NODE     95.60 TO NODE     95.60 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  16.07
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.180
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B       37.96     0.30       0.10    76
  CONDOMINIUMS                B       16.67     0.30       0.35    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.18
  SUBAREA AREA(ACRES) =    54.63      SUBAREA RUNOFF(CFS) =  153.74
  EFFECTIVE AREA(ACRES) =      99.40   AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.29
  TOTAL AREA(ACRES) =      99.40       PEAK FLOW RATE(CFS) =     276.56

****************************************************************************
  FLOW PROCESS FROM NODE     95.60 TO NODE     95.60 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  16.07
  RAINFALL INTENSITY(INCH/HR) =   3.18
  AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.29
  EFFECTIVE STREAM AREA(ACRES) =     99.40
  TOTAL STREAM AREA(ACRES) =     99.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     276.56

  ** CONFLUENCE DATA **
   STREAM     Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
   NUMBER   (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
      1   1082.20  16.76    3.103  0.23( 0.15) 0.68   397.0      90.10
      1   1082.25  16.76    3.103  0.23( 0.15) 0.68   397.0      93.00
      2    276.56  16.07    3.180  0.30( 0.09) 0.29    99.4      95.10

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM     Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
   NUMBER   (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
      1   1341.57  16.07    3.180  0.23( 0.14) 0.60   480.2      95.10
      2   1351.91  16.76    3.103  0.23( 0.14) 0.60   496.4      90.10
      3   1351.92  16.76    3.103  0.23( 0.14) 0.60   496.4      93.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =   1351.92    Tc(MIN.) =    16.76
  EFFECTIVE AREA(ACRES) =   496.44   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.23  AREA-AVERAGED Ap =  0.60
  TOTAL AREA(ACRES) =   3810.62
  LONGEST FLOWPATH FROM NODE     95.10 TO NODE     95.60 =  5000.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     95.60 TO NODE     95.70 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

11E


```
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    314.13  DOWNSTREAM(FEET) =    305.28
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1808.00   CHANNEL SLOPE =  0.0049
  CHANNEL BASE(FEET) =   15.00   "Z" FACTOR =   0.000
  MANNING'S FACTOR = 0.014   MAXIMUM DEPTH(FEET) =  10.00
  CHANNEL FLOW THRU SUBAREA(CFS) =   1351.92
  FLOW VELOCITY(FEET/SEC.) =  16.13   FLOW DEPTH(FEET) =   5.59
  TRAVEL TIME(MIN.) =   1.87   Tc(MIN.) =  18.63
  LONGEST FLOWPATH FROM NODE     95.10 TO NODE     95.70 =  6808.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     95.70 TO NODE     95.70 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  18.63
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.921
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                 B       18.14     0.30       0.85    76
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"        B       60.17     0.30       0.50    76
  COMMERCIAL                  B       33.19     0.30       0.10    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.44
  SUBAREA AREA(ACRES) =  111.50      SUBAREA RUNOFF(CFS) =  279.92
  EFFECTIVE AREA(ACRES) =     607.94   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.24  AREA-AVERAGED Ap =  0.57
  TOTAL AREA(ACRES) =   3922.12       PEAK FLOW RATE(CFS) =    1521.74

****************************************************************************
  FLOW PROCESS FROM NODE     95.70 TO NODE     95.75 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    305.28  DOWNSTREAM(FEET) =    280.16
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1525.00   CHANNEL SLOPE =  0.0165
  CHANNEL BASE(FEET) =   15.00   "Z" FACTOR =   0.000
  MANNING'S FACTOR = 0.014   MAXIMUM DEPTH(FEET) =  10.00
  CHANNEL FLOW THRU SUBAREA(CFS) =   1521.74
  FLOW VELOCITY(FEET/SEC.) =  25.69   FLOW DEPTH(FEET) =   3.95
  TRAVEL TIME(MIN.) =   0.99   Tc(MIN.) =  19.62
  LONGEST FLOWPATH FROM NODE     95.10 TO NODE     95.75 =  8333.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     95.75 TO NODE     95.75 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  19.62
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.834
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS                B       61.39     0.30       0.35    76
  COMMERCIAL                  B       38.05     0.30       0.10    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.25
  SUBAREA AREA(ACRES) =   99.44      SUBAREA RUNOFF(CFS) =  246.78
  EFFECTIVE AREA(ACRES) =     707.38   AREA-AVERAGED Fm(INCH/HR) =  0.13
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.53
  TOTAL AREA(ACRES) =   4021.56       PEAK FLOW RATE(CFS) =    1720.88
```

12E

12.5E

```
** PEAK FLOW RATE TABLE **
 STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
    1   1718.95  18.94    2.894  0.25( 0.13) 0.53   691.1      95.10
    2   1720.90  19.61    2.834  0.25( 0.13) 0.53   707.3      90.10
    3   1720.88  19.62    2.834  0.25( 0.13) 0.53   707.4      93.00
NEW PEAK FLOW DATA ARE:
PEAK FLOW RATE(CFS) =   1720.90  Tc(MIN.) =  19.61
AREA-AVERAGED Fm(INCH/HR) =  0.13  AREA-AVERAGED Fp(INCH/HR) =  0.25
AREA-AVERAGED Ap =  0.53  EFFECTIVE AREA(ACRES) =    707.32

****************************************************************************
FLOW PROCESS FROM NODE     95.75 TO NODE     95.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    280.16  DOWNSTREAM(FEET) =    261.96
CHANNEL LENGTH THRU SUBAREA(FEET) =  1389.00   CHANNEL SLOPE =  0.0131
CHANNEL BASE(FEET) =   15.00   "Z" FACTOR =   0.000
MANNING'S FACTOR = 0.014   MAXIMUM DEPTH(FEET) =  10.00
CHANNEL FLOW THRU SUBAREA(CFS) =   1720.90
FLOW VELOCITY(FEET/SEC.) =  24.59   FLOW DEPTH(FEET) =   4.67
TRAVEL TIME(MIN.) =   0.94   Tc(MIN.) =  20.56
LONGEST FLOWPATH FROM NODE     95.10 TO NODE     95.00 =  9722.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     95.00 TO NODE     95.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  20.56
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.758
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 B       78.27      0.30       0.10    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =   78.27      SUBAREA RUNOFF(CFS) =  192.15
EFFECTIVE AREA(ACRES) =    785.59   AREA-AVERAGED Fm(INCH/HR) =  0.12
AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.49
TOTAL AREA(ACRES) =   4099.83       PEAK FLOW RATE(CFS) =    1864.55

****************************************************************************
FLOW PROCESS FROM NODE     95.00 TO NODE     95.80 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    261.96  DOWNSTREAM(FEET) =    232.05
CHANNEL LENGTH THRU SUBAREA(FEET) =  2446.00   CHANNEL SLOPE =  0.0122
CHANNEL BASE(FEET) =   14.00   "Z" FACTOR =   0.000
MANNING'S FACTOR = 0.014   MAXIMUM DEPTH(FEET) =  10.00
CHANNEL FLOW THRU SUBAREA(CFS) =   1864.55
FLOW VELOCITY(FEET/SEC.) =  24.68   FLOW DEPTH(FEET) =   5.40
TRAVEL TIME(MIN.) =   1.65   Tc(MIN.) =  22.21
LONGEST FLOWPATH FROM NODE     95.10 TO NODE     95.80 = 12168.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     95.80 TO NODE     95.80 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

13E

14E


```
============================================================================
MAINLINE Tc(MIN) =  22.21
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.632
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 B       51.11      0.30       0.10    76
PUBLIC PARK                B        8.35      0.30       0.85    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.21
SUBAREA AREA(ACRES) =   59.46      SUBAREA RUNOFF(CFS) =  137.57
EFFECTIVE AREA(ACRES) =    845.05   AREA-AVERAGED Fm(INCH/HR) =  0.12
AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.47
TOTAL AREA(ACRES) =   4159.29       PEAK FLOW RATE(CFS) =    1913.35

** PEAK FLOW RATE TABLE **
 STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
    1   1915.56  21.53    2.684  0.25( 0.12) 0.46   828.9      95.10
    2   1913.35  22.21    2.632  0.25( 0.12) 0.47   845.0      90.10
    3   1913.30  22.21    2.632  0.25( 0.12) 0.47   845.1      93.00
NEW PEAK FLOW DATA ARE:
PEAK FLOW RATE(CFS) =   1915.56  Tc(MIN.) =  21.53
AREA-AVERAGED Fm(INCH/HR) =  0.12  AREA-AVERAGED Fp(INCH/HR) =  0.25
AREA-AVERAGED Ap =  0.46  EFFECTIVE AREA(ACRES) =    828.86

****************************************************************************
FLOW PROCESS FROM NODE     95.80 TO NODE     95.80 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  21.53
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.684
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 B       87.69      0.30       0.10    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =   87.69      SUBAREA RUNOFF(CFS) =  209.42
EFFECTIVE AREA(ACRES) =    916.55   AREA-AVERAGED Fm(INCH/HR) =  0.11
AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.43
TOTAL AREA(ACRES) =   4246.98       PEAK FLOW RATE(CFS) =    2124.98

****************************************************************************
FLOW PROCESS FROM NODE     95.80 TO NODE     95.90 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    232.05  DOWNSTREAM(FEET) =    212.54
CHANNEL LENGTH THRU SUBAREA(FEET) =  1457.00   CHANNEL SLOPE =  0.0134
CHANNEL BASE(FEET) =   14.00   "Z" FACTOR =   0.000
MANNING'S FACTOR = 0.014   MAXIMUM DEPTH(FEET) =  10.00
CHANNEL FLOW THRU SUBAREA(CFS) =   2124.98
FLOW VELOCITY(FEET/SEC.) =  26.43   FLOW DEPTH(FEET) =   5.74
TRAVEL TIME(MIN.) =   0.92   Tc(MIN.) =  22.45
LONGEST FLOWPATH FROM NODE     95.10 TO NODE     95.90 = 13625.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     95.90 TO NODE     95.90 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

14.5E

14.6E

```
MAINLINE Tc(MIN) =  22.45
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.614
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 B      118.41      0.30       0.10    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =  118.41      SUBAREA RUNOFF(CFS) =  275.35
EFFECTIVE AREA(ACRES) =   1034.96   AREA-AVERAGED Fm(INCH/HR) =  0.10
AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.39
TOTAL AREA(ACRES) =   4365.39       PEAK FLOW RATE(CFS) =    2342.74

****************************************************************************
FLOW PROCESS FROM NODE     95.90 TO NODE     96.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    212.54  DOWNSTREAM(FEET) =    205.67
CHANNEL LENGTH THRU SUBAREA(FEET) =   646.00   CHANNEL SLOPE =  0.0106
CHANNEL BASE(FEET) =   14.00   "Z" FACTOR =   0.000
MANNING'S FACTOR = 0.014   MAXIMUM DEPTH(FEET) =  10.00
CHANNEL FLOW THRU SUBAREA(CFS) =   2342.74
FLOW VELOCITY(FEET/SEC.) =  24.89   FLOW DEPTH(FEET) =   6.72
TRAVEL TIME(MIN.) =   0.43   Tc(MIN.) =  22.88
LONGEST FLOWPATH FROM NODE     95.10 TO NODE     96.00 = 14271.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     96.00 TO NODE     96.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  22.88
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.587
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 B       71.20      0.30       0.10    76
PUBLIC PARK                B       89.72      0.30       0.85    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.52
SUBAREA AREA(ACRES) =  160.92      SUBAREA RUNOFF(CFS) =  352.16
EFFECTIVE AREA(ACRES) =   1195.88   AREA-AVERAGED Fm(INCH/HR) =  0.11
AREA-AVERAGED Fp(INCH/HR) =  0.26  AREA-AVERAGED Ap =  0.41
TOTAL AREA(ACRES) =   4526.31       PEAK FLOW RATE(CFS) =    2669.98

****************************************************************************
FLOW PROCESS FROM NODE     96.00 TO NODE     97.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    205.67  DOWNSTREAM(FEET) =    204.04
CHANNEL LENGTH THRU SUBAREA(FEET) =   165.00   CHANNEL SLOPE =  0.0099
CHANNEL BASE(FEET) =   15.00   "Z" FACTOR =   0.000
MANNING'S FACTOR = 0.014   MAXIMUM DEPTH(FEET) =  10.00
CHANNEL FLOW THRU SUBAREA(CFS) =   2669.98
FLOW VELOCITY(FEET/SEC.) =  25.02   FLOW DEPTH(FEET) =   7.12
TRAVEL TIME(MIN.) =   0.11   Tc(MIN.) =  22.99
LONGEST FLOWPATH FROM NODE     95.10 TO NODE     97.00 = 14436.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     97.00 TO NODE     97.00 IS CODE =  81
```

15E

16E

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----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  22.99
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.580
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 B       94.07      0.30       0.10    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =   94.07      SUBAREA RUNOFF(CFS) =  215.93
EFFECTIVE AREA(ACRES) =   1289.95   AREA-AVERAGED Fm(INCH/HR) =  0.10
AREA-AVERAGED Fp(INCH/HR) =  0.26  AREA-AVERAGED Ap =  0.38
TOTAL AREA(ACRES) =   4620.38       PEAK FLOW RATE(CFS) =    2878.81
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17E

```
****************************************************************************
FLOW PROCESS FROM NODE     97.00 TO NODE     98.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    204.04  DOWNSTREAM(FEET) =    166.69
CHANNEL LENGTH THRU SUBAREA(FEET) =  2146.00   CHANNEL SLOPE =  0.0174
CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   1.500
MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  10.00
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.508
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 B       95.71      0.30       0.10    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =   2985.52
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  29.46
AVERAGE FLOW DEPTH(FEET) =   5.54   TRAVEL TIME(MIN.) =   1.21
Tc(MIN.) =  24.21
SUBAREA AREA(ACRES) =   95.71      SUBAREA RUNOFF(CFS) =  213.42
EFFECTIVE AREA(ACRES) =   1385.66   AREA-AVERAGED Fm(INCH/HR) =  0.10
AREA-AVERAGED Fp(INCH/HR) =  0.26  AREA-AVERAGED Ap =  0.37
TOTAL AREA(ACRES) =   4716.09       PEAK FLOW RATE(CFS) =    3007.67

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) =  5.56   FLOW VELOCITY(FEET/SEC.) =  29.50
LONGEST FLOWPATH FROM NODE     95.10 TO NODE     98.00 = 16582.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     98.00 TO NODE     99.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    166.69  DOWNSTREAM(FEET) =    153.80
CHANNEL LENGTH THRU SUBAREA(FEET) =  1075.00   CHANNEL SLOPE =  0.0120
CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   1.500
MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  10.00
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.466
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 B       83.84      0.30       0.10    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =   3099.58
```

18E

```
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  25.92
AVERAGE FLOW DEPTH(FEET) =   6.20   TRAVEL TIME(MIN.) =   0.69
Tc(MIN.) =  24.90
SUBAREA AREA(ACRES) =    83.84       SUBAREA RUNOFF(CFS) =  183.82
EFFECTIVE AREA(ACHES) =   1469.50     AREA-AVERAGED Fm(INCH/HR) =   0.09
AREA-AVERAGED Fp(INCH/HR) =   0.26  AREA-AVERAGED Ap =   0.35
TOTAL AREA(ACRES) =   4799.93         PEAK FLOW RATE(CFS) =    3139.76

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) =  6.24   FLOW VELOCITY(FEET/SEC.) =  26.01
LONGEST FLOWPATH FROM NODE     95.10 TO NODE     99.00 = 17657.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     99.00 TO NODE    100.00 IS CODE =  36
----------------------------------------------------------------------------
>>>>>COMPUTE BOX-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED BOX SIZE (PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   153.80  DOWNSTREAM(FEET) =   135.60
FLOW LENGTH(FEET) =  2696.00   MANNING'S N =  0.014
*GIVEN BOX BASEWIDTH(FEET) =  12.00   ESTIMATED BOX HEIGHT(FEET) =   14.36
BOX-FLOW VELOCITY(FEET/SEC.) =  18.22
BOX-FLOW(CFS) =   3139.76
BOX-FLOW TRAVEL TIME(MIN.) =   2.47    Tc(MIN.) =  27.36
LONGEST FLOWPATH FROM NODE     95.10 TO NODE    100.00 = 20353.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    100.00 TO NODE    100.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  27.36
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.337
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B      108.32      0.30       0.10    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =  108.32      SUBAREA RUNOFF(CFS) =  224.91
EFFECTIVE AREA(ACRES) =   1577.82   AREA-AVERAGED Fm(INCH/HR) =  0.09
AREA-AVERAGED Fp(INCH/HR) =  0.26  AREA-AVERAGED Ap =  0.33
TOTAL AREA(ACHES) =   4908.25       PEAK FLOW RATE(CFS) =    3193.97
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =   4908.25  TC(MIN.) =     27.36
EFFECTIVE AREA(ACRES) =   1577.82  AREA-AVERAGED Fm(INCH/HR)=  0.09
AREA-AVERAGED Fp(INCH/HR) =  0.26  AREA-AVERAGED Ap =  0.33
PEAK FLOW RATE(CFS)    =   3193.97

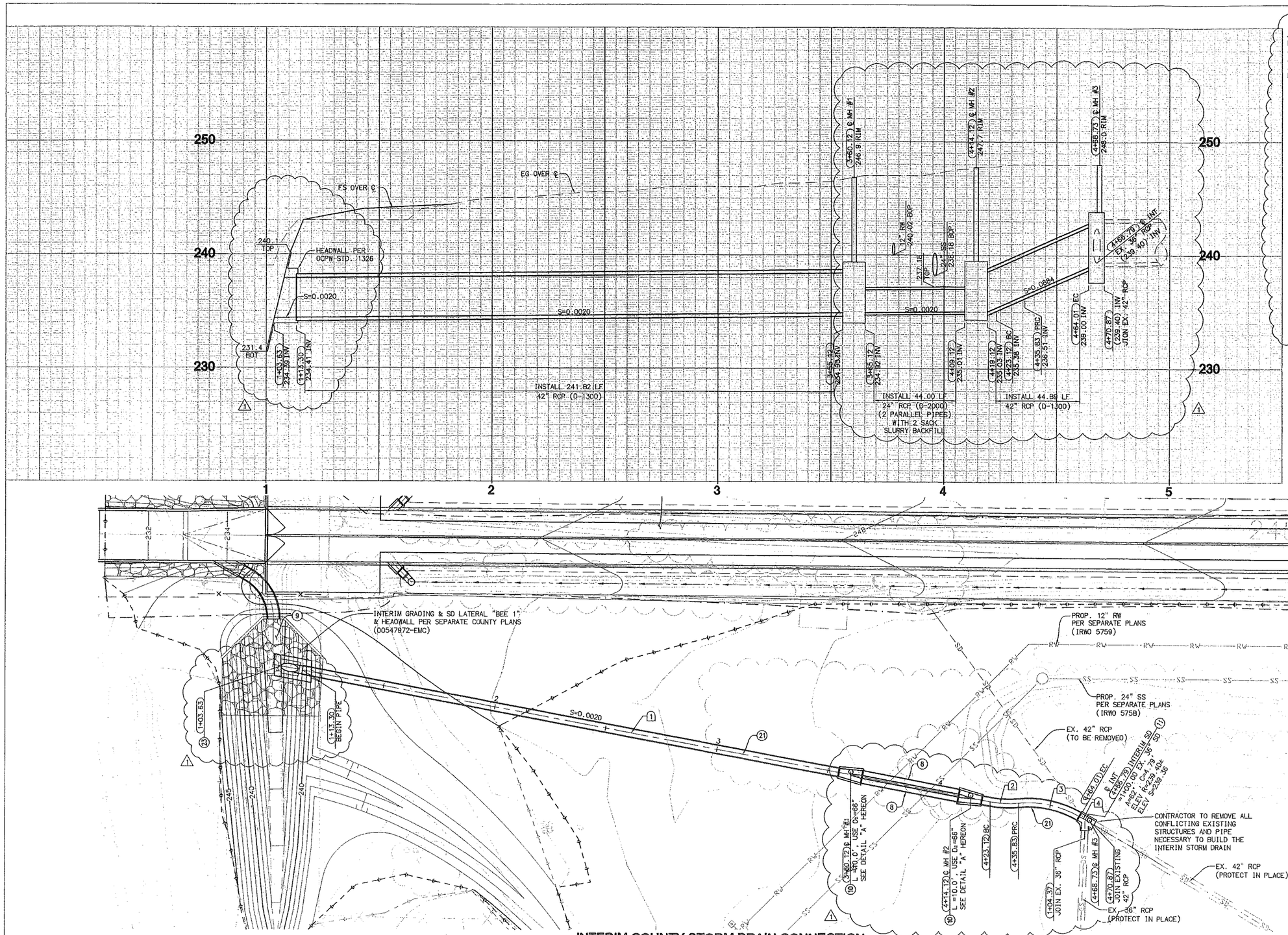
** PEAK FLOW RATE TABLE **
 STREAM     Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER   (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1   3193.97  27.36    2.337  0.26( 0.09) 0.33  1577.8      95.10
    2   3181.11  28.05    2.306  0.26( 0.09) 0.34  1594.0      90.10
    3   3181.01  28.05    2.306  0.26( 0.09) 0.34  1594.1      93.00
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

19E

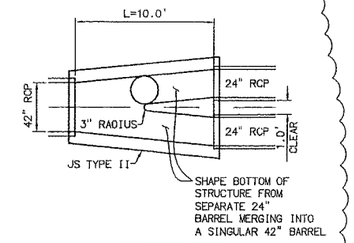
E

Appendix E – Bee Canyon Reports

See Attached Exhibits



NOTE:
EXISTING INVERT ELEVATIONS SHOWN FOR 42" RCP ARE DERIVED FROM BEST DATA AVAILABLE. CONTRACTOR TO FIELD VERIFY AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE BEGINNING CONSTRUCTION.



DETAIL "A"
NOT TO SCALE

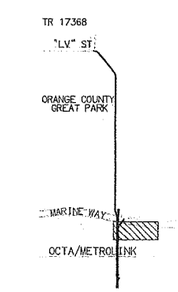
CONSTRUCTION NOTES

8. INSTALL 24" RCP (D-LOAD PER PLAN, OCFCD ST-29)
9. INSTALL RIP-RAP PER DETAIL ON SHEET 18
10. CONSTRUCT JUNCTION STRUCTURE, NO. II PER COI STD. 307
11. CONSTRUCT JUNCTION STRUCTURE, NO. III PER COI STD. 308
21. INSTALL 42" RCP (D-LOAD PER PLAN, OCFCD ST-29)
23. PIPE ENTRANCE TO EARTH CHANNEL PER OCPW STD. 1326

LINE/CURVE DATA TABLE

NO	BEARING/DELTA	RADIUS	LENGTH	TANGENT
1	N51°01'16"E	--	323.13'	--
2	16°11'01"	45.00'	12.71'	6.40'
3	35°52'16"	45.00'	28.17'	14.57'
4	N70°42'31"E	--	6.86'	--

INTERIM COUNTY STORM DRAIN CONNECTION



INDEX MAP
NOT TO SCALE

NOTE:
CONTRACTOR SHALL VERIFY HORIZONTAL AND VERTICAL LOCATION OF EXISTING FACILITIES PRIOR TO CONSTRUCTION AND NOTIFY THE ENGINEER OF ANY DISCREPANCIES.

PLAN CODE
SD-5

SCALE: 1"=20'

REGISTERED PROFESSIONAL ENGINEER JOHN D. LEONARD NO. C057794 CIVIL STATE OF CALIFORNIA

NO.	DATE	REVISIONS	ENGR.	APPROV.	DATE
7					
6					
5					
4					
3					
2					
1	8/20/13	REV SD CONNECTION, ADDED DETAIL "A" & CONSTRUCTION NOTE 10			

DRAWN BY: TM — DATE
DESIGNED BY: LW — DATE
CHECKED BY: JL — DATE

PLAN PREPARED BY:
RBF CONSULTING — PLANNING & DESIGN & CONSTRUCTION
1020 ALTON PARKWAY, IRVINE, CALIFORNIA 92618-2027
949.472.3505 • FAX 949.472.8122 • www.RBFConsulting.com
JOHN LEONARD — R.C.E. No.57794 — 9/18/13 DATE

STORM DRAIN PLANS
BEE CANYON CHANNEL (F17)
INTERIM STORM DRAIN CONNECTION

CITY OF IRVINE
PUBLIC WORKS DEPARTMENT

PLAN CHECK NO. 547972-EMC
PERMIT NO. 555168-MCE
PROJECT NO. 547972-EMC
SHEET 7 OF 18

VIEW = DWG = PATH =

SHEET REVISED: 8/15/07

RBF CONSULTING

PLANNING ■ DESIGN ■ CONSTRUCTION

Basis of Design Report

Bee Canyon Channel (F17) Improvements

Orange County, California

Prepared For:

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c/o Five Point Communities
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Consultant:

RBF CONSULTING
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Irvine, California 92618

Contacts:

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October 16, 2012
JN 10-108417

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1 Introduction

The purpose of this report is to document modifications necessary to convey the 100-year design discharges along Bee Canyon Channel, Orange County Facility Number F17, within the proposed City of Irvine-Orange County Great Park (COI-OCGP) development, and Heritage Fields EL Toro, LLC- Great Park Neighborhoods (GPN) development on the former El Toro Marine Corps Air Station (M.C.A.S.) property. Figure 1-1 shows a vicinity map of the project site. Figure 1-2 illustrates the project's Location Map. Figure 1-3 shows and Existing and Proposed Facilities Map.

The 100-year discharges were established in the *"Amendment to PA 51 and PA 30 Watershed -Bee Canyon Channel, Agua Chinon Channel, Borrego Canyon Channel, Serrano Creek Channel and Upper San Diego Creeks,-Dated July, 2011"* approved by the County of Orange and City of Irvine (Master Plan).

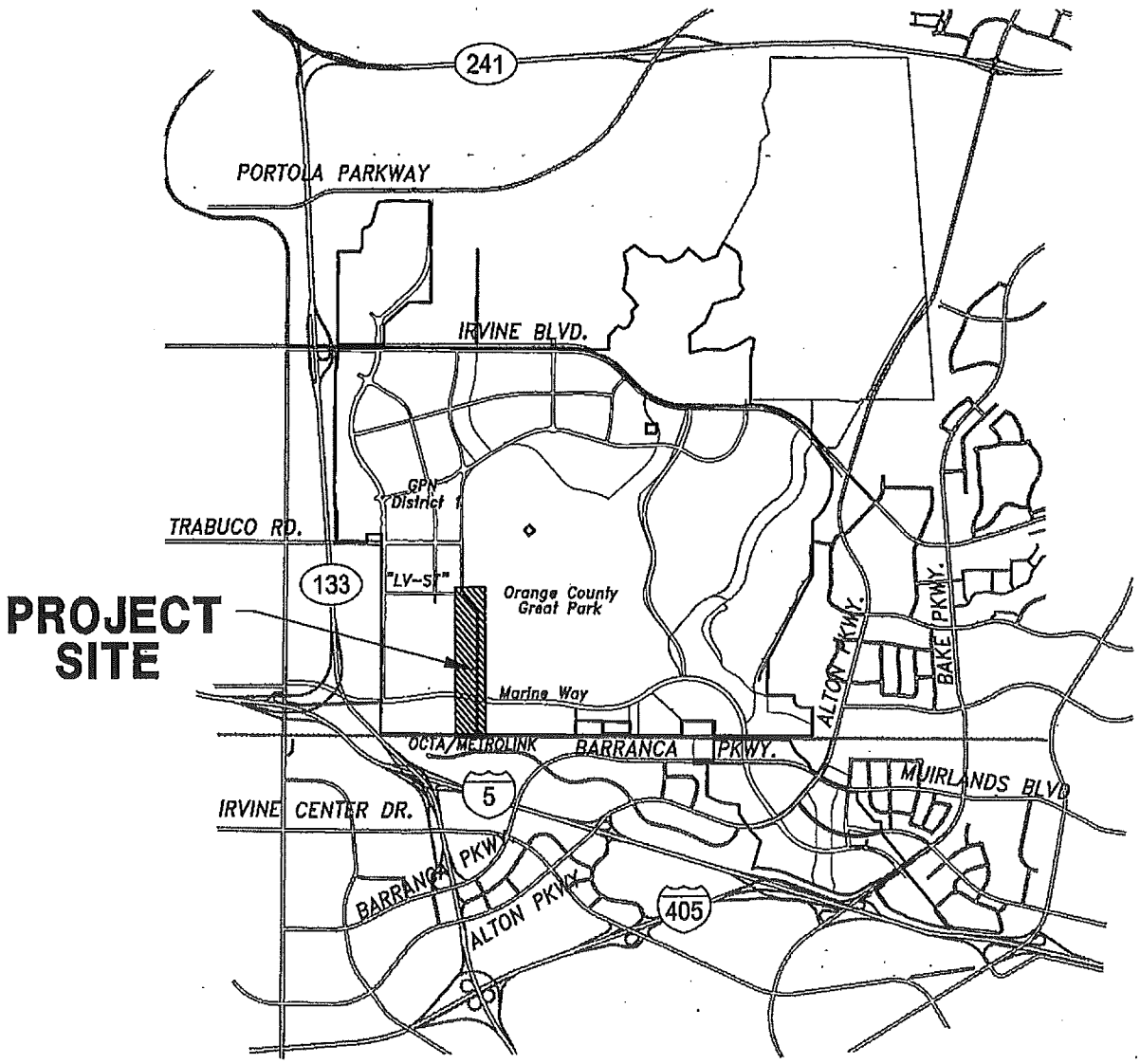
As part of the Master Plan studies referenced above, all runoff previously tributary to Bee Canyon Channel north of Irvine Blvd has been directed to the Marshburn Retarding Basin, adjacent to Irvine Blvd. Therefore the tributary area for the proposed Bee Canyon Improvements lies completely within the COI-OCGP/GPN property (see Exhibit "A").

The proposed improvements join the existing County of Orange owned double 12' wide x 9' high RCB just south of the OCTA/Metrolink Railroad right of way and extend approximately 4,200 linear feet to the southeastern most corner of District 1 of the GPN. This existing double RCB system is oversized and has additional capacity since it was installed prior to the completion of the Marshburn Basin Retarding Basin upstream. The proposed facility will be in addition to some of the existing drainage facilities constructed by the United States Navy for the former El Toro M.C.A.S. These existing facilities consist of a concrete and grouted riprap trapezoidal channel from the downstream connection point, through the OCTA/Metrolink right of way, approximately 185', then a natural open channel from the end of the OCTA/Metrolink right of way, to the southern side of the existing Perimeter Road, approximately 550', where it transitions to a triple 4.5' x 6' reinforced concrete box and extends to the northeast, beneath the existing runways beyond the limits of the proposed improvements. Due to the fact that these were private facilities constructed by the Military, the existing facilities will remain and maybe used by the COI-OCGP. This report does not analyze the capacity or structural integrity of the former Military drainage facilities.

Based on the agreement in the Master Plan, ownership and maintenance of the proposed improvements will be split between the Orange County Flood Control District (OCFCD) and the City of Irvine. OCFCD will own the portion of the facility from the downstream connection point (south of the OCTA/Metrolink Railroad) to the south side of the proposed Marine Way. The City of Irvine will own all parts of the facility within and north of Marine Way (see Exhibit 1-3).

This report considers the ultimate condition, with fully developed land uses from the GPN and COI-OCGP tributary areas. Supporting calculations develop the peak discharge hydraulic conditions along the proposed Bee Canyon Improvements, the recommended

channel sections to safely convey the 100-year High Confidence flows and verify that the proposed system adequately conveys those flows. The methodology, assumptions, and results are included in the following sections.



VICINITY MAP
N.T.S.

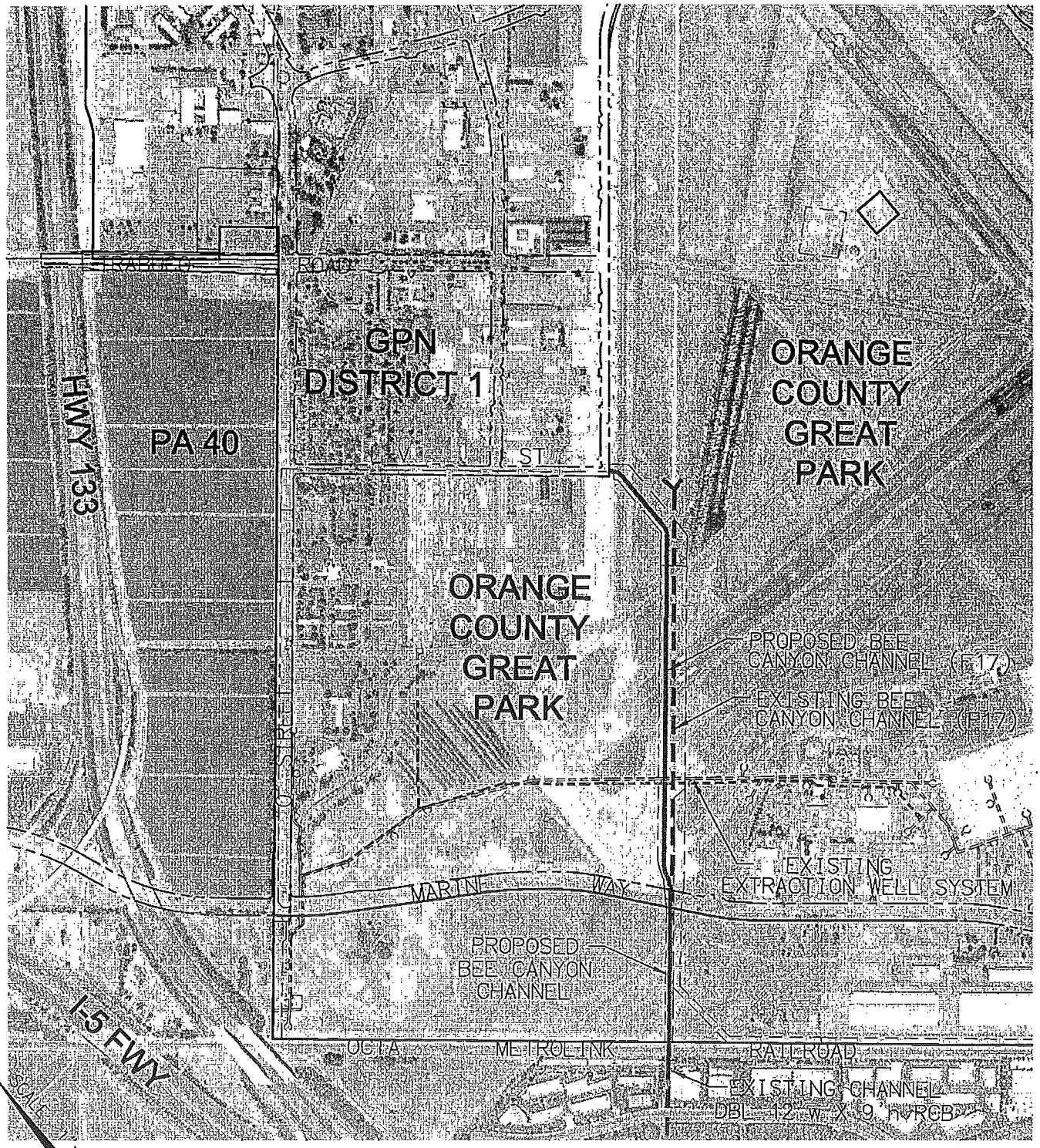
RBF CONSULTING

BEE CANYON CHANNEL (F17)
VICINITY MAP

CITY OF IRVINE

FIGURE
1-1

H:\PDATA\1010417\CADD\LAND\EXHIBITS\BEE CANYON\DESIGN REPORT\VICINITY_MAP (FIGURE 1-1).DWG LWOEHLK 7/30/12 9:01 am



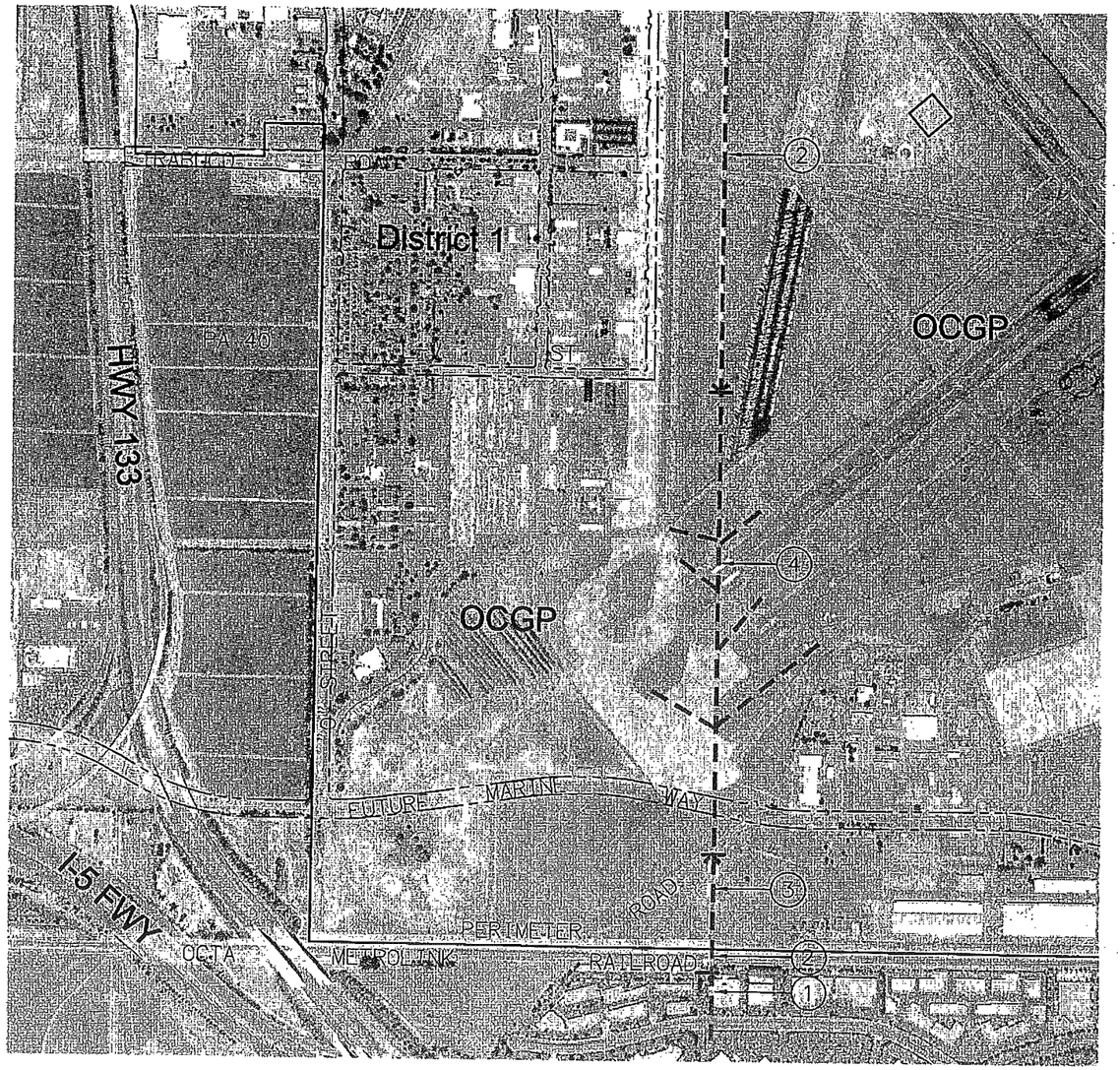
RBF CONSULTING

BEE CANYON CHANNEL (F17)
LOCATION MAP

CITY OF IRVINE

FIGURE
1-2

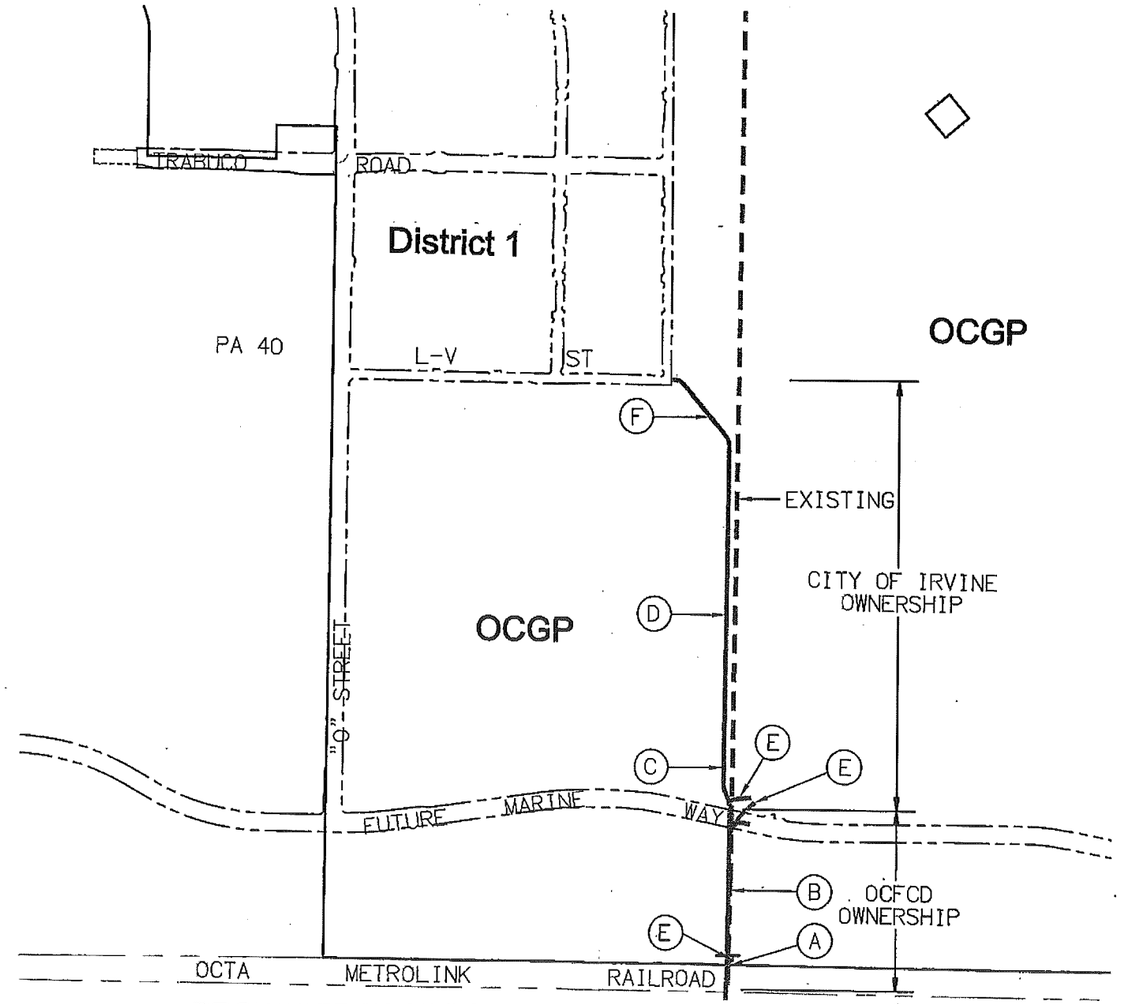
H:\PDATA\1D108417\CADD\LAND\EXHIBITS\BEE CANYON\DESIGN REPORT\LOCATION_MAP (FIGURE 1-2).DWG LWOEHLK 7/30/12 9:03 am



EXISTING FACILITIES

1. DBL 12'w X 9'h RCB
2. CONCRETE TRAPEZOIDAL CHANNEL LINED WITH GROUTED RIPRAP
3. NATURAL OPEN TRAPEZOIDAL CHANNEL
4. TRIPLE 6'w X 4.5'h RCB

SCALE: 1"=1000'



PROPOSED FACILITIES

- (A) - CONCRETE RECTANGULAR CHANNEL
- (B) - DBL 11'w X 8'h RCB
- (C) - 108" RCP
- (D) - 96" RCP
- (E) - PROPOSED STUB (VARIOUS RCP)
- (F) - 84" RCP

SCALE: 1"=1000'

RBF CONSULTING

BEE CANYON CHANNEL (F17)
FACILITY MAP
EXISTING & PROPOSED

CITY OF IRVINE

FIGURE
1-3

H:\PDATA\10108417\CADD\LAND\EXHIBITS\BEE CANYON\DESIGN REPORT\EXISTING-PROP-FACILITY MAP (FIGURE 1-3).DWG LWOEHLK 8/15/12 10:17 am

2 Summary of Recent Studies and Improvements

This section summarizes the San Diego Creek Master Plan updates and Marshburn Channel/Retarding Basin Hydrology and Hydraulics investigation as it relates to Bee Canyon Channel (F17).

2.1 Amendment to PA 51 and PA 30 Watershed - Bee Canyon Channel, Agua Chinon Channel, Borrego Canyon Channel, Serrano Creek Channel, and Upper San Diego Creek (Master Plan). (July 2011)

This study investigates the impacts of the City of Irvine Planning Areas 51 and 30 (PA 51/PA 30) redevelopment (former Marine Corps Air Station El Toro) on the "Flood Control Master Plan for San Diego Creek" (FCMPSDC). This report establishes ultimate condition drainage patterns and land use for the watersheds, identifies potential impacts and mitigation measures for the site redevelopment, updates design discharges for the study area, recommends backbone infrastructure improvements, and identifies future ownership of backbone facilities. The watershed boundary for Bee Canyon Channel (F17) determined in this report serves as the basis of design for this technical design study. This report is approved by the City of Irvine and County of Orange.

2.2 Marshburn Channel Improvements: Irvine Blvd. to Trabuco Road Conceptual Design Hydrology and Hydraulic Design

This study prepared in accordance with the *"Flood Control Master Plan for San Diego Creek"*, prepared by John Tettemer and Associates, April 1989, and the *"Basis of Design for Marshburn Retarding Basin"*, prepared by RBF Consulting, August 2005, implements a master planned diversion for Bee Canyon by directing all flows north of Irvine Blvd within the Bee Canyon watershed to the Marshburn Retarding Basin, and to San Diego Creek via Marshburn Channel.

2.3 Amendment to PA 51 Marshburn Watershed Update. (August 2011)

This study investigates the impacts of the ultimate condition improvements for the City of Irvine Planning Area 51 (PA 51). The report updates design discharges for the Marshburn Watershed area with the highest potential land uses. Identifies potential impacts and mitigation with the site development, establishes ultimate condition drainage patterns, recommends backbone infrastructure improvements and identifies future ownership of the backbone facilities. This report is approved by the City of Irvine and County of Orange.

3 Hydrology Methodology and Design Flow Rates

Regional hydrology for Bee Canyon Channel was completed as a portion of the *Master Plan*. This report developed design flow rates at major concentration points using the unit hydrograph method in accordance with County criteria and consistent with the *Master Plan* calculations. Peak flow rates in that report were developed at the OCTA/Metrolink Railroad crossing (Node Point 614) and upstream of the confluence with San Diego Creek (CP 1L).

Additional detailed hydrology was required for the design of the proposed Bee Canyon Channel (F17) improvements to determine discharges upstream of the OCTA/Metrolink Railroad crossing, as well as to size the proposed channel and its laterals. The peak flow rates for Bee Canyon Channel (F17), based on the design hydrology are summarized in Table 3-1, and illustrated on Figure 3-1.

The assumptions used for the ultimate condition hydrology analysis, included in this report generally use the same assumptions and methodology as the *Master Plan*. Where more current or detailed data was available, it was used in developing sub-area parameters. One hundred year, fifty year and twenty-five year storm events were analyzed. Exhibit "A" contains the study area for the Bee Canyon portion of the *Master Plan*. Exhibit "B" is the Ultimate Condition Hydrology Map for the areas tributary to the proposed Bee Canyon Improvements. Design level Rational Method hydrology calculations for the proposed facility can be found in Appendix "A".

Table 3-1: Bee Canyon Channel Design 100-Year Storm Hydrology Peak Flow Rates*

Node Point	Location	Ownership	Bee Canyon Channel Design Hydrology Ultimate Condition	
			Peak Flow (cfs)	Tributary Area (acres)
540	South Boundary of District 1.("L-V" St)	City of Irvine	952.5	338.1
175	OCGP Stub	OCFCD	***1512.6***	711.5
180	South of Marine Way	OCFCD	***1607.9***	759.4
190	North side of OCTA/ Metrolink Railroad	OCFCD	***1781.4***	842.5

*All bold flow rates in Table 3-1 are Unit Hydrograph Method outputs

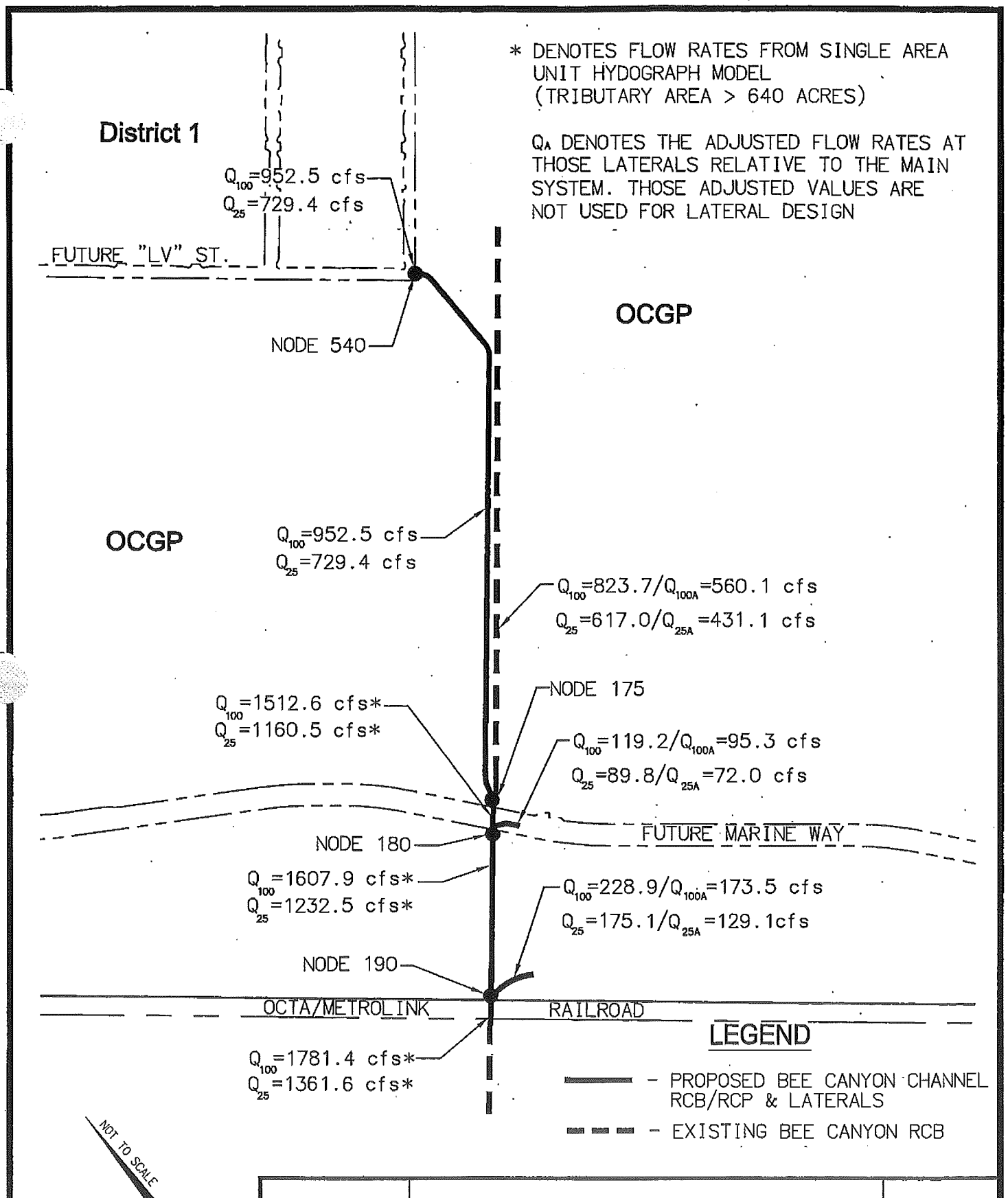
Due to the large tributary watershed to the Bee Canyon Channel (F17), both Rational and Unit Hydrograph methodologies had to be utilized in the design of the proposed facilities. Based on the *County of Orange Hydrology Manual,* the rational method is to be used in small watershed areas, with less than 640 acres. This change in methodology occurs at Node 175, shown in Figure 3-1, where the total tributary area surpasses the 640 acres. Thereafter, the unit hydrograph flow rate is to be used to determine the design flow. Design level Unit Hydrograph Method hydrology calculations for the proposed facility can be found in Appendix "B".

The *Master Plan* establishes a flow rate of Q_{100}=1779.7 cfs at the OCTA/Metrolink Railroad crossing. The single area unit hydrograph model, based on the design hydrology in Appendix "B" of this report yields a flow rate of Q_{100}=1781.4 cfs. These results are summarized in Table 3-2, below. Based on these results, the proposed design flow rates leaving the Project study area are in substantial conformance with the San Diego Creek Master Plan.

Table 3-2: Comparison: Bee Canyon Design Hydrology Vs. Master Plan Hydrology*

PA 51 & PA 30 Watershed Update Hydrology				**Bee Canyon Design Hydrology**			
Unit Hydrograph Method				Unit Hydrograph Method			
Node	Location	Area (Ac)	Flow Rate (cfs)	Node	Location	Area (Ac)	Flow Rate (cfs)
614	North of OCTA/Metrolink Railroad	842.9	***1779.7***	190	North of OCTA/Metrolink Railroad	842.5	***1781.4***

* All flow rates in Table 3-2 are 100-Year High Confidence Values



BEE CANYON CHANNEL (F17)
ULTIMATE FLOW MAP

CITY OF IRVINE

FIGURE
3-1

H:\PDATA\1010417\CADD\LAND\EXHIBITS\BEE CANYON\DESIGN REPORT\FLOWRATE-EXHIBIT (FIGURE 3-1).DWG LWOEHLK 10/16/12 4:57 pm

4 Bee Canyon Channel Hydraulics

The proposed improvements to Bee Canyon Channel (F17) extend from south of the OCTA/Metrolink Railroad right of way, to a point approximately 4,200 linear feet to the northeast at the boundary between the COI-OCGP and District 1 of GPN. The existing channel/RCB was constructed by the Military, as part of the El Toro MACS infrastructure and will remain as a private system for the COI-OCGP. Below are the results for the hydraulic analysis to convey 100-year design discharges through the proposed facility.

4.1 Hydraulic Analysis

The computer program *"Water Surface and Pressure Gradient Hydraulic Analysis"* (WSPG), developed by the Los Angeles County Flood Control District was used for the hydraulic analysis of the proposed Bee Canyon Channel (F17) improvements. The hydraulic analysis was prepared from the existing double 12'x9' RCB south of the OCTA/Metrolink, to the boundary between the COI-OCGP and District 1 of GPN. Manning's "n" values for these improvements are based on the guidelines in the Orange County *"Flood Control Design Manual."* There are various sections used in the proposed design of Bee Canyon Channel (F17), and the corresponding Manning's "n" values used are outlined below in Table 4-1. The stationing for the hydraulic run is based on the downstream OCFCD F17 Improvement Plans. The WSPG models are included in Appendix C.

Table 4-1: Summary of Manning's "n" for Bee Canyon Channel (F17) Design Sections

Station Range	Design Section	Manning's "n"
(STA 70+65.30 TO STA 70+70.30)	24.67' W x 9'H Rectangular Open Channel	.014
(STA 70+70.30 TO STA 71+17.73)	Transition from 24.67' W to 21.67' W Rectangular Open Channel	.014
(STA 71+17.73 TO STA 72+15.00)	21.67'W x 8'H Rectangular Open Channel	.014
(STA 72+15.00 TO STA 72+25.00)	Transition from 21.67' W to 22.67' W Rectangular Open Channel	.014
(STA 72+25.00 TO STA 80+17.99)	Dbl 11'W x 8'H RCB	.014
(STA 80+57.99 TO STA 112+11.40)	108", 96", & 84" RCP	.013
(Throughout from STA 82+17.99 TO STA 112+11.40)	Pipe Transition & Junction Structures	.015

4.2 Description of Hydraulic Models

A WSPG model of the proposed design was analyzed during this study. The model is described herein and the results are discussed in subsequent sections.

4.2.1 Updated Flow Rates (Proposed Condition)

This model is an analysis of the proposed facility, using the flow rates determined by the hydrology calculations found in Appendix "A" and in accordance with the Master Plan. The downstream control water surface elevation is the normal depth at a location 400 feet downstream of the existing double 12'x9' RCB (OCFCD) facility just south of the OCTA/Metrolink Railroad crossing (STA 66+89.79). Although the connection location of the proposed facility is at a Station of 70+65.30, the hydraulic model was run further downstream to determine if there is any effect on the water surface elevation at the Project Boundary from the downstream hydraulics. The corresponding stationing for the downstream run beginning point between proposed facility stationing and the existing Bee double 12'x9' RCP (OCFCD) facility is illustrated in Exhibit "E". The normal depth was calculated by using the Manning's equation for the existing structure at STA 66+89.79. This calculation can be found in Appendix "C". A critical depth run was also performed for the facility by setting the water surface elevation at STA 66+89.79 at zero and allowing the upstream hydraulics to control.

4.2.2 Sensitivity Analysis – Soffit Control

This model is an analysis of the proposed facility using the flow rates determined by the hydrology calculations found in Appendix "A". The water surface elevation is set at the soffit of the box at a location 400 feet downstream of the existing double 12'x9' RCB (OCFCD) at STA 66+89.79. This analysis was run to determine the sensitivity of the system, especially through the OCTA/Metrolink Railroad crossing.

4.2.3 Sensitivity Analysis – Soffit Control at Insufficient Freeboard

This model is an analysis of the proposed facility at the location where the WSPG output, described in Section 4.2.1, shows that the freeboard requirement is not met per Couny criteria (STA 72+25.00 to 82+57.99). As explained in Section 4.4, the freeboard required varies from 1.5' to 3.0' depending on the flow regime. To determine whether this will impact the hydraulics upstream and if the proposed facility can convey the flow entirely within its system, the water surface elevation is set at the soffit of the box at the downstream point.

4.3 Hydraulic Results

The hydraulic results for the model are as follows:

4.3.1 Updated Flow Rates (Proposed Condition)

The results of the normal depth hydraulic calculations demonstrate the proposed facility adequately conveys the 100-year storm event. The hydraulic grade line is completely contained within the channel/RCB at all points. It is only at the 84" RCP portion near the connection with District 1, that the pipe becomes sealed, but remains below the finished

surface. Results from the critical depth hydraulic calculations yielded the same results as that from the normal depth above. The lack of change in the model results indicates that the facilities' hydraulics is controlled by upstream conditions. The water depth and Froude number will then be reviewed for both models to determine what flow regime the water is in and whether it meets the freeboard requirement. Even though through the stretch of double RCB the 1.5' and 3.0' freeboard is not met, the hydraulic grade line for the 100-year high confidence flow remains within the limits of the proposed closed facilities. Specific results related to freeboard can be found in Section 4.4.

4.3.2 Sensitivity Analysis – Soffit Control

This analysis utilizes the same WSPG model described in 4.3.1, however, instead of assuming a normal depth calculation at the location 400 feet downstream of the connection point, the box is artificially sealed, by setting the water surface elevation to match the soffit of the RCB. This sensitivity analysis had no effect on the upstream hydraulics within the proposed system.

4.3.3 Sensitivity Analysis – Soffit Control at Insufficient Freeboard

This analysis utilizes the same WSPG model described in 4.3.2, however instead of artificially sealing the box at a point downstream of the connection point, the water surface control elevation is set to match the soffit of the box at the point just downstream of the system segment where the freeboard becomes deficient (STA 72+25.00 to 82+57.99), as specified by the OCFCD and outlined in 4.4. This is intended to determine the sensitivity of the system to this flow regime. Although the hydraulic analysis of the proposed condition described in Section 4.3.1 indicates that the minimum freeboard requirement is not met, this additional sensitivity analysis shows that the water surface elevation in this run resulted in additional inadequate freeboard just upstream from that sealed station (STA 72+25.00 to 74+21.25), but by STA 77+32.75, the flow hydraulics are the same as those analyses above. Even though through the stretch of double RCB the 1.5' and 3.0' freeboard is not met, the hydraulic grade line for the 100-year high confidence flow remains within the limits of the proposed closed facilities. Further explanation on freeboard requirements or for specific freeboard results can be found in Section 4.4 and in Appendix "D".

4.4 Channel Freeboard

In accordance with OCFCD's Design Manual, Addendum 3, the freeboard requirements in the channel are summarized in Table 4-2.

Table 4-2: Summary of Channel Freeboard Requirements (100-Year Return Frequency)

Channel Section	Flow Regime	Froude Number	Freeboard Requirement
Open Channels and Box Conduits designed as Open Channels	Sub-critical	Fr < 0.9	1.5 feet
	Super-critical	Fr > 1.2	3.0 feet
	Sub-critical-Unstable	0.9 < Fr <1.0	3.0 feet
	Super-critical unstable	1.0 < Fr < 1.2	Conjugate Depth + 3.0 feet
Closed Conduits designed as main trunk storm drain with all tributary systems considered	All	N/A	2.0' Below street gutter grade

The WSPG models were analyzed to determine available freeboard. The results are summarized in Appendix "D". The source data and calculations for the channel freeboard calculations are shown in Table 4-3.

Table 4-3: Summary of Channel Freeboard Calculations

Column Header	Data Source or Equation
Station	Proposed Bee Canyon Channel (F17) Improvement Plans (Exhibit "C")
Invert Elevation	Proposed Bee Canyon Channel (F17) Improvement Plans (Exhibit "C")
Depth of Flow	WSPG Results
Water Surface Elev.	WSPG Results
Q	*Bee Canyon Design Hydrology (Appendix "A")*
Velocity	WSPG Results
Velocity Head	WSPG Results
Energy Grade	WSPG Results
Critical Depth	WSPG Results
Channel Depth	As-Built Plans & Proposed Improvements (Exhibit "C")
Channel Type	As-Built Plans & Proposed Improvements (Exhibit "C")
Froude #	$\frac{Velocity}{\sqrt{g * Depth\_of\_flow}}$
Stability	Unstable if: 0.9 < Fr < 1.2
Unstable Conjugate Depth	If 1.0 < Fr <1.2 then: $Conjugate\_Depth = \frac{Depth\_of\_flow}{2}\left(\sqrt{1+8*F_r^{\,2}}-1\right)$
Freeboard Required	Freeboard per Table 4-1 added to Depth of Flow or Conjugate Depth (where applicable)
Actual Freeboard	In the Rectangular Channels: Channel Depth minus Depth of Flow. In RCB sections: Box Height minus Depth of Flow. In RCP sections: Pipe Soffit minus Depth of Flow. Insufficient freeboard can be determined by comparing Freeboard Required and Actual Freeboard. Note, in locations with unstable flow, freeboard requires conjugate depth +3.0'. For these locations, the actual freeboard listed is the Channel Depth/Box Height minus Conjugate Depth.
Overtop/Sealed	If the Depth of Flow is greater than the Channel Depth "OVERTOP" is shown in open channel. "SEALED" is shown for the same case in closed conduits.

4.4.1 Updated Flow Rates (Proposed Condition)

The results of the analysis indicate that the proposed Bee Canyon Channel (F17) Improvements adequately convey the 100-year design flow rates. The OCFCD portion of

the improvements (STA 70+65.30 to 80+57.99) was analyzed for flow regime, Froude number and Freeboard requirements identified in the *OCFCD Design Manual.*

Through the open channel portion of the design (STA 70+65.30 to 72+25.00), there are two locations where the 3.0' freeboard requirement is not satisfied within the proposed structure itself. However, the water surface elevation does remain 3.0' below the existing OCTA/Metrolink railroad bridge soffit (STA 71+17.73) and the proposed slopes adjacent to the open channel (STA 71+95.90 to 72+13.36). Therefore, the proposed open channel system, relative to the surrounding finished surface, provides the height to meet the 3.0' freeboard needed, while conveying the 100-year storm flow within the proposed structure.

Within the double 11'Wx8'H RCB portion (STA 72+25.00 to 80+57.99), the majority of the segment meets the agency requirements, including that of a 3.0' freeboard within the structure for Super-critical flow. After the introduction of flow at the lateral and through the box split transition, the hydraulic results indicate that the freeboard requirements are not met as it changes regimes. However, in areas of subcritical or unstable flow, where the freeboard requirements are 3.0' above the actual or conjugate depth, the actual freeboard provided is in excess of 2.0' (STA 80+07.89 to 80+77.50). At the transition (STA 82+57.99) and at STA 81+01.86, where the flow is running supercritical the freeboard is slightly less than the 1.5' required, but has an excess of 5.0' of cover over the system. It is due to these locations being within closed systems with several feet of cover and still freeboard within the conduit itself, that the system adequately conveys the 100-year flows.

The City of Irvine portion of the improvements (STA 80+57.99 to 112+11.40) was also analyzed using the more stringent criteria required by the County. In this analysis, the flow is described as "unstable" once the pipe is sealed (STA 106+17.66 to 112+11.40). The conjugate depth was checked through these "unstable" lengths to verify that the water surface does not reach the finished surface. The sealed section is allowable by City of Irvine Standards for a 100-year storm drain design and is well below the freeboard requirement of 2.0' beneath street gutter grade or the park's finished grade in this case.

5 Recommendations and Proposed Improvements

Several scenarios were examined to determine the most feasible recommendations with respect of contractibility, functionality, hydraulics, utility conflicts, impacts on the community, and construction costs. The proposed improvements discussed herein are the best case alternative to meet project constraints.

5.1 Alternative Discussion

5.1.1 Utilize existing facilities

There is currently an existing Bee Canyon Channel (F17) facility within the Project area. This facility was constructed by the Navy for the former El Toro M.C.A.S. and currently conveys on-site drainage through the site. No construction plans or hydraulic calculations for this facility can be located, and the construction methods/practices cannot be verified. In addition, these facilities are very shallow in depth. Given these considerations, a portion of the existing facilities will remain to serve areas of the COI-OCGP. Lateral "GP transitions from the existing triple box to confluence with the proposed Bee Canyon Channel, and is designed to convey the park's runoff delivered to the downstream connection of the existing system.

5.1.2 Reinforced Concrete Box vs. Open Channel (south of Marine Way)

The Bee Canyon Channel south of Marine Way (STA 70+65.30 to STA 80+57.99) is anticipated to be owned and maintained by OCFCD. The existing facility in this area transitions from a concrete trapezoidal channel lined with grouted rip-rap to a natural open trapezoidal channel upstream of the OCTA/Metrolink Railroad crossing. In the ultimate condition it proposed as a double 11'x8' RCB from approximately the north boundary of the OCTA/Metrolink Railroad (STA 72+25.00). The alignment of Bee Canyon runs through the middle of a large area owned by the City of Irvine, to be conveyed to the County of Orange Real Property. Typically, OCFCD prefers to own and maintain open channels; however, the decision to use a RCB in this area is based on maximizing the use of this land for the County of Orange. By constructing Bee Canyon as a RCB, the County will be able to site a parking lot, or other similar facility, over top of the proposed improvements.

5.1.3 Maintenance Access

The proposed plan for the portion of Bee Canyon Channel (F17) to be owned and maintained by OCFCD will provide a maintenance access drive from Marine Way in an ultimate condition. An interim condition, in which Marine Way has not yet been constructed, is proposed on the design improvement plans. This condition maintains that the existing Perimeter Road is the primary point of entrance for the access drive, with two driveways matching existing grade on either side, and provides for an additional 50'x50' turnaround north of the open channel (STA 72+25.00) and at the access shaft (STA 82+17.99). At the time of ultimate construction of Marine Way and abandonment of Perimeter Road, the Northerly turnaround would be removed and the ultimate driveways

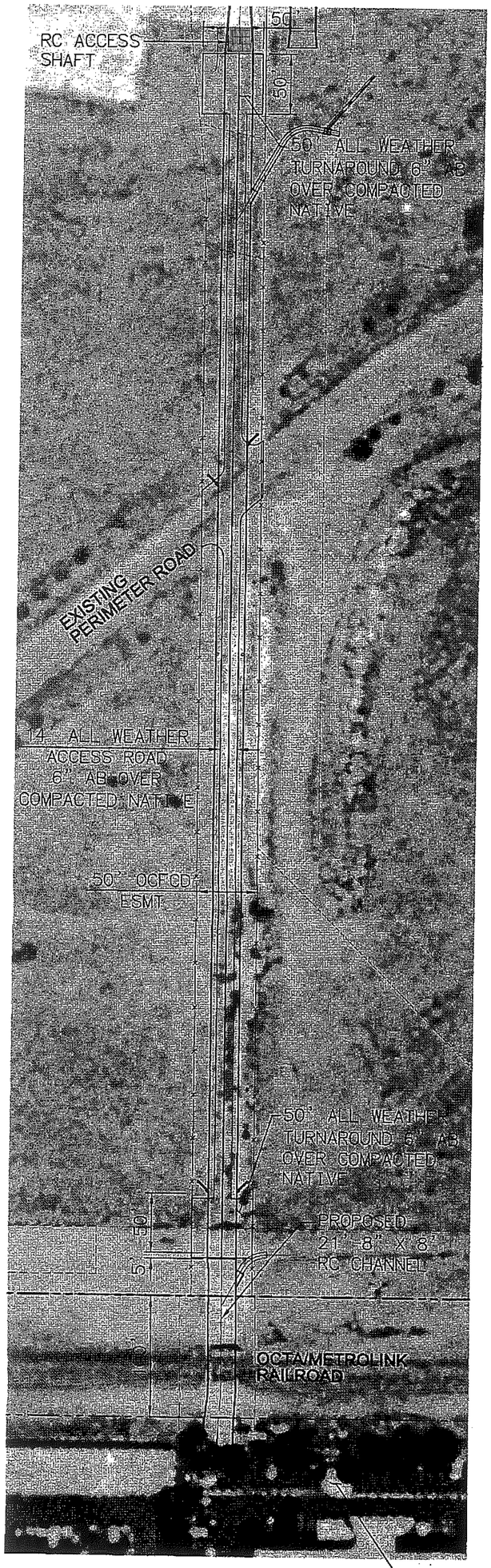
installed on both sides of Marine Way. These interim and ultimate conditions for the proposed maintenance access are illustrated on Figure 5-1.

Within County ownership, construction of an access shaft (STA 80+18.99 to 80+38.99) in accordance with County Standard Addendum #4 is anticipated, and illustrated on the design improvement plans. It is anticipated that OCFCD will assume fee ownership of these improvements by way of a 50' wide Right-of-Way from Marine Way to the North side of OCTA/Metrolink, and a 62' wide Hydraulic Conveyance Easement through the OCTA/Metrolink Right-of-Way. The access shaft (STA 80+18.99 to 80+38.99) will provide access to both OCFCD and COI drainage systems, and falls within a varying width utility easement, North of Marine Way, as identified on the design improvement plans, Exhibit "C".

5.1.4 OCTA/Metrolink Railroad Bridge Crossing

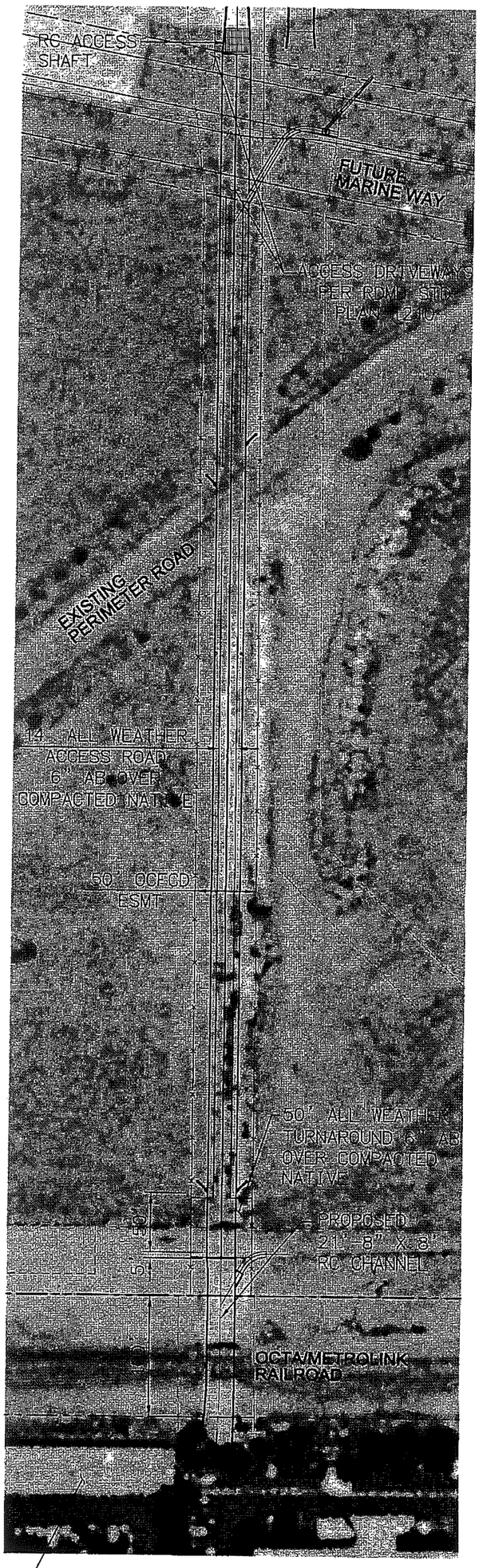
The existing facilities near the Project connection point of the proposed improvements includes a concrete-lined channel running from the double 12'x9' RCB (OCFCD), beneath the OCTA/Metrolink Railroad crossing bridge, and to the north side of the OCTA/Metrolink Railroad Right-of-Way. To maintain the structural integrity of the existing bridge, the proposed channel system through this crossing must pass beneath the bridge structure while remaining independent of the under crossing top and sides. An approved backfill, to be determined by soils and structural engineers, will be placed between the new channel and existing bridge abutments. In addition, numerous utility crossings exist within this Right-of-Way including: 30" HP gas, 2" Verizon fiber optic, 10" and 16" oil pipelines. These facilities have been "potholed" and the true crossing elevations, and subsequent 2' clearances per utility agency requirements, reflected in the design of the system segment through the OCTA/Metrolink Railroad Right-of-Way.

Provided these physical constraints, a 21.67'W x 6.5'W open rectangular channel is proposed through this OCTA/Metrolink crossing area. This proposed channel provides space for the placement of structural backfill between the two structures, while also adequately conveys the 100-year storm flow with freeboard. This intricate crossing is shown on the design plans, Exhibit "C", and shall be designed in further structural detail within the construction plans after further investigation into the structural integrity and design of the existing bridge.



INTERIM ACCESS PLAN

SCALE: 1"=100'



ULTIMATE ACCESS PLAN

SCALE: 1"=100'

ACCESS TO SOUTH SIDE OF OCTA/METROLINK R/W IS UNCHANGED BY THIS PROJECT

SCALE: 1"=100'

RBF CONSULTING

BEE CANYON CHANNEL INTERIM VS ULTIMATE MAINTENANCE ACCESS

CITY OF IRVINE

FIGURE 5-1

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5.1.5 Debris Allowance

The design of the proposed improvements shall consider the debris allowance for the channel. According to the *Orange County Flood Control District Design Manual*, the Facility Number 17 is considered a Category 3 for debris wall criteria, which requires debris walls with an applied a one-foot wide debris factor. The Category 3 rating for this facility is identified in the *Orange County Flood Control District Manual, 1973*. At the time of this report, the Bee Canyon watershed extended up into the foothills north of Irvine Blvd. However, with the adoption of the *1989 FCMPSDC* and the subsequent studies, this watershed has been modified, and no longer extends into the foothill region. The mostly natural terrain areas north of Irvine Blvd now drain to the Marshburn Retarding Basin.

Since the proposed Project is fully within the restricted watershed area south of Irvine Blvd, it could be considered an enclosed system, which would not require a Category 3 debris wall. Rather, at the two locations where large flow rates are diverging into double RCB (STA 70+65.30 & 82+17.99), debris noses are to be constructed per Orange County Flood Control District standards with no debris factor.

5.2 Recommended Alternative

The results of the hydraulic analysis give rise to the following recommendations. The proposed plans are included in Exhibit "C". The preliminary cost for the construction of the improvements is $3.33 million. A preliminary opinion of probable cost is included in Appendix "E".

6 Summary and Conclusions

The recommendations of this report provide the best-case alternative to conveying 100-year high confidence design flows from the Orange County Great Park (OCGP) and Great Park Neighborhoods (GPN) in the Bee Canyon Channel (F17). High-Confidence hydrology, hydraulic analyses, and freeboard calculations have been combined to provide redundant criteria to improve the Bee Canyon facility.

The existing drainage facilities will remain in service along with the proposed Bee Canyon Channel (F17) improvements and will provide service for the Project. The proposed improvements utilize a combination of reinforced concrete pipes and boxes, to maximize usable space within the Project. As such, the proposed improvements to Bee Canyon Channel (F17) represent the best and most efficient means of safely conveying design flows from COI-OCGP/GPN Project.

7 References

RBF Consulting. Amendment to *PA 51 and PA 30 Watershed Update Bee Canyon, Agua Chinon, Borrego, Serrano and Upper San Diego Creeks.* July 2011.

RBF Consulting. *Marshburn Channel Improvements: Irvine Blvd. to Trabuco Road Conceptual Design Hydrology and Hydraulic Design.* August 2006.

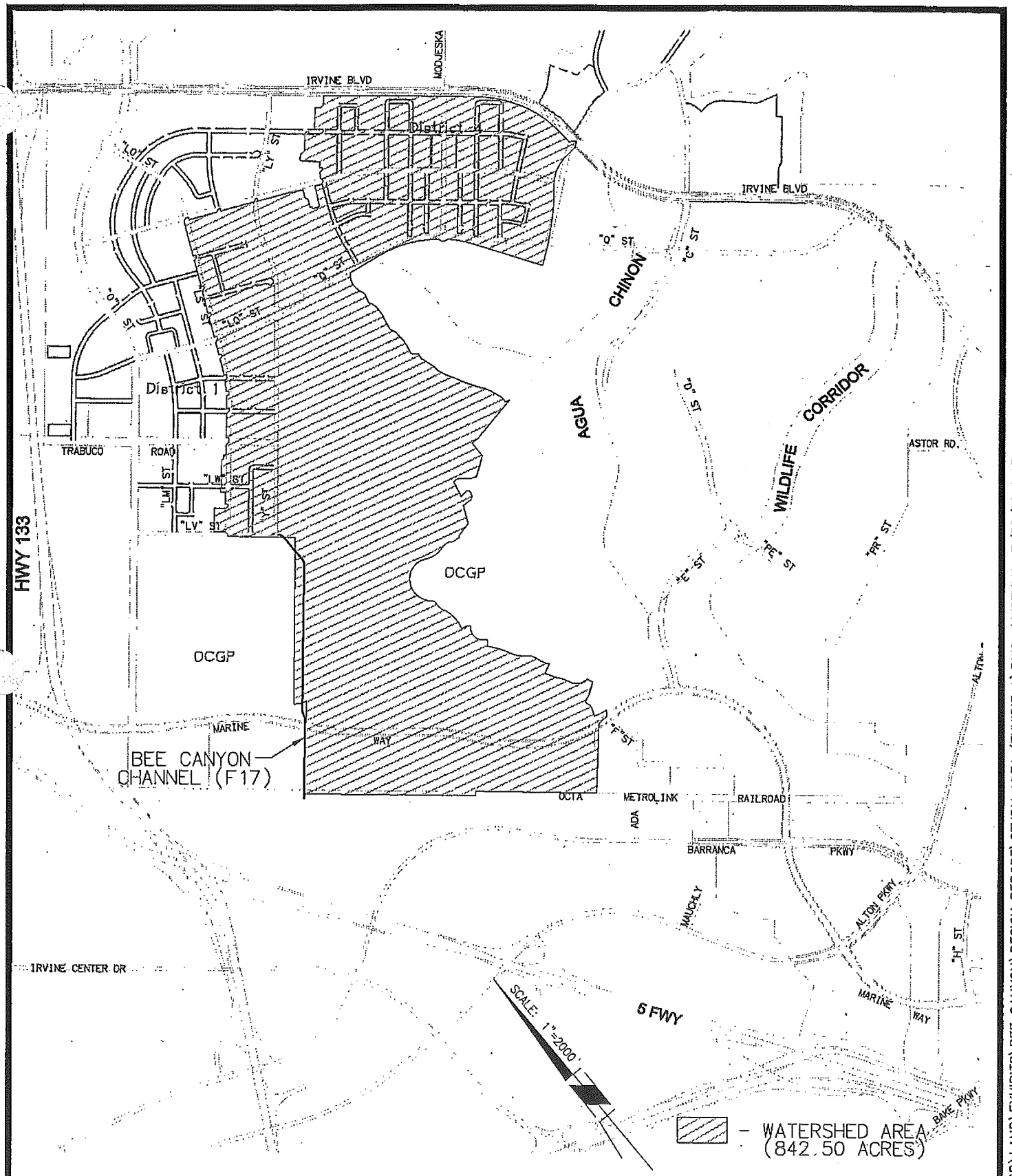
RBF Consulting. Amendment to *PA 51 Marshburn Watershed Update.* August 2011.

Orange County Resources and Development Management Department (RDMD). *Orange County Hydrology Manual.* Santa Ana, California. October 1986.

Resources & Development Management Department (RDMD). *Orange County Local Drainage Manual.* Santa Ana, California. May 1990.

Resources & Development Management Department (RDMD). *Flood Control Design Manual.* Santa Ana, California. Reprinted 1988

Exhibit A – Bee Canyon Channel (F17) Update Study Area



RBF CONSULTING

BEE CANYON CHANNEL (F17)
STUDY AREA

CITY OF IRVINE

EXHIBIT
A

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Exhibit C – Construction Plans - Bee Canyon Channel (F17) Improvements (60% complete)

COUNTY OF ORANGE
PUBLIC WORKS

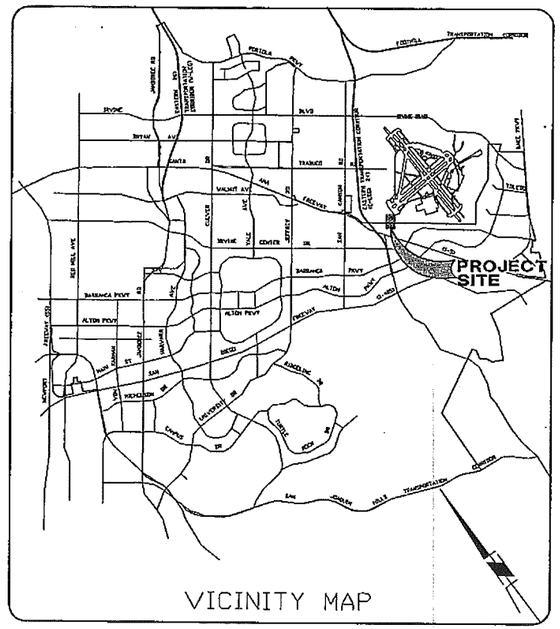
SANTA ANA, CALIFORNIA
IGNACIO G. OCHOA, INTERIM DIRECTOR

PLANS FOR CONSTRUCTION OF
THAT PORTION OF

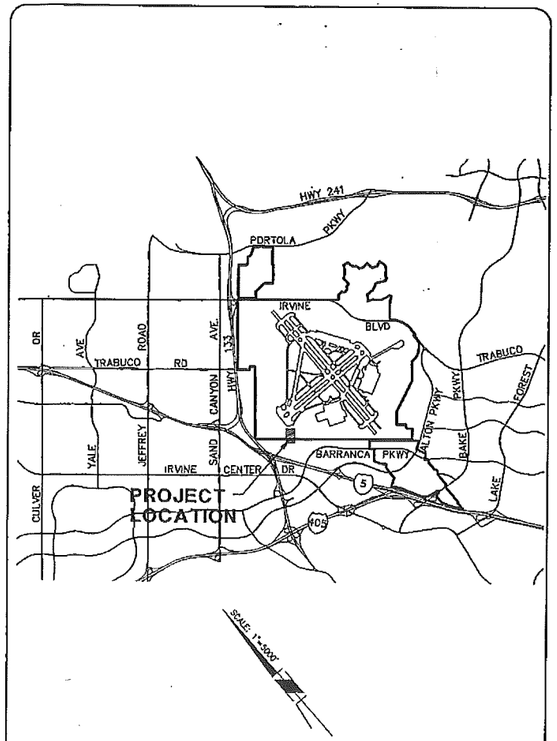
O.C.F.C.D. FACILITY NO. F17

BEE CANYON CHANNEL

OCTA/METROLINK RAILROAD TO 1062' N/E OF OCTA/METROLINK RAILROAD
(FROM STA 70+65.30 TO STA. 82+57.99)
WITHIN CITY OF IRVINE
OCTOBER 2012



VICINITY MAP



LOCATION MAP

OCFCD COUNTY PROPERTY ENCROACHMENT PERMIT

NUMBER: 2012-00513 DATE: TBD

MAINTAINED BY:

ORANGE COUNTY FLOOD CONTROL DISTRICT (OCFCD)
PER AGREEMENT NO. XXX-XXX, DATED X-XX-XXXX

MAINTENANCE RESPONSIBILITIES:

THE ORANGE COUNTY FLOOD CONTROL DISTRICT SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF THE FLOOD CONTROL FACILITIES.

PRIVATE ENGINEER'S NOTE TO CONTRACTOR

CAUTION: THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES TO, OR USES OF, THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

ENGINEER

RBF CONSULTING
PLANNING • DESIGN • CONSTRUCTION
14725 ALTON PARKWAY
IRVINE, CALIFORNIA 92618-2027
949.472.3505 • FAX 949.472.8373 • www.RBF.com

UNDER THE SUPERVISION OF:

JOHN A. McCARTHY R.C.E. NO. 47583

DATE:

CITY OF IRVINE

CIP # XXXXX PROJ # 547972-EMC

FOR REVIEW OF THE TRAFFIC SAFETY AND CONTROL, CITY STORM DRAIN CONNECTION ONLY

APPROVED BY CITY ENGINEER:

MARK CARROLL RCE 31515 EXP. DATE

DATE

ORANGE COUNTY PUBLIC WORKS DEPARTMENT

COUNTY OF ORANGE,

THIS PLAN IS SIGNED BY ORANGE COUNTY PUBLIC WORKS DEPARTMENT FOR CONCEPT AND ADHERENCE TO COUNTY STANDARDS AND REQUIREMENTS ONLY. ORANGE COUNTY PUBLIC WORKS DEVELOPMENT MANAGEMENT DEPARTMENT IS NOT RESPONSIBLE FOR DESIGN ASSUMPTIONS OR ACCURACY.

APPROVED:

DATE:

DEVELOPER

HERITAGE FIELDS EL TORO, LLC
C/o FIVEPOINT COMMUNITIES MANAGEMENT, INC
25 ENTERPRISE, SUITE 400
ALISO VIEJO, CA CA 92656

GEOTECHNICAL ENGINEER

ENGEO INC
2010 CROW CANYON PLACE
SAN RAMON, CA 94583

BASIS OF BEARING

THE BEARINGS SHOWN HEREON ARE BASED ON THE BEARING BETWEEN O.C.S. HORIZONTAL CONTROL STATION GPS NO. 6621 AND STATION GPS NO. 6678 BEING SOUTH 29°04'24" EAST PER RECORDS ON FILE IN THEOFFICE OF THE ORANGE COUNTY SURVEYOR.

INDEX OF SHEETS

SHEET	DESCRIPTION
1.	TITLE SHEET
2.	GENERAL NOTES, CONSTRUCTION NOTES AND ESTIMATED QUANTITIES
3.	PLAN AND PROFILE – STA 70+65.30 TO STA 80+00.00
4.	PLAN AND PROFILE – STA 80+00.00 TO 82+57.99, LATERALS "BEE 1" & "BEE 6"
5.	INTERIM GRADING PLAN – STA 70+65.30 TO STA 82+57.99
6.	ULTIMATE GRADING PLAN – STA 70+65.30 TO STA 82+57.99
7.	CONSTRUCTION DETAIL AT OCTA/METROLINK – STA 70+65.30 TO STA 72+25.00
8.	TRANSITION STRUCTURE & ACCESS SHAFT DETAILS
9.	DEMOLITION PLAN
10–19.	STRUCTURAL PLANS, DETAILS

UTILITY COMPANIES

AGENCY–UTILITY	PHONE NO.
CITY OF IRVINE	(949) 724-6000
OCTA/METROLINK RAILROAD	(714) 560-6282
SOUTHERN CALIFORNIA GAS COMPANY	(714) 634-3120
SOUTHERN CALIFORNIA EDISON	(714) 973-5409
SBC/PACIFIC BELL COMPANY	(800) 310-2355
UNDERGROUND SERVICE ALERT (USA)	(800) 422-4133
IRVINE RANCH WATER DISTRICT	(949) 453-5611
COX COMMUNICATIONS	(949) 546-2810
AT&T LOCAL SERVICES	(951) 354-9041
COUNTY SANITATION DISTRICTS OF ORANGE COUNTY	(714) 962-2411
MCI	(909) 421-3339
KINDER MORGAN	(714) 560-4400

BENCH MARK

ORANGE COUNTY SURVEYOR BENCHMARK NO. "3E-120-99"

DESCRIBED BY OCS 2002 – FOUND 3 3\4" OCS ALUMINUM BENCHMARK DISK STAMPED "3E-120-99", SET IN THE NORTHERLY CORNER OF A 4 FT. BY 11 FT. CONCRETE CATCH BASIN. MONUMENT IS LOCATED ALONG THE SOUTHWESTERLY SIDE OF IRVINE BOULEVARD, 500 FT. NORTHWESTERLY OF THE CENTERLINE OF N STREET AND 60 FT. SOUTHWESTERLY OF THE CENTERLINE OF IRVINE. MONUMENT IS SET LEVEL WITH THE SIDEWALK.

NGVD 29-1999 ADJ. ELEV.= 418.713

REVISIONS

NO.	DESCRIPTION	SHT.	APPROVED	DATE

OWG. NOS.
F17-XXX-X

H:\PDATA\10108417\CADD\LAND\OLV\IMPROVE\SD\BEE SD-COUNTY\8417-UT-BEE-SD-01.DWG J.LEONARD 10/29/12 11:07 am

OCPW NOTES

GENERAL NOTES

1. ALL WORK MUST BE IN CONFORMANCE WITH THE CURRENT STANDARD SPECIFICATIONS (STANDARD SPECIFICATION FOR PUBLIC WORKS CONSTRUCTION), (GREENBOOK) AND THESE PROVISIONS AND THE 2006 RDMD STANDARD PLANS, WHICH MUST KEPT ON THE JOB SITE AT ALL TIME.

2. THE CONTRACTOR MUST NOTIFY THE RDMD INSPECTOR AT LEAST TWO (2) WORKING DAYS PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION BY TELEPHONING 567-7804, OR BY WRITING THE ORANGE COUNTY RDMD, ATTN: CONSTRUCTION, 1152 E. FRUIT STREET, SANTA ANA CA 92701.

3. ALL SURVEYING REQUIRED FOR VERTICAL AND HORIZONTAL ALIGNMENT MUST BE PROVIDED BY THE CONTRACTOR OR DEVELOPER AND SUFFICIENT REFERENCE STAKING MUST BE IN ACCORDANCE WITH REQUEST OF THE OC PUBLIC WORKS INSPECTOR.

4. ALL MATERIALS TESTING FOR THE DRAINAGE FACILITIES SHALL BE PROVICED BY THE DEVELOPER OR CONTRACTOR IN ACCORDANCE WITH THE NUMBER, LOCATION, AND FREQUENCY REQUESTED BY THE OC PUBLIC WORKS INSPECTOR.

5. ALL FILLS MUST BE COMPACTED TO 90% RELATIVE COMPACTION AS DETERMINED BY THE CALIFORNIA TEST METHOD NO. 216, 1978 "FIVE LATER METHOD." ALL BACKFILL MUST BE FREF OF ORGANIC MATTER.

6. CHAMFER ALL EXPOSED EDGES OF CONCRETE ¾" MIN.

7. ALL REINFORCING BARS MUST BE SECURELY HELD IN THE PLACE IN THE FORMS PRIOR TO CONCRETE PLACEMENT TWO-WAY MATS OF STEEL MUST BE WIRED TOGETHER BOTH WAYS ALTERNATE INTERSECTION.

8. WORKING WITHIN ORANGE COUNTY FLOOD CONTROL FACILITIES IS RESTRICTED TO THE PERIOD OF APRIL 15 TO OCTOBER 15.

9. THE CONTRACTOR SHALL CONDUCT CONSTRUCTION OPERATIONS IN SUCH A MANNER THAT STORM OR OTHER WATERS MAY PROCEED UNINTERRUPTED ALONG THEIR EXISTING STREET OR DRAINAGE COURSES.

10. IN THE COURSE OF WATER CONTROL, THE CONTRACTOR SHALL CONDUCT CONSTRUCTION OPERATIONS TO PROTECT WATERS FROM POLLUTION WITH FUELS, OILS, BITUMENS, OR HARMFUL MATERIALS.

11. A SOILS INVESTIGATION REPORT HAS BEEN PREPARED BY EARTH MECHANICS INC. ENTITLED:
GEOTECHNICAL INVESTIGATION REPORT
CENTRAL IRVINE CHANNEL (OCFCD FACILITY NO. F25),
IRVINE, CALIFORNIA, DATED: FEBRUARY 20, 2006.

12. SURPLUS LOOSE RIPRAP TO BE CLEANED IN CONFORMANCE WITH GREENBOOK 2000, PART 2, CONSTRUCTION MATERIALS, 200-1.1 GENERAL SPECIFICATIONS, AND DELIVERED TO OC PUBLIC WORKS. ARRANGEMENTS FOR DELIVERY AND STOCKPILING OF THE SALVAGED RIPRAP MATERIALS ARE TO BE COORDINATED WITH JIM HOSKINS, OC PUBLIC WORKS/O&M/PUBLIC FACILITIES SUPERVISOR AT (714)567-6279.

13. CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS AND SITE CONDITIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

14. FOUNDATION EXCAVATIONS SHALL BE INSPECTED BY THE GEOTECHNICAL ENGINEER DURING EXCAVATION AND PRIOR TO PLACEMENT OF REINFORCING STEEL OR CONCRETE.

15. SOILS BENEATH FOOTINGS SHALL BE PRE-MOISTENED (IF NECESSARY) AND COMPACTED TO MINIMUM REQUIREMENTS PRIOR TO PLACING CONCRETE.

16. CEMENT SHALL CONFORM TO ASTM C-150.

17. CONCRETE SHALL HAVE AN ULTIMATE COMPRESSIVE STRENGTH OF 5000 PSI MINIMUM AT 28 DAYS (560-C-3250). ALL AGGREGATE SHALL CONFORM TO ASTM C-33.

18. REINFORCING STEEL SHALL BE DEFORMED BARS, CONFORMING TO ASTM A615, GRADE 60.

19. DIMENSIONS LOCATING REINFORCING BARS ARE CLEAR AND DENOTE CONCRETE. COVERAGE TO MAIN STEEL. UNLESS NOTED OTHERWISE, CONVERAGE SHALL BE AS FOLLOWS:

CONCRETE PLACED AGAINST EARTH (NO FORMED)	3"
FORMED CONCRETE AGAINST EARTH	2"
WALLS, ABOVE GRADE, EXPOSED TO WEATHER	2"

20. SUPPORT REINFORCING OFF FORMS WITH STEEL CHAIRS. SUPPORT REINFORCING OFF GRADE WITH DENSE CONCRETE BLOCKS. NO BRICK OR POROUS CONCRETE WILL BE PERMITTED TO SUPPORT REINFORCING.

21. NO REVISION SHALL BE MADE WITHOUT PRIOR WRITTEN APPROVAL OF THE ENGINEER.

22. CONTRACTOR SHALL SUBMIT ALL PCC MIX DESIGNS TO COUNTY INSPECTOR AND BE APPROVED BY COUNTY MATERIALS LAB PRIOR TO USE.

23. CONTRACTOR SHALL HAVE PRECONSTRUCTION MEETING WITH OC PUBLIC WORKS PRIOR TO BEGINNING CONSTRUCTION.

24. CONTRACTOR SHALL TAKE MEASURES TO PROTECT CHANNEL AND PROPOSED IMPROVEMENTS FROM DAMAGE RESULTING FROM WATER DISCHARGES FROM LOCAL WATER DISTRICT(S) FACILITIES.

25. ALL STEEL THAT IS TO BE CONTINUOUS SHALL BE LAPPED A MINIMUM OF 45 BAR DIAMETERS.

26. PRIOR TO COMMENCEMENT OF CONSTRUCTION, THE DEVELOPER'S CONTRACTOR SHALL OBTAIN A PERMIT FROM THE STATE DIVISION OF INDUSTRIAL SAFETY, A COPY OF PERMIT SHALL BE KEPT ON JOB SITE AT ALL TIME.

27. WHENEVER APPLICABLE, THE DEVELOPER SHALL OBTAIN A PERMIT FROM THE STATE DEPARTMENT OF FISH AND GAME IN ACCORDANCE WITH SECTION 1602 OF THE CALIFORNIA FISH AND GAME CODE PRIOR TO COMMENCEMENT OF CONSTRUCTION.

28. IN-PLACE DENSITY SHALL BE DETERMINED BY CALIFORNIA TEST METHOD 216 OR 231.

29. EPOXY SHALL CONFORM TO ASTM C-881.

STORM DRAIN GENERAL NOTES:

1. RCP SHALL COMPLY WITH ALL GREENBOOK REQUIREMENTS.

2. ALL PIPE LENGTHS ARE HORIZONTAL PROJECTIONS, UNLESS OTHERWISE SHOWN.

3. ALL REINFORCED CONCRETE PIPE MUST BE BEDDED IN ACCORDANCE WITH PIPE BEDDING DETAIL PER RDMD STANDARD PLAN 1319.

4. ALL PIPE TO BE BANDED AND GROUTED. (LESS THAN 24" OUTSIDE ONLY, 24" AND GREATER INSIDE AND OUTSIDE).

5. CONTRACTOR WILL NOTIFY OC PUBLIC WORKS MATERIALS LAB (PHONE # 567-7805) FOURTY-EIGHT (48) HOURS PRIOR TO D-LOAD TESTING OF RCP. FOR VERIFICATION OF RESULTS.

6. ALL MATERIALS TESTING FOR THE DRAINAGE FACILITIES SHALL BE PROVIDED BY THE DEVELOPER OR CONTRACTOR IN ACCORDANCE WITH THE NUMBER, LOCATION, AND FREQUENCY REQUESTED BY THE OC PUBLIC WORKS INSPECTOR.

7. PRIOR TO THE PLACEMENT OF STORM DRAIN IMPROVEMENTS, THE DEVELOPER'S SOIL ENGINEER SHALL CERTIFY IN WRITING TO THE RDMD INSPECTOR THAT THE STORM DRAIN'S SUB GRADE IS FIRM AND UNYIELDING AND ABLE TO SUPPORT THE STRUCTURES AND ANY ANTICIPATED LOADS.

8. STORM DRAIN BACKFILL FOR ALL FACILITIES WITHIN STREET RIGHT-OF-WAY IS TO BE PLACED AND COMPACTED UNDER PFRD INSPECTION AND MEET OR EXCEED RDMD MINIMUM STANDARD.

9. FOR TRENCH EXCAVATIONS, SHORING SHALL BE PROVIDED TO SATISFY STATE OF CALIFORNIA SAFETY REQUIREMENTS.

10. PIPE CONSTRUCTION IN FILL AREA MUST BE COORDINATED WITH THE GRADING TO INSURE THAT WHEN THE FILL OPERATION HAS COMPLETED AT GRADE THERE IS A MINIMUM OF 2 FEET OF FILL ABOVE THE TOP OF PIPE.

11. LENGTH OF MANHOLE STRUCTURES MAY BE INCREASED TO MEET PIPE ENDS AT OPTION OF CONTRACTOR AS LONG AS REINFORCING STEEL IS CONTINUED AS REQUIRED. ANY CHANGE IN SPUR LOCATION MUST BE APPROVED BY THE ENGINEER.

12. FLOOR OF MANHOLE STRUCTURES SHALL BE STEEL TROWELED TO SPRING LINE.

13. BODY OF MANHOLE STRUCTURE, INCLUDING SPUR, MUST BE PLACED IN ONE CONTINUOUS OPERATION, EXCEPT THAT CONSTRUCTION JOIN AT THE SPRING LINE WITH A LONGITUDINAL KEY WAY IS PERMITTED.

14. PLACE TRANSVERSE JOINTS IN REINFORCED CONCRETE CHANNEL AND BOX CULVERT PER RDMD STD PLAN 1318.

15. PRIOR TO MATERIAL TESTING CONTACT OC PUBLIC WORKS MATERIALS LAB - INDEPENDENT ASSURANCE 714-567-7878.

ENVIRONMENTAL NOTES:

1. SEDIMENT FROM AREAS DISTURBED BY CONSTRUCTION SHALL BE RETAINED ON SITE USING STRUCTURAL CONTROLS TO THE MAXIMUM EXTENT PRACTICABLE.

2. STOCKPILES OF SOIL SHALL BE PROPERLY CONTAINED TO ELIMINATE OR REDUCE SEDIMENT TRANSPORT FROM THE SITE TO THE STREETS, DRAINAGE OF FACILITIES OR ADJACENT PROPERTIES VIA RUNOFF, VEHICLE TRACKING, OR WIND.

3. APPROPRIATE BMPS FOR CONSTRUCTION-RELATED MATERIALS, WASTES, SPILLS OR RESIDUES SHALL BE IMPLEMENTED TO MINIMIZE TRANSPORT FROM THE SITE TO STREETS, DRAINAGE FACILITIES, OR ADJOINING PROPERTIES BY WIND OR RUNOFF.

4. RUNOFF FROM EQUIPMENT AND VEHICLE WASHING SHALL BE CONTAINED AT CONSTRUCTION SITES UNLESS TREATED TO REDUCE OR REMOVE SEDIMENT AND OTHER POLLUTANTS.

5. ALL CONSTRUCTION CONTRACTOR AND SUBCONTRACTOR PERSONNEL ARE TO BE MADE AWARE OF THE REQUIRED BEST MANAGEMENT PRACTICES AND GOOD HOUSEKEEPING MEASURES FOR THE PROJECT SITE AND ANY ASSOCIATED CONSTRUCTION STAGING AREAS.

6. AT THE END OF EACH DAY OF CONSTRUCTION ACTIVITY ALL CONSTRUCTION DEBRIS AND WASTE MATERIALS SHALL BE COLLECTED AND PROPERLY DISPOSED IN TRASH OR RECYCLE BINS.

7. CONSTRUCTION SITES SHALL BE MAINTAINED IN SUCH A CONDITION THAT A STORM DOES NOT CARRY WASTES OR POLLUTANTS OFF THE SITE. DISCHARGERS OTHER THAN STORMWATER (NON-STORMWATER DISCHARGES) ARE AUTHORIZED UNDER CALIFORNIA'S GENERAL PERMIT FOR STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY ONLY WHERE THEY DO NOT CAUSE OR CONTRIBUTE TO A VIOLATION OF ANY WATER QUALITY STANDARD AND ARE CONTROLLED THROUGH IMPLEMENTATION OF APPROPRIATE BMPS FOR ELIMINATION OR REDUCTION OF POLLUTANTS. NON-STORMWATER DISCHARGES MUST BE ELIMINATED OR REDUCED TO THE EXTENT FEASIBLE.

POTENTIAL POLLUTANTS INCLUDE BUT ARE NOT LIMITED TO: SOLID OR LIQUID CHEMICAL SPILLS; WASTES FROM PAINTS, STAINS, SEALANTS, SOLVENTS, DETERGENTS, GLUES, LIME, PESTICIDES, HERBICIDES, FERTILIZERS, WOOD, PRESERVATIVES, AND ASBESTOS FIBERS, PAINT FLAKES OR STUCCO FRAGMENTS; FUELS, OILS, LUBRICANTS AND HYDRAULIC, RADIATOR OR BATTERY FLUIDS; CONCRETE AND RELATED CUTTING OR CURING RESIDUES; FLOATABLE WASTES, WASTES FROM ANY ENGINE/EQUIPMENT STEAM CLEANING OR CHEMICAL DEGREASING; WASTES FROM STREET CLEANING; AND SUPERCHLORINATED POTABLE WATER LINE FLUSHING AND TESTING.

DURING CONSTRUCTION, DISPOSAL OF SUCH MATERIALS SHOULD OCCUR IN A SPECIFIED AND CONTROLLED TEMPORARY AREA ON-SITE PHYSICALLY SEPARATED FROM POTENTIAL STORMWATER RUNOFF, WITH ULTIMATE DISPOSAL IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REQUIREMENTS.

8. DISCHARGING CONTAMINATED GROUNDWATER PRODUCED BY DEWATERING GROUNDWATER THAT HAS INFILTRATED INTO CONSTRUCTION SITE IS PROHIBITED. DISCHARGING OF CONTAMINATED SOILS VIA SURFACE EROSION IS ALSO PROHIBITED. DISCHARGING OF NON-CONTAMINATED GROUNDWATER PRODUCED BY DEWATERING ACTIVITIES REQUIRES A ATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT FROM THE SANTA ANA REGIONAL WATER QUALITY CONTROL BOARD.

9. ANY SPILLAGE OF FUEL, OIL OR HAZARDOUS MATERIALS FROM CONSTRUCTION EQUIPMENT OR VEHICLES OR SIGNIFICANT RELEASES OF SEDIMENT DUE TO CONSTRUCTION ACTIVITIES OR BMP FAILURES IMPACTING DOWNSTREAM STORMDRAIN AREAS MUST BE IMMEDIATELY AND PROPERLY CLEANED UP AND REMOVED FROM THE OCFCD'S RIGHT-OF-WAY. FOR SPILLS OF SIGNIFICANT VOLUME, NOTIFICATIONS MUST BE IMMEDIATELY MADE TO RDMD/ENVIRONMENTAL RESOURCES FOR ASSESSMENT OF BEST CORRECTIVE ACTION. CONTAMINATED WATER, SOIL, SAND OR MATERIAL AND HAZARDOUS WASTES GENERATED FROM THE CLEANUP MUST BE DISPOSED BY APPROVED METHODS. PERMITTEE ASSUMES FULL RESPONSIBILITY FOR COSTS TO INVESTIGATE EXTENT OF CONTAMINATIOR, CLEANUP, WASTE REMOVAL AND IMPLEMENTATION OF AN APPROVED REMEDIAL ACTION PLAN FOR THE RELEASE OF ANY WASTES OR HAZARDOUS MATERIALS THAT RESULT IN SOIL AND GROUNDWATER CONTAMINATION.

NOTIFICATIONS OF SPILLS AND SIGNIFICANT RELEASES OF SEDIMENT DUE TO CONSTRUCTION ACTIVITIES OR BMP FAILURES IMPACTING DOWNSTREAM AREAS OR STORMDRAINS MUST BE IMMEDIATELY MADE TO:

RDMD/ENVIRONMENTAL RESOURCES,
ATTENTION:
DUC NGUYEN (714) 973-6690.

AFTER-HOURS SPILL NOTIFICATION SHOULD BE MADE THROUGH:
ORANGE COUNTY SHERIFF'S COMMUNICATIONS CONTROL 1 BY DIALING 911.

CONSTRUCTION NOTES

	CONSTRUCTION NOTES	UNITS	ESTIMATED QUANTITY
(1)	INSTALL 24'-8"W VARYING HEIGHT RC CHANNEL PER DETAIL ON SHT 12	LF	5
(2)	INSTALL 18" RCP (D-LOAD PER PLAN, OCFCD ST-29), BEDDING PER OC PUBLIC WORKS STD. PLAN 1319	LF	49
(3)	INSTALL 21'-8" X 8'H RC CHANNEL PER DETAIL ON SHT 13	LF	113
(4)	INSTALL DOUBLE 11'W X 8'H RCB PER DETAIL OR SHT 14	LF	993
(5)	INSTALL 60" RCP (D-LOAD PER PLAN, OCFCD ST-29), BEDDING PER OC PUBLIC WORKS STD. PLAN 1319	LF	29
(6)	INSTALL BRICK & MORTAR PLUG	EA	2
(7)	CONSTRUCT ALL WEATHER ACCESS ROAD, 6" AB OVER COMPACTED NATIVE, WIDTH PER PLAN	SF	15,902
(8)	CONSTRUCT ALL WEATHER TURNAROUND, 6" AB OVER COMPACTED NATIVE, DIMENSIONS AS SHOWN	SF	5,000
(9)	INSTALL MANHOLE IN RCB PER OC PUBLIC WORKS STD. PLAN 1506	EA	2
(10)	CONSTRUCT TRANSITION STRUCTURE #1 PER DETAIL ON SHEET 8	EA	1
(11)	CONSTRUCT JUNCTION STRUCTURE PER OC PUBLIC WORKS STD. PLAN NO. 1314	EA	1
(12)	INSTALL RC ACCESS SHAFT PER DETAIL ON SHT 17	EA	1
(13)	CONSTRUCT JUNCTION STRUCTURE #1 PER DETAIL ON SHEET 8	EA	1
(14)	INSTALL CULVERT DEBRIS WALL PER OC PUBLIC WORKS STD. PLAN NO. 1324	EA	5
(15)	INSTALL 5' HIGH CHAIN LINK FENCE PER OC PUBLIC WORKS STD. PLAN 600-1-OC	EA	2
(16)	CONSTRUCT JUNCTION STRUCTURE #2 PER APWA STD. 344 & DETAIL ON SHEET 8	EA	1,936
(17)	CONSTRUCT 14' MAINTANENCE ACCESS DRIVEWAY PER OC PUBLIC WORKS STD. PLAN 1210	EA	2
(18)	INSTALL 48" RCP (D-LOAD PER PLAN, OCFCD ST-29), BEDDING PER OC PUBLIC WORKS STD. PLAN 1319	LF	20
(19)	INSTALL INLET TYPE V PER OC PUBLIC WORKS STD. 1305	EA	4
(20)	CONSTRUCT 16' MAINTANENCE ACCESS DRIVEWAY TYPE II PER CITY OF IRVINE STD. PLAN NO. 205, R=10'	EA	4
(21)	CONSTRUCT RCB WINDOWS PER APWA STD. 382	EA	1
(22)	CONSTRUCT JUNCTION STRUCTURE #3 PER DETAIL ON SHT X	EA	1

LEGEND

RIGHT-OF-WAY LINE
LOT LINE
2:1 TOP OF SLOPE
TOE OF SLOPE
DW DOMESTIC WATER LINE
STORM DRAIN LINE

AB	AGGREGATE BASE
ARHM	ASPHALT RUBBER HOT MIX
B.C.	BEGIN CURVE
BEG	BEGIN
BOT	BOTTON
BTWN	BETWEEN
C&G	CURB AND GUTTER
CB	CATCH BASIN
℄	CENTER LINE
CLF	CHAIN LINK FENCE
CLR.	CLEARANCE
COI	CITY OF IRVINE
CONT.	CONTINUOUS
DIA	DIAMETER
DBL	DOUBLE
DW	DOMESTIC WATER
DWY	DRIVEWAY
EA.	EACH
E.C.	END CURVE
EF	EACH FACE
EFP	EQUIVALENT FLUID PRESSURE
EW	EACH WAY
EXIST	EXISTING
EXT	EXTENSION
FL	FLOWLINE
FS	FINISHED SURFACE
GALV	GALVANIZED
G.B.	GRADE BREAK
GL	GRADELINE
HGL	HYDRAULIC GRADELINE
HT	HEIGHT
INV	INVERT
LAT.	LATERAL
LOL	LAYOUT LINE
MAX	MAXIMUM
MBGR	METAL BEAM GUARD RAIL
MH	MANHOLE
MIN	MINIMUM
O.C.	ON CENTER
O.D.	OUTSIDE DIAMETER
OCFCD	ORANGE COUNTY FLOOD CONTOL DISTRICT
OPNG	OPENING
PB	PULL BOX
PCC	POINT OF CONTINUOUS CURVATURE
P/L	PROPERTY LINE
PRC	POINT OF REVERSE CURVATURE
PROP	PROPOSED
R.C.	REINFORCED CONCRETE
RCB	REINFORCED CONCRETE BOX
RCP	REINFORCED CONCRETE PIPE
RDMD	ORANGE COUNTY RESOURCES AND DEVELOPMENT MANAGEMENT DEPARTMENT
RECT	RECTANGULAR
RW	RECLAIMED WATER
R/W	RIGHT OF WAY
S.E.	SAND EQUIVALENT
SS	SANITARY SEWER
STA	STATION
STD	STANDARD
STL.	STEEL
T	TELEPHONE
TC	TOP OF CURB
TG	TOP OF GRATE
TS	TRAFFIC SIGNAL
TW	TOP OF WALL
TYP	TYPICAL
VAR	VARIES
VC	VERTICAL CURVE OR VALVE COVER
VLT	VAULT
W/	WITH
WM	WATER METER
WV	WATER VALVE

COUNTY OF ORANGE CALIFORNIA

MARK | DESCRIPTION | DATE | APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF: | DATE

REGISTERED PROFESSIONAL ENGINEER * JOHN Y. McCARTHY No. 47083 Exp. 12/31/11 CIVIL * STATE OF CALIFORNIA

DESIGNED BY: LW | DRAWN BY: LW | CHECKED BY: JL/JM | DRAWING CODE: F25-XXX-X | FILE NAME: | PLOT DATE: | SCALE: AS SHOWN

ORANGE COUNTY PUBLIC WORKS

PREPARED BY: RBF CONSULTING

BEE CANYON CHANNEL
FACILITY NO. F17
CHANNEL IMPROVEMENTS

Sheet Reference Number
2
of 19 Sheets

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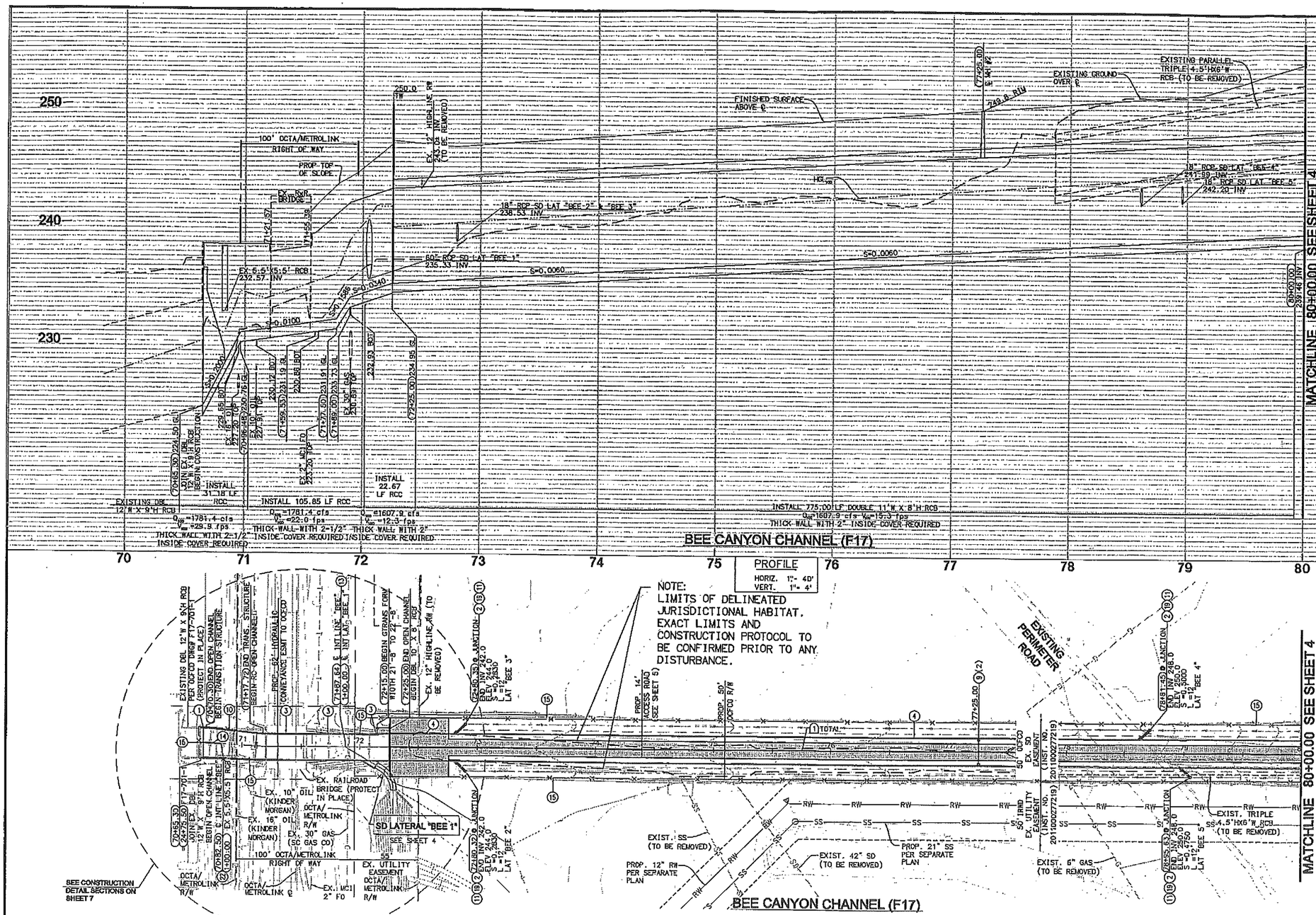


*NOTE: ALL STORM DRAIN LATERAL LINES WILL BE OWNED AND MAINTAINED BY THE FEE OWNER OR THE LOCAL AGENCY PER SEPARATE PERMIT.

CONSTRUCTION NOTES

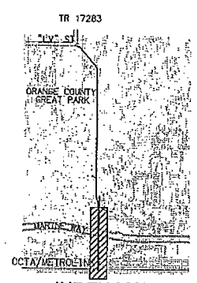
1. INSTALL 24'-8"W VARYING HEIGHT RC CHANNEL
2. INSTALL 18" RCP (D-LOAD PER PLAN, OCFCD ST-29)
3. INSTALL 21'-8" X 8'H RC CHANNEL
4. INSTALL DOUBLE 11'W X 8'H RCB PER CALTRANS STD. D-81
9. INSTALL MANHOLE IN RCB PER APWA STD. 323
10. CONSTRUCT TRANSITION STRUCTURE #1 PER DETAIL ON SHEET 8
11. CONSTRUCT JUNCTION STRUCTURE PER OC PUBLIC WORKS STD. PLAN NO. 1314
13. CONSTRUCT JUNCTION STRUCTURE #1 PER DETAIL ON SHEET 8
14. INSTALL CULVERT DEBRIS WALL PER OC PUBLIC WORKS STD. PLAN NO. 1324
15. INSTALL GUARD CABLE FENCE PER CALTRANS B11-47 OR APPROVED EQUAL
19. INSTALL INLET TYPE V PER OC PUBLIC WORKS STD. 1305

LINE/CURVE DATA TABLE

	M	BEARING/DELTA	RADIUS	LENGTH	TANGENT
TOTAL	1	N40°45'11"E	—	1121.26'	—

HYDRAULIC DATA

LINE	STA	TO STA	Q_{100}	S_o	n	D	d_n	V_n	d_c	V_c	N_f
BEE	70+65.30	70+70.30	1781.4	0.200	0.014	RCC	1.34	53.85	5.45	15.18	8.20
BEE	70+70.30	70+96.48	1781.4	0.200	0.014	RCC	1.40	55.00	5.68	15.82	8.20
BEE	70+96.48	71+77.50	1781.4	0.010	0.014	RCC	3.85	21.31	5.94	26.01	1.91
BEE	71+77.50	71+88.00	1781.4	.1886	0.014	RCC	1.57	52.25	5.94	103.53	7.34
BEE	71+87.00	72+02.33	1781.4	0.034	0.014	RCC	2.58	31.91	5.94	47.96	3.50
BEE	72+02.33	72+25.00	1607.9	0.0575	0.014	RCC	2.41	30.78	5.55	47.95	3.49
BEE	72+25.00	80+00.00	1607.9	0.006	0.014	RCB	4.76	15.35	5.50	18.14	1.24



INDEX MAP
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ORANGE COUNTY PUBLIC WORKS

PREPARED BY: RBF CONSULTING

BEE CANYON CHANNEL
FACILITY NO. F17
CHANNEL IMPROVEMENTS

STORM DRAIN
PLAN AND PROFILE
70+65.30 TO 80+00.00

Sheet Reference Number 3

of 19 Sheets

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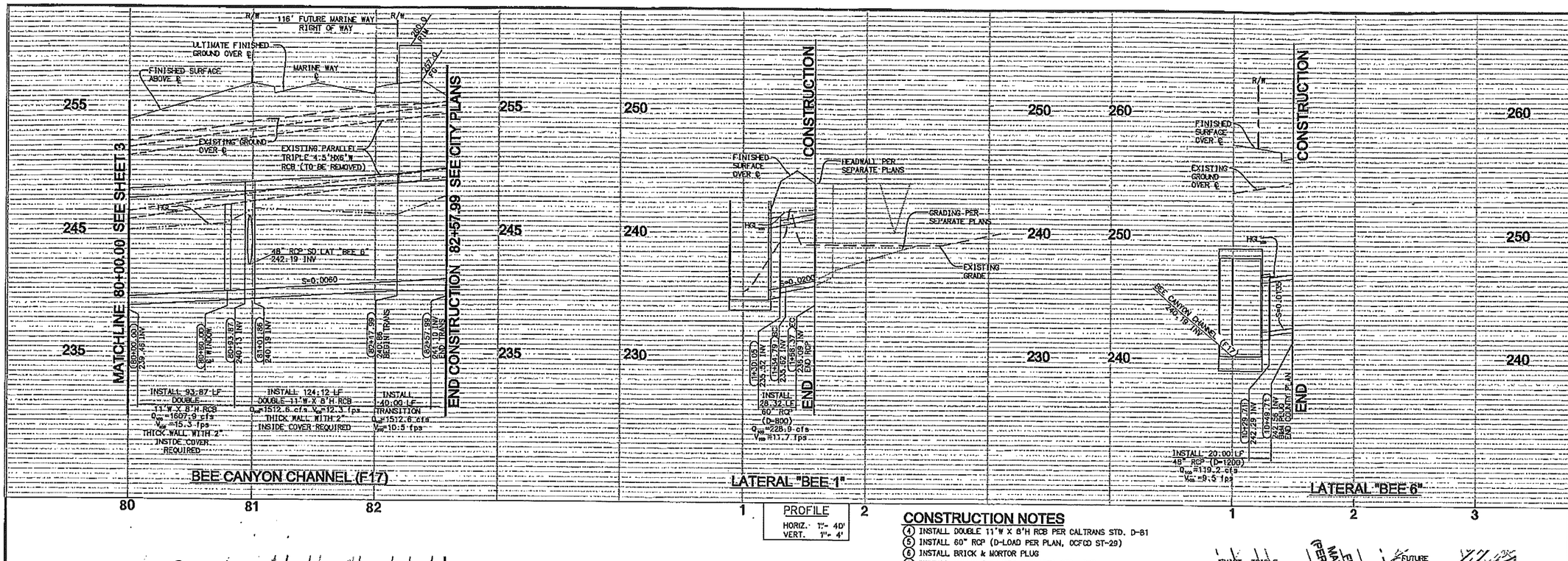
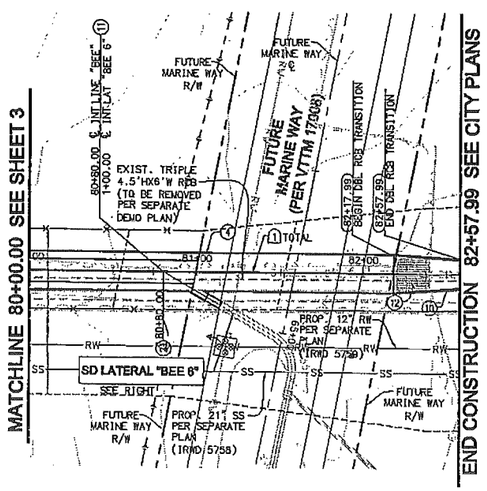


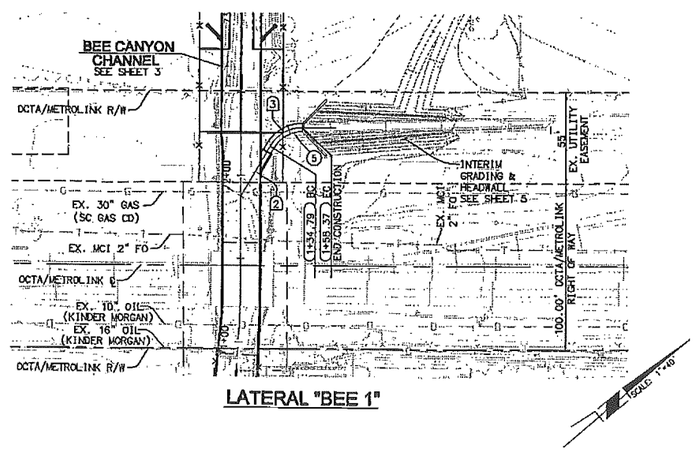
PROFILE
HORIZ. 1"= 40'
VERT. 1"= 4'

CONSTRUCTION NOTES

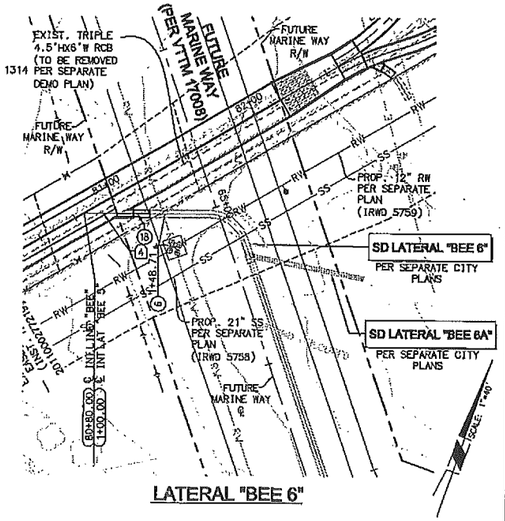
(4) INSTALL DOUBLE 11'W X 8'H RCB PER CALTRANS STD. D-81
(5) INSTALL 60" RCP (D-LOAD PER PLAN, OCFCD ST-29)
(6) INSTALL BRICK & MORTOR PLUG
(9) INSTALL MANHOLE IN RCB PER APWA STD. 323
(10) CONSTRUCT TRANSITION STRUCTURE #1 PER DETAIL ON SHEET 8
(11) CONSTRUCT JUNCTION STRUCTURE PER OC PUBLIC WORKS STD. PLAN NO. 1314
(12) INSTALL RC ACCESS SHAFT
(18) INSTALL 48" RCP (D-LOAD PER PLAN, OCFCD ST-29)
(21) CONSTRUCT RCB WINDOWS PER APWA STD. 382



BEE CANYON CHANNEL (F17)



LATERAL "BEE 1"



LATERAL "BEE 6"

HYDRAULIC DATA

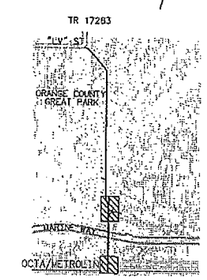
LINE	STA	TO STA	Q_{100}	S_o	n	D	d_n	V_n	d_c	V_c	Nf
BEE	80+00.00	80+93.87	1607.9	0.006	0.014	RCB	4.22	17.30	5.50	19.55	1.48
BEE	80+93.87	82+17.99	1512.6	0.006	0.014	RCB	4.05	16.96	5.28	1.92	1.48
"BEE-1"	1+30.05	1+58.37	228.9	0.020	0.013	5.0'	2.85	19.77	4.28	21.32	2.28
"BEE-6"	1+28.71	1+48.71	119.2	0.010	0.013	4	2.78	12.78	3.29	13.03	1.42

LINE/CURVE DATA TABLE

	NO	BEARING/DELTA	RADIUS	LENGTH	TANGENT
TOTAL	1	N40°45'11"E	—	1121.25'	—
	2	N70°45'11"E	—	34.79'	—
	3	60°02'28"	22.50'	23.58'	13.00'
	4	N70°47'39"E	—	48.71'	—

*NOTE: ALL STORM DRAIN LATERAL LINES WILL BE OWNED AND MAINTAINED BY THE FEE OWNER OR THE LOCAL AGENCY PER SEPARATE PERMIT.

40 0 40 80 120
SCALE: 1"=40'



INDEX MAP
NOT TO SCALE

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF: REGISTERED PROFESSIONAL ENGINEER JOHN L. LEONARD No. 61828 Exp. 12/31/12 CIVIL STATE OF CALIFORNIA

DATE

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DRAWN BY: LW
CHECKED BY: JL/JM
DRAWING CODE: 722-XXX-S
FILE NAME:
PLOT DATE:
SCALE: AS SHOWN

ORANGE COUNTY PUBLIC WORKS

PREPARED BY: RBF CONSULTING

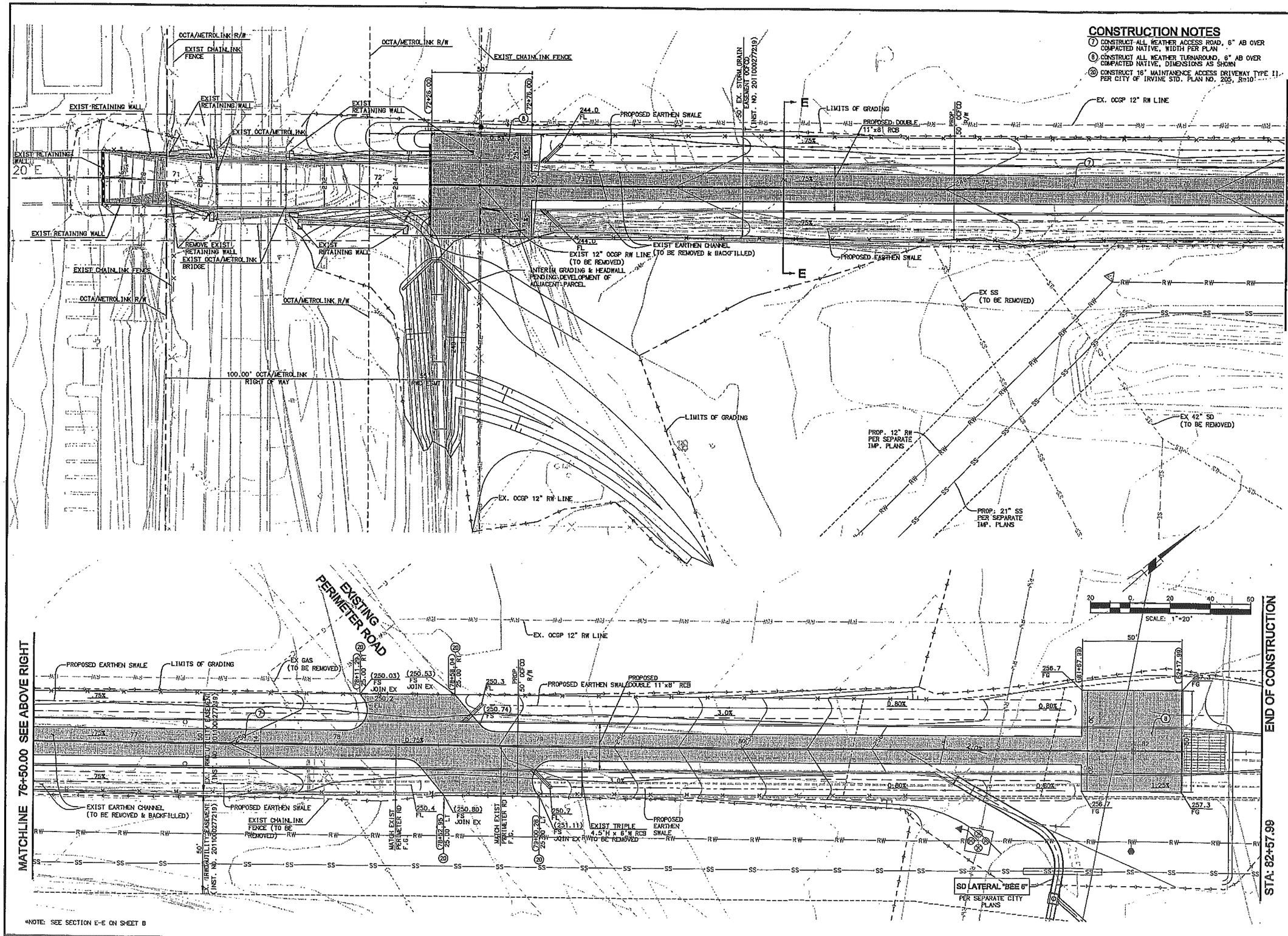
BEE CANYON CHANNEL
FACILITY NO. F17
CHANNEL IMPROVEMENTS
STORM DRAIN
PLAN AND PROFILE
80+00.00 TO 82+57.99
& LATERALS

Sheet Reference Number
4
of 19 Sheets

H:\PDATA\10108417\CADD\LAND\DLV\IMPROVE\SD\BEE SD-COUNTY\B417-UT-BEE-SD-04.DWG JLEONARD 10/29/12 11:19 am

CONSTRUCTION NOTES

7. CONSTRUCT ALL WEATHER ACCESS ROAD, 6" AB OVER COMPACTED NATIVE, WIDTH PER PLAN
8. CONSTRUCT ALL WEATHER TURNAROUND, 6" AB OVER COMPACTED NATIVE, DIMENSIONS AS SHOWN
20. CONSTRUCT 16' MAINTANENCE ACCESS DRIVEWAY TYPE II PER CITY OF IRVINE STD. PLAN NO. 205, R=10'



*NOTE: SEE SECTION E-E ON SHEET B

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF:

REGISTERED PROFESSIONAL ENGINEER — REGISTERED CIVIL ENGINEER — STATE OF CALIFORNIA

DATE

DESIGNED BY: LW
DRAWN BY: LW
CHECKED BY: JL/JM
DRAWING CODE: F23-XXX-X
FILE NAME:
PLOT DATE:
SCALE: AS SHOWN

ORANGE COUNTY PUBLIC WORKS

PREPARED BY: RBF CONSULTING

BEE CANYON CHANNEL
FACILITY NO. F17
CHANNEL IMPROVEMENTS
INTERIM GRADING PLAN

Sheet Reference Number
5
of 19 Sheets

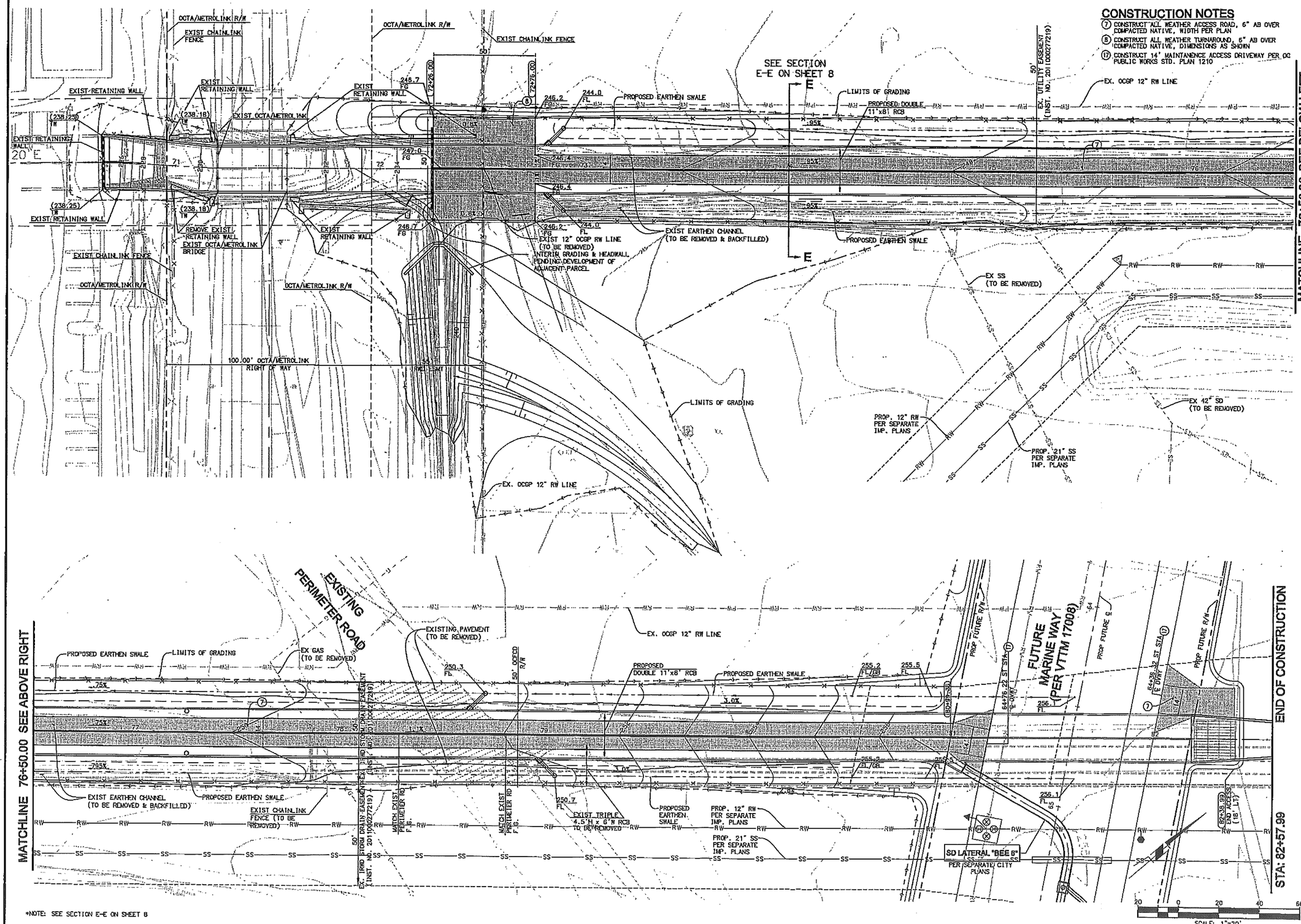
H:\DATA\01B417\CADD\LAND\DLV\IMPROVE\SD\BEE SD-COUNTY\B417-UT-BEE-SD-05.DWG JLEONARD 10/29/12 11:24 am

CONSTRUCTION NOTES

(7) CONSTRUCT ALL WEATHER ACCESS ROAD, 6" AB OVER COMPACTED NATIVE, WIDTH PER PLAN

(8) CONSTRUCT ALL WEATHER TURNAROUND, 6" AB OVER COMPACTED NATIVE, DIMENSIONS AS SHOWN

(17) CONSTRUCT 14' MAINTANENCE ACCESS DRIVEWAY PER OC PUBLIC WORKS STD. PLAN 1210



*NOTE: SEE SECTION E-E ON SHEET 8

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF: REGISTERED PROFESSIONAL ENGINEER, JOHN A. MCARTHUR, No. 42803, Exp. 06/30/13, CIVIL, STATE OF CALIFORNIA — DATE

DESIGNED BY: LW
DRAWN BY: LW
CHECKED BY: JL/JM
DRAWING CODE: F25-XXX-X
FILE NAME:
PLOT DATE:
SCALE: AS SHOWN

ORANGE COUNTY PUBLIC WORKS

PREPARED BY: RBF CONSULTING

BEE CANYON CHANNEL
FACILITY NO. F17
CHANNEL IMPROVEMENTS
ULTIMATE GRADING PLAN

Sheet Reference Number 6 of 19 Sheets

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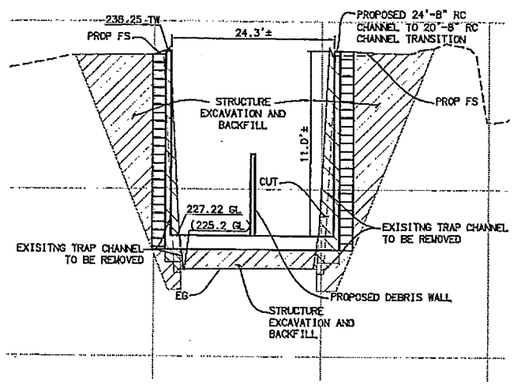

SECTION A-A
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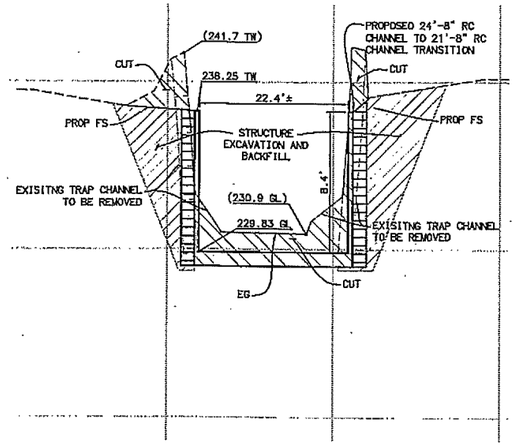
VERT. SCALE: 1"=4'



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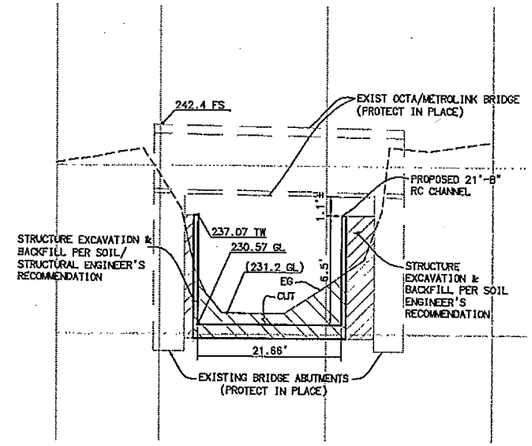
VERT. SCALE: 1"=4'



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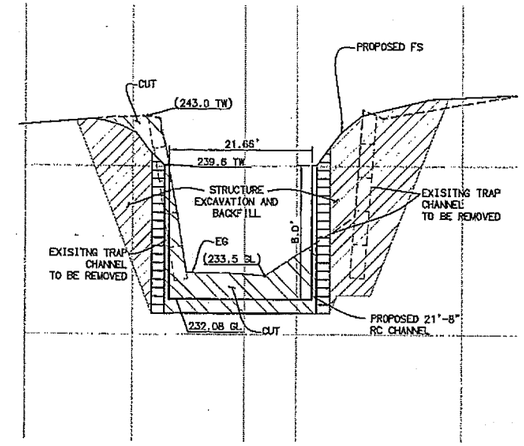
VERT. SCALE: 1"=4'



SECTION D-D
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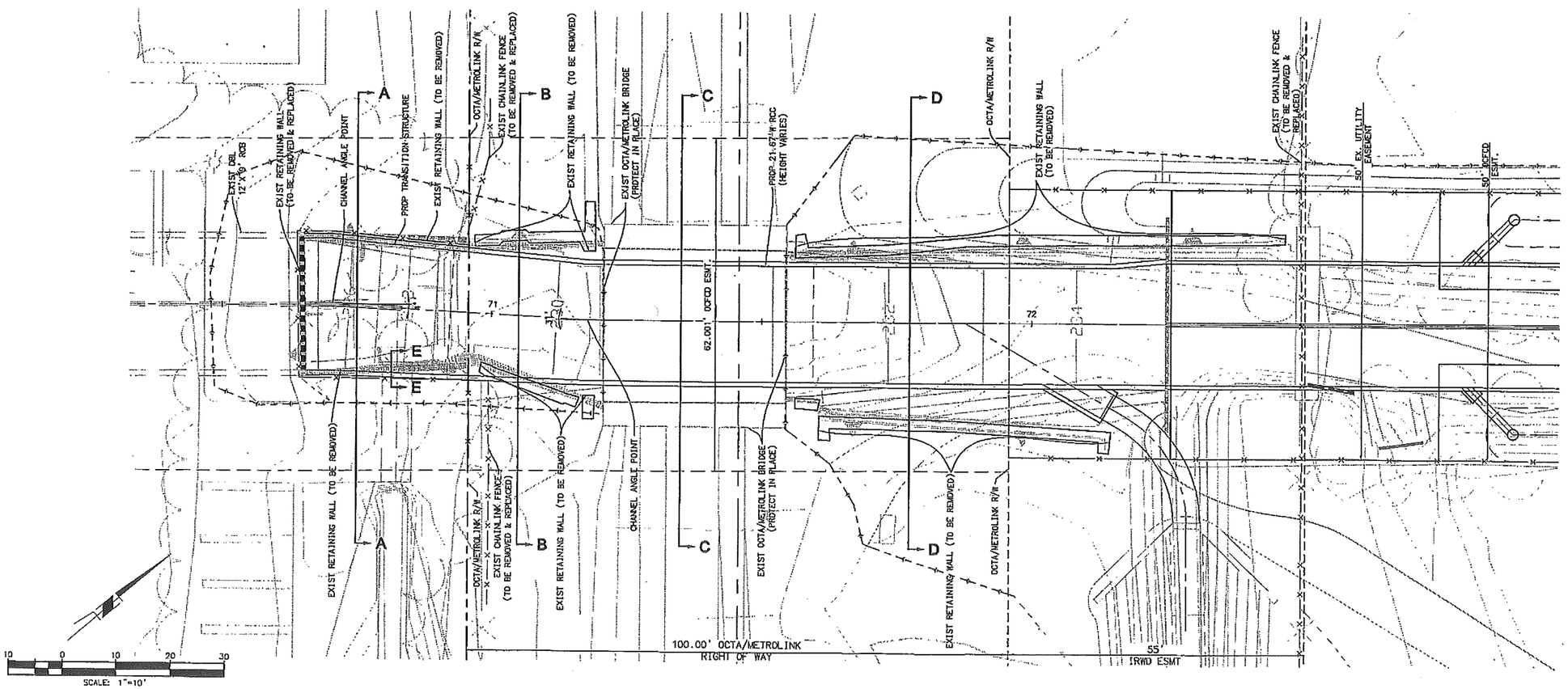
VERT. SCALE: 1"=4'

-CUT

-FILL



COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF:

REGISTERED PROFESSIONAL ENGINEER — DON R. ROBERTS — No. 55232 — Exp. 06/30/13 — Civil — STATE OF CALIFORNIA

DATE

DESIGNED BY: DM
DRAWN BY: DM
CHECKED BY: CWH
DRAWING CODE: T23-XXX-X
FILE NAME:
PLOT DATE:
SCALE: AS SHOWN

ORANGE COUNTY PUBLIC WORKS

PREPARED BY: RBF CONSULTING

BEE CANYON CHANNEL
FACILITY NO. F17
CHANNEL IMPROVEMENTS

CONSTRUCTION DETAILS

Sheet Reference Number
7
of 19 Sheets

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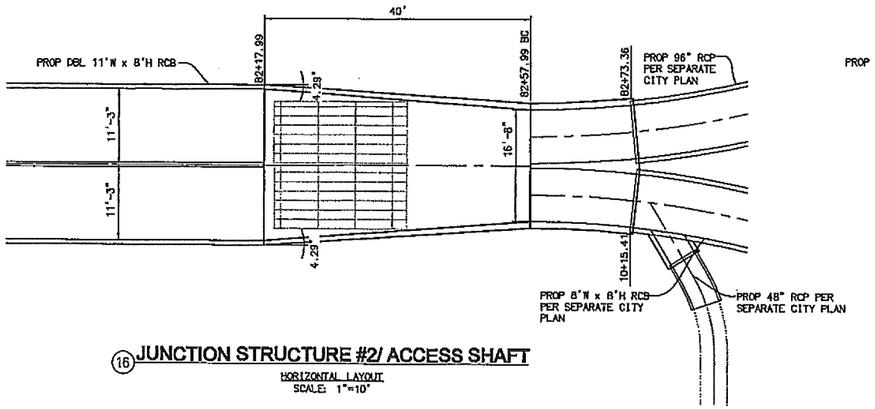
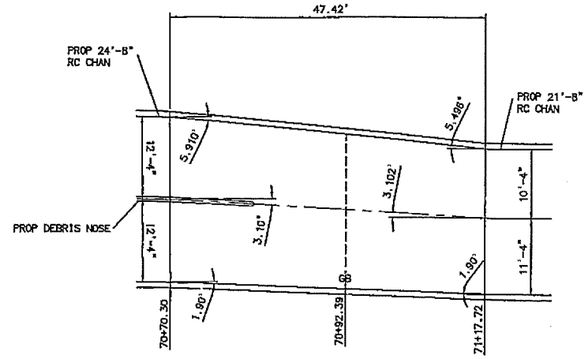
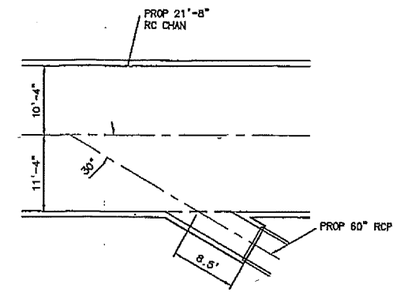


(16) JUNCTION STRUCTURE #2/ ACCESS SHAFT

HORIZONTAL LAYOUT
SCALE: 1"=10'

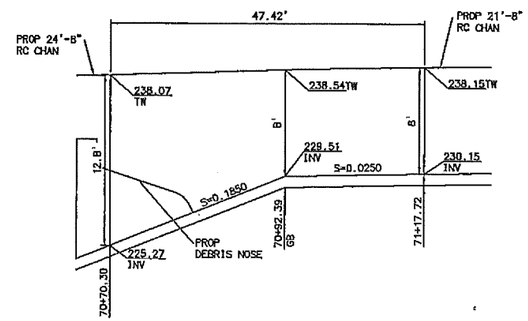


HORIZONTAL LAYOUT
SCALE: 1"=10'



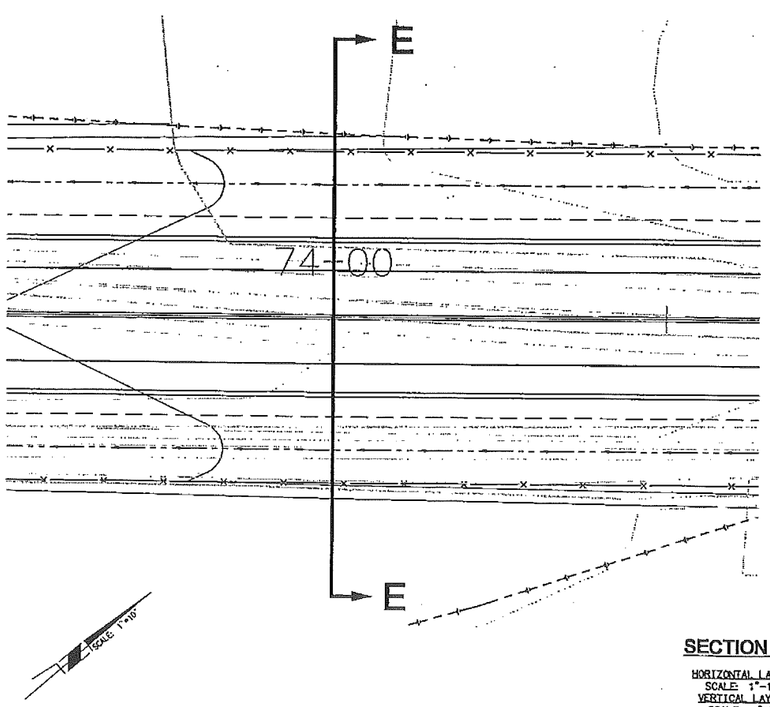
(13) JUNCTION STRUCTURE #1
60" RCP INTO 21'-8"W RC CHANNEL

HORIZONTAL LAYOUT
SCALE: 1"=10'



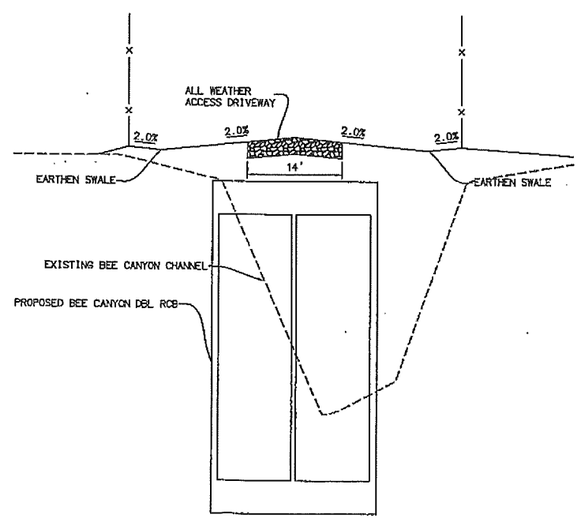
(10) TRANSITION STRUCTURE #1
24'-8"W TO 21'-8" RC CHANNEL

VERTICAL LAYOUT
SCALE: 1"=5'



SECTION E-E

HORIZONTAL LAYOUT
SCALE: 1"=10'
VERTICAL LAYOUT
SCALE: 1"=5'



(22) JUNCTION STRUCTURE #3

HORIZONTAL LAYOUT
SCALE: 1"=10'

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF:
REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER W. WEBB — No. 53532 — Exp. 06/30/2013 — STATE OF CALIFORNIA
DATE

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CHECKED BY: CWH
DRAWING CODE: F22-XXX-X
FILE NAME:
PLOT DATE:
SCALE: AS SHOWN

ORANGE COUNTY PUBLIC WORKS

PREPARED BY: RBF CONSULTING

BEE CANYON CHANNEL
FACILITY NO. F17
CHANNEL IMPROVEMENTS
STORM DRAIN DETAILS

Sheet Reference Number
8
of 19 Sheets

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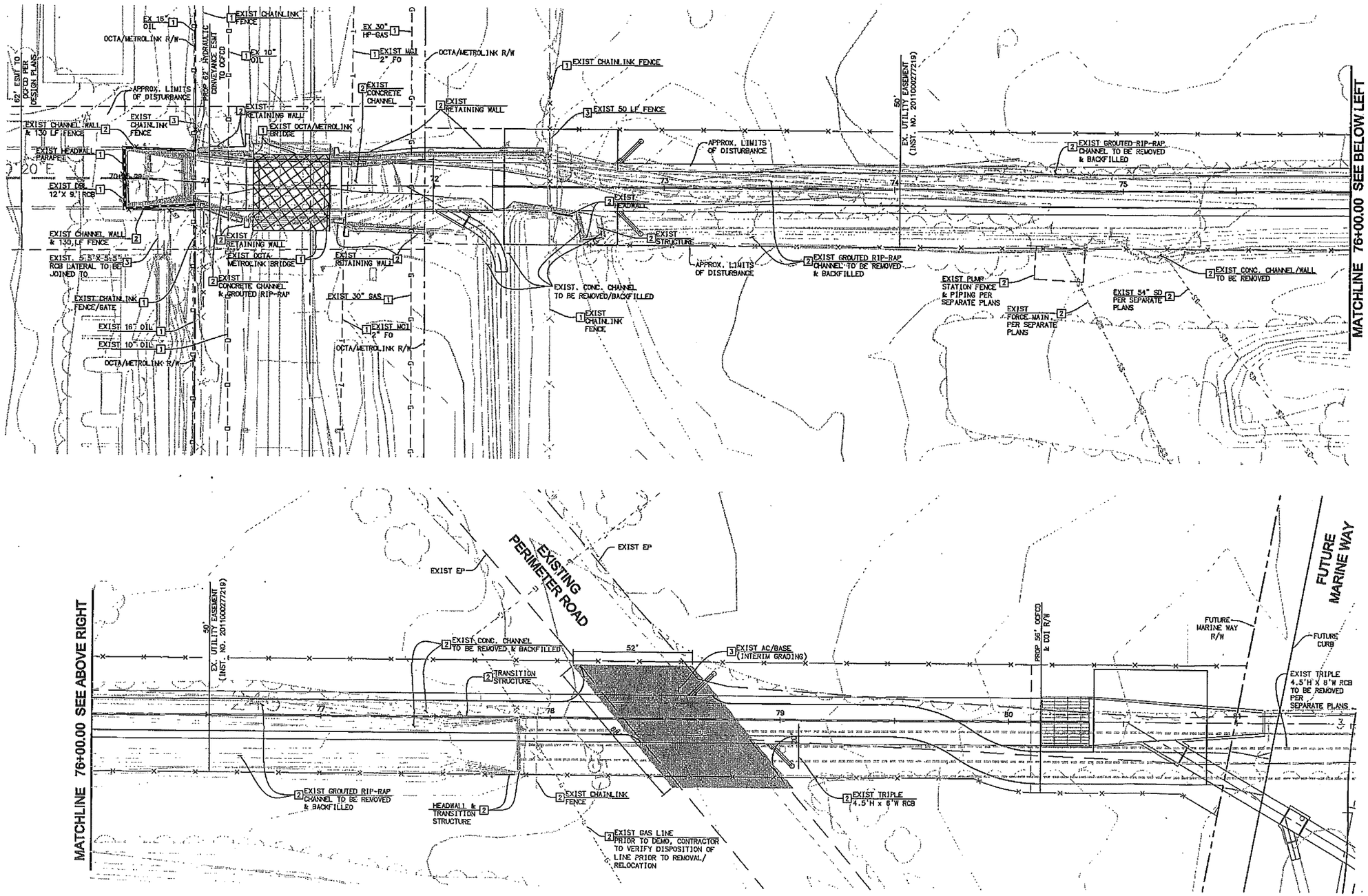

REMOVAL NOTES

1. PROTECT IN PLACE
2. REMOVE EXISTING FACILITIES
3. REMOVE & REPLACE EXISTING FACILITIES

CONCEPT PLAN

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF: REGISTERED PROFESSIONAL ENGINEER LOU WEASTAT No. 47135 Exp. 12/31/11 CIVIL STATE OF CALIFORNIA

DATE

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CHECKED BY: JL/JM
DRAWING CODE: F23-XXX-X
FILE NAME:
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ORANGE COUNTY PUBLIC WORKS

PREPARED BY: RBF CONSULTING

BEE CANYON CHANNEL
FACILITY NO. F17
CHANNEL IMPROVEMENTS
DEMO PLAN

Sheet Reference Number
9
of 19 Sheets

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F

Appendix F – Existing Caltrans 60" SSRP Hydraulic Analysis

See Attached Report

Hydraulic Analysis Report

Project Data

Project Title: El Toro Development – Existing Caltrans 60" SSRP capacity analysis

Designer: Tait

Project Date: Monday, April 13, 2015

Project Units: U.S. Customary Units

Notes: This Hydraulic Analysis was performed using Hydraulic Toolbox 4.2 from the Federal Highway Administration

Channel Analysis: Caltrans 60" SSRP

Notes: The channel Analysis Calculator uses Manning's Equation to solve for discharge given the design parameters.

Input Parameters

Channel Type: Circular

Pipe Diameter: 5.0000 ft

Longitudinal Slope: 0.0059 ft/ft

Manning's n: 0.0130

Flow: 189.0000 cfs

Result Parameters

Depth: 3.8704 ft

Area of Flow: 16.3087 ft^2

Wetted Perimeter: 10.7547 ft

Hydraulic Radius: 1.5164 ft

Average Velocity: 11.5889 ft/s

Top Width: 4.1819 ft

Froude Number: 1.0342

Critical Depth: 3.9307 ft

Critical Velocity: 11.4141 ft/s

Critical Slope: 0.0057 ft/ft

Critical Top Width: 4.10 ft

Calculated Max Shear Stress: 1.4249 lb/ft^2

Calculated Avg Shear Stress: 0.5583 lb/ft^2

G

Appendix G – Preliminary Detention Basin Analysis

See Attached Calculations

SP7531 **El Toro Development - Detention Basin Summary**

AES CH1 - Small Area Unit Hydrograph/Detention Basin Analysis

*For Individual Basin Analysis only - See RATSCX Rational Method Calculations for total system analysis

**Detention requirements based on Total Required Detention alotted by ratio of Tributary Area to total area

	Detention Basin	Tributary Area (AC)	*Undetained Q100 (CFS)	*Detained Q100 (CFS)	Tc (min)	ap	CN	**Detention Required (CFS)	Detention Provided (CFS)	Basin Volume (CF)
Marshburn	1	3.67	13.44	7.97	10.1	0.20	95	5.47	5.47	5780
	2	4.76	17.13	9.23	10.4	0.20	95	7.10	7.90	8890
	3	5.14	18.29	9.46	10.6	0.20	95	7.66	8.83	10260
	4	5.47	19.58	10.82	10.5	0.20	95	8.16	8.76	8440
	C	0.59	1.64	0.70	14.5	0.85	80	0.88	0.94	1370
	D	1.19	2.80	0.79	18.7	0.85	80	1.77	2.01	3800
	E1	0.56	1.59	0.72	14.0	0.85	80	0.84	0.87	1140
		21.38						**31.88**	**34.78**	
Bee Canyon	5	4.24	15.53	12.76	10.1	0.20	95	1.88	2.77	3800
	6	1.53	6.25	4.67	8.4	0.20	95	0.68	1.58	1520
	7	2.76	10.83	7.24	9.0	0.20	95	1.22	3.59	3040
	8	3.00	12.09	9.36	8.7	0.10	98	1.33	2.73	3040
	9	7.29	26.00	17.35	10.7	0.10	98	3.23	8.65	8890
	10	4.26	16.00	13.03	9.8	0.10	98	1.89	2.97	3800
	11	3.48	12.55	9.84	10.5	0.10	98	1.54	2.71	3500
	12	2.55	10.01	7.28	9.1	0.10	98	1.13	2.73	2580
	13	2.57	10.36	7.17	8.7	0.10	98	1.14	3.19	2740
	15	3.92	15.29	12.79	9.2	0.10	98	1.74	2.50	3340
	16	4.77	17.81	13.48	9.9	0.10	98	2.12	4.33	4560
	17	4.41	15.90	13.27	10.5	0.10	98	1.96	2.63	3800
	18	3.63	14.83	13.19	8.5	0.10	98	1.61	1.64	2580
	19	3.64	14.28	12.45	9.0	0.20	95	1.61	1.83	2890
	20	2.70	9.50	7.20	10.8	0.20	95	1.20	2.30	2740
	A	2.77	8.44	6.72	12.5	0.85	80	1.23	1.72	2580
	B	0.90	2.71	2.09	12.7	0.85	80	0.40	0.62	910
	E2	0.86	2.44	1.88	14.0	0.85	80	0.38	0.56	1060
	F	0.87	2.20	1.28	16.8	0.85	80	0.39	0.92	1370
	G	0.82	2.09	1.24	16.5	0.85	80	0.36	0.85	1220
	H	0.66	1.79	1.18	15.0	0.85	80	0.29	0.61	910
	I	0.83	2.10	1.25	16.7	0.85	80	0.37	0.85	1220
	J	0.94	2.32	1.75	17.4	0.85	80	0.42	0.57	1370
		63.40						**28.12**	**52.85**	
Agua Chinon	14	3.33	13.92	-	9.3	0.10	98	0	0	-

SP7531 **El Toro Development - HYDROGRAPH PARAMETERS**

AES CH1 - Small Area Unit Hydrograph/Detention Basin Analysis

	Detention Basin	Tributary Area (AC)	Tc (min)	Fp	ap	Fm	ap	CN	S	Ia	P24 (in)	Y	Ybar
Marshburn	1	3.67	10.1	0.30	0.20	0.06	0.20	95	0.53	0.11	5.63	0.90	0.10
	2	4.76	10.4	0.30	0.20	0.06	0.20	95	0.53	0.11	5.63	0.90	0.10
	3	5.14	10.6	0.30	0.20	0.06	0.20	95	0.53	0.11	5.63	0.90	0.10
	4	5.47	10.5	0.30	0.20	0.06	0.20	95	0.53	0.11	5.63	0.90	0.10
	C	0.59	14.5	0.30	0.85	0.26	0.85	80	2.50	0.50	5.63	0.61	0.39
	D	1.19	18.7	0.30	0.85	0.26	0.85	80	2.50	0.50	5.63	0.61	0.39
	E1	0.56	14.0	0.30	0.85	0.26	0.85	80	2.50	0.50	5.63	0.61	0.39
Bee Canyon	5	4.24	10.1	0.30	0.20	0.06	0.20	95	0.53	0.11	5.63	0.90	0.10
	6	1.53	8.4	0.30	0.20	0.06	0.20	95	0.53	0.11	5.63	0.90	0.10
	7	2.76	9.0	0.30	0.20	0.06	0.20	95	0.53	0.11	5.63	0.90	0.10
	8	3.00	8.7	0.30	0.10	0.03	0.10	98	0.20	0.04	5.63	0.96	0.04
	9	7.29	10.7	0.30	0.10	0.03	0.10	98	0.20	0.04	5.63	0.96	0.04
	10	4.26	9.8	0.30	0.10	0.03	0.10	98	0.20	0.04	5.63	0.96	0.04
	11	3.48	10.5	0.30	0.10	0.03	0.10	98	0.20	0.04	5.63	0.96	0.04
	12	2.55	9.1	0.30	0.10	0.03	0.10	98	0.20	0.04	5.63	0.96	0.04
	13	2.57	8.7	0.30	0.10	0.03	0.10	98	0.20	0.04	5.63	0.96	0.04
	15	3.92	9.2	0.30	0.10	0.03	0.10	98	0.20	0.04	5.63	0.96	0.04
	16	4.77	9.9	0.30	0.10	0.03	0.10	98	0.20	0.04	5.63	0.96	0.04
	17	4.41	10.5	0.30	0.10	0.03	0.10	98	0.20	0.04	5.63	0.96	0.04
	18	3.63	8.5	0.30	0.10	0.03	0.10	98	0.20	0.04	5.63	0.96	0.04
	19	3.64	9.0	0.30	0.20	0.06	0.20	95	0.53	0.11	5.63	0.90	0.10
	20	2.70	10.8	0.30	0.20	0.06	0.20	95	0.53	0.11	5.63	0.90	0.10
	A	2.77	12.5	0.30	0.85	0.26	0.85	80	2.50	0.50	5.63	0.61	0.39
	B	0.90	12.7	0.30	0.85	0.26	0.85	80	2.50	0.50	5.63	0.61	0.39
	E2	0.86	14.0	0.30	0.85	0.26	0.85	80	2.50	0.50	5.63	0.61	0.39
	F	0.87	16.8	0.30	0.85	0.26	0.85	80	2.50	0.50	5.63	0.61	0.39
	G	0.82	16.5	0.30	0.85	0.26	0.85	80	2.50	0.50	5.63	0.61	0.39
	H	0.66	15.0	0.30	0.85	0.26	0.85	80	2.50	0.50	5.63	0.61	0.39
	I	0.83	16.7	0.30	0.85	0.26	0.85	80	2.50	0.50	5.63	0.61	0.39
	J	0.94	17.4	0.30	0.85	0.26	0.85	80	2.50	0.50	5.63	0.61	0.39

```
****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
          (C) Copyright 1989-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                          Analysis prepared by:


****************************************************************************
----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN 5
----------------------------------------------------------------------------


     RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
     TOTAL CATCHMENT AREA(ACRES) =    4.24
     SOIL-LOSS RATE, Fm,(INCH/HR) =  0.060
     LOW LOSS FRACTION = 0.100
     TIME OF CONCENTRATION(MIN.) = 10.10
     SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
     ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
     RETURN FREQUENCY(YEARS) = 100
        5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
       30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
        1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
        3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
        6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
       24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

     TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.63
     TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.36

****************************************************************************
  TIME      VOLUME       Q    0.        5.0       10.0       15.0       20.0
 (HOURS)     (AF)      (CFS)
----------------------------------------------------------------------------
  0.01      0.0000      0.00  Q         .         .          .          .
  0.18      0.0021      0.30  Q         .         .          .          .
  0.34      0.0063      0.30  Q         .         .          .          .
  0.51      0.0105      0.30  Q         .         .          .          .
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****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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             Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                          Analysis prepared by:


****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
   EL TORO DEVELOPMENT
   100 YEAR STORM - PROPOSED CONDITION
   BASIN 1
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =     3.67
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.060
    LOW LOSS FRACTION = 0.100
    TIME OF CONCENTRATION(MIN.) = 10.10
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.41
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.31

****************************************************************************
  TIME      VOLUME        Q    0.         5.0       10.0       15.0       20.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.01      0.0000      0.00  Q          .          .          .          .
  0.18      0.0018      0.26  Q          .          .          .          .
  0.34      0.0054      0.26  Q          .          .          .          .
  0.51      0.0091      0.26  Q          .          .          .          .
```

0.68	0.0128	0.27	Q	.	.	.	.
0.85	0.0165	0.27	Q	.	.	.	.
1.02	0.0202	0.27	Q	.	.	.	.
1.19	0.0240	0.27	Q	.	.	.	.
1.35	0.0277	0.27	Q	.	.	.	.
1.52	0.0316	0.27	Q	.	.	.	.
1.69	0.0354	0.28	Q	.	.	.	.
1.86	0.0393	0.28	Q	.	.	.	.
2.03	0.0431	0.28	Q	.	.	.	.
2.20	0.0471	0.28	Q	.	.	.	.
2.36	0.0510	0.29	Q	.	.	.	.
2.53	0.0550	0.29	Q	.	.	.	.
2.70	0.0590	0.29	Q	.	.	.	.
2.87	0.0631	0.29	Q	.	.	.	.
3.04	0.0671	0.29	Q	.	.	.	.
3.21	0.0713	0.30	Q	.	.	.	.
3.37	0.0754	0.30	Q	.	.	.	.
3.54	0.0796	0.30	Q	.	.	.	.
3.71	0.0838	0.30	Q	.	.	.	.
3.88	0.0880	0.31	Q	.	.	.	.
4.05	0.0923	0.31	Q	.	.	.	.
4.22	0.0967	0.31	Q	.	.	.	.
4.38	0.1010	0.32	Q	.	.	.	.
4.55	0.1054	0.32	Q	.	.	.	.
4.72	0.1099	0.32	Q	.	.	.	.
4.89	0.1144	0.32	Q	.	.	.	.
5.06	0.1189	0.33	Q	.	.	.	.
5.23	0.1235	0.33	Q	.	.	.	.
5.39	0.1281	0.33	Q	.	.	.	.
5.56	0.1327	0.34	Q	.	.	.	.
5.73	0.1374	0.34	Q	.	.	.	.
5.90	0.1422	0.34	Q	.	.	.	.
6.07	0.1470	0.35	Q	.	.	.	.
6.24	0.1519	0.35	Q	.	.	.	.
6.40	0.1568	0.36	Q	.	.	.	.
6.57	0.1617	0.36	Q	.	.	.	.
6.74	0.1667	0.36	Q	.	.	.	.
6.91	0.1718	0.37	Q	.	.	.	.
7.08	0.1769	0.37	Q	.	.	.	.
7.25	0.1821	0.37	Q	.	.	.	.
7.41	0.1874	0.38	Q	.	.	.	.
7.58	0.1927	0.38	Q	.	.	.	.
7.75	0.1981	0.39	Q	.	.	.	.
7.92	0.2035	0.39	Q	.	.	.	.
8.09	0.2091	0.40	Q	.	.	.	.
8.26	0.2147	0.40	Q	.	.	.	.
8.42	0.2203	0.41	Q	.	.	.	.
8.59	0.2261	0.42	Q	.	.	.	.
8.76	0.2319	0.42	Q	.	.	.	.
8.93	0.2378	0.43	Q	.	.	.	.
9.10	0.2438	0.44	Q	.	.	.	.
9.27	0.2499	0.44	Q	.	.	.	.

9.43	0.2561	0.45	Q
9.60	0.2624	0.45	Q
9.77	0.2688	0.46	Q
9.94	0.2753	0.47	Q
10.11	0.2819	0.48	Q
10.28	0.2886	0.49	Q
10.45	0.2955	0.50	Q
10.61	0.3024	0.50	.Q
10.78	0.3095	0.52	.Q
10.95	0.3168	0.52	.Q
11.12	0.3242	0.54	.Q
11.29	0.3317	0.55	.Q
11.45	0.3395	0.56	.Q
11.62	0.3474	0.57	.Q
11.79	0.3555	0.59	.Q
11.96	0.3637	0.60	.Q
12.13	0.3729	0.72	.Q
12.30	0.3835	0.79	.Q
12.46	0.3947	0.82	.Q
12.63	0.4061	0.83	.Q
12.80	0.4179	0.86	.Q
12.97	0.4300	0.88	.Q
13.14	0.4424	0.91	.Q
13.31	0.4553	0.93	.Q
13.48	0.4685	0.97	.Q
13.64	0.4822	0.99	.Q
13.81	0.4963	1.04	. Q
13.98	0.5111	1.07	. Q
14.15	0.5265	1.14	. Q
14.32	0.5426	1.18	. Q
14.48	0.5596	1.26	. Q
14.65	0.5775	1.31	. Q
14.82	0.5966	1.43	. Q
14.99	0.6169	1.50	. Q
15.16	0.6390	1.68	. Q
15.33	0.6631	1.79	. Q
15.49	0.6887	1.88	. Q
15.66	0.7166	2.13	. Q
15.83	0.7531	3.11	. Q
16.00	0.8048	4.32	. Q
16.17	0.9284	13.44	. Q
16.34	1.0393	2.50	. Q
16.50	1.0703	1.95	. Q
16.67	1.0948	1.58	. Q
16.84	1.1153	1.37	. Q
17.01	1.1333	1.22	. Q
17.18	1.1495	1.10	. Q
17.35	1.1642	1.02	. Q
17.52	1.1779	0.95	.Q
17.68	1.1907	0.89	.Q
17.85	1.2028	0.85	.Q
18.02	1.2143	0.80	.Q

18.19	1.2242	0.61	.Q	.	.	.	.
18.36	1.2325	0.58	.Q	.	.	.	.
18.52	1.2404	0.56	.Q	.	.	.	.
18.69	1.2479	0.53	.Q	.	.	.	.
18.86	1.2552	0.51	.Q	.	.	.	.
19.03	1.2621	0.49	Q	.	.	.	.
19.20	1.2689	0.47	Q	.	.	.	.
19.37	1.2754	0.46	Q	.	.	.	.
19.53	1.2817	0.44	Q	.	.	.	.
19.70	1.2878	0.43	Q	.	.	.	.
19.87	1.2937	0.42	Q	.	.	.	.
20.04	1.2994	0.41	Q	.	.	.	.
20.21	1.3050	0.40	Q	.	.	.	.
20.38	1.3105	0.39	Q	.	.	.	.
20.55	1.3158	0.38	Q	.	.	.	.
20.71	1.3210	0.37	Q	.	.	.	.
20.88	1.3261	0.36	Q	.	.	.	.
21.05	1.3310	0.35	Q	.	.	.	.
21.22	1.3359	0.35	Q	.	.	.	.
21.39	1.3406	0.34	Q	.	.	.	.
21.56	1.3453	0.33	Q	.	.	.	.
21.72	1.3499	0.33	Q	.	.	.	.
21.89	1.3543	0.32	Q	.	.	.	.
22.06	1.3587	0.31	Q	.	.	.	.
22.23	1.3631	0.31	Q	.	.	.	.
22.40	1.3673	0.30	Q	.	.	.	.
22.57	1.3715	0.30	Q	.	.	.	.
22.73	1.3756	0.29	Q	.	.	.	.
22.90	1.3797	0.29	Q	.	.	.	.
23.07	1.3836	0.28	Q	.	.	.	.
23.24	1.3876	0.28	Q	.	.	.	.
23.41	1.3914	0.28	Q	.	.	.	.
23.58	1.3952	0.27	Q	.	.	.	.
23.74	1.3990	0.27	Q	.	.	.	.
23.91	1.4027	0.26	Q	.	.	.	.
24.08	1.4064	0.26	Q	.	.	.	.
24.25	1.4082	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1444.3
10%	131.3
20%	30.3
30%	20.2
40%	10.1

50%	10.1
60%	10.1
70%	10.1
80%	10.1
90%	10.1

Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN 1

==========

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 10.100
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

```
                INFLOW
                  |
                  |
                  |
                  V                 __effective depth
            -------------           |   (and volume)
            |           |     |     |
            | detention |     |....V.............
            |   basin   |<-->|          outflow
            |           |     |.........__________
            -------------     |         |    \
                  |           | storage |     basin outlet
                  V           -----------
               OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) **	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) *
0.000	0.000	0.000**	0.500	0.017	1.080*
1.000	0.033	3.060**	1.500	0.050	5.530*
2.000	0.066	6.930**	2.500	0.083	8.090*
3.000	0.099	9.110**	3.500	0.116	10.020*
4.000	0.133	10.860**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)

1	0.00	0.00000	0.00000
2	0.50	0.00949	0.02451
3	1.00	0.01171	0.05429
4	1.50	0.01153	0.08847
5	2.00	0.01780	0.11420
6	2.50	0.02673	0.13927
7	3.00	0.03563	0.16237
8	3.50	0.04630	0.18570
9	4.00	0.05746	0.20854

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.008	0.000	0.00	0.00	0.00	0.000
0.177	0.000	0.26	0.07	0.08	0.003
0.345	0.000	0.26	0.10	0.19	0.003
0.513	0.000	0.26	0.11	0.23	0.004
0.682	0.000	0.27	0.12	0.25	0.004
0.850	0.000	0.27	0.12	0.26	0.004
1.018	0.000	0.27	0.12	0.27	0.004
1.187	0.000	0.27	0.12	0.27	0.004
1.355	0.000	0.27	0.13	0.27	0.004
1.523	0.000	0.27	0.13	0.27	0.004
1.692	0.000	0.28	0.13	0.27	0.004
1.860	0.000	0.28	0.13	0.28	0.004
2.028	0.000	0.28	0.13	0.28	0.004
2.197	0.000	0.28	0.13	0.28	0.004
2.365	0.000	0.29	0.13	0.28	0.004
2.533	0.000	0.29	0.13	0.28	0.005
2.702	0.000	0.29	0.13	0.29	0.005
2.870	0.000	0.29	0.13	0.29	0.005
3.038	0.000	0.29	0.14	0.29	0.005
3.207	0.000	0.30	0.14	0.29	0.005
3.375	0.000	0.30	0.14	0.30	0.005
3.543	0.000	0.30	0.14	0.30	0.005
3.712	0.000	0.30	0.14	0.30	0.005
3.880	0.000	0.31	0.14	0.30	0.005
4.048	0.000	0.31	0.14	0.31	0.005
4.217	0.000	0.31	0.14	0.31	0.005
4.385	0.000	0.32	0.15	0.31	0.005
4.553	0.000	0.32	0.15	0.31	0.005
4.722	0.000	0.32	0.15	0.32	0.005
4.890	0.000	0.32	0.15	0.32	0.005
5.058	0.000	0.33	0.15	0.32	0.005
5.227	0.000	0.33	0.15	0.33	0.005
5.395	0.000	0.33	0.15	0.33	0.005

5.563	0.000	0.34	0.15	0.33	0.005
5.732	0.000	0.34	0.16	0.34	0.005
5.900	0.000	0.34	0.16	0.34	0.005
6.068	0.000	0.35	0.16	0.34	0.005
6.237	0.000	0.35	0.16	0.35	0.005
6.405	0.000	0.36	0.16	0.35	0.006
6.573	0.000	0.36	0.16	0.35	0.006
6.742	0.000	0.36	0.17	0.36	0.006
6.910	0.000	0.37	0.17	0.36	0.006
7.078	0.000	0.37	0.17	0.37	0.006
7.247	0.000	0.37	0.17	0.37	0.006
7.415	0.000	0.38	0.17	0.37	0.006
7.583	0.000	0.38	0.18	0.38	0.006
7.752	0.000	0.39	0.18	0.38	0.006
7.920	0.000	0.39	0.18	0.39	0.006
8.088	0.000	0.40	0.18	0.39	0.006
8.257	0.000	0.40	0.19	0.40	0.006
8.425	0.000	0.41	0.19	0.40	0.006
8.593	0.000	0.42	0.19	0.41	0.006
8.762	0.000	0.42	0.19	0.42	0.007
8.930	0.000	0.43	0.20	0.42	0.007
9.098	0.000	0.44	0.20	0.43	0.007
9.267	0.000	0.44	0.20	0.43	0.007
9.435	0.000	0.45	0.21	0.44	0.007
9.603	0.000	0.45	0.21	0.45	0.007
9.772	0.000	0.46	0.21	0.45	0.007
9.940	0.000	0.47	0.22	0.46	0.007
10.108	0.000	0.48	0.22	0.47	0.007
10.277	0.000	0.49	0.22	0.48	0.008
10.445	0.000	0.50	0.23	0.49	0.008
10.613	0.000	0.50	0.23	0.50	0.008
10.782	0.000	0.52	0.24	0.51	0.008
10.950	0.000	0.52	0.24	0.51	0.008
11.118	0.000	0.54	0.25	0.53	0.008
11.287	0.000	0.55	0.25	0.54	0.009
11.455	0.000	0.56	0.26	0.55	0.009
11.623	0.000	0.57	0.26	0.56	0.009
11.792	0.000	0.59	0.27	0.57	0.009
11.960	0.000	0.60	0.27	0.59	0.009
12.128	0.000	0.72	0.31	0.63	0.011
12.297	0.000	0.79	0.35	0.71	0.012
12.465	0.000	0.82	0.37	0.77	0.012
12.633	0.000	0.83	0.38	0.80	0.013
12.802	0.000	0.86	0.39	0.83	0.013
12.970	0.000	0.88	0.40	0.85	0.014
13.138	0.000	0.91	0.41	0.88	0.014
13.307	0.000	0.93	0.42	0.90	0.014
13.475	0.000	0.97	0.44	0.93	0.015
13.643	0.000	0.99	0.45	0.96	0.015
13.812	0.000	1.04	0.47	1.00	0.016
13.980	0.000	1.07	0.49	1.04	0.017
14.148	0.000	1.14	0.51	1.09	0.017

14.317	0.000	1.18	0.52	1.15	0.018
14.485	0.000	1.26	0.54	1.22	0.018
14.653	0.000	1.31	0.56	1.28	0.019
14.822	0.000	1.43	0.59	1.36	0.020
14.990	0.000	1.50	0.60	1.46	0.020
15.158	0.000	1.68	0.65	1.58	0.022
15.327	0.000	1.79	0.68	1.72	0.023
15.495	0.000	1.88	0.70	1.83	0.023
15.663	0.000	2.13	0.76	1.99	0.025
15.832	0.000	3.11	0.99	2.57	0.033
16.000	0.000	4.32	1.26	3.68	0.042
16.168	0.000	13.44	3.78	7.41	0.126
16.337	0.000	2.50	1.48	7.97	0.049
16.505	0.000	1.95	0.74	3.74	0.025
16.673	0.000	1.58	0.63	1.82	0.021
16.842	0.000	1.37	0.58	1.50	0.019
17.010	0.000	1.22	0.54	1.31	0.018
17.178	0.000	1.10	0.51	1.17	0.017
17.347	0.000	1.02	0.48	1.08	0.016
17.515	0.000	0.95	0.46	1.02	0.016
17.683	0.000	0.89	0.43	0.96	0.015
17.852	0.000	0.85	0.41	0.90	0.014
18.020	0.000	0.80	0.39	0.86	0.013
18.188	0.000	0.61	0.32	0.76	0.011
18.357	0.000	0.58	0.29	0.66	0.010
18.525	0.000	0.56	0.27	0.60	0.009
18.693	0.000	0.53	0.26	0.57	0.009
18.862	0.000	0.51	0.24	0.54	0.008
19.030	0.000	0.49	0.23	0.52	0.008
19.198	0.000	0.47	0.23	0.50	0.008
19.367	0.000	0.46	0.22	0.48	0.007
19.535	0.000	0.44	0.21	0.46	0.007
19.703	0.000	0.43	0.20	0.45	0.007
19.872	0.000	0.42	0.20	0.43	0.007
20.040	0.000	0.41	0.19	0.42	0.007
20.208	0.000	0.40	0.19	0.41	0.006
20.377	0.000	0.39	0.18	0.40	0.006
20.545	0.000	0.38	0.18	0.39	0.006
20.713	0.000	0.37	0.17	0.38	0.006
20.882	0.000	0.36	0.17	0.37	0.006
21.050	0.000	0.35	0.17	0.36	0.006
21.218	0.000	0.35	0.16	0.35	0.006
21.387	0.000	0.34	0.16	0.35	0.005
21.555	0.000	0.33	0.16	0.34	0.005
21.723	0.000	0.33	0.15	0.33	0.005
21.892	0.000	0.32	0.15	0.33	0.005
22.060	0.000	0.31	0.15	0.32	0.005
22.228	0.000	0.31	0.14	0.31	0.005
22.397	0.000	0.30	0.14	0.31	0.005
22.565	0.000	0.30	0.14	0.30	0.005
22.733	0.000	0.29	0.14	0.30	0.005
22.902	0.000	0.29	0.13	0.29	0.005

23.070	0.000	0.28	0.13	0.29	0.005
23.238	0.000	0.28	0.13	0.28	0.004
23.407	0.000	0.28	0.13	0.28	0.004
23.575	0.000	0.27	0.13	0.28	0.004
23.743	0.000	0.27	0.13	0.27	0.004
23.912	0.000	0.26	0.12	0.27	0.004
24.080	0.000	0.26	0.12	0.26	0.004
24.248	0.000	0.00	0.05	0.18	0.002
24.417	0.000	0.00	0.02	0.07	0.001

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****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
          (C) Copyright 1989-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                              Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  EL TORO DEVELOPMENT
  100 YEAR STORM - PROPOSED CONDITION
  BASIN 2
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    4.76
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.060
    LOW LOSS FRACTION = 0.100
    TIME OF CONCENTRATION(MIN.) = 10.40
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.83
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.41

****************************************************************************
  TIME      VOLUME        Q    0.        5.0       10.0      15.0      20.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.05      0.0000      0.00  Q          .         .         .         .
  0.23      0.0024      0.34  Q          .         .         .         .
  0.40      0.0073      0.34  Q          .         .         .         .
  0.57      0.0122      0.34  Q          .         .         .         .
```

0.75	0.0171	0.34	Q	.	.	.	.
0.92	0.0221	0.35	Q	.	.	.	.
1.09	0.0270	0.35	Q	.	.	.	.
1.27	0.0321	0.35	Q	.	.	.	.
1.44	0.0371	0.35	Q	.	.	.	.
1.61	0.0423	0.36	Q	.	.	.	.
1.79	0.0474	0.36	Q	.	.	.	.
1.96	0.0526	0.36	Q	.	.	.	.
2.13	0.0578	0.37	Q	.	.	.	.
2.31	0.0631	0.37	Q	.	.	.	.
2.48	0.0684	0.37	Q	.	.	.	.
2.65	0.0737	0.38	Q	.	.	.	.
2.83	0.0791	0.38	Q	.	.	.	.
3.00	0.0845	0.38	Q	.	.	.	.
3.17	0.0900	0.38	Q	.	.	.	.
3.35	0.0956	0.39	Q	.	.	.	.
3.52	0.1011	0.39	Q	.	.	.	.
3.69	0.1068	0.39	Q	.	.	.	.
3.87	0.1124	0.40	Q	.	.	.	.
4.04	0.1181	0.40	Q	.	.	.	.
4.21	0.1239	0.40	Q	.	.	.	.
4.39	0.1297	0.41	Q	.	.	.	.
4.56	0.1356	0.41	Q	.	.	.	.
4.73	0.1416	0.42	Q	.	.	.	.
4.91	0.1476	0.42	Q	.	.	.	.
5.08	0.1536	0.43	Q	.	.	.	.
5.25	0.1597	0.43	Q	.	.	.	.
5.43	0.1659	0.43	Q	.	.	.	.
5.60	0.1721	0.44	Q	.	.	.	.
5.77	0.1784	0.44	Q	.	.	.	.
5.95	0.1848	0.45	Q	.	.	.	.
6.12	0.1912	0.45	Q	.	.	.	.
6.29	0.1977	0.46	Q	.	.	.	.
6.47	0.2043	0.46	Q	.	.	.	.
6.64	0.2110	0.47	Q	.	.	.	.
6.81	0.2177	0.47	Q	.	.	.	.
6.99	0.2245	0.48	Q	.	.	.	.
7.16	0.2314	0.48	Q	.	.	.	.
7.33	0.2384	0.49	Q	.	.	.	.
7.51	0.2454	0.50	Q	.	.	.	.
7.68	0.2526	0.50	.Q	.	.	.	.
7.85	0.2598	0.51	.Q	.	.	.	.
8.03	0.2671	0.51	.Q	.	.	.	.
8.20	0.2746	0.52	.Q	.	.	.	.
8.37	0.2821	0.53	.Q	.	.	.	.
8.55	0.2898	0.54	.Q	.	.	.	.
8.72	0.2975	0.54	.Q	.	.	.	.
8.89	0.3054	0.55	.Q	.	.	.	.
9.07	0.3134	0.56	.Q	.	.	.	.
9.24	0.3215	0.57	.Q	.	.	.	.
9.41	0.3297	0.58	.Q	.	.	.	.
9.59	0.3381	0.59	.Q	.	.	.	.

9.76	0.3466	0.60	.Q . . . .
9.93	0.3553	0.61	.Q . . . .
10.11	0.3641	0.62	.Q . . . .
10.28	0.3731	0.63	.Q . . . .
10.45	0.3822	0.64	.Q . . . .
10.63	0.3915	0.66	.Q . . . .
10.80	0.4011	0.67	.Q . . . .
10.97	0.4108	0.69	.Q . . . .
11.15	0.4207	0.70	.Q . . . .
11.32	0.4308	0.72	.Q . . . .
11.49	0.4411	0.73	.Q . . . .
11.67	0.4517	0.75	.Q . . . .
11.84	0.4626	0.76	.Q . . . .
12.01	0.4738	0.79	.Q . . . .
12.19	0.4861	0.93	.Q . . . .
12.36	0.5003	1.04	. Q . . . .
12.53	0.5153	1.06	. Q . . . .
12.71	0.5308	1.10	. Q . . . .
12.88	0.5467	1.12	. Q . . . .
13.05	0.5631	1.16	. Q . . . .
13.23	0.5799	1.19	. Q . . . .
13.40	0.5973	1.24	. Q . . . .
13.57	0.6153	1.27	. Q . . . .
13.75	0.6339	1.33	. Q . . . .
13.92	0.6533	1.37	. Q . . . .
14.09	0.6735	1.45	. Q . . . .
14.27	0.6947	1.51	. Q . . . .
14.44	0.7171	1.61	. Q . . . .
14.61	0.7406	1.67	. Q . . . .
14.79	0.7657	1.82	. Q . . . .
14.96	0.7924	1.91	. Q . . . .
15.13	0.8215	2.14	. Q . . . .
15.31	0.8532	2.29	. Q . . . .
15.48	0.8872	2.46	. Q . . . .
15.65	0.9242	2.71	. Q . . . .
15.83	0.9720	3.96	. Q . . . .
16.00	1.0398	5.51	. .Q . . .
16.17	1.2020	17.13	. . . . Q .
16.35	1.3476	3.19	. Q . . . .
16.52	1.3882	2.49	. Q . . . .
16.69	1.4205	2.02	. Q . . . .
16.87	1.4474	1.74	. Q . . . .
17.04	1.4710	1.56	. Q . . . .
17.21	1.4923	1.41	. Q . . . .
17.39	1.5117	1.30	. Q . . . .
17.56	1.5297	1.21	. Q . . . .
17.73	1.5466	1.14	. Q . . . .
17.91	1.5625	1.08	. Q . . . .
18.08	1.5776	1.03	. Q . . . .
18.25	1.5905	0.78	.Q . . . .
18.43	1.6014	0.74	.Q . . . .
18.60	1.6117	0.71	.Q . . . .

18.77	1.6216	0.68	.Q	.	.	.	.
18.95	1.6312	0.65	.Q	.	.	.	.
19.12	1.6403	0.63	.Q	.	.	.	.
19.29	1.6491	0.60	.Q	.	.	.	.
19.47	1.6576	0.58	.Q	.	.	.	.
19.64	1.6659	0.57	.Q	.	.	.	.
19.81	1.6739	0.55	.Q	.	.	.	.
19.99	1.6816	0.53	.Q	.	.	.	.
20.16	1.6892	0.52	.Q	.	.	.	.
20.33	1.6965	0.51	.Q	.	.	.	.
20.51	1.7037	0.49	Q	.	.	.	.
20.68	1.7106	0.48	Q	.	.	.	.
20.85	1.7174	0.47	Q	.	.	.	.
21.03	1.7241	0.46	Q	.	.	.	.
21.20	1.7306	0.45	Q	.	.	.	.
21.37	1.7370	0.44	Q	.	.	.	.
21.55	1.7432	0.43	Q	.	.	.	.
21.72	1.7493	0.42	Q	.	.	.	.
21.89	1.7553	0.41	Q	.	.	.	.
22.07	1.7612	0.41	Q	.	.	.	.
22.24	1.7670	0.40	Q	.	.	.	.
22.41	1.7726	0.39	Q	.	.	.	.
22.59	1.7782	0.39	Q	.	.	.	.
22.76	1.7837	0.38	Q	.	.	.	.
22.93	1.7891	0.37	Q	.	.	.	.
23.11	1.7944	0.37	Q	.	.	.	.
23.28	1.7996	0.36	Q	.	.	.	.
23.45	1.8048	0.36	Q	.	.	.	.
23.63	1.8098	0.35	Q	.	.	.	.
23.80	1.8148	0.35	Q	.	.	.	.
23.97	1.8197	0.34	Q	.	.	.	.
24.15	1.8246	0.34	Q	.	.	.	.
24.32	1.8270	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1445.6
10%	135.2
20%	31.2
30%	20.8
40%	10.4
50%	10.4
60%	10.4
70%	10.4
80%	10.4

90% 10.4

Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN 2

==========

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 10.400
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

```
                INFLOW
                  |
                  |
                  |
                  V                 __effective depth
            -------------           |   (and volume)
            |           |     |     |
            | detention |     |....V.............
            |   basin   |<-->|          outflow
            |           |     |.........________
            -------------     |        |    \
                  |           | storage |     basin outlet
                  V           -----------
               OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) **	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) *
0.000	0.000	0.000**	0.500	0.026	1.080*
1.000	0.051	3.060**	1.500	0.077	5.530*
2.000	0.102	6.930**	2.500	0.128	8.090*
3.000	0.153	9.110**	3.500	0.179	10.020*
4.000	0.204	10.860**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	0.01826	0.03374
3	1.00	0.02908	0.07292
4	1.50	0.03739	0.11661

5	2.00	0.05236	0.15164
6	2.50	0.07006	0.18594
7	3.00	0.08775	0.21825
8	3.50	0.10723	0.25077
9	4.00	0.12621	0.28179

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.053	0.000	0.00	0.00	0.00	0.000
0.227	0.000	0.34	0.07	0.08	0.004
0.400	0.000	0.34	0.11	0.20	0.006
0.573	0.000	0.34	0.13	0.26	0.007
0.747	0.000	0.34	0.15	0.30	0.008
0.920	0.000	0.35	0.15	0.32	0.008
1.093	0.000	0.35	0.16	0.33	0.008
1.267	0.000	0.35	0.16	0.34	0.008
1.440	0.000	0.35	0.16	0.35	0.008
1.613	0.000	0.36	0.16	0.35	0.009
1.787	0.000	0.36	0.17	0.35	0.009
1.960	0.000	0.36	0.17	0.36	0.009
2.133	0.000	0.37	0.17	0.36	0.009
2.307	0.000	0.37	0.17	0.36	0.009
2.480	0.000	0.37	0.17	0.37	0.009
2.653	0.000	0.38	0.17	0.37	0.009
2.827	0.000	0.38	0.17	0.37	0.009
3.000	0.000	0.38	0.17	0.38	0.009
3.173	0.000	0.38	0.18	0.38	0.009
3.347	0.000	0.39	0.18	0.38	0.009
3.520	0.000	0.39	0.18	0.39	0.009
3.693	0.000	0.39	0.18	0.39	0.009
3.867	0.000	0.40	0.18	0.39	0.009
4.040	0.000	0.40	0.18	0.40	0.010
4.213	0.000	0.40	0.19	0.40	0.010
4.387	0.000	0.41	0.19	0.40	0.010
4.560	0.000	0.41	0.19	0.41	0.010
4.733	0.000	0.42	0.19	0.41	0.010
4.907	0.000	0.42	0.19	0.41	0.010
5.080	0.000	0.43	0.19	0.42	0.010
5.253	0.000	0.43	0.20	0.42	0.010
5.427	0.000	0.43	0.20	0.43	0.010
5.600	0.000	0.44	0.20	0.43	0.010
5.773	0.000	0.44	0.20	0.43	0.011
5.947	0.000	0.45	0.20	0.44	0.011
6.120	0.000	0.45	0.21	0.44	0.011
6.293	0.000	0.46	0.21	0.45	0.011

6.467	0.000	0.46	0.21	0.45	0.011
6.640	0.000	0.47	0.21	0.46	0.011
6.813	0.000	0.47	0.22	0.46	0.011
6.987	0.000	0.48	0.22	0.47	0.011
7.160	0.000	0.48	0.22	0.47	0.011
7.333	0.000	0.49	0.22	0.48	0.012
7.507	0.000	0.50	0.23	0.49	0.012
7.680	0.000	0.50	0.23	0.49	0.012
7.853	0.000	0.51	0.23	0.50	0.012
8.027	0.000	0.51	0.23	0.50	0.012
8.200	0.000	0.52	0.24	0.51	0.012
8.373	0.000	0.53	0.24	0.52	0.013
8.547	0.000	0.54	0.25	0.53	0.013
8.720	0.000	0.54	0.25	0.53	0.013
8.893	0.000	0.55	0.25	0.54	0.013
9.067	0.000	0.56	0.26	0.55	0.013
9.240	0.000	0.57	0.26	0.56	0.014
9.413	0.000	0.58	0.26	0.57	0.014
9.587	0.000	0.59	0.27	0.57	0.014
9.760	0.000	0.60	0.27	0.58	0.014
9.933	0.000	0.61	0.28	0.59	0.014
10.107	0.000	0.62	0.28	0.60	0.015
10.280	0.000	0.63	0.29	0.61	0.015
10.453	0.000	0.64	0.29	0.63	0.015
10.627	0.000	0.66	0.30	0.64	0.015
10.800	0.000	0.67	0.30	0.65	0.016
10.973	0.000	0.69	0.31	0.66	0.016
11.147	0.000	0.70	0.32	0.68	0.016
11.320	0.000	0.72	0.32	0.69	0.017
11.493	0.000	0.73	0.33	0.71	0.017
11.667	0.000	0.75	0.34	0.72	0.018
11.840	0.000	0.76	0.35	0.74	0.018
12.013	0.000	0.79	0.36	0.76	0.018
12.187	0.000	0.93	0.39	0.80	0.020
12.360	0.000	1.04	0.43	0.89	0.023
12.533	0.000	1.06	0.46	0.96	0.024
12.707	0.000	1.10	0.48	1.02	0.025
12.880	0.000	1.12	0.50	1.06	0.026
13.053	0.000	1.16	0.51	1.11	0.027
13.227	0.000	1.19	0.52	1.16	0.027
13.400	0.000	1.24	0.54	1.20	0.028
13.573	0.000	1.27	0.54	1.24	0.028
13.747	0.000	1.33	0.56	1.28	0.029
13.920	0.000	1.37	0.57	1.33	0.029
14.093	0.000	1.45	0.59	1.39	0.030
14.267	0.000	1.51	0.60	1.46	0.031
14.440	0.000	1.61	0.63	1.53	0.032
14.613	0.000	1.67	0.64	1.61	0.033
14.787	0.000	1.82	0.68	1.71	0.035
14.960	0.000	1.91	0.70	1.83	0.036
15.133	0.000	2.14	0.75	1.97	0.038
15.307	0.000	2.29	0.79	2.15	0.040

15.480	0.000	2.46	0.83	2.31	0.043
15.653	0.000	2.71	0.89	2.51	0.045
15.827	0.000	3.96	1.12	3.14	0.057
16.000	0.000	5.51	1.42	4.41	0.073
16.173	0.000	17.13	4.00	8.01	0.204
16.347	0.000	3.19	2.29	9.23	0.117
16.520	0.000	2.49	1.29	6.05	0.066
16.693	0.000	2.02	0.87	3.52	0.045
16.867	0.000	1.74	0.72	2.26	0.037
17.040	0.000	1.56	0.65	1.82	0.033
17.213	0.000	1.41	0.60	1.58	0.031
17.387	0.000	1.30	0.57	1.42	0.029
17.560	0.000	1.21	0.54	1.30	0.028
17.733	0.000	1.14	0.52	1.21	0.027
17.907	0.000	1.08	0.51	1.14	0.026
18.080	0.000	1.03	0.49	1.08	0.026
18.253	0.000	0.78	0.43	1.00	0.022
18.427	0.000	0.74	0.39	0.89	0.020
18.600	0.000	0.71	0.36	0.81	0.019
18.773	0.000	0.68	0.34	0.76	0.018
18.947	0.000	0.65	0.32	0.71	0.017
19.120	0.000	0.63	0.31	0.68	0.016
19.293	0.000	0.60	0.29	0.65	0.015
19.467	0.000	0.58	0.28	0.62	0.015
19.640	0.000	0.57	0.27	0.60	0.014
19.813	0.000	0.55	0.26	0.58	0.014
19.987	0.000	0.53	0.26	0.56	0.013
20.160	0.000	0.52	0.25	0.55	0.013
20.333	0.000	0.51	0.24	0.53	0.013
20.507	0.000	0.49	0.24	0.52	0.012
20.680	0.000	0.48	0.23	0.50	0.012
20.853	0.000	0.47	0.22	0.49	0.012
21.027	0.000	0.46	0.22	0.48	0.011
21.200	0.000	0.45	0.21	0.47	0.011
21.373	0.000	0.44	0.21	0.46	0.011
21.547	0.000	0.43	0.20	0.45	0.011
21.720	0.000	0.42	0.20	0.44	0.010
21.893	0.000	0.41	0.20	0.43	0.010
22.067	0.000	0.41	0.19	0.42	0.010
22.240	0.000	0.40	0.19	0.41	0.010
22.413	0.000	0.39	0.19	0.40	0.010
22.587	0.000	0.39	0.18	0.40	0.009
22.760	0.000	0.38	0.18	0.39	0.009
22.933	0.000	0.37	0.18	0.38	0.009
23.107	0.000	0.37	0.17	0.38	0.009
23.280	0.000	0.36	0.17	0.37	0.009
23.453	0.000	0.36	0.17	0.37	0.009
23.627	0.000	0.35	0.17	0.36	0.009
23.800	0.000	0.35	0.16	0.36	0.008
23.973	0.000	0.34	0.16	0.35	0.008
24.147	0.000	0.34	0.16	0.35	0.008
24.320	0.000	0.00	0.09	0.26	0.004

24.493	0.000	0.00	0.05	0.14	0.002
24.667	0.000	0.00	0.03	0.08	0.001

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                        SMALL AREA UNIT HYDROGRAPH MODEL
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                              Analysis prepared by:



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 Problem Descriptions:
  EL TORO DEVELOPMENT
  100 YEAR STORM - PROPOSED CONDITION
  BASIN 3
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    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =     5.14
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.060
    LOW LOSS FRACTION = 0.100
    TIME OF CONCENTRATION(MIN.) = 10.60
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

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    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      1.97
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.44

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  TIME      VOLUME        Q    0.        5.0       10.0      15.0      20.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.10      0.0000      0.00  Q          .         .         .         .
  0.28      0.0027      0.37  Q          .         .         .         .
  0.45      0.0080      0.37  Q          .         .         .         .
  0.63      0.0134      0.37  Q          .         .         .         .
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0.81	0.0189	0.37	Q	.	.	.	.
0.98	0.0243	0.38	Q	.	.	.	.
1.16	0.0298	0.38	Q	.	.	.	.
1.34	0.0354	0.38	Q	.	.	.	.
1.51	0.0410	0.38	Q	.	.	.	.
1.69	0.0466	0.39	Q	.	.	.	.
1.87	0.0523	0.39	Q	.	.	.	.
2.04	0.0580	0.39	Q	.	.	.	.
2.22	0.0638	0.40	Q	.	.	.	.
2.40	0.0696	0.40	Q	.	.	.	.
2.57	0.0755	0.40	Q	.	.	.	.
2.75	0.0814	0.41	Q	.	.	.	.
2.93	0.0873	0.41	Q	.	.	.	.
3.10	0.0934	0.41	Q	.	.	.	.
3.28	0.0994	0.42	Q	.	.	.	.
3.46	0.1055	0.42	Q	.	.	.	.
3.63	0.1117	0.42	Q	.	.	.	.
3.81	0.1179	0.43	Q	.	.	.	.
3.99	0.1242	0.43	Q	.	.	.	.
4.16	0.1305	0.44	Q	.	.	.	.
4.34	0.1369	0.44	Q	.	.	.	.
4.52	0.1434	0.44	Q	.	.	.	.
4.69	0.1499	0.45	Q	.	.	.	.
4.87	0.1565	0.45	Q	.	.	.	.
5.05	0.1631	0.46	Q	.	.	.	.
5.22	0.1698	0.46	Q	.	.	.	.
5.40	0.1766	0.47	Q	.	.	.	.
5.58	0.1835	0.47	Q	.	.	.	.
5.75	0.1904	0.48	Q	.	.	.	.
5.93	0.1974	0.48	Q	.	.	.	.
6.11	0.2045	0.49	Q	.	.	.	.
6.28	0.2116	0.49	Q	.	.	.	.
6.46	0.2189	0.50	Q	.	.	.	.
6.64	0.2262	0.51	.Q	.	.	.	.
6.81	0.2336	0.51	.Q	.	.	.	.
6.99	0.2411	0.52	.Q	.	.	.	.
7.17	0.2487	0.52	.Q	.	.	.	.
7.34	0.2563	0.53	.Q	.	.	.	.
7.52	0.2641	0.53	.Q	.	.	.	.
7.70	0.2720	0.54	.Q	.	.	.	.
7.87	0.2800	0.55	.Q	.	.	.	.
8.05	0.2880	0.56	.Q	.	.	.	.
8.23	0.2962	0.56	.Q	.	.	.	.
8.40	0.3046	0.57	.Q	.	.	.	.
8.58	0.3130	0.58	.Q	.	.	.	.
8.76	0.3216	0.59	.Q	.	.	.	.
8.93	0.3302	0.60	.Q	.	.	.	.
9.11	0.3391	0.61	.Q	.	.	.	.
9.29	0.3480	0.62	.Q	.	.	.	.
9.46	0.3571	0.63	.Q	.	.	.	.
9.64	0.3664	0.64	.Q	.	.	.	.
9.82	0.3758	0.65	.Q	.	.	.	.

9.99	0.3854	0.66	.Q . . . .
10.17	0.3952	0.68	.Q . . . .
10.35	0.4051	0.69	.Q . . . .
10.52	0.4152	0.70	.Q . . . .
10.70	0.4256	0.71	.Q . . . .
10.88	0.4361	0.73	.Q . . . .
11.05	0.4469	0.74	.Q . . . .
11.23	0.4579	0.77	.Q . . . .
11.41	0.4692	0.78	.Q . . . .
11.58	0.4807	0.80	.Q . . . .
11.76	0.4925	0.82	.Q . . . .
11.94	0.5047	0.84	.Q . . . .
12.11	0.5171	0.86	.Q . . . .
12.29	0.5315	1.12	. Q . . . .
12.47	0.5479	1.13	. Q . . . .
12.64	0.5648	1.17	. Q . . . .
12.82	0.5821	1.20	. Q . . . .
13.00	0.5999	1.24	. Q . . . .
13.17	0.6183	1.27	. Q . . . .
13.35	0.6372	1.33	. Q . . . .
13.53	0.6568	1.36	. Q . . . .
13.70	0.6771	1.43	. Q . . . .
13.88	0.6983	1.46	. Q . . . .
14.06	0.7203	1.55	. Q . . . .
14.23	0.7434	1.61	. Q . . . .
14.41	0.7677	1.72	. Q . . . .
14.59	0.7933	1.79	. Q . . . .
14.76	0.8206	1.95	. Q . . . .
14.94	0.8498	2.05	. Q . . . .
15.12	0.8814	2.29	. Q . . . .
15.29	0.9160	2.45	. Q . . . .
15.47	0.9533	2.67	. Q . . . .
15.65	0.9939	2.89	. Q . . . .
15.82	1.0458	4.23	. Q . . . .
16.00	1.1196	5.88	. .Q . . .
16.18	1.2961	18.29	. . . . Q .
16.35	1.4545	3.40	. Q . . . .
16.53	1.4987	2.65	. Q . . . .
16.71	1.5338	2.16	. Q . . . .
16.88	1.5631	1.86	. Q . . . .
17.06	1.5889	1.66	. Q . . . .
17.24	1.6120	1.51	. Q . . . .
17.41	1.6332	1.39	. Q . . . .
17.59	1.6528	1.30	. Q . . . .
17.77	1.6712	1.22	. Q . . . .
17.94	1.6885	1.15	. Q . . . .
18.12	1.7049	1.09	. Q . . . .
18.30	1.7189	0.83	.Q . . . .
18.47	1.7307	0.79	.Q . . . .
18.65	1.7420	0.75	.Q . . . .
18.83	1.7528	0.72	.Q . . . .
19.00	1.7631	0.69	.Q . . . .

19.18	1.7731	0.67	.Q	.	.	.	.
19.36	1.7827	0.65	.Q	.	.	.	.
19.53	1.7919	0.62	.Q	.	.	.	.
19.71	1.8009	0.60	.Q	.	.	.	.
19.89	1.8096	0.59	.Q	.	.	.	.
20.06	1.8180	0.57	.Q	.	.	.	.
20.24	1.8262	0.55	.Q	.	.	.	.
20.42	1.8342	0.54	.Q	.	.	.	.
20.59	1.8420	0.53	.Q	.	.	.	.
20.77	1.8496	0.51	.Q	.	.	.	.
20.95	1.8570	0.50	.Q	.	.	.	.
21.12	1.8642	0.49	Q	.	.	.	.
21.30	1.8713	0.48	Q	.	.	.	.
21.48	1.8782	0.47	Q	.	.	.	.
21.65	1.8850	0.46	Q	.	.	.	.
21.83	1.8916	0.45	Q	.	.	.	.
22.01	1.8981	0.44	Q	.	.	.	.
22.18	1.9045	0.43	Q	.	.	.	.
22.36	1.9108	0.43	Q	.	.	.	.
22.54	1.9170	0.42	Q	.	.	.	.
22.71	1.9230	0.41	Q	.	.	.	.
22.89	1.9290	0.40	Q	.	.	.	.
23.07	1.9349	0.40	Q	.	.	.	.
23.24	1.9406	0.39	Q	.	.	.	.
23.42	1.9463	0.39	Q	.	.	.	.
23.60	1.9519	0.38	Q	.	.	.	.
23.77	1.9574	0.37	Q	.	.	.	.
23.95	1.9629	0.37	Q	.	.	.	.
24.13	1.9682	0.36	Q	.	.	.	.
24.30	1.9709	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1441.6
10%	137.8
20%	31.8
30%	21.2
40%	10.6
50%	10.6
60%	10.6
70%	10.6
80%	10.6
90%	10.6

Problem Descriptions:

EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN 3

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FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 10.600
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

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                INFLOW
                  |
                  |
                  |
                  V                 __effective depth
            -------------           |   (and volume)
            |           |     |     |
            | detention |     |....V.............
            |   basin   |<-->|          outflow
            |           |     |.........________
            -------------     |         |    \
                  |           | storage |     basin outlet
                  V           -----------
              OUTFLOW
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DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) **	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) *
0.000	0.000	0.000**	0.500	0.029	1.080*
1.000	0.059	3.060**	1.500	0.088	5.530*
2.000	0.118	6.930**	2.500	0.147	8.090*
3.000	0.177	9.110**	3.500	0.206	10.020*
4.000	0.236	10.860**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	0.02112	0.03688
3	1.00	0.03666	0.08134
4	1.50	0.04763	0.12837
5	2.00	0.06741	0.16859
6	2.50	0.08794	0.20606
7	3.00	0.11049	0.24351

8	3.50	0.13285	0.27915
9	4.00	0.15672	0.31528

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.100	0.000	0.00	0.00	0.00	0.000
0.277	0.000	0.37	0.07	0.08	0.004
0.453	0.000	0.37	0.11	0.20	0.007
0.630	0.000	0.37	0.14	0.27	0.008
0.807	0.000	0.37	0.15	0.32	0.009
0.983	0.000	0.38	0.16	0.34	0.009
1.160	0.000	0.38	0.17	0.36	0.010
1.337	0.000	0.38	0.17	0.37	0.010
1.513	0.000	0.38	0.17	0.37	0.010
1.690	0.000	0.39	0.18	0.38	0.010
1.867	0.000	0.39	0.18	0.38	0.010
2.043	0.000	0.39	0.18	0.39	0.010
2.220	0.000	0.40	0.18	0.39	0.011
2.397	0.000	0.40	0.18	0.39	0.011
2.573	0.000	0.40	0.18	0.40	0.011
2.750	0.000	0.41	0.19	0.40	0.011
2.927	0.000	0.41	0.19	0.40	0.011
3.103	0.000	0.41	0.19	0.41	0.011
3.280	0.000	0.42	0.19	0.41	0.011
3.457	0.000	0.42	0.19	0.41	0.011
3.633	0.000	0.42	0.19	0.42	0.011
3.810	0.000	0.43	0.20	0.42	0.011
3.987	0.000	0.43	0.20	0.43	0.011
4.163	0.000	0.44	0.20	0.43	0.012
4.340	0.000	0.44	0.20	0.43	0.012
4.517	0.000	0.44	0.20	0.44	0.012
4.693	0.000	0.45	0.20	0.44	0.012
4.870	0.000	0.45	0.21	0.45	0.012
5.047	0.000	0.46	0.21	0.45	0.012
5.223	0.000	0.46	0.21	0.45	0.012
5.400	0.000	0.47	0.21	0.46	0.012
5.577	0.000	0.47	0.22	0.46	0.013
5.753	0.000	0.48	0.22	0.47	0.013
5.930	0.000	0.48	0.22	0.47	0.013
6.107	0.000	0.49	0.22	0.48	0.013
6.283	0.000	0.49	0.22	0.48	0.013
6.460	0.000	0.50	0.23	0.49	0.013
6.637	0.000	0.51	0.23	0.49	0.013
6.813	0.000	0.51	0.23	0.50	0.013
6.990	0.000	0.52	0.24	0.51	0.014

7.167	0.000	0.52	0.24	0.51	0.014
7.343	0.000	0.53	0.24	0.52	0.014
7.520	0.000	0.53	0.24	0.52	0.014
7.697	0.000	0.54	0.25	0.53	0.014
7.873	0.000	0.55	0.25	0.54	0.015
8.050	0.000	0.56	0.25	0.54	0.015
8.227	0.000	0.56	0.26	0.55	0.015
8.403	0.000	0.57	0.26	0.56	0.015
8.580	0.000	0.58	0.26	0.57	0.015
8.757	0.000	0.59	0.27	0.58	0.016
8.933	0.000	0.60	0.27	0.58	0.016
9.110	0.000	0.61	0.28	0.59	0.016
9.287	0.000	0.62	0.28	0.60	0.016
9.463	0.000	0.63	0.29	0.61	0.017
9.640	0.000	0.64	0.29	0.62	0.017
9.817	0.000	0.65	0.29	0.63	0.017
9.993	0.000	0.66	0.30	0.64	0.017
10.170	0.000	0.68	0.31	0.65	0.018
10.347	0.000	0.69	0.31	0.67	0.018
10.523	0.000	0.70	0.32	0.68	0.018
10.700	0.000	0.71	0.32	0.69	0.019
10.877	0.000	0.73	0.33	0.70	0.019
11.053	0.000	0.74	0.34	0.72	0.019
11.230	0.000	0.77	0.34	0.73	0.020
11.407	0.000	0.78	0.35	0.75	0.020
11.583	0.000	0.80	0.36	0.77	0.021
11.760	0.000	0.82	0.37	0.79	0.021
11.937	0.000	0.84	0.38	0.80	0.022
12.113	0.000	0.86	0.39	0.82	0.022
12.290	0.000	1.12	0.44	0.89	0.026
12.467	0.000	1.13	0.48	0.99	0.028
12.643	0.000	1.17	0.50	1.07	0.029
12.820	0.000	1.20	0.52	1.13	0.030
12.997	0.000	1.24	0.53	1.19	0.031
13.173	0.000	1.27	0.54	1.23	0.032
13.350	0.000	1.33	0.56	1.28	0.032
13.527	0.000	1.36	0.56	1.32	0.033
13.703	0.000	1.43	0.58	1.37	0.034
13.880	0.000	1.46	0.59	1.42	0.034
14.057	0.000	1.55	0.61	1.48	0.036
14.233	0.000	1.61	0.63	1.54	0.037
14.410	0.000	1.72	0.65	1.62	0.038
14.587	0.000	1.79	0.67	1.71	0.039
14.763	0.000	1.95	0.70	1.81	0.041
14.940	0.000	2.05	0.73	1.93	0.043
15.117	0.000	2.29	0.78	2.09	0.046
15.293	0.000	2.45	0.82	2.27	0.048
15.470	0.000	2.67	0.87	2.46	0.051
15.647	0.000	2.89	0.93	2.67	0.055
15.823	0.000	4.23	1.16	3.31	0.068
16.000	0.000	5.88	1.47	4.62	0.087
16.177	0.000	18.29	3.98	8.12	0.235

16.353	0.000	3.40	2.49	9.46	0.147
16.530	0.000	2.65	1.48	6.75	0.087
16.707	0.000	2.16	0.97	4.19	0.057
16.883	0.000	1.86	0.79	2.59	0.047
17.060	0.000	1.66	0.70	2.05	0.041
17.237	0.000	1.51	0.64	1.75	0.037
17.413	0.000	1.39	0.60	1.55	0.035
17.590	0.000	1.30	0.57	1.42	0.033
17.767	0.000	1.22	0.55	1.31	0.032
17.943	0.000	1.15	0.53	1.23	0.031
18.120	0.000	1.09	0.51	1.16	0.030
18.297	0.000	0.83	0.46	1.05	0.026
18.473	0.000	0.79	0.42	0.94	0.024
18.650	0.000	0.75	0.39	0.87	0.023
18.827	0.000	0.72	0.37	0.81	0.021
19.003	0.000	0.69	0.35	0.77	0.020
19.180	0.000	0.67	0.33	0.73	0.019
19.357	0.000	0.65	0.32	0.70	0.018
19.533	0.000	0.62	0.30	0.67	0.018
19.710	0.000	0.60	0.29	0.65	0.017
19.887	0.000	0.59	0.28	0.62	0.016
20.063	0.000	0.57	0.28	0.60	0.016
20.240	0.000	0.55	0.27	0.59	0.016
20.417	0.000	0.54	0.26	0.57	0.015
20.593	0.000	0.53	0.25	0.55	0.015
20.770	0.000	0.51	0.25	0.54	0.014
20.947	0.000	0.50	0.24	0.53	0.014
21.123	0.000	0.49	0.23	0.51	0.014
21.300	0.000	0.48	0.23	0.50	0.013
21.477	0.000	0.47	0.22	0.49	0.013
21.653	0.000	0.46	0.22	0.48	0.013
21.830	0.000	0.45	0.21	0.47	0.012
22.007	0.000	0.44	0.21	0.46	0.012
22.183	0.000	0.43	0.21	0.45	0.012
22.360	0.000	0.43	0.20	0.44	0.012
22.537	0.000	0.42	0.20	0.43	0.012
22.713	0.000	0.41	0.20	0.43	0.011
22.890	0.000	0.40	0.19	0.42	0.011
23.067	0.000	0.40	0.19	0.41	0.011
23.243	0.000	0.39	0.19	0.40	0.011
23.420	0.000	0.39	0.18	0.40	0.011
23.597	0.000	0.38	0.18	0.39	0.010
23.773	0.000	0.37	0.18	0.39	0.010
23.950	0.000	0.37	0.17	0.38	0.010
24.127	0.000	0.36	0.17	0.37	0.010
24.303	0.000	0.00	0.10	0.29	0.006
24.480	0.000	0.00	0.06	0.17	0.003
24.657	0.000	0.00	0.03	0.10	0.002
24.833	0.000	0.00	0.02	0.05	0.001

```
****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                              Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  EL TORO DEVELOPMENT
  100 YEAR STORM - PROPOSED CONDITION
  BASIN 4
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =     5.47
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.060
    LOW LOSS FRACTION = 0.100
    TIME OF CONCENTRATION(MIN.) = 10.50
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     2.10
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.47

****************************************************************************
  TIME      VOLUME        Q    0.        5.0       10.0       15.0       20.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.08      0.0012      0.39  Q          .          .          .          .
  0.25      0.0068      0.39  Q          .          .          .          .
  0.43      0.0124      0.39  Q          .          .          .          .
  0.60      0.0181      0.39  Q          .          .          .          .
```

0.77	0.0238	0.40	Q	.	.	.	.
0.95	0.0296	0.40	Q	.	.	.	.
1.12	0.0354	0.40	Q	.	.	.	.
1.30	0.0413	0.41	Q	.	.	.	.
1.48	0.0471	0.41	Q	.	.	.	.
1.65	0.0531	0.41	Q	.	.	.	.
1.83	0.0591	0.42	Q	.	.	.	.
2.00	0.0651	0.42	Q	.	.	.	.
2.17	0.0711	0.42	Q	.	.	.	.
2.35	0.0773	0.42	Q	.	.	.	.
2.53	0.0834	0.43	Q	.	.	.	.
2.70	0.0896	0.43	Q	.	.	.	.
2.88	0.0959	0.44	Q	.	.	.	.
3.05	0.1022	0.44	Q	.	.	.	.
3.22	0.1086	0.44	Q	.	.	.	.
3.40	0.1150	0.45	Q	.	.	.	.
3.58	0.1215	0.45	Q	.	.	.	.
3.75	0.1281	0.45	Q	.	.	.	.
3.92	0.1347	0.46	Q	.	.	.	.
4.10	0.1413	0.46	Q	.	.	.	.
4.28	0.1480	0.47	Q	.	.	.	.
4.45	0.1548	0.47	Q	.	.	.	.
4.62	0.1617	0.48	Q	.	.	.	.
4.80	0.1686	0.48	Q	.	.	.	.
4.97	0.1756	0.49	Q	.	.	.	.
5.15	0.1826	0.49	Q	.	.	.	.
5.32	0.1897	0.50	Q	.	.	.	.
5.50	0.1969	0.50	Q	.	.	.	.
5.68	0.2042	0.51	.Q	.	.	.	.
5.85	0.2115	0.51	.Q	.	.	.	.
6.03	0.2189	0.52	.Q	.	.	.	.
6.20	0.2264	0.52	.Q	.	.	.	.
6.38	0.2340	0.53	.Q	.	.	.	.
6.55	0.2417	0.53	.Q	.	.	.	.
6.72	0.2495	0.54	.Q	.	.	.	.
6.90	0.2573	0.54	.Q	.	.	.	.
7.07	0.2653	0.55	.Q	.	.	.	.
7.25	0.2733	0.56	.Q	.	.	.	.
7.43	0.2814	0.57	.Q	.	.	.	.
7.60	0.2897	0.57	.Q	.	.	.	.
7.78	0.2980	0.58	.Q	.	.	.	.
7.95	0.3065	0.59	.Q	.	.	.	.
8.12	0.3151	0.60	.Q	.	.	.	.
8.30	0.3238	0.60	.Q	.	.	.	.
8.48	0.3326	0.62	.Q	.	.	.	.
8.65	0.3415	0.62	.Q	.	.	.	.
8.82	0.3506	0.63	.Q	.	.	.	.
9.00	0.3598	0.64	.Q	.	.	.	.
9.18	0.3692	0.65	.Q	.	.	.	.
9.35	0.3787	0.66	.Q	.	.	.	.
9.52	0.3883	0.68	.Q	.	.	.	.
9.70	0.3982	0.68	.Q	.	.	.	.

9.88	0.4082	0.70	.Q . . . .
10.05	0.4183	0.71	.Q . . . .
10.23	0.4287	0.72	.Q . . . .
10.40	0.4392	0.73	.Q . . . .
10.57	0.4500	0.75	.Q . . . .
10.75	0.4609	0.76	.Q . . . .
10.93	0.4721	0.78	.Q . . . .
11.10	0.4835	0.80	.Q . . . .
11.27	0.4952	0.82	.Q . . . .
11.45	0.5072	0.83	.Q . . . .
11.62	0.5194	0.86	.Q . . . .
11.80	0.5319	0.87	.Q . . . .
11.98	0.5448	0.90	.Q . . . .
12.15	0.5585	0.99	.Q . . . .
12.32	0.5742	1.19	. Q . . . .
12.50	0.5916	1.21	. Q . . . .
12.68	0.6095	1.26	. Q . . . .
12.85	0.6278	1.28	. Q . . . .
13.02	0.6467	1.33	. Q . . . .
13.20	0.6662	1.36	. Q . . . .
13.38	0.6862	1.42	. Q . . . .
13.55	0.7070	1.45	. Q . . . .
13.73	0.7285	1.53	. Q . . . .
13.90	0.7509	1.57	. Q . . . .
14.07	0.7742	1.66	. Q . . . .
14.25	0.7987	1.72	. Q . . . .
14.43	0.8245	1.84	. Q . . . .
14.60	0.8516	1.91	. Q . . . .
14.77	0.8806	2.08	. Q . . . .
14.95	0.9115	2.19	. Q . . . .
15.12	0.9450	2.45	. Q . . . .
15.30	0.9816	2.62	. Q . . . .
15.48	1.0210	2.83	. Q . . . .
15.65	1.0639	3.09	. Q . . . .
15.82	1.1190	4.53	. Q. . . .
16.00	1.1972	6.29	. . Q . . .
16.17	1.3843	19.58	. . . . Q.
16.35	1.5522	3.64	. Q . . . .
16.52	1.5990	2.84	. Q . . . .
16.70	1.6363	2.31	. Q . . . .
16.88	1.6674	1.99	. Q . . . .
17.05	1.6947	1.78	. Q . . . .
17.23	1.7192	1.61	. Q . . . .
17.40	1.7416	1.49	. Q . . . .
17.58	1.7624	1.39	. Q . . . .
17.75	1.7819	1.30	. Q . . . .
17.92	1.8002	1.23	. Q . . . .
18.10	1.8176	1.17	. Q . . . .
18.27	1.8326	0.89	.Q . . . .
18.45	1.8451	0.85	.Q . . . .
18.62	1.8570	0.81	.Q . . . .
18.80	1.8685	0.77	.Q . . . .

18.98	1.8794	0.74	.Q	.	.	.	.
19.15	1.8900	0.72	.Q	.	.	.	.
19.33	1.9002	0.69	.Q	.	.	.	.
19.50	1.9100	0.67	.Q	.	.	.	.
19.67	1.9195	0.65	.Q	.	.	.	.
19.85	1.9287	0.63	.Q	.	.	.	.
20.02	1.9376	0.61	.Q	.	.	.	.
20.20	1.9463	0.59	.Q	.	.	.	.
20.38	1.9548	0.58	.Q	.	.	.	.
20.55	1.9631	0.56	.Q	.	.	.	.
20.73	1.9711	0.55	.Q	.	.	.	.
20.90	1.9789	0.54	.Q	.	.	.	.
21.08	1.9866	0.52	.Q	.	.	.	.
21.25	1.9941	0.51	.Q	.	.	.	.
21.42	2.0015	0.50	.Q	.	.	.	.
21.60	2.0087	0.49	Q	.	.	.	.
21.77	2.0157	0.48	Q	.	.	.	.
21.95	2.0226	0.47	Q	.	.	.	.
22.12	2.0294	0.46	Q	.	.	.	.
22.30	2.0361	0.46	Q	.	.	.	.
22.48	2.0426	0.45	Q	.	.	.	.
22.65	2.0490	0.44	Q	.	.	.	.
22.83	2.0554	0.43	Q	.	.	.	.
23.00	2.0616	0.43	Q	.	.	.	.
23.17	2.0677	0.42	Q	.	.	.	.
23.35	2.0737	0.41	Q	.	.	.	.
23.52	2.0796	0.41	Q	.	.	.	.
23.70	2.0855	0.40	Q	.	.	.	.
23.88	2.0913	0.40	Q	.	.	.	.
24.05	2.0969	0.39	Q	.	.	.	.
24.23	2.0998	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1449.0
10%	136.5
20%	31.5
30%	21.0
40%	10.5
50%	10.5
60%	10.5
70%	10.5
80%	10.5
90%	10.5

Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN 4

==========

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 10.500
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

```
                INFLOW
                  |
                  |
                  |
                  V                 __effective depth
            -------------           |   (and volume)
            |           |     |     |
            | detention |     |....V.............
            |   basin   |<-->|          outflow
            |           |     |.........__________
            -------------     |         |    \
                  |           | storage |     basin outlet
                  V           -----------
              OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) **	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) *
0.000	0.000	0.000**	0.500	0.024	1.300*
1.000	0.048	3.680**	1.500	0.073	7.370*
2.000	0.097	9.510**	2.500	0.121	11.260*
3.000	0.145	12.760**	3.500	0.169	14.110*
4.000	0.194	15.340**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	0.01460	0.03340
3	1.00	0.02139	0.07461
4	1.50	0.01970	0.12630
5	2.00	0.02823	0.16577
6	2.50	0.03957	0.20243

7	3.00	0.05273	0.23727
8	3.50	0.06696	0.27104
9	4.00	0.08307	0.30493

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.075	0.000	0.39	0.08	0.11	0.004
0.250	0.000	0.39	0.12	0.27	0.006
0.425	0.000	0.39	0.14	0.34	0.007
0.600	0.000	0.39	0.15	0.37	0.007
0.775	0.000	0.40	0.15	0.38	0.007
0.950	0.000	0.40	0.15	0.39	0.007
1.125	0.000	0.40	0.15	0.40	0.007
1.300	0.000	0.41	0.15	0.40	0.007
1.475	0.000	0.41	0.16	0.40	0.008
1.650	0.000	0.41	0.16	0.41	0.008
1.825	0.000	0.42	0.16	0.41	0.008
2.000	0.000	0.42	0.16	0.41	0.008
2.175	0.000	0.42	0.16	0.42	0.008
2.350	0.000	0.42	0.16	0.42	0.008
2.525	0.000	0.43	0.16	0.42	0.008
2.700	0.000	0.43	0.16	0.43	0.008
2.875	0.000	0.44	0.17	0.43	0.008
3.050	0.000	0.44	0.17	0.43	0.008
3.225	0.000	0.44	0.17	0.44	0.008
3.400	0.000	0.45	0.17	0.44	0.008
3.575	0.000	0.45	0.17	0.45	0.008
3.750	0.000	0.45	0.17	0.45	0.008
3.925	0.000	0.46	0.18	0.45	0.008
4.100	0.000	0.46	0.18	0.46	0.008
4.275	0.000	0.47	0.18	0.46	0.009
4.450	0.000	0.47	0.18	0.47	0.009
4.625	0.000	0.48	0.18	0.47	0.009
4.800	0.000	0.48	0.18	0.47	0.009
4.975	0.000	0.49	0.19	0.48	0.009
5.150	0.000	0.49	0.19	0.48	0.009
5.325	0.000	0.50	0.19	0.49	0.009
5.500	0.000	0.50	0.19	0.49	0.009
5.675	0.000	0.51	0.19	0.50	0.009
5.850	0.000	0.51	0.19	0.50	0.009
6.025	0.000	0.52	0.20	0.51	0.009
6.200	0.000	0.52	0.20	0.51	0.010
6.375	0.000	0.53	0.20	0.52	0.010
6.550	0.000	0.53	0.20	0.53	0.010
6.725	0.000	0.54	0.21	0.53	0.010

6.900	0.000	0.54	0.21	0.54	0.010
7.075	0.000	0.55	0.21	0.54	0.010
7.250	0.000	0.56	0.21	0.55	0.010
7.425	0.000	0.57	0.22	0.56	0.010
7.600	0.000	0.57	0.22	0.56	0.010
7.775	0.000	0.58	0.22	0.57	0.011
7.950	0.000	0.59	0.22	0.58	0.011
8.125	0.000	0.60	0.23	0.59	0.011
8.300	0.000	0.60	0.23	0.59	0.011
8.475	0.000	0.62	0.23	0.60	0.011
8.650	0.000	0.62	0.24	0.61	0.011
8.825	0.000	0.63	0.24	0.62	0.012
9.000	0.000	0.64	0.24	0.63	0.012
9.175	0.000	0.65	0.25	0.64	0.012
9.350	0.000	0.66	0.25	0.65	0.012
9.525	0.000	0.68	0.26	0.66	0.012
9.700	0.000	0.68	0.26	0.67	0.012
9.875	0.000	0.70	0.26	0.68	0.013
10.050	0.000	0.71	0.27	0.69	0.013
10.225	0.000	0.72	0.27	0.71	0.013
10.400	0.000	0.73	0.28	0.72	0.013
10.575	0.000	0.75	0.28	0.73	0.014
10.750	0.000	0.76	0.29	0.75	0.014
10.925	0.000	0.78	0.30	0.76	0.014
11.100	0.000	0.80	0.30	0.78	0.014
11.275	0.000	0.82	0.31	0.79	0.015
11.450	0.000	0.83	0.32	0.81	0.015
11.625	0.000	0.86	0.32	0.83	0.016
11.800	0.000	0.87	0.33	0.85	0.016
11.975	0.000	0.90	0.34	0.87	0.016
12.150	0.000	0.99	0.36	0.91	0.017
12.325	0.000	1.19	0.42	1.01	0.020
12.500	0.000	1.21	0.44	1.12	0.021
12.675	0.000	1.26	0.47	1.18	0.022
12.850	0.000	1.28	0.48	1.23	0.023
13.025	0.000	1.33	0.50	1.27	0.024
13.200	0.000	1.36	0.51	1.32	0.024
13.375	0.000	1.42	0.52	1.38	0.025
13.550	0.000	1.45	0.53	1.43	0.025
13.725	0.000	1.53	0.54	1.48	0.026
13.900	0.000	1.57	0.55	1.53	0.027
14.075	0.000	1.66	0.57	1.60	0.027
14.250	0.000	1.72	0.59	1.68	0.028
14.425	0.000	1.84	0.61	1.76	0.029
14.600	0.000	1.91	0.63	1.86	0.030
14.775	0.000	2.08	0.66	1.98	0.032
14.950	0.000	2.19	0.68	2.11	0.033
15.125	0.000	2.45	0.73	2.28	0.035
15.300	0.000	2.62	0.77	2.49	0.037
15.475	0.000	2.83	0.81	2.69	0.039
15.650	0.000	3.09	0.87	2.92	0.042
15.825	0.000	4.53	1.10	3.73	0.053

16.000	0.000	6.29	1.36	5.39	0.066
16.175	0.000	19.58	3.98	10.82	0.193
16.350	0.000	3.64	1.61	11.56	0.078
16.525	0.000	2.84	0.85	5.41	0.041
16.700	0.000	2.31	0.74	2.70	0.035
16.875	0.000	1.99	0.66	2.24	0.032
17.050	0.000	1.78	0.61	1.95	0.029
17.225	0.000	1.61	0.57	1.74	0.027
17.400	0.000	1.49	0.54	1.58	0.026
17.575	0.000	1.39	0.52	1.46	0.025
17.750	0.000	1.30	0.50	1.36	0.024
17.925	0.000	1.23	0.49	1.29	0.023
18.100	0.000	1.17	0.47	1.24	0.022
18.275	0.000	0.89	0.40	1.12	0.019
18.450	0.000	0.85	0.36	0.98	0.017
18.625	0.000	0.81	0.33	0.89	0.016
18.800	0.000	0.77	0.31	0.84	0.015
18.975	0.000	0.74	0.30	0.79	0.014
19.150	0.000	0.72	0.28	0.76	0.014
19.325	0.000	0.69	0.27	0.73	0.013
19.500	0.000	0.67	0.26	0.70	0.013
19.675	0.000	0.65	0.26	0.68	0.012
19.850	0.000	0.63	0.25	0.65	0.012
20.025	0.000	0.61	0.24	0.63	0.012
20.200	0.000	0.59	0.23	0.62	0.011
20.375	0.000	0.58	0.23	0.60	0.011
20.550	0.000	0.56	0.22	0.58	0.011
20.725	0.000	0.55	0.22	0.57	0.010
20.900	0.000	0.54	0.21	0.55	0.010
21.075	0.000	0.52	0.21	0.54	0.010
21.250	0.000	0.51	0.20	0.53	0.010
21.425	0.000	0.50	0.20	0.52	0.009
21.600	0.000	0.49	0.19	0.51	0.009
21.775	0.000	0.48	0.19	0.50	0.009
21.950	0.000	0.47	0.18	0.49	0.009
22.125	0.000	0.46	0.18	0.48	0.009
22.300	0.000	0.46	0.18	0.47	0.009
22.475	0.000	0.45	0.17	0.46	0.008
22.650	0.000	0.44	0.17	0.45	0.008
22.825	0.000	0.43	0.17	0.44	0.008
23.000	0.000	0.43	0.17	0.44	0.008
23.175	0.000	0.42	0.16	0.43	0.008
23.350	0.000	0.41	0.16	0.42	0.008
23.525	0.000	0.41	0.16	0.42	0.008
23.700	0.000	0.40	0.16	0.41	0.007
23.875	0.000	0.40	0.15	0.40	0.007
24.050	0.000	0.39	0.15	0.40	0.007
24.225	0.000	0.00	0.07	0.28	0.003
24.400	0.000	0.00	0.03	0.12	0.001

0.68	0.0148	0.31	Q	.	.	.	.
0.85	0.0190	0.31	Q	.	.	.	.
1.02	0.0233	0.31	Q	.	.	.	.
1.19	0.0277	0.31	Q	.	.	.	.
1.35	0.0321	0.32	Q	.	.	.	.
1.52	0.0365	0.32	Q	.	.	.	.
1.69	0.0409	0.32	Q	.	.	.	.
1.86	0.0454	0.32	Q	.	.	.	.
2.03	0.0498	0.32	Q	.	.	.	.
2.20	0.0544	0.33	Q	.	.	.	.
2.36	0.0589	0.33	Q	.	.	.	.
2.53	0.0636	0.33	Q	.	.	.	.
2.70	0.0682	0.34	Q	.	.	.	.
2.87	0.0729	0.34	Q	.	.	.	.
3.04	0.0776	0.34	Q	.	.	.	.
3.21	0.0823	0.34	Q	.	.	.	.
3.37	0.0871	0.35	Q	.	.	.	.
3.54	0.0919	0.35	Q	.	.	.	.
3.71	0.0968	0.35	Q	.	.	.	.
3.88	0.1017	0.35	Q	.	.	.	.
4.05	0.1067	0.36	Q	.	.	.	.
4.22	0.1117	0.36	Q	.	.	.	.
4.38	0.1167	0.36	Q	.	.	.	.
4.55	0.1218	0.37	Q	.	.	.	.
4.72	0.1269	0.37	Q	.	.	.	.
4.89	0.1321	0.37	Q	.	.	.	.
5.06	0.1374	0.38	Q	.	.	.	.
5.23	0.1426	0.38	Q	.	.	.	.
5.39	0.1480	0.39	Q	.	.	.	.
5.56	0.1533	0.39	Q	.	.	.	.
5.73	0.1588	0.39	Q	.	.	.	.
5.90	0.1643	0.40	Q	.	.	.	.
6.07	0.1698	0.40	Q	.	.	.	.
6.24	0.1754	0.40	Q	.	.	.	.
6.40	0.1811	0.41	Q	.	.	.	.
6.57	0.1868	0.41	Q	.	.	.	.
6.74	0.1926	0.42	Q	.	.	.	.
6.91	0.1985	0.42	Q	.	.	.	.
7.08	0.2044	0.43	Q	.	.	.	.
7.25	0.2104	0.43	Q	.	.	.	.
7.41	0.2165	0.44	Q	.	.	.	.
7.58	0.2226	0.44	Q	.	.	.	.
7.75	0.2289	0.45	Q	.	.	.	.
7.92	0.2352	0.45	Q	.	.	.	.
8.09	0.2415	0.46	Q	.	.	.	.
8.26	0.2480	0.47	Q	.	.	.	.
8.42	0.2546	0.48	Q	.	.	.	.
8.59	0.2612	0.48	Q	.	.	.	.
8.76	0.2679	0.49	Q	.	.	.	.
8.93	0.2748	0.49	Q	.	.	.	.
9.10	0.2817	0.50	.Q	.	.	.	.
9.27	0.2887	0.51	.Q	.	.	.	.

9.43	0.2959	0.52	.Q . . . .
9.60	0.3031	0.52	.Q . . . .
9.77	0.3105	0.54	.Q . . . .
9.94	0.3180	0.54	.Q . . . .
10.11	0.3257	0.55	.Q . . . .
10.28	0.3334	0.56	.Q . . . .
10.45	0.3413	0.58	.Q . . . .
10.61	0.3494	0.58	.Q . . . .
10.78	0.3576	0.60	.Q . . . .
10.95	0.3660	0.61	.Q . . . .
11.12	0.3745	0.62	.Q . . . .
11.29	0.3833	0.63	.Q . . . .
11.45	0.3922	0.65	.Q . . . .
11.62	0.4013	0.66	.Q . . . .
11.79	0.4107	0.68	.Q . . . .
11.96	0.4202	0.69	.Q . . . .
12.13	0.4309	0.84	.Q . . . .
12.30	0.4430	0.91	.Q . . . .
12.46	0.4560	0.94	.Q . . . .
12.63	0.4692	0.96	.Q . . . .
12.80	0.4828	0.99	.Q . . . .
12.97	0.4968	1.01	. Q . . . .
13.14	0.5112	1.05	. Q . . . .
13.31	0.5260	1.07	. Q . . . .
13.48	0.5412	1.12	. Q . . . .
13.64	0.5570	1.15	. Q . . . .
13.81	0.5734	1.21	. Q . . . .
13.98	0.5905	1.24	. Q . . . .
14.15	0.6083	1.32	. Q . . . .
14.32	0.6269	1.36	. Q . . . .
14.48	0.6465	1.46	. Q . . . .
14.65	0.6672	1.52	. Q . . . .
14.82	0.6892	1.65	. Q . . . .
14.99	0.7127	1.73	. Q . . . .
15.16	0.7382	1.94	. Q . . . .
15.33	0.7661	2.07	. Q . . . .
15.49	0.7957	2.18	. Q . . . .
15.66	0.8279	2.46	. Q . . . .
15.83	0.8700	3.60	. Q . . . .
16.00	0.9298	5.00	. Q. . . .
16.17	1.0726	15.53	. . . .Q .
16.34	1.2007	2.89	. Q . . . .
16.50	1.2365	2.25	. Q . . . .
16.67	1.2649	1.83	. Q . . . .
16.84	1.2886	1.58	. Q . . . .
17.01	1.3093	1.41	. Q . . . .
17.18	1.3280	1.28	. Q . . . .
17.35	1.3450	1.18	. Q . . . .
17.52	1.3609	1.10	. Q . . . .
17.68	1.3757	1.03	. Q . . . .
17.85	1.3897	0.98	.Q . . . .
18.02	1.4029	0.93	.Q . . . .

18.19	1.4143	0.71	.Q	.	.	.	.
18.36	1.4239	0.67	.Q	.	.	.	.
18.52	1.4330	0.64	.Q	.	.	.	.
18.69	1.4417	0.61	.Q	.	.	.	.
18.86	1.4501	0.59	.Q	.	.	.	.
19.03	1.4582	0.57	.Q	.	.	.	.
19.20	1.4659	0.55	.Q	.	.	.	.
19.37	1.4735	0.53	.Q	.	.	.	.
19.53	1.4807	0.51	.Q	.	.	.	.
19.70	1.4878	0.50	Q	.	.	.	.
19.87	1.4946	0.48	Q	.	.	.	.
20.04	1.5012	0.47	Q	.	.	.	.
20.21	1.5077	0.46	Q	.	.	.	.
20.38	1.5140	0.45	Q	.	.	.	.
20.55	1.5201	0.44	Q	.	.	.	.
20.71	1.5261	0.43	Q	.	.	.	.
20.88	1.5320	0.42	Q	.	.	.	.
21.05	1.5377	0.41	Q	.	.	.	.
21.22	1.5433	0.40	Q	.	.	.	.
21.39	1.5488	0.39	Q	.	.	.	.
21.56	1.5542	0.38	Q	.	.	.	.
21.72	1.5595	0.38	Q	.	.	.	.
21.89	1.5647	0.37	Q	.	.	.	.
22.06	1.5698	0.36	Q	.	.	.	.
22.23	1.5748	0.36	Q	.	.	.	.
22.40	1.5797	0.35	Q	.	.	.	.
22.57	1.5845	0.34	Q	.	.	.	.
22.73	1.5893	0.34	Q	.	.	.	.
22.90	1.5939	0.33	Q	.	.	.	.
23.07	1.5985	0.33	Q	.	.	.	.
23.24	1.6031	0.32	Q	.	.	.	.
23.41	1.6075	0.32	Q	.	.	.	.
23.58	1.6119	0.31	Q	.	.	.	.
23.74	1.6163	0.31	Q	.	.	.	.
23.91	1.6206	0.31	Q	.	.	.	.
24.08	1.6248	0.30	Q	.	.	.	.
24.25	1.6269	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1444.3
10%	131.3
20%	30.3
30%	20.2
40%	10.1

50%	10.1
60%	10.1
70%	10.1
80%	10.1
90%	10.1

Problem Descriptions:

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==============================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =   10.100
     DEAD STORAGE(AF) =       0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =       0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =    0.00


                 INFLOW
                   |
                   |
                   |
                   V                 __effective depth
             -------------           |   (and volume)
             |           |     |     |
             | detention |     |....V.............
             |   basin   |<-->|          outflow
             |           |     |.........__________
             -------------     |         |    \
                   |           | storage |     basin outlet
                   V           -----------
                OUTFLOW


     DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
     TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES =   9
     *BASIN-DEPTH  STORAGE    OUTFLOW  **BASIN-DEPTH  STORAGE    OUTFLOW  *
     *   (FEET)  (ACRE-FEET)   (CFS)   **   (FEET)  (ACRE-FEET)   (CFS)   *
     *      0.000      0.000      0.000**      0.500      0.011      1.520*
     *      1.000      0.022      4.290**      1.500      0.033      7.880*
     *      2.000      0.044     12.280**      2.500      0.055     14.760*
     *      3.000      0.065     16.880**      3.500      0.076     18.760*
     *      4.000      0.087     20.470**
-------------------------------------------------------------------------------
     BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:
      INTERVAL   DEPTH    {S-O*DT/2}    {S+O*DT/2}
       NUMBER   (FEET)   (ACRE-FEET)   (ACRE-FEET)
```

1	0.00	0.00000	0.00000
2	0.50	0.00043	0.02157
3	1.00	-0.00784	0.05184
4	1.50	-0.02181	0.08781
5	2.00	-0.04142	0.12942
6	2.50	-0.04767	0.15767
7	3.00	-0.05242	0.18242
8	3.50	-0.05449	0.20649
9	4.00	-0.05539	0.22939

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.008	0.000	0.00	0.00	0.00	0.000
0.177	0.000	0.30	0.10	0.15	0.002
0.345	0.000	0.30	0.10	0.30	0.002
0.513	0.000	0.30	0.10	0.30	0.002
0.682	0.000	0.31	0.10	0.31	0.002
0.850	0.000	0.31	0.10	0.31	0.002
1.018	0.000	0.31	0.10	0.31	0.002
1.187	0.000	0.31	0.10	0.31	0.002
1.355	0.000	0.32	0.10	0.31	0.002
1.523	0.000	0.32	0.10	0.32	0.002
1.692	0.000	0.32	0.11	0.32	0.002
1.860	0.000	0.32	0.11	0.32	0.002
2.028	0.000	0.32	0.11	0.32	0.002
2.197	0.000	0.33	0.11	0.33	0.002
2.365	0.000	0.33	0.11	0.33	0.002
2.533	0.000	0.33	0.11	0.33	0.002
2.702	0.000	0.34	0.11	0.33	0.002
2.870	0.000	0.34	0.11	0.34	0.002
3.038	0.000	0.34	0.11	0.34	0.002
3.207	0.000	0.34	0.11	0.34	0.002
3.375	0.000	0.35	0.11	0.34	0.003
3.543	0.000	0.35	0.11	0.35	0.003
3.712	0.000	0.35	0.12	0.35	0.003
3.880	0.000	0.35	0.12	0.35	0.003
4.048	0.000	0.36	0.12	0.36	0.003
4.217	0.000	0.36	0.12	0.36	0.003
4.385	0.000	0.36	0.12	0.36	0.003
4.553	0.000	0.37	0.12	0.37	0.003
4.722	0.000	0.37	0.12	0.37	0.003
4.890	0.000	0.37	0.12	0.37	0.003
5.058	0.000	0.38	0.12	0.38	0.003
5.227	0.000	0.38	0.13	0.38	0.003
5.395	0.000	0.39	0.13	0.38	0.003

5.563	0.000	0.39	0.13	0.39	0.003
5.732	0.000	0.39	0.13	0.39	0.003
5.900	0.000	0.40	0.13	0.39	0.003
6.068	0.000	0.40	0.13	0.40	0.003
6.237	0.000	0.40	0.13	0.40	0.003
6.405	0.000	0.41	0.13	0.41	0.003
6.573	0.000	0.41	0.14	0.41	0.003
6.742	0.000	0.42	0.14	0.42	0.003
6.910	0.000	0.42	0.14	0.42	0.003
7.078	0.000	0.43	0.14	0.43	0.003
7.247	0.000	0.43	0.14	0.43	0.003
7.415	0.000	0.44	0.14	0.44	0.003
7.583	0.000	0.44	0.15	0.44	0.003
7.752	0.000	0.45	0.15	0.45	0.003
7.920	0.000	0.45	0.15	0.45	0.003
8.088	0.000	0.46	0.15	0.46	0.003
8.257	0.000	0.47	0.15	0.46	0.003
8.425	0.000	0.48	0.16	0.47	0.003
8.593	0.000	0.48	0.16	0.48	0.003
8.762	0.000	0.49	0.16	0.48	0.004
8.930	0.000	0.49	0.16	0.49	0.004
9.098	0.000	0.50	0.17	0.50	0.004
9.267	0.000	0.51	0.17	0.51	0.004
9.435	0.000	0.52	0.17	0.51	0.004
9.603	0.000	0.52	0.17	0.52	0.004
9.772	0.000	0.54	0.18	0.53	0.004
9.940	0.000	0.54	0.18	0.54	0.004
10.108	0.000	0.55	0.18	0.55	0.004
10.277	0.000	0.56	0.18	0.56	0.004
10.445	0.000	0.58	0.19	0.57	0.004
10.613	0.000	0.58	0.19	0.58	0.004
10.782	0.000	0.60	0.20	0.59	0.004
10.950	0.000	0.61	0.20	0.60	0.004
11.118	0.000	0.62	0.20	0.61	0.005
11.287	0.000	0.63	0.21	0.63	0.005
11.455	0.000	0.65	0.21	0.64	0.005
11.623	0.000	0.66	0.22	0.66	0.005
11.792	0.000	0.68	0.22	0.67	0.005
11.960	0.000	0.69	0.23	0.69	0.005
12.128	0.000	0.84	0.27	0.76	0.006
12.297	0.000	0.91	0.30	0.87	0.007
12.465	0.000	0.94	0.31	0.93	0.007
12.633	0.000	0.96	0.32	0.95	0.007
12.802	0.000	0.99	0.33	0.98	0.007
12.970	0.000	1.01	0.33	1.00	0.007
13.138	0.000	1.05	0.35	1.03	0.008
13.307	0.000	1.07	0.35	1.06	0.008
13.475	0.000	1.12	0.37	1.10	0.008
13.643	0.000	1.15	0.38	1.13	0.008
13.812	0.000	1.21	0.40	1.18	0.009
13.980	0.000	1.24	0.41	1.22	0.009
14.148	0.000	1.32	0.43	1.28	0.010

14.317	0.000	1.36	0.45	1.34	0.010
14.485	0.000	1.46	0.48	1.41	0.011
14.653	0.000	1.52	0.50	1.49	0.011
14.822	0.000	1.65	0.53	1.60	0.012
14.990	0.000	1.73	0.54	1.72	0.012
15.158	0.000	1.94	0.59	1.88	0.013
15.327	0.000	2.07	0.62	2.10	0.014
15.495	0.000	2.18	0.64	2.25	0.014
15.663	0.000	2.46	0.71	2.50	0.016
15.832	0.000	3.60	0.97	3.40	0.021
16.000	0.000	5.00	1.25	5.09	0.027
16.168	0.000	15.53	3.71	12.76	0.081
16.337	0.000	2.89	0.81	11.35	0.018
16.505	0.000	2.25	0.66	2.82	0.015
16.673	0.000	1.83	0.56	2.14	0.012
16.842	0.000	1.58	0.51	1.71	0.011
17.010	0.000	1.41	0.46	1.48	0.010
17.178	0.000	1.28	0.42	1.34	0.009
17.347	0.000	1.18	0.39	1.23	0.009
17.515	0.000	1.10	0.36	1.14	0.008
17.683	0.000	1.03	0.34	1.07	0.007
17.852	0.000	0.98	0.32	1.01	0.007
18.020	0.000	0.93	0.31	0.95	0.007
18.188	0.000	0.71	0.23	0.82	0.005
18.357	0.000	0.67	0.22	0.69	0.005
18.525	0.000	0.64	0.21	0.66	0.005
18.693	0.000	0.61	0.20	0.63	0.004
18.862	0.000	0.59	0.19	0.60	0.004
19.030	0.000	0.57	0.19	0.58	0.004
19.198	0.000	0.55	0.18	0.56	0.004
19.367	0.000	0.53	0.17	0.54	0.004
19.535	0.000	0.51	0.17	0.52	0.004
19.703	0.000	0.50	0.16	0.51	0.004
19.872	0.000	0.48	0.16	0.49	0.004
20.040	0.000	0.47	0.15	0.48	0.003
20.208	0.000	0.46	0.15	0.47	0.003
20.377	0.000	0.45	0.15	0.45	0.003
20.545	0.000	0.44	0.14	0.44	0.003
20.713	0.000	0.43	0.14	0.43	0.003
20.882	0.000	0.42	0.14	0.42	0.003
21.050	0.000	0.41	0.13	0.41	0.003
21.218	0.000	0.40	0.13	0.40	0.003
21.387	0.000	0.39	0.13	0.40	0.003
21.555	0.000	0.38	0.13	0.39	0.003
21.723	0.000	0.38	0.12	0.38	0.003
21.892	0.000	0.37	0.12	0.37	0.003
22.060	0.000	0.36	0.12	0.37	0.003
22.228	0.000	0.36	0.12	0.36	0.003
22.397	0.000	0.35	0.12	0.35	0.003
22.565	0.000	0.34	0.11	0.35	0.002
22.733	0.000	0.34	0.11	0.34	0.002
22.902	0.000	0.33	0.11	0.34	0.002

23.070	0.000	0.33	0.11	0.33	0.002
23.238	0.000	0.32	0.11	0.33	0.002
23.407	0.000	0.32	0.10	0.32	0.002
23.575	0.000	0.31	0.10	0.32	0.002
23.743	0.000	0.31	0.10	0.31	0.002
23.912	0.000	0.31	0.10	0.31	0.002
24.080	0.000	0.30	0.10	0.30	0.002
24.248	0.000	0.00	0.00	0.15	0.000
24.417	0.000	0.00	0.00	0.00	0.000

```
****************************************************************************
          NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
                    AND LOW LOSS FRACTION ESTIMATIONS
============================================================================
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                          Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN 6
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =     1.53
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.060
    LOW LOSS FRACTION = 0.100
    TIME OF CONCENTRATION(MIN.) =  8.40
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      0.59
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.13

****************************************************************************
  TIME      VOLUME        Q    0.         2.5        5.0        7.5       10.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.04      0.0000      0.00  Q          .          .          .          .
  0.18      0.0006      0.11  Q          .          .          .          .
  0.32      0.0019      0.11  Q          .          .          .          .
```

0.46	0.0032	0.11	Q	.	.	.	.
0.60	0.0044	0.11	Q	.	.	.	.
0.74	0.0057	0.11	Q	.	.	.	.
0.88	0.0070	0.11	Q	.	.	.	.
1.02	0.0083	0.11	Q	.	.	.	.
1.16	0.0096	0.11	Q	.	.	.	.
1.30	0.0109	0.11	Q	.	.	.	.
1.44	0.0122	0.11	Q	.	.	.	.
1.58	0.0135	0.12	Q	.	.	.	.
1.72	0.0149	0.12	Q	.	.	.	.
1.86	0.0162	0.12	Q	.	.	.	.
2.00	0.0176	0.12	Q	.	.	.	.
2.14	0.0189	0.12	Q	.	.	.	.
2.28	0.0203	0.12	Q	.	.	.	.
2.42	0.0217	0.12	Q	.	.	.	.
2.56	0.0231	0.12	Q	.	.	.	.
2.70	0.0245	0.12	Q	.	.	.	.
2.84	0.0259	0.12	Q	.	.	.	.
2.98	0.0273	0.12	Q	.	.	.	.
3.12	0.0287	0.12	Q	.	.	.	.
3.26	0.0301	0.12	Q	.	.	.	.
3.40	0.0316	0.12	Q	.	.	.	.
3.54	0.0330	0.13	Q	.	.	.	.
3.68	0.0345	0.13	Q	.	.	.	.
3.82	0.0360	0.13	Q	.	.	.	.
3.96	0.0374	0.13	Q	.	.	.	.
4.10	0.0389	0.13	Q	.	.	.	.
4.24	0.0404	0.13	Q	.	.	.	.
4.38	0.0420	0.13	Q	.	.	.	.
4.52	0.0435	0.13	Q	.	.	.	.
4.66	0.0450	0.13	Q	.	.	.	.
4.80	0.0466	0.13	Q	.	.	.	.
4.94	0.0481	0.14	Q	.	.	.	.
5.08	0.0497	0.14	Q	.	.	.	.
5.22	0.0513	0.14	Q	.	.	.	.
5.36	0.0529	0.14	Q	.	.	.	.
5.50	0.0545	0.14	Q	.	.	.	.
5.64	0.0561	0.14	Q	.	.	.	.
5.78	0.0578	0.14	Q	.	.	.	.
5.92	0.0594	0.14	Q	.	.	.	.
6.06	0.0611	0.15	Q	.	.	.	.
6.20	0.0628	0.15	Q	.	.	.	.
6.34	0.0645	0.15	Q	.	.	.	.
6.48	0.0662	0.15	Q	.	.	.	.
6.62	0.0679	0.15	Q	.	.	.	.
6.76	0.0697	0.15	Q	.	.	.	.
6.90	0.0714	0.15	Q	.	.	.	.
7.04	0.0732	0.15	Q	.	.	.	.
7.18	0.0750	0.16	Q	.	.	.	.
7.32	0.0768	0.16	Q	.	.	.	.
7.46	0.0787	0.16	Q	.	.	.	.
7.60	0.0805	0.16	Q	.	.	.	.

7.74	0.0824	0.16	Q	.	.	.	.
7.88	0.0843	0.16	Q	.	.	.	.
8.02	0.0862	0.17	Q	.	.	.	.
8.16	0.0881	0.17	Q	.	.	.	.
8.30	0.0901	0.17	Q	.	.	.	.
8.44	0.0920	0.17	Q	.	.	.	.
8.58	0.0940	0.17	Q	.	.	.	.
8.72	0.0961	0.18	Q	.	.	.	.
8.86	0.0981	0.18	Q	.	.	.	.
9.00	0.1002	0.18	Q	.	.	.	.
9.14	0.1023	0.18	Q	.	.	.	.
9.28	0.1044	0.18	Q	.	.	.	.
9.42	0.1065	0.19	Q	.	.	.	.
9.56	0.1087	0.19	Q	.	.	.	.
9.70	0.1109	0.19	Q	.	.	.	.
9.84	0.1132	0.19	Q	.	.	.	.
9.98	0.1154	0.20	Q	.	.	.	.
10.12	0.1177	0.20	Q	.	.	.	.
10.26	0.1201	0.20	Q	.	.	.	.
10.40	0.1224	0.21	Q	.	.	.	.
10.54	0.1248	0.21	Q	.	.	.	.
10.68	0.1273	0.21	Q	.	.	.	.
10.82	0.1298	0.22	Q	.	.	.	.
10.96	0.1323	0.22	Q	.	.	.	.
11.10	0.1349	0.22	Q	.	.	.	.
11.24	0.1375	0.23	Q	.	.	.	.
11.38	0.1402	0.23	Q	.	.	.	.
11.52	0.1429	0.24	Q	.	.	.	.
11.66	0.1456	0.24	Q	.	.	.	.
11.80	0.1485	0.25	Q	.	.	.	.
11.94	0.1513	0.25	.Q	.	.	.	.
12.08	0.1543	0.26	.Q	.	.	.	.
12.22	0.1577	0.33	.Q	.	.	.	.
12.36	0.1615	0.33	.Q	.	.	.	.
12.50	0.1654	0.34	.Q	.	.	.	.
12.64	0.1694	0.35	.Q	.	.	.	.
12.78	0.1735	0.36	.Q	.	.	.	.
12.92	0.1777	0.36	.Q	.	.	.	.
13.06	0.1820	0.38	.Q	.	.	.	.
13.20	0.1864	0.38	.Q	.	.	.	.
13.34	0.1909	0.40	.Q	.	.	.	.
13.48	0.1955	0.40	.Q	.	.	.	.
13.62	0.2003	0.42	.Q	.	.	.	.
13.76	0.2052	0.43	.Q	.	.	.	.
13.90	0.2102	0.45	.Q	.	.	.	.
14.04	0.2155	0.46	.Q	.	.	.	.
14.18	0.2209	0.48	.Q	.	.	.	.
14.32	0.2266	0.50	.Q	.	.	.	.
14.46	0.2325	0.53	. Q	.	.	.	.
14.60	0.2386	0.54	. Q	.	.	.	.
14.74	0.2451	0.58	. Q	.	.	.	.
14.88	0.2520	0.60	. Q	.	.	.	.

15.02	0.2593	0.66	. Q . . . .
15.16	0.2670	0.69	. Q . . . .
15.30	0.2755	0.77	. Q . . . .
15.44	0.2847	0.82	. Q . . . .
15.58	0.2945	0.88	. Q . . . .
15.72	0.3053	1.00	. Q . . . .
15.86	0.3195	1.46	. Q . . . .
16.00	0.3396	2.02	. Q . . . .
16.14	0.3875	6.25	. . . Q . .
16.28	0.4305	1.17	. Q . . . .
16.42	0.4418	0.79	. Q . . . .
16.56	0.4506	0.73	. Q . . . .
16.70	0.4584	0.63	. Q . . . .
16.84	0.4653	0.56	. Q . . . .
16.98	0.4715	0.51	. Q . . . .
17.12	0.4771	0.47	.Q . . . .
17.26	0.4824	0.44	.Q . . . .
17.40	0.4873	0.41	.Q . . . .
17.54	0.4919	0.39	.Q . . . .
17.68	0.4963	0.37	.Q . . . .
17.82	0.5005	0.35	.Q . . . .
17.96	0.5045	0.34	.Q . . . .
18.10	0.5083	0.32	.Q . . . .
18.24	0.5116	0.25	Q . . . .
18.38	0.5144	0.24	Q . . . .
18.52	0.5171	0.23	Q . . . .
18.66	0.5197	0.22	Q . . . .
18.80	0.5222	0.21	Q . . . .
18.94	0.5247	0.21	Q . . . .
19.08	0.5271	0.20	Q . . . .
19.22	0.5294	0.20	Q . . . .
19.36	0.5316	0.19	Q . . . .
19.50	0.5338	0.19	Q . . . .
19.64	0.5359	0.18	Q . . . .
19.78	0.5380	0.18	Q . . . .
19.92	0.5400	0.17	Q . . . .
20.06	0.5420	0.17	Q . . . .
20.20	0.5439	0.17	Q . . . .
20.34	0.5458	0.16	Q . . . .
20.48	0.5476	0.16	Q . . . .
20.62	0.5495	0.16	Q . . . .
20.76	0.5512	0.15	Q . . . .
20.90	0.5530	0.15	Q . . . .
21.04	0.5547	0.15	Q . . . .
21.18	0.5564	0.14	Q . . . .
21.32	0.5580	0.14	Q . . . .
21.46	0.5597	0.14	Q . . . .
21.60	0.5613	0.14	Q . . . .
21.74	0.5628	0.14	Q . . . .
21.88	0.5644	0.13	Q . . . .
22.02	0.5659	0.13	Q . . . .
22.16	0.5674	0.13	Q . . . .

22.30	0.5689	0.13	Q	.	.	.	.
22.44	0.5704	0.13	Q	.	.	.	.
22.58	0.5718	0.12	Q	.	.	.	.
22.72	0.5732	0.12	Q	.	.	.	.
22.86	0.5746	0.12	Q	.	.	.	.
23.00	0.5760	0.12	Q	.	.	.	.
23.14	0.5774	0.12	Q	.	.	.	.
23.28	0.5787	0.12	Q	.	.	.	.
23.42	0.5801	0.11	Q	.	.	.	.
23.56	0.5814	0.11	Q	.	.	.	.
23.70	0.5827	0.11	Q	.	.	.	.
23.84	0.5840	0.11	Q	.	.	.	.
23.98	0.5853	0.11	Q	.	.	.	.
24.12	0.5865	0.11	Q	.	.	.	.
24.26	0.5871	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1444.8
10%	109.2
20%	25.2
30%	16.8
40%	8.4
50%	8.4
60%	8.4
70%	8.4
80%	8.4
90%	8.4

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 8.400
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

INFLOW
|
|
|

```
          V                    __effective depth
   -------------               |   (and volume)
   |           |     |         |
   | detention |     |....V.............
   |   basin   |<-->|          outflow
   |           |     |.........__________
   -------------     |         |    \
         |           | storage |     basin outlet
         V           -----------
      OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) **	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) *
0.000	0.000	0.000**	0.500	0.004	0.870*
1.000	0.009	2.670**	1.500	0.013	3.780*
2.000	0.017	4.630**	2.500	0.022	5.350*
3.000	0.026	5.980**	3.500	0.031	6.550*
4.000	0.035	7.070**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	-0.00103	0.00903
3	1.00	-0.00645	0.02445
4	1.50	-0.00887	0.03487
5	2.00	-0.00979	0.04379
6	2.50	-0.00895	0.05295
7	3.00	-0.00860	0.06060
8	3.50	-0.00689	0.06889
9	4.00	-0.00590	0.07590

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.040	0.000	0.00	0.00	0.00	0.000
0.180	0.000	0.11	0.07	0.06	0.001
0.320	0.000	0.11	0.07	0.12	0.001
0.460	0.000	0.11	0.07	0.12	0.001
0.600	0.000	0.11	0.07	0.12	0.001
0.740	0.000	0.11	0.07	0.12	0.001
0.880	0.000	0.11	0.07	0.12	0.001
1.020	0.000	0.11	0.07	0.12	0.001

1.160	0.000	0.11	0.07	0.13	0.001
1.300	0.000	0.11	0.07	0.13	0.001
1.440	0.000	0.11	0.07	0.13	0.001
1.580	0.000	0.12	0.07	0.13	0.001
1.720	0.000	0.12	0.07	0.13	0.001
1.860	0.000	0.12	0.07	0.13	0.001
2.000	0.000	0.12	0.07	0.13	0.001
2.140	0.000	0.12	0.08	0.13	0.001
2.280	0.000	0.12	0.08	0.13	0.001
2.420	0.000	0.12	0.08	0.13	0.001
2.560	0.000	0.12	0.08	0.13	0.001
2.700	0.000	0.12	0.08	0.13	0.001
2.840	0.000	0.12	0.08	0.14	0.001
2.980	0.000	0.12	0.08	0.14	0.001
3.120	0.000	0.12	0.08	0.14	0.001
3.260	0.000	0.12	0.08	0.14	0.001
3.400	0.000	0.12	0.08	0.14	0.001
3.540	0.000	0.13	0.08	0.14	0.001
3.680	0.000	0.13	0.08	0.14	0.001
3.820	0.000	0.13	0.08	0.14	0.001
3.960	0.000	0.13	0.08	0.14	0.001
4.100	0.000	0.13	0.08	0.14	0.001
4.240	0.000	0.13	0.08	0.14	0.001
4.380	0.000	0.13	0.08	0.15	0.001
4.520	0.000	0.13	0.08	0.15	0.001
4.660	0.000	0.13	0.09	0.15	0.001
4.800	0.000	0.13	0.09	0.15	0.001
4.940	0.000	0.14	0.09	0.15	0.001
5.080	0.000	0.14	0.09	0.15	0.001
5.220	0.000	0.14	0.09	0.15	0.001
5.360	0.000	0.14	0.09	0.15	0.001
5.500	0.000	0.14	0.09	0.16	0.001
5.640	0.000	0.14	0.09	0.16	0.001
5.780	0.000	0.14	0.09	0.16	0.001
5.920	0.000	0.14	0.09	0.16	0.001
6.060	0.000	0.15	0.09	0.16	0.001
6.200	0.000	0.15	0.09	0.16	0.001
6.340	0.000	0.15	0.09	0.16	0.001
6.480	0.000	0.15	0.10	0.17	0.001
6.620	0.000	0.15	0.10	0.17	0.001
6.760	0.000	0.15	0.10	0.17	0.001
6.900	0.000	0.15	0.10	0.17	0.001
7.040	0.000	0.15	0.10	0.17	0.001
7.180	0.000	0.16	0.10	0.17	0.001
7.320	0.000	0.16	0.10	0.17	0.001
7.460	0.000	0.16	0.10	0.18	0.001
7.600	0.000	0.16	0.10	0.18	0.001
7.740	0.000	0.16	0.10	0.18	0.001
7.880	0.000	0.16	0.10	0.18	0.001
8.020	0.000	0.17	0.11	0.18	0.001
8.160	0.000	0.17	0.11	0.19	0.001
8.300	0.000	0.17	0.11	0.19	0.001

8.440	0.000	0.17	0.11	0.19	0.001
8.580	0.000	0.17	0.11	0.19	0.001
8.720	0.000	0.18	0.11	0.19	0.001
8.860	0.000	0.18	0.11	0.20	0.001
9.000	0.000	0.18	0.12	0.20	0.001
9.140	0.000	0.18	0.12	0.20	0.001
9.280	0.000	0.18	0.12	0.20	0.001
9.420	0.000	0.19	0.12	0.21	0.001
9.560	0.000	0.19	0.12	0.21	0.001
9.700	0.000	0.19	0.12	0.21	0.001
9.840	0.000	0.19	0.12	0.22	0.001
9.980	0.000	0.20	0.13	0.22	0.001
10.120	0.000	0.20	0.13	0.22	0.001
10.260	0.000	0.20	0.13	0.23	0.001
10.400	0.000	0.21	0.13	0.23	0.001
10.540	0.000	0.21	0.13	0.23	0.001
10.680	0.000	0.21	0.14	0.24	0.001
10.820	0.000	0.22	0.14	0.24	0.001
10.960	0.000	0.22	0.14	0.24	0.001
11.100	0.000	0.22	0.14	0.25	0.001
11.240	0.000	0.23	0.15	0.25	0.001
11.380	0.000	0.23	0.15	0.26	0.001
11.520	0.000	0.24	0.15	0.26	0.001
11.660	0.000	0.24	0.16	0.27	0.001
11.800	0.000	0.25	0.16	0.27	0.001
11.940	0.000	0.25	0.16	0.28	0.001
12.080	0.000	0.26	0.16	0.28	0.001
12.220	0.000	0.33	0.21	0.33	0.002
12.360	0.000	0.33	0.21	0.37	0.002
12.500	0.000	0.34	0.22	0.38	0.002
12.640	0.000	0.35	0.22	0.39	0.002
12.780	0.000	0.36	0.23	0.39	0.002
12.920	0.000	0.36	0.23	0.40	0.002
13.060	0.000	0.38	0.24	0.41	0.002
13.200	0.000	0.38	0.24	0.42	0.002
13.340	0.000	0.40	0.25	0.43	0.002
13.480	0.000	0.40	0.26	0.45	0.002
13.620	0.000	0.42	0.27	0.46	0.002
13.760	0.000	0.43	0.27	0.47	0.002
13.900	0.000	0.45	0.29	0.49	0.002
14.040	0.000	0.46	0.29	0.50	0.002
14.180	0.000	0.48	0.31	0.52	0.002
14.320	0.000	0.50	0.32	0.55	0.003
14.460	0.000	0.53	0.34	0.57	0.003
14.600	0.000	0.54	0.35	0.59	0.003
14.740	0.000	0.58	0.37	0.63	0.003
14.880	0.000	0.60	0.39	0.66	0.003
15.020	0.000	0.66	0.42	0.70	0.003
15.160	0.000	0.69	0.44	0.75	0.004
15.300	0.000	0.77	0.50	0.81	0.004
15.440	0.000	0.82	0.51	0.89	0.004
15.580	0.000	0.88	0.54	0.96	0.004

15.720	0.000	1.00	0.58	1.08	0.005
15.860	0.000	1.46	0.75	1.47	0.007
16.000	0.000	2.02	0.96	2.16	0.009
16.140	0.000	6.25	3.75	4.67	0.033
16.280	0.000	1.17	0.65	4.10	0.005
16.420	0.000	0.79	0.50	1.14	0.004
16.560	0.000	0.73	0.47	0.84	0.004
16.700	0.000	0.63	0.40	0.75	0.003
16.840	0.000	0.56	0.36	0.66	0.003
16.980	0.000	0.51	0.33	0.60	0.003
17.120	0.000	0.47	0.30	0.55	0.002
17.260	0.000	0.44	0.28	0.51	0.002
17.400	0.000	0.41	0.26	0.47	0.002
17.540	0.000	0.39	0.25	0.45	0.002
17.680	0.000	0.37	0.24	0.42	0.002
17.820	0.000	0.35	0.23	0.40	0.002
17.960	0.000	0.34	0.22	0.39	0.002
18.100	0.000	0.32	0.20	0.37	0.002
18.240	0.000	0.25	0.16	0.32	0.001
18.380	0.000	0.24	0.15	0.27	0.001
18.520	0.000	0.23	0.15	0.26	0.001
18.660	0.000	0.22	0.14	0.25	0.001
18.800	0.000	0.21	0.14	0.24	0.001
18.940	0.000	0.21	0.13	0.24	0.001
19.080	0.000	0.20	0.13	0.23	0.001
19.220	0.000	0.20	0.13	0.22	0.001
19.360	0.000	0.19	0.12	0.22	0.001
19.500	0.000	0.19	0.12	0.21	0.001
19.640	0.000	0.18	0.12	0.20	0.001
19.780	0.000	0.18	0.11	0.20	0.001
19.920	0.000	0.17	0.11	0.19	0.001
20.060	0.000	0.17	0.11	0.19	0.001
20.200	0.000	0.17	0.11	0.19	0.001
20.340	0.000	0.16	0.10	0.18	0.001
20.480	0.000	0.16	0.10	0.18	0.001
20.620	0.000	0.16	0.10	0.17	0.001
20.760	0.000	0.15	0.10	0.17	0.001
20.900	0.000	0.15	0.10	0.17	0.001
21.040	0.000	0.15	0.09	0.17	0.001
21.180	0.000	0.14	0.09	0.16	0.001
21.320	0.000	0.14	0.09	0.16	0.001
21.460	0.000	0.14	0.09	0.16	0.001
21.600	0.000	0.14	0.09	0.15	0.001
21.740	0.000	0.14	0.09	0.15	0.001
21.880	0.000	0.13	0.09	0.15	0.001
22.020	0.000	0.13	0.08	0.15	0.001
22.160	0.000	0.13	0.08	0.14	0.001
22.300	0.000	0.13	0.08	0.14	0.001
22.440	0.000	0.13	0.08	0.14	0.001
22.580	0.000	0.12	0.08	0.14	0.001
22.720	0.000	0.12	0.08	0.14	0.001
22.860	0.000	0.12	0.08	0.14	0.001

23.000	0.000	0.12	0.08	0.13	0.001
23.140	0.000	0.12	0.08	0.13	0.001
23.280	0.000	0.12	0.07	0.13	0.001
23.420	0.000	0.11	0.07	0.13	0.001
23.560	0.000	0.11	0.07	0.13	0.001
23.700	0.000	0.11	0.07	0.13	0.001
23.840	0.000	0.11	0.07	0.12	0.001
23.980	0.000	0.11	0.07	0.12	0.001
24.120	0.000	0.11	0.07	0.12	0.001
24.260	0.000	0.00	0.00	0.06	0.000
24.400	0.000	0.00	0.00	0.00	0.000

```
****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                          Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN 7
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    2.76
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.060
    LOW LOSS FRACTION = 0.100
    TIME OF CONCENTRATION(MIN.) =  9.00
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.06
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.24

****************************************************************************
  TIME      VOLUME       Q    0.        5.0       10.0       15.0       20.0
 (HOURS)     (AF)      (CFS)
----------------------------------------------------------------------------
  0.10      0.0000      0.00  Q         .         .          .          .
  0.25      0.0012      0.20  Q         .         .          .          .
  0.40      0.0037      0.20  Q         .         .          .          .
  0.55      0.0061      0.20  Q         .         .          .          .
```

0.70	0.0086	0.20	Q	.	.	.	.
0.85	0.0111	0.20	Q	.	.	.	.
1.00	0.0136	0.20	Q	.	.	.	.
1.15	0.0161	0.20	Q	.	.	.	.
1.30	0.0186	0.20	Q	.	.	.	.
1.45	0.0212	0.21	Q	.	.	.	.
1.60	0.0237	0.21	Q	.	.	.	.
1.75	0.0263	0.21	Q	.	.	.	.
1.90	0.0289	0.21	Q	.	.	.	.
2.05	0.0315	0.21	Q	.	.	.	.
2.20	0.0341	0.21	Q	.	.	.	.
2.35	0.0368	0.21	Q	.	.	.	.
2.50	0.0395	0.22	Q	.	.	.	.
2.65	0.0422	0.22	Q	.	.	.	.
2.80	0.0449	0.22	Q	.	.	.	.
2.95	0.0476	0.22	Q	.	.	.	.
3.10	0.0503	0.22	Q	.	.	.	.
3.25	0.0531	0.22	Q	.	.	.	.
3.40	0.0559	0.23	Q	.	.	.	.
3.55	0.0587	0.23	Q	.	.	.	.
3.70	0.0615	0.23	Q	.	.	.	.
3.85	0.0644	0.23	Q	.	.	.	.
4.00	0.0672	0.23	Q	.	.	.	.
4.15	0.0701	0.23	Q	.	.	.	.
4.30	0.0730	0.24	Q	.	.	.	.
4.45	0.0760	0.24	Q	.	.	.	.
4.60	0.0789	0.24	Q	.	.	.	.
4.75	0.0819	0.24	Q	.	.	.	.
4.90	0.0849	0.24	Q	.	.	.	.
5.05	0.0880	0.25	Q	.	.	.	.
5.20	0.0910	0.25	Q	.	.	.	.
5.35	0.0941	0.25	Q	.	.	.	.
5.50	0.0972	0.25	Q	.	.	.	.
5.65	0.1004	0.26	Q	.	.	.	.
5.80	0.1036	0.26	Q	.	.	.	.
5.95	0.1068	0.26	Q	.	.	.	.
6.10	0.1100	0.26	Q	.	.	.	.
6.25	0.1132	0.26	Q	.	.	.	.
6.40	0.1165	0.27	Q	.	.	.	.
6.55	0.1199	0.27	Q	.	.	.	.
6.70	0.1232	0.27	Q	.	.	.	.
6.85	0.1266	0.28	Q	.	.	.	.
7.00	0.1300	0.28	Q	.	.	.	.
7.15	0.1335	0.28	Q	.	.	.	.
7.30	0.1370	0.28	Q	.	.	.	.
7.45	0.1405	0.29	Q	.	.	.	.
7.60	0.1441	0.29	Q	.	.	.	.
7.75	0.1477	0.29	Q	.	.	.	.
7.90	0.1514	0.30	Q	.	.	.	.
8.05	0.1551	0.30	Q	.	.	.	.
8.20	0.1588	0.30	Q	.	.	.	.
8.35	0.1626	0.31	Q	.	.	.	.

8.50	0.1664	0.31	Q	.	.	.	.
8.65	0.1703	0.32	Q	.	.	.	.
8.80	0.1742	0.32	Q	.	.	.	.
8.95	0.1782	0.32	Q	.	.	.	.
9.10	0.1822	0.33	Q	.	.	.	.
9.25	0.1863	0.33	Q	.	.	.	.
9.40	0.1905	0.34	Q	.	.	.	.
9.55	0.1947	0.34	Q	.	.	.	.
9.70	0.1989	0.35	Q	.	.	.	.
9.85	0.2033	0.35	Q	.	.	.	.
10.00	0.2077	0.36	Q	.	.	.	.
10.15	0.2121	0.36	Q	.	.	.	.
10.30	0.2166	0.37	Q	.	.	.	.
10.45	0.2212	0.38	Q	.	.	.	.
10.60	0.2259	0.38	Q	.	.	.	.
10.75	0.2307	0.39	Q	.	.	.	.
10.90	0.2355	0.39	Q	.	.	.	.
11.05	0.2405	0.40	Q	.	.	.	.
11.20	0.2455	0.41	Q	.	.	.	.
11.35	0.2506	0.42	Q	.	.	.	.
11.50	0.2558	0.42	Q	.	.	.	.
11.65	0.2612	0.44	Q	.	.	.	.
11.80	0.2666	0.44	Q	.	.	.	.
11.95	0.2722	0.46	Q	.	.	.	.
12.10	0.2779	0.46	Q	.	.	.	.
12.25	0.2844	0.60	.Q	.	.	.	.
12.40	0.2919	0.61	.Q	.	.	.	.
12.55	0.2995	0.62	.Q	.	.	.	.
12.70	0.3073	0.63	.Q	.	.	.	.
12.85	0.3153	0.65	.Q	.	.	.	.
13.00	0.3234	0.66	.Q	.	.	.	.
13.15	0.3318	0.69	.Q	.	.	.	.
13.30	0.3404	0.70	.Q	.	.	.	.
13.45	0.3493	0.73	.Q	.	.	.	.
13.60	0.3584	0.74	.Q	.	.	.	.
13.75	0.3679	0.78	.Q	.	.	.	.
13.90	0.3776	0.80	.Q	.	.	.	.
14.05	0.3877	0.84	.Q	.	.	.	.
14.20	0.3982	0.86	.Q	.	.	.	.
14.35	0.4092	0.91	.Q	.	.	.	.
14.50	0.4207	0.94	.Q	.	.	.	.
14.65	0.4328	1.01	. Q	.	.	.	.
14.80	0.4456	1.05	. Q	.	.	.	.
14.95	0.4592	1.14	. Q	.	.	.	.
15.10	0.4737	1.20	. Q	.	.	.	.
15.25	0.4894	1.34	. Q	.	.	.	.
15.40	0.5067	1.44	. Q	.	.	.	.
15.55	0.5250	1.51	. Q	.	.	.	.
15.70	0.5450	1.72	. Q	.	.	.	.
15.85	0.5713	2.52	. Q	.	.	.	.
16.00	0.6085	3.49	. Q	.	.	.	.
16.15	0.6973	10.83	.	.	.Q	.	.

16.30	0.7770	2.03	. Q	.	.	.	.
16.45	0.7984	1.43	. Q	.	.	.	.
16.60	0.8151	1.26	. Q	.	.	.	.
16.75	0.8297	1.09	. Q	.	.	.	.
16.90	0.8425	0.97	.Q	.	.	.	.
17.05	0.8540	0.89	.Q	.	.	.	.
17.20	0.8646	0.81	.Q	.	.	.	.
17.35	0.8743	0.76	.Q	.	.	.	.
17.50	0.8835	0.71	.Q	.	.	.	.
17.65	0.8921	0.68	.Q	.	.	.	.
17.80	0.9003	0.64	.Q	.	.	.	.
17.95	0.9080	0.61	.Q	.	.	.	.
18.10	0.9155	0.59	.Q	.	.	.	.
18.25	0.9219	0.45	Q	.	.	.	.
18.40	0.9274	0.43	Q	.	.	.	.
18.55	0.9326	0.41	Q	.	.	.	.
18.70	0.9376	0.40	Q	.	.	.	.
18.85	0.9425	0.38	Q	.	.	.	.
19.00	0.9472	0.37	Q	.	.	.	.
19.15	0.9517	0.36	Q	.	.	.	.
19.30	0.9561	0.35	Q	.	.	.	.
19.45	0.9603	0.34	Q	.	.	.	.
19.60	0.9645	0.33	Q	.	.	.	.
19.75	0.9685	0.32	Q	.	.	.	.
19.90	0.9725	0.31	Q	.	.	.	.
20.05	0.9763	0.31	Q	.	.	.	.
20.20	0.9800	0.30	Q	.	.	.	.
20.35	0.9837	0.29	Q	.	.	.	.
20.50	0.9873	0.29	Q	.	.	.	.
20.65	0.9908	0.28	Q	.	.	.	.
20.80	0.9942	0.27	Q	.	.	.	.
20.95	0.9975	0.27	Q	.	.	.	.
21.10	1.0008	0.26	Q	.	.	.	.
21.25	1.0041	0.26	Q	.	.	.	.
21.40	1.0072	0.25	Q	.	.	.	.
21.55	1.0104	0.25	Q	.	.	.	.
21.70	1.0134	0.24	Q	.	.	.	.
21.85	1.0164	0.24	Q	.	.	.	.
22.00	1.0194	0.24	Q	.	.	.	.
22.15	1.0223	0.23	Q	.	.	.	.
22.30	1.0252	0.23	Q	.	.	.	.
22.45	1.0280	0.23	Q	.	.	.	.
22.60	1.0308	0.22	Q	.	.	.	.
22.75	1.0335	0.22	Q	.	.	.	.
22.90	1.0362	0.22	Q	.	.	.	.
23.05	1.0389	0.21	Q	.	.	.	.
23.20	1.0415	0.21	Q	.	.	.	.
23.35	1.0441	0.21	Q	.	.	.	.
23.50	1.0467	0.21	Q	.	.	.	.
23.65	1.0492	0.20	Q	.	.	.	.
23.80	1.0517	0.20	Q	.	.	.	.
23.95	1.0542	0.20	Q	.	.	.	.

```
 24.10      1.0566      0.20  Q          .          .          .          .
 24.25      1.0579      0.00  Q          .          .          .          .
 ---------------------------------------------------------------------------
-----------------------------------------------------------------------------
--
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)
```

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1440.0
10%	117.0
20%	27.0
30%	18.0
40%	9.0
50%	9.0
60%	9.0
70%	9.0
80%	9.0
90%	9.0

Problem Descriptions:

```
=============================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =    9.000
     DEAD STORAGE(AF) =       0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =       0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =    0.00


                 INFLOW
                   |
                   |
                   |
                   V                 __effective depth
             -------------           |   (and volume)
             |           |     |     |
             | detention |     |....V.............
             |   basin   |<-->|          outflow
             |           |     |.........__________
             -------------     |         |    \
                   |           | storage |     basin outlet
```

```
                    V          -----------
                 OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) **	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) *
0.000	0.000	0.000**	0.500	0.009	1.080*
1.000	0.017	3.060**	1.500	0.026	5.530*
2.000	0.035	6.930**	2.500	0.044	8.090*
3.000	0.052	9.110**	3.500	0.061	10.020*
4.000	0.070	10.860**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	0.00231	0.01569
3	1.00	-0.00197	0.03597
4	1.50	-0.00828	0.06028
5	2.00	-0.00795	0.07795
6	2.50	-0.00614	0.09414
7	3.00	-0.00447	0.10847
8	3.50	-0.00111	0.12311
9	4.00	0.00269	0.13731

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.100	0.000	0.00	0.00	0.00	0.000
0.250	0.000	0.20	0.08	0.08	0.001
0.400	0.000	0.20	0.09	0.18	0.002
0.550	0.000	0.20	0.09	0.20	0.002
0.700	0.000	0.20	0.09	0.20	0.002
0.850	0.000	0.20	0.09	0.20	0.002
1.000	0.000	0.20	0.09	0.20	0.002
1.150	0.000	0.20	0.09	0.20	0.002
1.300	0.000	0.20	0.09	0.20	0.002
1.450	0.000	0.21	0.10	0.21	0.002
1.600	0.000	0.21	0.10	0.21	0.002
1.750	0.000	0.21	0.10	0.21	0.002
1.900	0.000	0.21	0.10	0.21	0.002
2.050	0.000	0.21	0.10	0.21	0.002
2.200	0.000	0.21	0.10	0.21	0.002
2.350	0.000	0.21	0.10	0.21	0.002

2.500	0.000	0.22	0.10	0.21	0.002
2.650	0.000	0.22	0.10	0.22	0.002
2.800	0.000	0.22	0.10	0.22	0.002
2.950	0.000	0.22	0.10	0.22	0.002
3.100	0.000	0.22	0.10	0.22	0.002
3.250	0.000	0.22	0.10	0.22	0.002
3.400	0.000	0.23	0.10	0.22	0.002
3.550	0.000	0.23	0.11	0.23	0.002
3.700	0.000	0.23	0.11	0.23	0.002
3.850	0.000	0.23	0.11	0.23	0.002
4.000	0.000	0.23	0.11	0.23	0.002
4.150	0.000	0.23	0.11	0.23	0.002
4.300	0.000	0.24	0.11	0.23	0.002
4.450	0.000	0.24	0.11	0.24	0.002
4.600	0.000	0.24	0.11	0.24	0.002
4.750	0.000	0.24	0.11	0.24	0.002
4.900	0.000	0.24	0.11	0.24	0.002
5.050	0.000	0.25	0.11	0.24	0.002
5.200	0.000	0.25	0.11	0.25	0.002
5.350	0.000	0.25	0.12	0.25	0.002
5.500	0.000	0.25	0.12	0.25	0.002
5.650	0.000	0.26	0.12	0.25	0.002
5.800	0.000	0.26	0.12	0.26	0.002
5.950	0.000	0.26	0.12	0.26	0.002
6.100	0.000	0.26	0.12	0.26	0.002
6.250	0.000	0.26	0.12	0.26	0.002
6.400	0.000	0.27	0.12	0.27	0.002
6.550	0.000	0.27	0.12	0.27	0.002
6.700	0.000	0.27	0.13	0.27	0.002
6.850	0.000	0.28	0.13	0.27	0.002
7.000	0.000	0.28	0.13	0.28	0.002
7.150	0.000	0.28	0.13	0.28	0.002
7.300	0.000	0.28	0.13	0.28	0.002
7.450	0.000	0.29	0.13	0.28	0.002
7.600	0.000	0.29	0.13	0.29	0.002
7.750	0.000	0.29	0.14	0.29	0.002
7.900	0.000	0.30	0.14	0.29	0.002
8.050	0.000	0.30	0.14	0.30	0.002
8.200	0.000	0.30	0.14	0.30	0.003
8.350	0.000	0.31	0.14	0.30	0.003
8.500	0.000	0.31	0.14	0.31	0.003
8.650	0.000	0.32	0.15	0.31	0.003
8.800	0.000	0.32	0.15	0.32	0.003
8.950	0.000	0.32	0.15	0.32	0.003
9.100	0.000	0.33	0.15	0.32	0.003
9.250	0.000	0.33	0.15	0.33	0.003
9.400	0.000	0.34	0.16	0.33	0.003
9.550	0.000	0.34	0.16	0.34	0.003
9.700	0.000	0.35	0.16	0.34	0.003
9.850	0.000	0.35	0.16	0.35	0.003
10.000	0.000	0.36	0.16	0.35	0.003
10.150	0.000	0.36	0.17	0.36	0.003

10.300	0.000	0.37	0.17	0.36	0.003
10.450	0.000	0.38	0.17	0.37	0.003
10.600	0.000	0.38	0.18	0.38	0.003
10.750	0.000	0.39	0.18	0.38	0.003
10.900	0.000	0.39	0.18	0.39	0.003
11.050	0.000	0.40	0.19	0.40	0.003
11.200	0.000	0.41	0.19	0.40	0.003
11.350	0.000	0.42	0.19	0.41	0.003
11.500	0.000	0.42	0.20	0.42	0.004
11.650	0.000	0.44	0.20	0.43	0.004
11.800	0.000	0.44	0.20	0.44	0.004
11.950	0.000	0.46	0.21	0.45	0.004
12.100	0.000	0.46	0.21	0.46	0.004
12.250	0.000	0.60	0.27	0.52	0.005
12.400	0.000	0.61	0.28	0.59	0.005
12.550	0.000	0.62	0.29	0.61	0.005
12.700	0.000	0.63	0.29	0.63	0.005
12.850	0.000	0.65	0.30	0.64	0.005
13.000	0.000	0.66	0.31	0.66	0.006
13.150	0.000	0.69	0.32	0.67	0.006
13.300	0.000	0.70	0.32	0.69	0.006
13.450	0.000	0.73	0.34	0.71	0.006
13.600	0.000	0.74	0.34	0.73	0.006
13.750	0.000	0.78	0.36	0.76	0.006
13.900	0.000	0.80	0.37	0.78	0.007
14.050	0.000	0.84	0.38	0.81	0.007
14.200	0.000	0.86	0.40	0.84	0.007
14.350	0.000	0.91	0.42	0.88	0.008
14.500	0.000	0.94	0.43	0.92	0.008
14.650	0.000	1.01	0.46	0.97	0.008
14.800	0.000	1.05	0.48	1.02	0.009
14.950	0.000	1.14	0.52	1.09	0.009
15.100	0.000	1.20	0.53	1.18	0.010
15.250	0.000	1.34	0.57	1.29	0.010
15.400	0.000	1.44	0.60	1.41	0.011
15.550	0.000	1.51	0.61	1.49	0.011
15.700	0.000	1.72	0.67	1.65	0.012
15.850	0.000	2.52	0.90	2.22	0.015
16.000	0.000	3.49	1.15	3.24	0.020
16.150	0.000	10.83	3.89	7.24	0.068
16.300	0.000	2.03	0.78	6.43	0.013
16.450	0.000	1.43	0.55	1.73	0.010
16.600	0.000	1.26	0.55	1.27	0.010
16.750	0.000	1.09	0.49	1.16	0.009
16.900	0.000	0.97	0.46	1.03	0.008
17.050	0.000	0.89	0.42	0.94	0.008
17.200	0.000	0.81	0.38	0.86	0.007
17.350	0.000	0.76	0.36	0.80	0.006
17.500	0.000	0.71	0.33	0.75	0.006
17.650	0.000	0.68	0.32	0.70	0.006
17.800	0.000	0.64	0.30	0.67	0.005
17.950	0.000	0.61	0.29	0.63	0.005

18.100	0.000	0.59	0.27	0.61	0.005
18.250	0.000	0.45	0.22	0.53	0.004
18.400	0.000	0.43	0.20	0.45	0.004
18.550	0.000	0.41	0.19	0.43	0.003
18.700	0.000	0.40	0.19	0.41	0.003
18.850	0.000	0.38	0.18	0.39	0.003
19.000	0.000	0.37	0.17	0.38	0.003
19.150	0.000	0.36	0.17	0.37	0.003
19.300	0.000	0.35	0.16	0.36	0.003
19.450	0.000	0.34	0.16	0.35	0.003
19.600	0.000	0.33	0.15	0.34	0.003
19.750	0.000	0.32	0.15	0.33	0.003
19.900	0.000	0.31	0.15	0.32	0.003
20.050	0.000	0.31	0.14	0.31	0.003
20.200	0.000	0.30	0.14	0.30	0.002
20.350	0.000	0.29	0.14	0.30	0.002
20.500	0.000	0.29	0.13	0.29	0.002
20.650	0.000	0.28	0.13	0.28	0.002
20.800	0.000	0.27	0.13	0.28	0.002
20.950	0.000	0.27	0.12	0.27	0.002
21.100	0.000	0.26	0.12	0.27	0.002
21.250	0.000	0.26	0.12	0.26	0.002
21.400	0.000	0.25	0.12	0.26	0.002
21.550	0.000	0.25	0.12	0.25	0.002
21.700	0.000	0.24	0.11	0.25	0.002
21.850	0.000	0.24	0.11	0.24	0.002
22.000	0.000	0.24	0.11	0.24	0.002
22.150	0.000	0.23	0.11	0.24	0.002
22.300	0.000	0.23	0.11	0.23	0.002
22.450	0.000	0.23	0.11	0.23	0.002
22.600	0.000	0.22	0.10	0.23	0.002
22.750	0.000	0.22	0.10	0.22	0.002
22.900	0.000	0.22	0.10	0.22	0.002
23.050	0.000	0.21	0.10	0.22	0.002
23.200	0.000	0.21	0.10	0.21	0.002
23.350	0.000	0.21	0.10	0.21	0.002
23.500	0.000	0.21	0.10	0.21	0.002
23.650	0.000	0.20	0.09	0.20	0.002
23.800	0.000	0.20	0.09	0.20	0.002
23.950	0.000	0.20	0.09	0.20	0.002
24.100	0.000	0.20	0.09	0.20	0.002
24.250	0.000	0.00	0.01	0.11	0.000
24.400	0.000	0.00	0.00	0.02	0.000

```
****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                              Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN 8
----------------------------------------------------------------------------


     RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
     TOTAL CATCHMENT AREA(ACRES) =     3.00
     SOIL-LOSS RATE, Fm,(INCH/HR) =  0.030
     LOW LOSS FRACTION = 0.040
     TIME OF CONCENTRATION(MIN.) =  8.70
     SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
     ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
     RETURN FREQUENCY(YEARS) = 100
        5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
       30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
        1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
        3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
        6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
       24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

     TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      1.21
     TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.19

****************************************************************************
  TIME      VOLUME        Q     0.         5.0       10.0       15.0       20.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.05      0.0000       0.00  Q          .          .          .          .
  0.20      0.0014       0.23  Q          .          .          .          .
  0.34      0.0041       0.23  Q          .          .          .          .
  0.49      0.0068       0.23  Q          .          .          .          .
```

0.63	0.0096	0.23	Q	.	.	.	.
0.78	0.0124	0.23	Q	.	.	.	.
0.92	0.0152	0.23	Q	.	.	.	.
1.07	0.0180	0.24	Q	.	.	.	.
1.21	0.0208	0.24	Q	.	.	.	.
1.36	0.0236	0.24	Q	.	.	.	.
1.50	0.0265	0.24	Q	.	.	.	.
1.65	0.0294	0.24	Q	.	.	.	.
1.79	0.0323	0.24	Q	.	.	.	.
1.94	0.0352	0.24	Q	.	.	.	.
2.08	0.0381	0.25	Q	.	.	.	.
2.23	0.0411	0.25	Q	.	.	.	.
2.37	0.0441	0.25	Q	.	.	.	.
2.52	0.0471	0.25	Q	.	.	.	.
2.66	0.0501	0.25	Q	.	.	.	.
2.81	0.0531	0.25	Q	.	.	.	.
2.95	0.0562	0.26	Q	.	.	.	.
3.10	0.0592	0.26	Q	.	.	.	.
3.24	0.0623	0.26	Q	.	.	.	.
3.39	0.0655	0.26	Q	.	.	.	.
3.53	0.0686	0.26	Q	.	.	.	.
3.68	0.0718	0.27	Q	.	.	.	.
3.82	0.0750	0.27	Q	.	.	.	.
3.97	0.0782	0.27	Q	.	.	.	.
4.11	0.0814	0.27	Q	.	.	.	.
4.26	0.0847	0.27	Q	.	.	.	.
4.40	0.0879	0.27	Q	.	.	.	.
4.55	0.0913	0.28	Q	.	.	.	.
4.69	0.0946	0.28	Q	.	.	.	.
4.84	0.0980	0.28	Q	.	.	.	.
4.98	0.1014	0.28	Q	.	.	.	.
5.12	0.1048	0.29	Q	.	.	.	.
5.27	0.1082	0.29	Q	.	.	.	.
5.42	0.1117	0.29	Q	.	.	.	.
5.56	0.1152	0.29	Q	.	.	.	.
5.71	0.1187	0.30	Q	.	.	.	.
5.85	0.1223	0.30	Q	.	.	.	.
6.00	0.1259	0.30	Q	.	.	.	.
6.14	0.1295	0.30	Q	.	.	.	.
6.29	0.1332	0.31	Q	.	.	.	.
6.43	0.1369	0.31	Q	.	.	.	.
6.57	0.1406	0.31	Q	.	.	.	.
6.72	0.1444	0.32	Q	.	.	.	.
6.87	0.1482	0.32	Q	.	.	.	.
7.01	0.1521	0.32	Q	.	.	.	.
7.16	0.1559	0.33	Q	.	.	.	.
7.30	0.1599	0.33	Q	.	.	.	.
7.45	0.1638	0.33	Q	.	.	.	.
7.59	0.1678	0.34	Q	.	.	.	.
7.74	0.1719	0.34	Q	.	.	.	.
7.88	0.1760	0.34	Q	.	.	.	.
8.02	0.1801	0.35	Q	.	.	.	.

8.17	0.1843	0.35	Q	.	.	.	.
8.32	0.1885	0.36	Q	.	.	.	.
8.46	0.1928	0.36	Q	.	.	.	.
8.60	0.1971	0.36	Q	.	.	.	.
8.75	0.2015	0.37	Q	.	.	.	.
8.90	0.2060	0.37	Q	.	.	.	.
9.04	0.2105	0.38	Q	.	.	.	.
9.19	0.2150	0.38	Q	.	.	.	.
9.33	0.2196	0.39	Q	.	.	.	.
9.48	0.2243	0.39	Q	.	.	.	.
9.62	0.2291	0.40	Q	.	.	.	.
9.77	0.2339	0.41	Q	.	.	.	.
9.91	0.2387	0.41	Q	.	.	.	.
10.05	0.2437	0.42	Q	.	.	.	.
10.20	0.2487	0.42	Q	.	.	.	.
10.35	0.2538	0.43	Q	.	.	.	.
10.49	0.2590	0.43	Q	.	.	.	.
10.64	0.2643	0.44	Q	.	.	.	.
10.78	0.2696	0.45	Q	.	.	.	.
10.93	0.2751	0.46	Q	.	.	.	.
11.07	0.2806	0.47	Q	.	.	.	.
11.22	0.2863	0.48	Q	.	.	.	.
11.36	0.2920	0.48	Q	.	.	.	.
11.51	0.2979	0.50	Q	.	.	.	.
11.65	0.3039	0.50	.Q	.	.	.	.
11.80	0.3100	0.52	.Q	.	.	.	.
11.94	0.3162	0.52	.Q	.	.	.	.
12.09	0.3229	0.59	.Q	.	.	.	.
12.23	0.3305	0.69	.Q	.	.	.	.
12.38	0.3389	0.71	.Q	.	.	.	.
12.52	0.3474	0.72	.Q	.	.	.	.
12.66	0.3561	0.74	.Q	.	.	.	.
12.81	0.3650	0.75	.Q	.	.	.	.
12.95	0.3741	0.77	.Q	.	.	.	.
13.10	0.3834	0.78	.Q	.	.	.	.
13.24	0.3930	0.81	.Q	.	.	.	.
13.39	0.4028	0.83	.Q	.	.	.	.
13.53	0.4129	0.86	.Q	.	.	.	.
13.68	0.4233	0.88	.Q	.	.	.	.
13.82	0.4341	0.92	.Q	.	.	.	.
13.97	0.4452	0.94	.Q	.	.	.	.
14.12	0.4568	0.99	.Q	.	.	.	.
14.26	0.4688	1.02	. Q	.	.	.	.
14.40	0.4814	1.08	. Q	.	.	.	.
14.55	0.4945	1.11	. Q	.	.	.	.
14.70	0.5083	1.19	. Q	.	.	.	.
14.84	0.5229	1.24	. Q	.	.	.	.
14.98	0.5383	1.35	. Q	.	.	.	.
15.13	0.5549	1.41	. Q	.	.	.	.
15.27	0.5728	1.58	. Q	.	.	.	.
15.42	0.5924	1.69	. Q	.	.	.	.
15.57	0.6132	1.77	. Q	.	.	.	.

15.71	0.6357	2.00	. Q . . . .
15.85	0.6649	2.87	. Q . . . .
16.00	0.7058	3.95	. Q . . . .
16.15	0.8020	12.09	. . . Q . .
16.29	0.8884	2.33	. Q . . . .
16.43	0.9121	1.63	. Q . . . .
16.58	0.9308	1.49	. Q . . . .
16.73	0.9474	1.29	. Q . . . .
16.87	0.9621	1.15	. Q . . . .
17.02	0.9752	1.05	. Q . . . .
17.16	0.9873	0.96	.Q . . . .
17.31	0.9984	0.90	.Q . . . .
17.45	1.0088	0.84	.Q . . . .
17.59	1.0187	0.80	.Q . . . .
17.74	1.0280	0.76	.Q . . . .
17.89	1.0369	0.73	.Q . . . .
18.03	1.0454	0.70	.Q . . . .
18.17	1.0528	0.53	.Q . . . .
18.32	1.0590	0.51	.Q . . . .
18.47	1.0650	0.49	Q . . . .
18.61	1.0707	0.47	Q . . . .
18.76	1.0763	0.45	Q . . . .
18.90	1.0816	0.44	Q . . . .
19.05	1.0868	0.43	Q . . . .
19.19	1.0919	0.41	Q . . . .
19.33	1.0967	0.40	Q . . . .
19.48	1.1015	0.39	Q . . . .
19.62	1.1061	0.38	Q . . . .
19.77	1.1106	0.37	Q . . . .
19.92	1.1150	0.36	Q . . . .
20.06	1.1193	0.35	Q . . . .
20.20	1.1234	0.35	Q . . . .
20.35	1.1275	0.34	Q . . . .
20.49	1.1315	0.33	Q . . . .
20.64	1.1355	0.32	Q . . . .
20.78	1.1393	0.32	Q . . . .
20.93	1.1431	0.31	Q . . . .
21.08	1.1468	0.31	Q . . . .
21.22	1.1504	0.30	Q . . . .
21.36	1.1540	0.30	Q . . . .
21.51	1.1575	0.29	Q . . . .
21.66	1.1609	0.29	Q . . . .
21.80	1.1643	0.28	Q . . . .
21.94	1.1677	0.28	Q . . . .
22.09	1.1710	0.27	Q . . . .
22.23	1.1742	0.27	Q . . . .
22.38	1.1774	0.26	Q . . . .
22.52	1.1805	0.26	Q . . . .
22.67	1.1836	0.26	Q . . . .
22.82	1.1867	0.25	Q . . . .
22.96	1.1897	0.25	Q . . . .
23.11	1.1927	0.25	Q . . . .

23.25	1.1956	0.24	Q	.	.	.	.
23.39	1.1985	0.24	Q	.	.	.	.
23.54	1.2014	0.24	Q	.	.	.	.
23.68	1.2042	0.23	Q	.	.	.	.
23.83	1.2070	0.23	Q	.	.	.	.
23.98	1.2097	0.23	Q	.	.	.	.
24.12	1.2125	0.23	Q	.	.	.	.
24.26	1.2138	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1444.2
10%	121.8
20%	26.1
30%	17.4
40%	8.7
50%	8.7
60%	8.7
70%	8.7
80%	8.7
90%	8.7

Problem Descriptions:

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 8.700
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

```
INFLOW
  |
  |
  |
  V                 __effective depth
-------------       |   (and volume)
```

```
|            |     |     |
| detention  |     |....V.............
|   basin    |<-->|          outflow
|            |     |.........________
-------------     |         |    \
      |           | storage |      basin outlet
      V           -----------
   OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS)	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS)
* 0.000	0.000	0.000**	0.500	0.009	1.300*
* 1.000	0.017	3.680**	1.500	0.026	7.370*
* 2.000	0.035	9.510**	2.500	0.044	11.260*
* 3.000	0.052	12.760**	3.500	0.061	14.110*
* 4.000	0.070	15.340**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	0.00121	0.01679
3	1.00	-0.00505	0.03905
4	1.50	-0.01816	0.07016
5	2.00	-0.02198	0.09198
6	2.50	-0.02347	0.11147
7	3.00	-0.02445	0.12845
8	3.50	-0.02354	0.14554
9	4.00	-0.02191	0.16191

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.050	0.000	0.00	0.00	0.00	0.000
0.195	0.000	0.23	0.08	0.11	0.001
0.340	0.000	0.23	0.09	0.22	0.002
0.485	0.000	0.23	0.09	0.23	0.002
0.630	0.000	0.23	0.09	0.23	0.002
0.775	0.000	0.23	0.09	0.23	0.002
0.920	0.000	0.23	0.09	0.23	0.002
1.065	0.000	0.24	0.09	0.23	0.002
1.210	0.000	0.24	0.09	0.24	0.002
1.355	0.000	0.24	0.09	0.24	0.002

1.500	0.000	0.24	0.09	0.24	0.002
1.645	0.000	0.24	0.09	0.24	0.002
1.790	0.000	0.24	0.09	0.24	0.002
1.935	0.000	0.24	0.09	0.24	0.002
2.080	0.000	0.25	0.09	0.24	0.002
2.225	0.000	0.25	0.10	0.25	0.002
2.370	0.000	0.25	0.10	0.25	0.002
2.515	0.000	0.25	0.10	0.25	0.002
2.660	0.000	0.25	0.10	0.25	0.002
2.805	0.000	0.25	0.10	0.25	0.002
2.950	0.000	0.26	0.10	0.25	0.002
3.095	0.000	0.26	0.10	0.26	0.002
3.240	0.000	0.26	0.10	0.26	0.002
3.385	0.000	0.26	0.10	0.26	0.002
3.530	0.000	0.26	0.10	0.26	0.002
3.675	0.000	0.27	0.10	0.26	0.002
3.820	0.000	0.27	0.10	0.27	0.002
3.965	0.000	0.27	0.10	0.27	0.002
4.110	0.000	0.27	0.10	0.27	0.002
4.255	0.000	0.27	0.11	0.27	0.002
4.400	0.000	0.27	0.11	0.27	0.002
4.545	0.000	0.28	0.11	0.28	0.002
4.690	0.000	0.28	0.11	0.28	0.002
4.835	0.000	0.28	0.11	0.28	0.002
4.980	0.000	0.28	0.11	0.28	0.002
5.125	0.000	0.29	0.11	0.29	0.002
5.270	0.000	0.29	0.11	0.29	0.002
5.415	0.000	0.29	0.11	0.29	0.002
5.560	0.000	0.29	0.11	0.29	0.002
5.705	0.000	0.30	0.11	0.29	0.002
5.850	0.000	0.30	0.11	0.30	0.002
5.995	0.000	0.30	0.12	0.30	0.002
6.140	0.000	0.30	0.12	0.30	0.002
6.285	0.000	0.31	0.12	0.31	0.002
6.430	0.000	0.31	0.12	0.31	0.002
6.575	0.000	0.31	0.12	0.31	0.002
6.720	0.000	0.32	0.12	0.31	0.002
6.865	0.000	0.32	0.12	0.32	0.002
7.010	0.000	0.32	0.12	0.32	0.002
7.155	0.000	0.33	0.13	0.32	0.002
7.300	0.000	0.33	0.13	0.33	0.002
7.445	0.000	0.33	0.13	0.33	0.002
7.590	0.000	0.34	0.13	0.33	0.002
7.735	0.000	0.34	0.13	0.34	0.002
7.880	0.000	0.34	0.13	0.34	0.002
8.025	0.000	0.35	0.13	0.34	0.002
8.170	0.000	0.35	0.13	0.35	0.002
8.315	0.000	0.36	0.14	0.35	0.002
8.460	0.000	0.36	0.14	0.36	0.002
8.605	0.000	0.36	0.14	0.36	0.003
8.750	0.000	0.37	0.14	0.37	0.003
8.895	0.000	0.37	0.14	0.37	0.003

9.040	0.000	0.38	0.14	0.37	0.003
9.185	0.000	0.38	0.15	0.38	0.003
9.330	0.000	0.39	0.15	0.38	0.003
9.475	0.000	0.39	0.15	0.39	0.003
9.620	0.000	0.40	0.15	0.40	0.003
9.765	0.000	0.41	0.16	0.40	0.003
9.910	0.000	0.41	0.16	0.41	0.003
10.055	0.000	0.42	0.16	0.41	0.003
10.200	0.000	0.42	0.16	0.42	0.003
10.345	0.000	0.43	0.17	0.43	0.003
10.490	0.000	0.43	0.17	0.43	0.003
10.635	0.000	0.44	0.17	0.44	0.003
10.780	0.000	0.45	0.17	0.45	0.003
10.925	0.000	0.46	0.18	0.45	0.003
11.070	0.000	0.47	0.18	0.46	0.003
11.215	0.000	0.48	0.18	0.47	0.003
11.360	0.000	0.48	0.19	0.48	0.003
11.505	0.000	0.50	0.19	0.49	0.003
11.650	0.000	0.50	0.19	0.50	0.003
11.795	0.000	0.52	0.20	0.51	0.004
11.940	0.000	0.52	0.20	0.52	0.004
12.085	0.000	0.59	0.23	0.56	0.004
12.230	0.000	0.69	0.26	0.63	0.005
12.375	0.000	0.71	0.27	0.69	0.005
12.520	0.000	0.72	0.27	0.71	0.005
12.665	0.000	0.74	0.28	0.72	0.005
12.810	0.000	0.75	0.29	0.74	0.005
12.955	0.000	0.77	0.30	0.76	0.005
13.100	0.000	0.78	0.30	0.78	0.005
13.245	0.000	0.81	0.31	0.80	0.006
13.390	0.000	0.83	0.32	0.82	0.006
13.535	0.000	0.86	0.33	0.84	0.006
13.680	0.000	0.88	0.34	0.87	0.006
13.825	0.000	0.92	0.35	0.90	0.006
13.970	0.000	0.94	0.36	0.93	0.006
14.115	0.000	0.99	0.38	0.96	0.007
14.260	0.000	1.02	0.39	1.00	0.007
14.405	0.000	1.08	0.41	1.04	0.007
14.550	0.000	1.11	0.43	1.09	0.008
14.695	0.000	1.19	0.46	1.15	0.008
14.840	0.000	1.24	0.47	1.21	0.009
14.985	0.000	1.35	0.51	1.29	0.009
15.130	0.000	1.41	0.53	1.39	0.009
15.275	0.000	1.58	0.57	1.53	0.010
15.420	0.000	1.69	0.59	1.67	0.010
15.565	0.000	1.77	0.60	1.75	0.011
15.710	0.000	2.00	0.66	1.92	0.012
15.855	0.000	2.87	0.90	2.62	0.015
16.000	0.000	3.95	1.13	3.93	0.019
16.145	0.000	12.09	3.48	9.36	0.061
16.290	0.000	2.33	0.75	8.28	0.013
16.435	0.000	1.63	0.56	2.04	0.010

16.580	0.000	1.49	0.53	1.53	0.010
16.725	0.000	1.29	0.48	1.36	0.009
16.870	0.000	1.15	0.45	1.21	0.008
17.015	0.000	1.05	0.41	1.11	0.007
17.160	0.000	0.96	0.37	1.01	0.007
17.305	0.000	0.90	0.35	0.94	0.006
17.450	0.000	0.84	0.33	0.88	0.006
17.595	0.000	0.80	0.31	0.82	0.006
17.740	0.000	0.76	0.29	0.78	0.005
17.885	0.000	0.73	0.28	0.75	0.005
18.030	0.000	0.70	0.27	0.71	0.005
18.175	0.000	0.53	0.21	0.62	0.004
18.320	0.000	0.51	0.20	0.53	0.004
18.465	0.000	0.49	0.19	0.50	0.003
18.610	0.000	0.47	0.18	0.48	0.003
18.755	0.000	0.45	0.18	0.46	0.003
18.900	0.000	0.44	0.17	0.45	0.003
19.045	0.000	0.43	0.16	0.43	0.003
19.190	0.000	0.41	0.16	0.42	0.003
19.335	0.000	0.40	0.15	0.41	0.003
19.480	0.000	0.39	0.15	0.40	0.003
19.625	0.000	0.38	0.15	0.39	0.003
19.770	0.000	0.37	0.14	0.38	0.003
19.915	0.000	0.36	0.14	0.37	0.003
20.060	0.000	0.35	0.14	0.36	0.002
20.205	0.000	0.35	0.13	0.35	0.002
20.350	0.000	0.34	0.13	0.34	0.002
20.495	0.000	0.33	0.13	0.33	0.002
20.640	0.000	0.32	0.12	0.33	0.002
20.785	0.000	0.32	0.12	0.32	0.002
20.930	0.000	0.31	0.12	0.32	0.002
21.075	0.000	0.31	0.12	0.31	0.002
21.220	0.000	0.30	0.12	0.30	0.002
21.365	0.000	0.30	0.11	0.30	0.002
21.510	0.000	0.29	0.11	0.29	0.002
21.655	0.000	0.29	0.11	0.29	0.002
21.800	0.000	0.28	0.11	0.28	0.002
21.945	0.000	0.28	0.11	0.28	0.002
22.090	0.000	0.27	0.10	0.27	0.002
22.235	0.000	0.27	0.10	0.27	0.002
22.380	0.000	0.26	0.10	0.27	0.002
22.525	0.000	0.26	0.10	0.26	0.002
22.670	0.000	0.26	0.10	0.26	0.002
22.815	0.000	0.25	0.10	0.26	0.002
22.960	0.000	0.25	0.10	0.25	0.002
23.105	0.000	0.25	0.09	0.25	0.002
23.250	0.000	0.24	0.09	0.25	0.002
23.395	0.000	0.24	0.09	0.24	0.002
23.540	0.000	0.24	0.09	0.24	0.002
23.685	0.000	0.23	0.09	0.24	0.002
23.830	0.000	0.23	0.09	0.23	0.002
23.975	0.000	0.23	0.09	0.23	0.002

24.120	0.000	0.23	0.09	0.23	0.002
24.265	0.000	0.00	0.01	0.12	0.000
24.410	0.000	0.00	0.00	0.01	0.000

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                    SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                         Analysis prepared by:


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----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN 9
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    7.29
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.030
    LOW LOSS FRACTION = 0.040
    TIME OF CONCENTRATION(MIN.) = 10.70
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     2.95
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.47

****************************************************************************
  TIME      VOLUME       Q    0.        7.5       15.0      22.5      30.0
 (HOURS)     (AF)      (CFS)
----------------------------------------------------------------------------
  0.13      0.0029      0.55  Q         .         .         .         .
  0.31      0.0111      0.55  Q         .         .         .         .
  0.49      0.0192      0.56  Q         .         .         .         .
  0.66      0.0275      0.56  Q         .         .         .         .
```

0.84	0.0358	0.57	Q	.	.	.	.
1.02	0.0442	0.57	Q	.	.	.	.
1.20	0.0526	0.57	Q	.	.	.	.
1.38	0.0611	0.58	Q	.	.	.	.
1.56	0.0696	0.58	Q	.	.	.	.
1.73	0.0783	0.59	Q	.	.	.	.
1.91	0.0870	0.59	Q	.	.	.	.
2.09	0.0957	0.60	Q	.	.	.	.
2.27	0.1045	0.60	Q	.	.	.	.
2.45	0.1134	0.61	Q	.	.	.	.
2.63	0.1224	0.61	Q	.	.	.	.
2.80	0.1315	0.62	Q	.	.	.	.
2.98	0.1406	0.62	Q	.	.	.	.
3.16	0.1498	0.63	Q	.	.	.	.
3.34	0.1591	0.63	Q	.	.	.	.
3.52	0.1684	0.64	Q	.	.	.	.
3.70	0.1779	0.64	Q	.	.	.	.
3.87	0.1874	0.65	Q	.	.	.	.
4.05	0.1970	0.66	Q	.	.	.	.
4.23	0.2068	0.66	Q	.	.	.	.
4.41	0.2166	0.67	Q	.	.	.	.
4.59	0.2264	0.67	Q	.	.	.	.
4.77	0.2364	0.68	Q	.	.	.	.
4.94	0.2465	0.69	Q	.	.	.	.
5.12	0.2567	0.70	Q	.	.	.	.
5.30	0.2670	0.70	Q	.	.	.	.
5.48	0.2774	0.71	Q	.	.	.	.
5.66	0.2879	0.72	Q	.	.	.	.
5.84	0.2986	0.73	Q	.	.	.	.
6.01	0.3093	0.73	Q	.	.	.	.
6.19	0.3201	0.74	Q	.	.	.	.
6.37	0.3311	0.75	Q	.	.	.	.
6.55	0.3422	0.76	.Q	.	.	.	.
6.73	0.3535	0.77	.Q	.	.	.	.
6.91	0.3649	0.78	.Q	.	.	.	.
7.08	0.3764	0.78	.Q	.	.	.	.
7.26	0.3880	0.80	.Q	.	.	.	.
7.44	0.3998	0.80	.Q	.	.	.	.
7.62	0.4118	0.82	.Q	.	.	.	.
7.80	0.4239	0.83	.Q	.	.	.	.
7.97	0.4362	0.84	.Q	.	.	.	.
8.15	0.4486	0.85	.Q	.	.	.	.
8.33	0.4612	0.86	.Q	.	.	.	.
8.51	0.4740	0.87	.Q	.	.	.	.
8.69	0.4870	0.89	.Q	.	.	.	.
8.87	0.5002	0.90	.Q	.	.	.	.
9.05	0.5136	0.92	.Q	.	.	.	.
9.22	0.5272	0.93	.Q	.	.	.	.
9.40	0.5411	0.95	.Q	.	.	.	.
9.58	0.5551	0.96	.Q	.	.	.	.
9.76	0.5694	0.98	.Q	.	.	.	.
9.94	0.5840	0.99	.Q	.	.	.	.

10.12	0.5988	1.02	.Q . . . .
10.29	0.6139	1.03	.Q . . . .
10.47	0.6293	1.06	.Q . . . .
10.65	0.6450	1.07	.Q . . . .
10.83	0.6610	1.10	.Q . . . .
11.01	0.6773	1.12	.Q . . . .
11.18	0.6941	1.15	.Q . . . .
11.36	0.7112	1.17	.Q . . . .
11.54	0.7287	1.21	.Q . . . .
11.72	0.7466	1.23	.Q . . . .
11.90	0.7650	1.27	.Q . . . .
12.08	0.7839	1.29	.Q . . . .
12.26	0.8058	1.68	. Q . . . .
12.43	0.8308	1.71	. Q . . . .
12.61	0.8564	1.77	. Q . . . .
12.79	0.8827	1.80	. Q . . . .
12.97	0.9098	1.87	. Q . . . .
13.15	0.9376	1.91	. Q . . . .
13.32	0.9664	2.00	. Q . . . .
13.50	0.9962	2.04	. Q . . . .
13.68	1.0271	2.15	. Q . . . .
13.86	1.0592	2.20	. Q . . . .
14.04	1.0926	2.34	. Q . . . .
14.22	1.1277	2.42	. Q . . . .
14.40	1.1646	2.59	. Q . . . .
14.57	1.2036	2.69	. Q . . . .
14.75	1.2451	2.93	. Q . . . .
14.93	1.2894	3.08	. Q . . . .
15.11	1.3375	3.44	. Q . . . .
15.29	1.3900	3.68	. Q . . . .
15.47	1.4467	4.02	. Q . . . .
15.64	1.5079	4.29	. Q . . . .
15.82	1.5849	6.16	. Q . . . .
16.00	1.6928	8.49	. .Q . . . .
16.18	1.9469	26.00	. . . . Q .
16.36	2.1753	4.99	. Q . . . .
16.53	2.2413	3.97	. Q . . . .
16.71	2.2945	3.25	. Q . . . .
16.89	2.3391	2.81	. Q . . . .
17.07	2.3783	2.50	. Q . . . .
17.25	2.4134	2.27	. Q . . . .
17.43	2.4456	2.09	. Q . . . .
17.61	2.4754	1.95	. Q . . . .
17.78	2.5033	1.84	. Q . . . .
17.96	2.5296	1.74	. Q . . . .
18.14	2.5537	1.53	. Q . . . .
18.32	2.5742	1.25	.Q . . . .
18.50	2.5922	1.19	.Q . . . .
18.67	2.6093	1.13	.Q . . . .
18.85	2.6257	1.09	.Q . . . .
19.03	2.6414	1.04	.Q . . . .
19.21	2.6565	1.01	.Q . . . .

19.39	2.6710	0.97	.Q	.	.	.	.
19.57	2.6851	0.94	.Q	.	.	.	.
19.74	2.6987	0.91	.Q	.	.	.	.
19.92	2.7119	0.88	.Q	.	.	.	.
20.10	2.7247	0.86	.Q	.	.	.	.
20.28	2.7372	0.83	.Q	.	.	.	.
20.46	2.7493	0.81	.Q	.	.	.	.
20.64	2.7611	0.79	.Q	.	.	.	.
20.82	2.7726	0.77	.Q	.	.	.	.
20.99	2.7838	0.75	.Q	.	.	.	.
21.17	2.7948	0.74	Q	.	.	.	.
21.35	2.8055	0.72	Q	.	.	.	.
21.53	2.8161	0.71	Q	.	.	.	.
21.71	2.8264	0.69	Q	.	.	.	.
21.89	2.8364	0.68	Q	.	.	.	.
22.06	2.8463	0.66	Q	.	.	.	.
22.24	2.8561	0.65	Q	.	.	.	.
22.42	2.8656	0.64	Q	.	.	.	.
22.60	2.8750	0.63	Q	.	.	.	.
22.78	2.8842	0.62	Q	.	.	.	.
22.95	2.8932	0.61	Q	.	.	.	.
23.13	2.9021	0.60	Q	.	.	.	.
23.31	2.9109	0.59	Q	.	.	.	.
23.49	2.9195	0.58	Q	.	.	.	.
23.67	2.9280	0.57	Q	.	.	.	.
23.85	2.9363	0.56	Q	.	.	.	.
24.02	2.9446	0.56	Q	.	.	.	.
24.20	2.9487	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1444.5
10%	149.8
20%	32.1
30%	21.4
40%	10.7
50%	10.7
60%	10.7
70%	10.7
80%	10.7
90%	10.7

Problem Descriptions:

```
==============================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =   10.700
     DEAD STORAGE(AF) =       0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =       0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =    0.00


                 INFLOW
                   |
                   |
                   |
                   V                 __effective depth
             -------------           |   (and volume)
             |           |     |     |
             | detention |     |....V.............
             |   basin   |<-->|          outflow
             |           |     |.........________
             -------------     |         |    \
                   |           | storage |     basin outlet
                   V           -----------
                OUTFLOW


     DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
     TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES =   9
     *BASIN-DEPTH  STORAGE    OUTFLOW  **BASIN-DEPTH  STORAGE    OUTFLOW  *
     *   (FEET)  (ACRE-FEET)   (CFS)   **   (FEET)  (ACRE-FEET)   (CFS)   *
     *      0.000      0.000      0.000**      0.500      0.026      1.730*
     *      1.000      0.051      4.900**      1.500      0.077      9.000*
     *      2.000      0.102     15.130**      2.500      0.128     18.530*
     *      3.000      0.153     21.390**      3.500      0.179     23.920*
     *      4.000      0.204     26.200**
------------------------------------------------------------------------------
     BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:
      INTERVAL   DEPTH   {S-O*DT/2}   {S+O*DT/2}
       NUMBER   (FEET)   (ACRE-FEET)  (ACRE-FEET)
          1      0.00       0.00000      0.00000
          2      0.50       0.01325      0.03875
          3      1.00       0.01489      0.08711
          4      1.50       0.01068      0.14332
          5      2.00      -0.00950      0.21350
          6      2.50      -0.00855      0.26455
          7      3.00      -0.00463      0.31063
          8      3.50       0.00273      0.35527
          9      4.00       0.01093      0.39707
```

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.128	0.000	0.55	0.10	0.18	0.005
0.307	0.000	0.55	0.14	0.43	0.007
0.485	0.000	0.56	0.15	0.51	0.008
0.663	0.000	0.56	0.16	0.54	0.008
0.842	0.000	0.57	0.16	0.56	0.008
1.020	0.000	0.57	0.16	0.56	0.009
1.198	0.000	0.57	0.17	0.57	0.009
1.377	0.000	0.58	0.17	0.57	0.009
1.555	0.000	0.58	0.17	0.58	0.009
1.733	0.000	0.59	0.17	0.58	0.009
1.912	0.000	0.59	0.17	0.59	0.009
2.090	0.000	0.60	0.17	0.59	0.009
2.268	0.000	0.60	0.17	0.60	0.009
2.447	0.000	0.61	0.17	0.60	0.009
2.625	0.000	0.61	0.18	0.61	0.009
2.803	0.000	0.62	0.18	0.61	0.009
2.982	0.000	0.62	0.18	0.62	0.009
3.160	0.000	0.63	0.18	0.62	0.009
3.338	0.000	0.63	0.18	0.63	0.009
3.517	0.000	0.64	0.18	0.63	0.010
3.695	0.000	0.64	0.19	0.64	0.010
3.873	0.000	0.65	0.19	0.64	0.010
4.052	0.000	0.66	0.19	0.65	0.010
4.230	0.000	0.66	0.19	0.66	0.010
4.408	0.000	0.67	0.19	0.66	0.010
4.587	0.000	0.67	0.19	0.67	0.010
4.765	0.000	0.68	0.20	0.67	0.010
4.943	0.000	0.69	0.20	0.68	0.010
5.122	0.000	0.70	0.20	0.69	0.010
5.300	0.000	0.70	0.20	0.69	0.010
5.478	0.000	0.71	0.20	0.70	0.011
5.657	0.000	0.72	0.21	0.71	0.011
5.835	0.000	0.73	0.21	0.72	0.011
6.013	0.000	0.73	0.21	0.72	0.011
6.192	0.000	0.74	0.21	0.73	0.011
6.370	0.000	0.75	0.22	0.74	0.011
6.548	0.000	0.76	0.22	0.75	0.011
6.727	0.000	0.77	0.22	0.76	0.011
6.905	0.000	0.78	0.22	0.77	0.012
7.083	0.000	0.78	0.23	0.78	0.012
7.262	0.000	0.80	0.23	0.79	0.012
7.440	0.000	0.80	0.23	0.80	0.012

7.618	0.000	0.82	0.23	0.81	0.012
7.797	0.000	0.83	0.24	0.82	0.012
7.975	0.000	0.84	0.24	0.83	0.013
8.153	0.000	0.85	0.24	0.84	0.013
8.332	0.000	0.86	0.25	0.85	0.013
8.510	0.000	0.87	0.25	0.86	0.013
8.688	0.000	0.89	0.26	0.88	0.013
8.867	0.000	0.90	0.26	0.89	0.013
9.045	0.000	0.92	0.26	0.90	0.014
9.223	0.000	0.93	0.27	0.92	0.014
9.402	0.000	0.95	0.27	0.93	0.014
9.580	0.000	0.96	0.28	0.95	0.014
9.758	0.000	0.98	0.28	0.96	0.015
9.937	0.000	0.99	0.28	0.98	0.015
10.115	0.000	1.02	0.29	1.00	0.015
10.293	0.000	1.03	0.30	1.01	0.015
10.472	0.000	1.06	0.30	1.03	0.016
10.650	0.000	1.07	0.31	1.05	0.016
10.828	0.000	1.10	0.31	1.08	0.016
11.007	0.000	1.12	0.32	1.10	0.017
11.185	0.000	1.15	0.33	1.12	0.017
11.363	0.000	1.17	0.33	1.15	0.017
11.542	0.000	1.21	0.34	1.17	0.018
11.720	0.000	1.23	0.35	1.20	0.018
11.898	0.000	1.27	0.36	1.23	0.019
12.077	0.000	1.29	0.37	1.26	0.019
12.255	0.000	1.68	0.45	1.41	0.023
12.433	0.000	1.71	0.48	1.60	0.025
12.612	0.000	1.77	0.50	1.69	0.026
12.790	0.000	1.80	0.51	1.76	0.027
12.968	0.000	1.87	0.52	1.83	0.027
13.147	0.000	1.91	0.53	1.89	0.027
13.325	0.000	2.00	0.54	1.95	0.028
13.503	0.000	2.04	0.55	2.02	0.028
13.682	0.000	2.15	0.57	2.09	0.029
13.860	0.000	2.20	0.57	2.17	0.030
14.038	0.000	2.34	0.59	2.27	0.031
14.217	0.000	2.42	0.61	2.37	0.031
14.395	0.000	2.59	0.64	2.50	0.033
14.573	0.000	2.69	0.65	2.64	0.034
14.752	0.000	2.93	0.69	2.81	0.035
14.930	0.000	3.08	0.71	3.00	0.037
15.108	0.000	3.44	0.77	3.25	0.039
15.287	0.000	3.68	0.81	3.55	0.041
15.465	0.000	4.02	0.86	3.84	0.044
15.643	0.000	4.29	0.90	4.14	0.046
15.822	0.000	6.16	1.16	5.25	0.059
16.000	0.000	8.49	1.46	7.44	0.075
16.178	0.000	26.00	3.97	17.35	0.202
16.357	0.000	4.99	0.97	15.37	0.049
16.535	0.000	3.97	0.86	4.34	0.044
16.713	0.000	3.25	0.74	3.63	0.038

16.892	0.000	2.81	0.67	3.05	0.035
17.070	0.000	2.50	0.62	2.67	0.032
17.248	0.000	2.27	0.59	2.40	0.030
17.427	0.000	2.09	0.56	2.19	0.029
17.605	0.000	1.95	0.54	2.03	0.028
17.783	0.000	1.84	0.52	1.90	0.027
17.962	0.000	1.74	0.50	1.79	0.026
18.140	0.000	1.53	0.46	1.67	0.024
18.318	0.000	1.25	0.40	1.48	0.021
18.497	0.000	1.19	0.36	1.31	0.019
18.675	0.000	1.13	0.34	1.21	0.018
18.853	0.000	1.09	0.32	1.15	0.017
19.032	0.000	1.04	0.31	1.09	0.016
19.210	0.000	1.01	0.30	1.05	0.015
19.388	0.000	0.97	0.29	1.01	0.015
19.567	0.000	0.94	0.28	0.97	0.014
19.745	0.000	0.91	0.27	0.94	0.014
19.923	0.000	0.88	0.26	0.91	0.013
20.102	0.000	0.86	0.25	0.88	0.013
20.280	0.000	0.83	0.24	0.86	0.013
20.458	0.000	0.81	0.24	0.83	0.012
20.637	0.000	0.79	0.23	0.81	0.012
20.815	0.000	0.77	0.23	0.79	0.012
20.993	0.000	0.75	0.22	0.77	0.011
21.172	0.000	0.74	0.22	0.75	0.011
21.350	0.000	0.72	0.21	0.74	0.011
21.528	0.000	0.71	0.21	0.72	0.011
21.707	0.000	0.69	0.20	0.71	0.011
21.885	0.000	0.68	0.20	0.69	0.010
22.063	0.000	0.66	0.19	0.68	0.010
22.242	0.000	0.65	0.19	0.67	0.010
22.420	0.000	0.64	0.19	0.65	0.010
22.598	0.000	0.63	0.18	0.64	0.010
22.777	0.000	0.62	0.18	0.63	0.009
22.955	0.000	0.61	0.18	0.62	0.009
23.133	0.000	0.60	0.17	0.61	0.009
23.312	0.000	0.59	0.17	0.60	0.009
23.490	0.000	0.58	0.17	0.59	0.009
23.668	0.000	0.57	0.17	0.58	0.009
23.847	0.000	0.56	0.16	0.57	0.009
24.025	0.000	0.56	0.16	0.56	0.008
24.203	0.000	0.00	0.06	0.38	0.003
24.382	0.000	0.00	0.02	0.13	0.001

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****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                              Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN 10
----------------------------------------------------------------------------


     RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
     TOTAL CATCHMENT AREA(ACRES) =    4.26
     SOIL-LOSS RATE, Fm,(INCH/HR) =  0.030
     LOW LOSS FRACTION = 0.040
     TIME OF CONCENTRATION(MIN.) =  9.80
     SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
     ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
     RETURN FREQUENCY(YEARS) = 100
        5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
       30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
        1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
        3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
        6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
       24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

     TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.72
     TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.28

****************************************************************************
  TIME      VOLUME        Q     0.        5.0       10.0       15.0       20.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.16      0.0021      0.32  Q          .          .          .          .
  0.32      0.0064      0.32  Q          .          .          .          .
  0.48      0.0108      0.33  Q          .          .          .          .
  0.65      0.0152      0.33  Q          .          .          .          .
```

0.81	0.0197	0.33	Q	.	.	.	.
0.97	0.0242	0.33	Q	.	.	.	.
1.14	0.0287	0.34	Q	.	.	.	.
1.30	0.0332	0.34	Q	.	.	.	.
1.46	0.0378	0.34	Q	.	.	.	.
1.63	0.0424	0.34	Q	.	.	.	.
1.79	0.0470	0.34	Q	.	.	.	.
1.95	0.0517	0.35	Q	.	.	.	.
2.12	0.0564	0.35	Q	.	.	.	.
2.28	0.0611	0.35	Q	.	.	.	.
2.44	0.0659	0.35	Q	.	.	.	.
2.61	0.0707	0.36	Q	.	.	.	.
2.77	0.0755	0.36	Q	.	.	.	.
2.93	0.0804	0.36	Q	.	.	.	.
3.10	0.0853	0.37	Q	.	.	.	.
3.26	0.0902	0.37	Q	.	.	.	.
3.42	0.0952	0.37	Q	.	.	.	.
3.59	0.1003	0.37	Q	.	.	.	.
3.75	0.1053	0.38	Q	.	.	.	.
3.91	0.1105	0.38	Q	.	.	.	.
4.08	0.1156	0.38	Q	.	.	.	.
4.24	0.1208	0.39	Q	.	.	.	.
4.40	0.1261	0.39	Q	.	.	.	.
4.57	0.1314	0.39	Q	.	.	.	.
4.73	0.1367	0.40	Q	.	.	.	.
4.89	0.1421	0.40	Q	.	.	.	.
5.06	0.1475	0.41	Q	.	.	.	.
5.22	0.1530	0.41	Q	.	.	.	.
5.38	0.1586	0.41	Q	.	.	.	.
5.55	0.1642	0.42	Q	.	.	.	.
5.71	0.1698	0.42	Q	.	.	.	.
5.87	0.1755	0.42	Q	.	.	.	.
6.04	0.1813	0.43	Q	.	.	.	.
6.20	0.1871	0.43	Q	.	.	.	.
6.36	0.1930	0.44	Q	.	.	.	.
6.53	0.1989	0.44	Q	.	.	.	.
6.69	0.2050	0.45	Q	.	.	.	.
6.85	0.2110	0.45	Q	.	.	.	.
7.02	0.2172	0.46	Q	.	.	.	.
7.18	0.2234	0.46	Q	.	.	.	.
7.34	0.2297	0.47	Q	.	.	.	.
7.51	0.2360	0.47	Q	.	.	.	.
7.67	0.2425	0.48	Q	.	.	.	.
7.83	0.2490	0.48	Q	.	.	.	.
8.00	0.2556	0.49	Q	.	.	.	.
8.16	0.2622	0.50	Q	.	.	.	.
8.32	0.2690	0.51	.Q	.	.	.	.
8.49	0.2758	0.51	.Q	.	.	.	.
8.65	0.2828	0.52	.Q	.	.	.	.
8.81	0.2898	0.52	.Q	.	.	.	.
8.98	0.2970	0.53	.Q	.	.	.	.
9.14	0.3042	0.54	.Q	.	.	.	.

9.30	0.3116	0.55	.Q . . . .
9.47	0.3190	0.56	.Q . . . .
9.63	0.3266	0.57	.Q . . . .
9.79	0.3343	0.57	.Q . . . .
9.96	0.3421	0.59	.Q . . . .
10.12	0.3501	0.59	.Q . . . .
10.28	0.3581	0.61	.Q . . . .
10.45	0.3664	0.61	.Q . . . .
10.61	0.3748	0.63	.Q . . . .
10.77	0.3833	0.64	.Q . . . .
10.94	0.3920	0.65	.Q . . . .
11.10	0.4009	0.66	.Q . . . .
11.26	0.4099	0.68	.Q . . . .
11.43	0.4192	0.69	.Q . . . .
11.59	0.4286	0.71	.Q . . . .
11.75	0.4383	0.72	.Q . . . .
11.92	0.4482	0.75	.Q . . . .
12.08	0.4584	0.76	.Q . . . .
12.24	0.4701	0.98	.Q . . . .
12.41	0.4834	1.00	.Q . . . .
12.57	0.4971	1.03	. Q . . . .
12.73	0.5111	1.05	. Q . . . .
12.90	0.5255	1.08	. Q . . . .
13.06	0.5402	1.10	. Q . . . .
13.22	0.5554	1.15	. Q . . . .
13.39	0.5711	1.17	. Q . . . .
13.55	0.5872	1.22	. Q . . . .
13.71	0.6039	1.25	. Q . . . .
13.88	0.6212	1.31	. Q . . . .
14.04	0.6392	1.35	. Q . . . .
14.20	0.6580	1.44	. Q . . . .
14.37	0.6777	1.48	. Q . . . .
14.53	0.6985	1.59	. Q . . . .
14.69	0.7203	1.65	. Q . . . .
14.86	0.7436	1.80	. Q . . . .
15.02	0.7684	1.89	. Q . . . .
15.18	0.7954	2.11	. Q . . . .
15.35	0.8248	2.25	. Q . . . .
15.51	0.8559	2.34	. Q . . . .
15.67	0.8895	2.64	. Q . . . .
15.84	0.9329	3.80	. Q . . . .
16.00	0.9938	5.23	. Q . . . .
16.16	1.1371	16.00	. . . . Q .
16.33	1.2659	3.08	. Q . . . .
16.49	1.3028	2.39	. Q . . . .
16.65	1.3324	1.99	. Q . . . .
16.82	1.3574	1.72	. Q . . . .
16.98	1.3794	1.53	. Q . . . .
17.14	1.3991	1.39	. Q . . . .
17.31	1.4171	1.28	. Q . . . .
17.47	1.4339	1.20	. Q . . . .
17.63	1.4495	1.12	. Q . . . .

17.80	1.4643	1.06	. Q	.	.	.	.
17.96	1.4783	1.01	. Q	.	.	.	.
18.12	1.4913	0.91	.Q	.	.	.	.
18.29	1.5024	0.73	.Q	.	.	.	.
18.45	1.5121	0.70	.Q	.	.	.	.
18.61	1.5214	0.67	.Q	.	.	.	.
18.78	1.5302	0.64	.Q	.	.	.	.
18.94	1.5388	0.62	.Q	.	.	.	.
19.10	1.5470	0.60	.Q	.	.	.	.
19.27	1.5550	0.58	.Q	.	.	.	.
19.43	1.5627	0.56	.Q	.	.	.	.
19.59	1.5701	0.54	.Q	.	.	.	.
19.76	1.5774	0.53	.Q	.	.	.	.
19.92	1.5844	0.51	.Q	.	.	.	.
20.08	1.5913	0.50	.Q	.	.	.	.
20.25	1.5979	0.49	Q	.	.	.	.
20.41	1.6045	0.48	Q	.	.	.	.
20.57	1.6108	0.47	Q	.	.	.	.
20.74	1.6170	0.45	Q	.	.	.	.
20.90	1.6231	0.45	Q	.	.	.	.
21.06	1.6290	0.44	Q	.	.	.	.
21.23	1.6349	0.43	Q	.	.	.	.
21.39	1.6406	0.42	Q	.	.	.	.
21.55	1.6462	0.41	Q	.	.	.	.
21.72	1.6517	0.40	Q	.	.	.	.
21.88	1.6571	0.40	Q	.	.	.	.
22.04	1.6624	0.39	Q	.	.	.	.
22.21	1.6676	0.38	Q	.	.	.	.
22.37	1.6727	0.38	Q	.	.	.	.
22.53	1.6777	0.37	Q	.	.	.	.
22.70	1.6827	0.36	Q	.	.	.	.
22.86	1.6875	0.36	Q	.	.	.	.
23.02	1.6923	0.35	Q	.	.	.	.
23.19	1.6971	0.35	Q	.	.	.	.
23.35	1.7017	0.34	Q	.	.	.	.
23.51	1.7063	0.34	Q	.	.	.	.
23.68	1.7109	0.33	Q	.	.	.	.
23.84	1.7153	0.33	Q	.	.	.	.
24.00	1.7198	0.32	Q	.	.	.	.
24.17	1.7220	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1440.6
10%	137.2

20%	29.4
30%	19.6
40%	9.8
50%	9.8
60%	9.8
70%	9.8
80%	9.8
90%	9.8

Problem Descriptions:

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==============================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =    9.800
     DEAD STORAGE(AF) =       0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =       0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =    0.00


                 INFLOW
                   |
                   |
                   |
                   V                 __effective depth
             -------------           |   (and volume)
             |           |     |     |
             | detention |     |....V.............
             |   basin   |<-->|          outflow
             |           |     |.........________
             -------------     |          |    \
                   |           | storage |     basin outlet
                   V           -----------
                OUTFLOW


     DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
     TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES =   9
     *BASIN-DEPTH  STORAGE    OUTFLOW  **BASIN-DEPTH  STORAGE    OUTFLOW  *
     *   (FEET)  (ACRE-FEET)   (CFS)   **   (FEET)  (ACRE-FEET)   (CFS)   *
     *      0.000      0.000      0.000**      0.500      0.011      1.520*
     *      1.000      0.022      4.290**      1.500      0.033      7.880*
     *      2.000      0.044     12.280**      2.500      0.055     14.760*
     *      3.000      0.065     16.880**      3.500      0.076     18.760*
     *      4.000      0.087     20.470**
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BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	0.00074	0.02126
3	1.00	-0.00695	0.05095
4	1.50	-0.02018	0.08618
5	2.00	-0.03888	0.12688
6	2.50	-0.04462	0.15462
7	3.00	-0.04893	0.17893
8	3.50	-0.05062	0.20262
9	4.00	-0.05116	0.22516

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.157	0.000	0.32	0.10	0.16	0.002
0.320	0.000	0.32	0.11	0.32	0.002
0.483	0.000	0.33	0.11	0.32	0.002
0.647	0.000	0.33	0.11	0.33	0.002
0.810	0.000	0.33	0.11	0.33	0.002
0.973	0.000	0.33	0.11	0.33	0.002
1.137	0.000	0.34	0.11	0.33	0.002
1.300	0.000	0.34	0.11	0.34	0.002
1.463	0.000	0.34	0.11	0.34	0.002
1.627	0.000	0.34	0.11	0.34	0.002
1.790	0.000	0.34	0.11	0.34	0.002
1.953	0.000	0.35	0.11	0.35	0.003
2.117	0.000	0.35	0.12	0.35	0.003
2.280	0.000	0.35	0.12	0.35	0.003
2.443	0.000	0.35	0.12	0.35	0.003
2.607	0.000	0.36	0.12	0.36	0.003
2.770	0.000	0.36	0.12	0.36	0.003
2.933	0.000	0.36	0.12	0.36	0.003
3.097	0.000	0.37	0.12	0.36	0.003
3.260	0.000	0.37	0.12	0.37	0.003
3.423	0.000	0.37	0.12	0.37	0.003
3.587	0.000	0.37	0.12	0.37	0.003
3.750	0.000	0.38	0.12	0.38	0.003
3.913	0.000	0.38	0.13	0.38	0.003
4.077	0.000	0.38	0.13	0.38	0.003
4.240	0.000	0.39	0.13	0.39	0.003
4.403	0.000	0.39	0.13	0.39	0.003
4.567	0.000	0.39	0.13	0.39	0.003
4.730	0.000	0.40	0.13	0.40	0.003
4.893	0.000	0.40	0.13	0.40	0.003

5.057	0.000	0.41	0.13	0.40	0.003
5.220	0.000	0.41	0.13	0.41	0.003
5.383	0.000	0.41	0.14	0.41	0.003
5.547	0.000	0.42	0.14	0.41	0.003
5.710	0.000	0.42	0.14	0.42	0.003
5.873	0.000	0.42	0.14	0.42	0.003
6.037	0.000	0.43	0.14	0.43	0.003
6.200	0.000	0.43	0.14	0.43	0.003
6.363	0.000	0.44	0.14	0.44	0.003
6.527	0.000	0.44	0.15	0.44	0.003
6.690	0.000	0.45	0.15	0.44	0.003
6.853	0.000	0.45	0.15	0.45	0.003
7.017	0.000	0.46	0.15	0.45	0.003
7.180	0.000	0.46	0.15	0.46	0.003
7.343	0.000	0.47	0.15	0.47	0.003
7.507	0.000	0.47	0.16	0.47	0.003
7.670	0.000	0.48	0.16	0.48	0.003
7.833	0.000	0.48	0.16	0.48	0.004
7.997	0.000	0.49	0.16	0.49	0.004
8.160	0.000	0.50	0.16	0.49	0.004
8.323	0.000	0.51	0.17	0.50	0.004
8.487	0.000	0.51	0.17	0.51	0.004
8.650	0.000	0.52	0.17	0.51	0.004
8.813	0.000	0.52	0.17	0.52	0.004
8.977	0.000	0.53	0.18	0.53	0.004
9.140	0.000	0.54	0.18	0.54	0.004
9.303	0.000	0.55	0.18	0.54	0.004
9.467	0.000	0.56	0.18	0.55	0.004
9.630	0.000	0.57	0.19	0.56	0.004
9.793	0.000	0.57	0.19	0.57	0.004
9.957	0.000	0.59	0.19	0.58	0.004
10.120	0.000	0.59	0.19	0.59	0.004
10.283	0.000	0.61	0.20	0.60	0.004
10.447	0.000	0.61	0.20	0.61	0.004
10.610	0.000	0.63	0.21	0.62	0.005
10.773	0.000	0.64	0.21	0.63	0.005
10.937	0.000	0.65	0.21	0.64	0.005
11.100	0.000	0.66	0.22	0.66	0.005
11.263	0.000	0.68	0.22	0.67	0.005
11.427	0.000	0.69	0.23	0.68	0.005
11.590	0.000	0.71	0.23	0.70	0.005
11.753	0.000	0.72	0.24	0.72	0.005
11.917	0.000	0.75	0.24	0.73	0.005
12.080	0.000	0.76	0.25	0.75	0.005
12.243	0.000	0.98	0.32	0.87	0.007
12.407	0.000	1.00	0.33	0.98	0.007
12.570	0.000	1.03	0.34	1.01	0.007
12.733	0.000	1.05	0.34	1.04	0.008
12.897	0.000	1.08	0.36	1.06	0.008
13.060	0.000	1.10	0.36	1.09	0.008
13.223	0.000	1.15	0.38	1.12	0.008
13.387	0.000	1.17	0.38	1.16	0.008

13.550	0.000	1.22	0.40	1.20	0.009
13.713	0.000	1.25	0.41	1.24	0.009
13.877	0.000	1.31	0.43	1.28	0.009
14.040	0.000	1.35	0.44	1.33	0.010
14.203	0.000	1.44	0.47	1.39	0.010
14.367	0.000	1.48	0.49	1.46	0.011
14.530	0.000	1.59	0.52	1.54	0.011
14.693	0.000	1.65	0.53	1.63	0.012
14.857	0.000	1.80	0.56	1.75	0.012
15.020	0.000	1.89	0.57	1.87	0.013
15.183	0.000	2.11	0.62	2.05	0.014
15.347	0.000	2.25	0.65	2.28	0.014
15.510	0.000	2.34	0.67	2.43	0.015
15.673	0.000	2.64	0.74	2.67	0.016
15.837	0.000	3.80	1.00	3.59	0.022
16.000	0.000	5.23	1.28	5.31	0.028
16.163	0.000	16.00	3.80	13.03	0.083
16.327	0.000	3.08	0.84	11.59	0.019
16.490	0.000	2.39	0.69	2.98	0.015
16.653	0.000	1.99	0.59	2.30	0.013
16.817	0.000	1.72	0.53	1.87	0.012
16.980	0.000	1.53	0.49	1.60	0.011
17.143	0.000	1.39	0.46	1.45	0.010
17.307	0.000	1.28	0.42	1.34	0.009
17.470	0.000	1.20	0.39	1.24	0.009
17.633	0.000	1.12	0.37	1.16	0.008
17.797	0.000	1.06	0.35	1.10	0.008
17.960	0.000	1.01	0.33	1.04	0.007
18.123	0.000	0.91	0.30	0.97	0.007
18.287	0.000	0.73	0.24	0.83	0.005
18.450	0.000	0.70	0.23	0.72	0.005
18.613	0.000	0.67	0.22	0.69	0.005
18.777	0.000	0.64	0.21	0.66	0.005
18.940	0.000	0.62	0.20	0.63	0.004
19.103	0.000	0.60	0.20	0.61	0.004
19.267	0.000	0.58	0.19	0.59	0.004
19.430	0.000	0.56	0.18	0.57	0.004
19.593	0.000	0.54	0.18	0.55	0.004
19.757	0.000	0.53	0.17	0.54	0.004
19.920	0.000	0.51	0.17	0.52	0.004
20.083	0.000	0.50	0.16	0.51	0.004
20.247	0.000	0.49	0.16	0.50	0.004
20.410	0.000	0.48	0.16	0.48	0.003
20.573	0.000	0.47	0.15	0.47	0.003
20.737	0.000	0.45	0.15	0.46	0.003
20.900	0.000	0.45	0.15	0.45	0.003
21.063	0.000	0.44	0.14	0.44	0.003
21.227	0.000	0.43	0.14	0.43	0.003
21.390	0.000	0.42	0.14	0.42	0.003
21.553	0.000	0.41	0.14	0.41	0.003
21.717	0.000	0.40	0.13	0.41	0.003
21.880	0.000	0.40	0.13	0.40	0.003

22.043	0.000	0.39	0.13	0.39	0.003
22.207	0.000	0.38	0.13	0.39	0.003
22.370	0.000	0.38	0.12	0.38	0.003
22.533	0.000	0.37	0.12	0.37	0.003
22.697	0.000	0.36	0.12	0.37	0.003
22.860	0.000	0.36	0.12	0.36	0.003
23.023	0.000	0.35	0.12	0.36	0.003
23.187	0.000	0.35	0.11	0.35	0.003
23.350	0.000	0.34	0.11	0.35	0.002
23.513	0.000	0.34	0.11	0.34	0.002
23.677	0.000	0.33	0.11	0.34	0.002
23.840	0.000	0.33	0.11	0.33	0.002
24.003	0.000	0.32	0.11	0.33	0.002
24.167	0.000	0.00	0.00	0.17	0.000
24.330	0.000	0.00	0.00	0.01	0.000

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                    SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                         Analysis prepared by:


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----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN 11
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    3.48
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.030
    LOW LOSS FRACTION = 0.040
    TIME OF CONCENTRATION(MIN.) = 10.50
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.41
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.22

****************************************************************************
  TIME      VOLUME       Q    0.        5.0       10.0      15.0      20.0
 (HOURS)     (AF)      (CFS)
----------------------------------------------------------------------------
  0.08      0.0008      0.26  Q         .         .         .         .
  0.25      0.0046      0.26  Q         .         .         .         .
  0.43      0.0084      0.27  Q         .         .         .         .
  0.60      0.0123      0.27  Q         .         .         .         .
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0.77	0.0162	0.27	Q	.	.	.	.
0.95	0.0201	0.27	Q	.	.	.	.
1.12	0.0240	0.27	Q	.	.	.	.
1.30	0.0280	0.27	Q	.	.	.	.
1.48	0.0320	0.28	Q	.	.	.	.
1.65	0.0360	0.28	Q	.	.	.	.
1.83	0.0401	0.28	Q	.	.	.	.
2.00	0.0442	0.28	Q	.	.	.	.
2.17	0.0483	0.29	Q	.	.	.	.
2.35	0.0524	0.29	Q	.	.	.	.
2.53	0.0566	0.29	Q	.	.	.	.
2.70	0.0608	0.29	Q	.	.	.	.
2.88	0.0651	0.30	Q	.	.	.	.
3.05	0.0694	0.30	Q	.	.	.	.
3.22	0.0737	0.30	Q	.	.	.	.
3.40	0.0781	0.30	Q	.	.	.	.
3.58	0.0825	0.31	Q	.	.	.	.
3.75	0.0869	0.31	Q	.	.	.	.
3.92	0.0914	0.31	Q	.	.	.	.
4.10	0.0959	0.31	Q	.	.	.	.
4.28	0.1005	0.32	Q	.	.	.	.
4.45	0.1051	0.32	Q	.	.	.	.
4.62	0.1097	0.32	Q	.	.	.	.
4.80	0.1144	0.33	Q	.	.	.	.
4.97	0.1191	0.33	Q	.	.	.	.
5.15	0.1239	0.33	Q	.	.	.	.
5.32	0.1287	0.34	Q	.	.	.	.
5.50	0.1336	0.34	Q	.	.	.	.
5.68	0.1386	0.34	Q	.	.	.	.
5.85	0.1435	0.35	Q	.	.	.	.
6.03	0.1486	0.35	Q	.	.	.	.
6.20	0.1537	0.35	Q	.	.	.	.
6.38	0.1588	0.36	Q	.	.	.	.
6.55	0.1640	0.36	Q	.	.	.	.
6.72	0.1693	0.37	Q	.	.	.	.
6.90	0.1746	0.37	Q	.	.	.	.
7.07	0.1800	0.38	Q	.	.	.	.
7.25	0.1855	0.38	Q	.	.	.	.
7.43	0.1910	0.39	Q	.	.	.	.
7.60	0.1966	0.39	Q	.	.	.	.
7.78	0.2023	0.40	Q	.	.	.	.
7.95	0.2080	0.40	Q	.	.	.	.
8.12	0.2138	0.41	Q	.	.	.	.
8.30	0.2197	0.41	Q	.	.	.	.
8.48	0.2257	0.42	Q	.	.	.	.
8.65	0.2318	0.42	Q	.	.	.	.
8.82	0.2379	0.43	Q	.	.	.	.
9.00	0.2442	0.43	Q	.	.	.	.
9.18	0.2505	0.44	Q	.	.	.	.
9.35	0.2570	0.45	Q	.	.	.	.
9.52	0.2635	0.46	Q	.	.	.	.
9.70	0.2702	0.46	Q	.	.	.	.

9.88	0.2770	0.47	Q
10.05	0.2839	0.48	Q
10.23	0.2909	0.49	Q
10.40	0.2981	0.50	Q
10.57	0.3053	0.51	.Q
10.75	0.3128	0.52	.Q
10.93	0.3204	0.53	.Q
11.10	0.3281	0.54	.Q
11.27	0.3361	0.56	.Q
11.45	0.3442	0.56	.Q
11.62	0.3525	0.58	.Q
11.80	0.3610	0.59	.Q
11.98	0.3697	0.61	.Q
12.15	0.3790	0.67	.Q
12.32	0.3897	0.81	.Q
12.50	0.4015	0.82	.Q
12.68	0.4136	0.85	.Q
12.85	0.4261	0.87	.Q
13.02	0.4389	0.90	.Q
13.20	0.4521	0.92	.Q
13.38	0.4657	0.96	.Q
13.55	0.4798	0.99	.Q
13.73	0.4944	1.04	. Q
13.90	0.5096	1.06	. Q
14.07	0.5254	1.13	. Q
14.25	0.5420	1.17	. Q
14.43	0.5595	1.25	. Q
14.60	0.5779	1.30	. Q
14.77	0.5976	1.41	. Q
14.95	0.6185	1.48	. Q
15.12	0.6413	1.66	. Q
15.30	0.6661	1.78	. Q
15.48	0.6928	1.91	. Q
15.65	0.7216	2.07	. Q
15.82	0.7580	2.97	. Q
16.00	0.8092	4.10	. Q .
16.17	0.9296	12.55	. Q
16.35	1.0377	2.41	. Q
16.52	1.0690	1.92	. Q
16.70	1.0942	1.57	. Q
16.88	1.1153	1.35	. Q
17.05	1.1338	1.21	. Q
17.23	1.1504	1.09	. Q
17.40	1.1656	1.01	. Q
17.58	1.1798	0.94	.Q
17.75	1.1930	0.89	.Q
17.92	1.2054	0.84	.Q
18.10	1.2172	0.80	.Q
18.27	1.2274	0.60	.Q
18.45	1.2359	0.57	.Q
18.62	1.2440	0.55	.Q
18.80	1.2517	0.52	.Q

18.98	1.2592	0.50	.Q	.	.	.	.
19.15	1.2663	0.49	Q	.	.	.	.
19.33	1.2732	0.47	Q	.	.	.	.
19.50	1.2799	0.45	Q	.	.	.	.
19.67	1.2864	0.44	Q	.	.	.	.
19.85	1.2926	0.43	Q	.	.	.	.
20.02	1.2987	0.41	Q	.	.	.	.
20.20	1.3046	0.40	Q	.	.	.	.
20.38	1.3103	0.39	Q	.	.	.	.
20.55	1.3159	0.38	Q	.	.	.	.
20.73	1.3214	0.37	Q	.	.	.	.
20.90	1.3267	0.36	Q	.	.	.	.
21.08	1.3319	0.36	Q	.	.	.	.
21.25	1.3370	0.35	Q	.	.	.	.
21.42	1.3420	0.34	Q	.	.	.	.
21.60	1.3469	0.33	Q	.	.	.	.
21.77	1.3517	0.33	Q	.	.	.	.
21.95	1.3564	0.32	Q	.	.	.	.
22.12	1.3610	0.32	Q	.	.	.	.
22.30	1.3655	0.31	Q	.	.	.	.
22.48	1.3699	0.30	Q	.	.	.	.
22.65	1.3743	0.30	Q	.	.	.	.
22.83	1.3786	0.29	Q	.	.	.	.
23.00	1.3828	0.29	Q	.	.	.	.
23.17	1.3869	0.28	Q	.	.	.	.
23.35	1.3910	0.28	Q	.	.	.	.
23.52	1.3950	0.28	Q	.	.	.	.
23.70	1.3990	0.27	Q	.	.	.	.
23.88	1.4029	0.27	Q	.	.	.	.
24.05	1.4068	0.26	Q	.	.	.	.
24.23	1.4087	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1449.0
10%	147.0
20%	31.5
30%	21.0
40%	10.5
50%	10.5
60%	10.5
70%	10.5
80%	10.5
90%	10.5

Problem Descriptions:

```
==============================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =   10.500
     DEAD STORAGE(AF) =        0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =       0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =    0.00


                    INFLOW
                      |
                      |
                      |
                      V                 __effective depth
                -------------           |   (and volume)
                |           |     |     |
                | detention |     |....V.............
                |   basin   |<-->|          outflow
                |           |     |.........________
                -------------     |         |    \
                      |           | storage |     basin outlet
                      V           -----------
                   OUTFLOW


     DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
     TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES =   9
     *BASIN-DEPTH  STORAGE    OUTFLOW  **BASIN-DEPTH  STORAGE    OUTFLOW  *
     *   (FEET)  (ACRE-FEET)   (CFS)   **   (FEET)  (ACRE-FEET)   (CFS)   *
     *      0.000      0.000      0.000**      0.500      0.010      1.300*
     *      1.000      0.020      3.680**      1.500      0.030      7.370*
     *      2.000      0.040      9.510**      2.500      0.050     11.260*
     *      3.000      0.060     12.760**      3.500      0.070     14.110*
     *      4.000      0.080     15.340**
------------------------------------------------------------------------------
     BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:
      INTERVAL   DEPTH   {S-O*DT/2}   {S+O*DT/2}
       NUMBER   (FEET)   (ACRE-FEET)  (ACRE-FEET)
           1     0.00       0.00000      0.00000
           2     0.50       0.00060      0.01940
           3     1.00      -0.00661      0.04661
           4     1.50      -0.02330      0.08330
           5     2.00      -0.02877      0.10877
           6     2.50      -0.03143      0.13143
```

7	3.00	-0.03227	0.15227
8	3.50	-0.03204	0.17204
9	4.00	-0.03093	0.19093

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.075	0.000	0.26	0.10	0.13	0.002
0.250	0.000	0.26	0.10	0.26	0.002
0.425	0.000	0.27	0.10	0.26	0.002
0.600	0.000	0.27	0.10	0.27	0.002
0.775	0.000	0.27	0.10	0.27	0.002
0.950	0.000	0.27	0.10	0.27	0.002
1.125	0.000	0.27	0.11	0.27	0.002
1.300	0.000	0.27	0.11	0.27	0.002
1.475	0.000	0.28	0.11	0.28	0.002
1.650	0.000	0.28	0.11	0.28	0.002
1.825	0.000	0.28	0.11	0.28	0.002
2.000	0.000	0.28	0.11	0.28	0.002
2.175	0.000	0.29	0.11	0.28	0.002
2.350	0.000	0.29	0.11	0.29	0.002
2.525	0.000	0.29	0.11	0.29	0.002
2.700	0.000	0.29	0.11	0.29	0.002
2.875	0.000	0.30	0.11	0.29	0.002
3.050	0.000	0.30	0.11	0.30	0.002
3.225	0.000	0.30	0.12	0.30	0.002
3.400	0.000	0.30	0.12	0.30	0.002
3.575	0.000	0.31	0.12	0.30	0.002
3.750	0.000	0.31	0.12	0.31	0.002
3.925	0.000	0.31	0.12	0.31	0.002
4.100	0.000	0.31	0.12	0.31	0.002
4.275	0.000	0.32	0.12	0.32	0.002
4.450	0.000	0.32	0.12	0.32	0.002
4.625	0.000	0.32	0.12	0.32	0.002
4.800	0.000	0.33	0.13	0.32	0.003
4.975	0.000	0.33	0.13	0.33	0.003
5.150	0.000	0.33	0.13	0.33	0.003
5.325	0.000	0.34	0.13	0.33	0.003
5.500	0.000	0.34	0.13	0.34	0.003
5.675	0.000	0.34	0.13	0.34	0.003
5.850	0.000	0.35	0.13	0.34	0.003
6.025	0.000	0.35	0.13	0.35	0.003
6.200	0.000	0.35	0.14	0.35	0.003
6.375	0.000	0.36	0.14	0.36	0.003
6.550	0.000	0.36	0.14	0.36	0.003
6.725	0.000	0.37	0.14	0.36	0.003

6.900	0.000	0.37	0.14	0.37	0.003
7.075	0.000	0.38	0.14	0.37	0.003
7.250	0.000	0.38	0.15	0.38	0.003
7.425	0.000	0.39	0.15	0.38	0.003
7.600	0.000	0.39	0.15	0.39	0.003
7.775	0.000	0.40	0.15	0.39	0.003
7.950	0.000	0.40	0.15	0.40	0.003
8.125	0.000	0.41	0.16	0.40	0.003
8.300	0.000	0.41	0.16	0.41	0.003
8.475	0.000	0.42	0.16	0.41	0.003
8.650	0.000	0.42	0.16	0.42	0.003
8.825	0.000	0.43	0.17	0.43	0.003
9.000	0.000	0.43	0.17	0.43	0.003
9.175	0.000	0.44	0.17	0.44	0.003
9.350	0.000	0.45	0.17	0.45	0.003
9.525	0.000	0.46	0.18	0.45	0.004
9.700	0.000	0.46	0.18	0.46	0.004
9.875	0.000	0.47	0.18	0.47	0.004
10.050	0.000	0.48	0.18	0.48	0.004
10.225	0.000	0.49	0.19	0.49	0.004
10.400	0.000	0.50	0.19	0.49	0.004
10.575	0.000	0.51	0.20	0.50	0.004
10.750	0.000	0.52	0.20	0.51	0.004
10.925	0.000	0.53	0.20	0.52	0.004
11.100	0.000	0.54	0.21	0.54	0.004
11.275	0.000	0.56	0.21	0.55	0.004
11.450	0.000	0.56	0.22	0.56	0.004
11.625	0.000	0.58	0.22	0.57	0.004
11.800	0.000	0.59	0.23	0.59	0.005
11.975	0.000	0.61	0.24	0.60	0.005
12.150	0.000	0.67	0.26	0.64	0.005
12.325	0.000	0.81	0.31	0.74	0.006
12.500	0.000	0.82	0.32	0.81	0.006
12.675	0.000	0.85	0.33	0.84	0.007
12.850	0.000	0.87	0.33	0.86	0.007
13.025	0.000	0.90	0.35	0.88	0.007
13.200	0.000	0.92	0.35	0.91	0.007
13.375	0.000	0.96	0.37	0.94	0.007
13.550	0.000	0.99	0.38	0.97	0.008
13.725	0.000	1.04	0.40	1.01	0.008
13.900	0.000	1.06	0.41	1.05	0.008
14.075	0.000	1.13	0.43	1.09	0.009
14.250	0.000	1.17	0.45	1.15	0.009
14.425	0.000	1.25	0.48	1.21	0.010
14.600	0.000	1.30	0.50	1.27	0.010
14.775	0.000	1.41	0.53	1.37	0.011
14.950	0.000	1.48	0.54	1.47	0.011
15.125	0.000	1.66	0.59	1.60	0.012
15.300	0.000	1.78	0.62	1.78	0.012
15.475	0.000	1.91	0.65	1.93	0.013
15.650	0.000	2.07	0.69	2.12	0.014
15.825	0.000	2.97	0.93	2.79	0.019

16.000	0.000	4.10	1.17	4.16	0.023
16.175	0.000	12.55	3.75	9.84	0.075
16.350	0.000	2.41	0.78	8.69	0.016
16.525	0.000	1.92	0.65	2.34	0.013
16.700	0.000	1.57	0.56	1.80	0.011
16.875	0.000	1.35	0.50	1.45	0.010
17.050	0.000	1.21	0.46	1.26	0.009
17.225	0.000	1.09	0.42	1.15	0.008
17.400	0.000	1.01	0.39	1.05	0.008
17.575	0.000	0.94	0.36	0.98	0.007
17.750	0.000	0.89	0.34	0.92	0.007
17.925	0.000	0.84	0.32	0.86	0.006
18.100	0.000	0.80	0.31	0.82	0.006
18.275	0.000	0.60	0.23	0.70	0.005
18.450	0.000	0.57	0.22	0.59	0.004
18.625	0.000	0.55	0.21	0.56	0.004
18.800	0.000	0.52	0.20	0.54	0.004
18.975	0.000	0.50	0.19	0.52	0.004
19.150	0.000	0.49	0.19	0.50	0.004
19.325	0.000	0.47	0.18	0.48	0.004
19.500	0.000	0.45	0.17	0.46	0.003
19.675	0.000	0.44	0.17	0.45	0.003
19.850	0.000	0.43	0.16	0.43	0.003
20.025	0.000	0.41	0.16	0.42	0.003
20.200	0.000	0.40	0.15	0.41	0.003
20.375	0.000	0.39	0.15	0.40	0.003
20.550	0.000	0.38	0.15	0.39	0.003
20.725	0.000	0.37	0.14	0.38	0.003
20.900	0.000	0.36	0.14	0.37	0.003
21.075	0.000	0.36	0.14	0.36	0.003
21.250	0.000	0.35	0.13	0.35	0.003
21.425	0.000	0.34	0.13	0.34	0.003
21.600	0.000	0.33	0.13	0.34	0.003
21.775	0.000	0.33	0.13	0.33	0.003
21.950	0.000	0.32	0.12	0.32	0.002
22.125	0.000	0.32	0.12	0.32	0.002
22.300	0.000	0.31	0.12	0.31	0.002
22.475	0.000	0.30	0.12	0.31	0.002
22.650	0.000	0.30	0.12	0.30	0.002
22.825	0.000	0.29	0.11	0.30	0.002
23.000	0.000	0.29	0.11	0.29	0.002
23.175	0.000	0.28	0.11	0.29	0.002
23.350	0.000	0.28	0.11	0.28	0.002
23.525	0.000	0.28	0.11	0.28	0.002
23.700	0.000	0.27	0.10	0.27	0.002
23.875	0.000	0.27	0.10	0.27	0.002
24.050	0.000	0.26	0.10	0.27	0.002
24.225	0.000	0.00	0.00	0.14	0.000
24.400	0.000	0.00	0.00	0.00	0.000

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                    SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                         Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN 12
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =     2.55
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.030
    LOW LOSS FRACTION = 0.040
    TIME OF CONCENTRATION(MIN.) =  9.10
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      1.03
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.16

****************************************************************************
  TIME      VOLUME       Q    0.        5.0       10.0       15.0       20.0
 (HOURS)     (AF)      (CFS)
----------------------------------------------------------------------------
  0.07      0.0006      0.19  Q         .         .          .          .
  0.23      0.0030      0.19  Q         .         .          .          .
  0.38      0.0054      0.19  Q         .         .          .          .
  0.53      0.0079      0.20  Q         .         .          .          .
```

0.68	0.0103	0.20	Q	.	.	.	.
0.83	0.0128	0.20	Q	.	.	.	.
0.98	0.0153	0.20	Q	.	.	.	.
1.14	0.0178	0.20	Q	.	.	.	.
1.29	0.0203	0.20	Q	.	.	.	.
1.44	0.0229	0.20	Q	.	.	.	.
1.59	0.0254	0.20	Q	.	.	.	.
1.74	0.0280	0.21	Q	.	.	.	.
1.89	0.0306	0.21	Q	.	.	.	.
2.05	0.0332	0.21	Q	.	.	.	.
2.20	0.0358	0.21	Q	.	.	.	.
2.35	0.0385	0.21	Q	.	.	.	.
2.50	0.0411	0.21	Q	.	.	.	.
2.65	0.0438	0.21	Q	.	.	.	.
2.80	0.0465	0.22	Q	.	.	.	.
2.96	0.0492	0.22	Q	.	.	.	.
3.11	0.0519	0.22	Q	.	.	.	.
3.26	0.0547	0.22	Q	.	.	.	.
3.41	0.0575	0.22	Q	.	.	.	.
3.56	0.0603	0.22	Q	.	.	.	.
3.71	0.0631	0.23	Q	.	.	.	.
3.87	0.0659	0.23	Q	.	.	.	.
4.02	0.0688	0.23	Q	.	.	.	.
4.17	0.0717	0.23	Q	.	.	.	.
4.32	0.0746	0.23	Q	.	.	.	.
4.47	0.0775	0.23	Q	.	.	.	.
4.62	0.0805	0.24	Q	.	.	.	.
4.78	0.0834	0.24	Q	.	.	.	.
4.93	0.0864	0.24	Q	.	.	.	.
5.08	0.0895	0.24	Q	.	.	.	.
5.23	0.0925	0.25	Q	.	.	.	.
5.38	0.0956	0.25	Q	.	.	.	.
5.53	0.0987	0.25	Q	.	.	.	.
5.69	0.1019	0.25	Q	.	.	.	.
5.84	0.1050	0.25	Q	.	.	.	.
5.99	0.1082	0.26	Q	.	.	.	.
6.14	0.1115	0.26	Q	.	.	.	.
6.29	0.1147	0.26	Q	.	.	.	.
6.44	0.1180	0.26	Q	.	.	.	.
6.60	0.1213	0.27	Q	.	.	.	.
6.75	0.1247	0.27	Q	.	.	.	.
6.90	0.1281	0.27	Q	.	.	.	.
7.05	0.1315	0.28	Q	.	.	.	.
7.20	0.1350	0.28	Q	.	.	.	.
7.36	0.1385	0.28	Q	.	.	.	.
7.51	0.1420	0.28	Q	.	.	.	.
7.66	0.1456	0.29	Q	.	.	.	.
7.81	0.1492	0.29	Q	.	.	.	.
7.96	0.1529	0.29	Q	.	.	.	.
8.11	0.1566	0.30	Q	.	.	.	.
8.27	0.1603	0.30	Q	.	.	.	.
8.42	0.1641	0.30	Q	.	.	.	.

8.57	0.1679	0.31	Q	.	.	.	.
8.72	0.1718	0.31	Q	.	.	.	.
8.87	0.1758	0.32	Q	.	.	.	.
9.02	0.1797	0.32	Q	.	.	.	.
9.18	0.1838	0.33	Q	.	.	.	.
9.33	0.1879	0.33	Q	.	.	.	.
9.48	0.1920	0.33	Q	.	.	.	.
9.63	0.1963	0.34	Q	.	.	.	.
9.78	0.2005	0.34	Q	.	.	.	.
9.93	0.2049	0.35	Q	.	.	.	.
10.09	0.2093	0.36	Q	.	.	.	.
10.24	0.2138	0.36	Q	.	.	.	.
10.39	0.2183	0.37	Q	.	.	.	.
10.54	0.2230	0.37	Q	.	.	.	.
10.69	0.2277	0.38	Q	.	.	.	.
10.84	0.2325	0.38	Q	.	.	.	.
10.99	0.2373	0.39	Q	.	.	.	.
11.15	0.2423	0.40	Q	.	.	.	.
11.30	0.2474	0.41	Q	.	.	.	.
11.45	0.2525	0.42	Q	.	.	.	.
11.60	0.2578	0.43	Q	.	.	.	.
11.75	0.2632	0.43	Q	.	.	.	.
11.90	0.2687	0.45	Q	.	.	.	.
12.06	0.2743	0.45	Q	.	.	.	.
12.21	0.2809	0.59	.Q	.	.	.	.
12.36	0.2882	0.59	.Q	.	.	.	.
12.51	0.2958	0.61	.Q	.	.	.	.
12.66	0.3035	0.62	.Q	.	.	.	.
12.81	0.3114	0.64	.Q	.	.	.	.
12.97	0.3195	0.65	.Q	.	.	.	.
13.12	0.3278	0.67	.Q	.	.	.	.
13.27	0.3363	0.69	.Q	.	.	.	.
13.42	0.3451	0.71	.Q	.	.	.	.
13.57	0.3542	0.73	.Q	.	.	.	.
13.73	0.3635	0.76	.Q	.	.	.	.
13.88	0.3732	0.78	.Q	.	.	.	.
14.03	0.3832	0.82	.Q	.	.	.	.
14.18	0.3936	0.84	.Q	.	.	.	.
14.33	0.4045	0.90	.Q	.	.	.	.
14.48	0.4159	0.92	.Q	.	.	.	.
14.63	0.4279	0.99	.Q	.	.	.	.
14.79	0.4405	1.03	. Q	.	.	.	.
14.94	0.4540	1.12	. Q	.	.	.	.
15.09	0.4683	1.17	. Q	.	.	.	.
15.24	0.4839	1.31	. Q	.	.	.	.
15.39	0.5009	1.40	. Q	.	.	.	.
15.55	0.5189	1.47	. Q	.	.	.	.
15.70	0.5384	1.65	. Q	.	.	.	.
15.85	0.5637	2.38	. Q	.	.	.	.
16.00	0.5991	3.27	. Q	.	.	.	.
16.15	0.6823	10.01	.	.	Q	.	.
16.30	0.7571	1.93	. Q	.	.	.	.

16.45	0.7780	1.40	. Q	.	.	.	.
16.61	0.7945	1.24	. Q	.	.	.	.
16.76	0.8090	1.07	. Q	.	.	.	.
16.91	0.8217	0.95	.Q	.	.	.	.
17.06	0.8331	0.87	.Q	.	.	.	.
17.21	0.8436	0.80	.Q	.	.	.	.
17.36	0.8532	0.74	.Q	.	.	.	.
17.52	0.8623	0.70	.Q	.	.	.	.
17.67	0.8708	0.66	.Q	.	.	.	.
17.82	0.8789	0.63	.Q	.	.	.	.
17.97	0.8866	0.60	.Q	.	.	.	.
18.12	0.8937	0.53	.Q	.	.	.	.
18.27	0.8998	0.44	Q	.	.	.	.
18.43	0.9051	0.42	Q	.	.	.	.
18.58	0.9103	0.40	Q	.	.	.	.
18.73	0.9153	0.39	Q	.	.	.	.
18.88	0.9201	0.38	Q	.	.	.	.
19.03	0.9247	0.36	Q	.	.	.	.
19.18	0.9292	0.35	Q	.	.	.	.
19.34	0.9335	0.34	Q	.	.	.	.
19.49	0.9378	0.33	Q	.	.	.	.
19.64	0.9419	0.32	Q	.	.	.	.
19.79	0.9459	0.31	Q	.	.	.	.
19.94	0.9497	0.31	Q	.	.	.	.
20.09	0.9535	0.30	Q	.	.	.	.
20.25	0.9572	0.29	Q	.	.	.	.
20.40	0.9609	0.29	Q	.	.	.	.
20.55	0.9644	0.28	Q	.	.	.	.
20.70	0.9679	0.27	Q	.	.	.	.
20.85	0.9712	0.27	Q	.	.	.	.
21.01	0.9746	0.26	Q	.	.	.	.
21.16	0.9778	0.26	Q	.	.	.	.
21.31	0.9810	0.25	Q	.	.	.	.
21.46	0.9842	0.25	Q	.	.	.	.
21.61	0.9872	0.24	Q	.	.	.	.
21.76	0.9903	0.24	Q	.	.	.	.
21.92	0.9933	0.24	Q	.	.	.	.
22.07	0.9962	0.23	Q	.	.	.	.
22.22	0.9991	0.23	Q	.	.	.	.
22.37	1.0019	0.22	Q	.	.	.	.
22.52	1.0047	0.22	Q	.	.	.	.
22.67	1.0075	0.22	Q	.	.	.	.
22.83	1.0102	0.22	Q	.	.	.	.
22.98	1.0129	0.21	Q	.	.	.	.
23.13	1.0155	0.21	Q	.	.	.	.
23.28	1.0181	0.21	Q	.	.	.	.
23.43	1.0207	0.20	Q	.	.	.	.
23.58	1.0232	0.20	Q	.	.	.	.
23.73	1.0257	0.20	Q	.	.	.	.
23.89	1.0282	0.20	Q	.	.	.	.
24.04	1.0306	0.19	Q	.	.	.	.
24.19	1.0318	0.00	Q	.	.	.	.

--

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1446.9
10%	127.4
20%	27.3
30%	18.2
40%	9.1
50%	9.1
60%	9.1
70%	9.1
80%	9.1
90%	9.1

Problem Descriptions:

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FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 9.100
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

```
        INFLOW
          |
          |
          |
          |
          V                 __effective depth
    -------------           |   (and volume)
    |           |     |     |
    | detention |     |....V.............
    |   basin   |<-->|          outflow
    |           |     |.........________
    -------------     |         |    \
          |           | storage |     basin outlet
          V           -----------
       OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) **	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) *
0.000	0.000	0.000**	0.500	0.007	1.080*
1.000	0.015	3.060**	1.500	0.022	5.530*
2.000	0.030	6.930**	2.500	0.037	8.090*
3.000	0.044	9.110**	3.500	0.052	10.020*
4.000	0.059	10.860**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	0.00023	0.01377
3	1.00	-0.00418	0.03418
4	1.50	-0.01266	0.05666
5	2.00	-0.01343	0.07343
6	2.50	-0.01370	0.08770
7	3.00	-0.01309	0.10109
8	3.50	-0.01080	0.11480
9	4.00	-0.00906	0.12706

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.075	0.000	0.19	0.09	0.09	0.001
0.227	0.000	0.19	0.09	0.19	0.001
0.378	0.000	0.19	0.09	0.19	0.001
0.530	0.000	0.20	0.09	0.19	0.001
0.682	0.000	0.20	0.09	0.20	0.001
0.833	0.000	0.20	0.09	0.20	0.001
0.985	0.000	0.20	0.09	0.20	0.001
1.137	0.000	0.20	0.09	0.20	0.001
1.288	0.000	0.20	0.09	0.20	0.001
1.440	0.000	0.20	0.09	0.20	0.001
1.592	0.000	0.20	0.09	0.20	0.001
1.743	0.000	0.21	0.10	0.21	0.001
1.895	0.000	0.21	0.10	0.21	0.001
2.047	0.000	0.21	0.10	0.21	0.001
2.198	0.000	0.21	0.10	0.21	0.001
2.350	0.000	0.21	0.10	0.21	0.001
2.502	0.000	0.21	0.10	0.21	0.001
2.653	0.000	0.21	0.10	0.21	0.001

2.805	0.000	0.22	0.10	0.22	0.001
2.957	0.000	0.22	0.10	0.22	0.001
3.108	0.000	0.22	0.10	0.22	0.001
3.260	0.000	0.22	0.10	0.22	0.001
3.412	0.000	0.22	0.10	0.22	0.001
3.563	0.000	0.22	0.10	0.22	0.001
3.715	0.000	0.23	0.10	0.22	0.001
3.867	0.000	0.23	0.11	0.23	0.001
4.018	0.000	0.23	0.11	0.23	0.001
4.170	0.000	0.23	0.11	0.23	0.001
4.322	0.000	0.23	0.11	0.23	0.002
4.473	0.000	0.23	0.11	0.23	0.002
4.625	0.000	0.24	0.11	0.24	0.002
4.777	0.000	0.24	0.11	0.24	0.002
4.928	0.000	0.24	0.11	0.24	0.002
5.080	0.000	0.24	0.11	0.24	0.002
5.232	0.000	0.25	0.11	0.24	0.002
5.383	0.000	0.25	0.11	0.25	0.002
5.535	0.000	0.25	0.12	0.25	0.002
5.687	0.000	0.25	0.12	0.25	0.002
5.838	0.000	0.25	0.12	0.25	0.002
5.990	0.000	0.26	0.12	0.26	0.002
6.142	0.000	0.26	0.12	0.26	0.002
6.293	0.000	0.26	0.12	0.26	0.002
6.445	0.000	0.26	0.12	0.26	0.002
6.597	0.000	0.27	0.12	0.27	0.002
6.748	0.000	0.27	0.12	0.27	0.002
6.900	0.000	0.27	0.13	0.27	0.002
7.052	0.000	0.28	0.13	0.27	0.002
7.203	0.000	0.28	0.13	0.28	0.002
7.355	0.000	0.28	0.13	0.28	0.002
7.507	0.000	0.28	0.13	0.28	0.002
7.658	0.000	0.29	0.13	0.29	0.002
7.810	0.000	0.29	0.13	0.29	0.002
7.962	0.000	0.29	0.14	0.29	0.002
8.113	0.000	0.30	0.14	0.30	0.002
8.265	0.000	0.30	0.14	0.30	0.002
8.417	0.000	0.30	0.14	0.30	0.002
8.568	0.000	0.31	0.14	0.31	0.002
8.720	0.000	0.31	0.14	0.31	0.002
8.872	0.000	0.32	0.15	0.31	0.002
9.023	0.000	0.32	0.15	0.32	0.002
9.175	0.000	0.33	0.15	0.32	0.002
9.327	0.000	0.33	0.15	0.33	0.002
9.478	0.000	0.33	0.15	0.33	0.002
9.630	0.000	0.34	0.16	0.34	0.002
9.782	0.000	0.34	0.16	0.34	0.002
9.933	0.000	0.35	0.16	0.35	0.002
10.085	0.000	0.36	0.16	0.35	0.002
10.237	0.000	0.36	0.17	0.36	0.002
10.388	0.000	0.37	0.17	0.36	0.002
10.540	0.000	0.37	0.17	0.37	0.002

10.692	0.000	0.38	0.18	0.38	0.002
10.843	0.000	0.38	0.18	0.38	0.002
10.995	0.000	0.39	0.18	0.39	0.003
11.147	0.000	0.40	0.18	0.40	0.003
11.298	0.000	0.41	0.19	0.40	0.003
11.450	0.000	0.42	0.19	0.41	0.003
11.602	0.000	0.43	0.20	0.42	0.003
11.753	0.000	0.43	0.20	0.43	0.003
11.905	0.000	0.45	0.21	0.44	0.003
12.057	0.000	0.45	0.21	0.45	0.003
12.208	0.000	0.59	0.27	0.52	0.004
12.360	0.000	0.59	0.27	0.59	0.004
12.512	0.000	0.61	0.28	0.60	0.004
12.663	0.000	0.62	0.29	0.62	0.004
12.815	0.000	0.64	0.30	0.63	0.004
12.967	0.000	0.65	0.30	0.65	0.004
13.118	0.000	0.67	0.31	0.66	0.004
13.270	0.000	0.69	0.32	0.68	0.004
13.422	0.000	0.71	0.33	0.70	0.005
13.573	0.000	0.73	0.34	0.72	0.005
13.725	0.000	0.76	0.35	0.74	0.005
13.877	0.000	0.78	0.36	0.77	0.005
14.028	0.000	0.82	0.38	0.80	0.005
14.180	0.000	0.84	0.39	0.83	0.005
14.332	0.000	0.90	0.41	0.87	0.006
14.483	0.000	0.92	0.43	0.91	0.006
14.635	0.000	0.99	0.46	0.96	0.006
14.787	0.000	1.03	0.48	1.01	0.007
14.938	0.000	1.12	0.51	1.08	0.007
15.090	0.000	1.17	0.53	1.15	0.007
15.242	0.000	1.31	0.57	1.26	0.008
15.393	0.000	1.40	0.59	1.40	0.008
15.545	0.000	1.47	0.61	1.49	0.009
15.697	0.000	1.65	0.67	1.64	0.010
15.848	0.000	2.38	0.89	2.19	0.013
16.000	0.000	3.27	1.15	3.22	0.017
16.152	0.000	10.01	3.93	7.28	0.058
16.303	0.000	1.93	0.75	6.42	0.011
16.455	0.000	1.40	0.59	1.77	0.008
16.607	0.000	1.24	0.54	1.35	0.008
16.758	0.000	1.07	0.49	1.15	0.007
16.910	0.000	0.95	0.44	1.00	0.006
17.062	0.000	0.87	0.40	0.91	0.006
17.213	0.000	0.80	0.37	0.83	0.005
17.365	0.000	0.74	0.35	0.77	0.005
17.517	0.000	0.70	0.32	0.72	0.005
17.668	0.000	0.66	0.31	0.68	0.004
17.820	0.000	0.63	0.29	0.65	0.004
17.972	0.000	0.60	0.28	0.62	0.004
18.123	0.000	0.53	0.24	0.56	0.003
18.275	0.000	0.44	0.20	0.48	0.003
18.427	0.000	0.42	0.19	0.43	0.003

18.578	0.000	0.40	0.19	0.41	0.003
18.730	0.000	0.39	0.18	0.40	0.003
18.882	0.000	0.38	0.17	0.38	0.002
19.033	0.000	0.36	0.17	0.37	0.002
19.185	0.000	0.35	0.16	0.36	0.002
19.337	0.000	0.34	0.16	0.35	0.002
19.488	0.000	0.33	0.15	0.34	0.002
19.640	0.000	0.32	0.15	0.33	0.002
19.792	0.000	0.31	0.15	0.32	0.002
19.943	0.000	0.31	0.14	0.31	0.002
20.095	0.000	0.30	0.14	0.30	0.002
20.247	0.000	0.29	0.14	0.30	0.002
20.398	0.000	0.29	0.13	0.29	0.002
20.550	0.000	0.28	0.13	0.28	0.002
20.702	0.000	0.27	0.13	0.28	0.002
20.853	0.000	0.27	0.12	0.27	0.002
21.005	0.000	0.26	0.12	0.27	0.002
21.157	0.000	0.26	0.12	0.26	0.002
21.308	0.000	0.25	0.12	0.26	0.002
21.460	0.000	0.25	0.11	0.25	0.002
21.612	0.000	0.24	0.11	0.25	0.002
21.763	0.000	0.24	0.11	0.24	0.002
21.915	0.000	0.24	0.11	0.24	0.002
22.067	0.000	0.23	0.11	0.23	0.002
22.218	0.000	0.23	0.11	0.23	0.001
22.370	0.000	0.22	0.10	0.23	0.001
22.522	0.000	0.22	0.10	0.22	0.001
22.673	0.000	0.22	0.10	0.22	0.001
22.825	0.000	0.22	0.10	0.22	0.001
22.977	0.000	0.21	0.10	0.21	0.001
23.128	0.000	0.21	0.10	0.21	0.001
23.280	0.000	0.21	0.10	0.21	0.001
23.432	0.000	0.20	0.09	0.21	0.001
23.583	0.000	0.20	0.09	0.20	0.001
23.735	0.000	0.20	0.09	0.20	0.001
23.887	0.000	0.20	0.09	0.20	0.001
24.038	0.000	0.19	0.09	0.20	0.001
24.190	0.000	0.00	0.00	0.10	0.000
24.342	0.000	0.00	0.00	0.00	0.000

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****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                              Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN 13
----------------------------------------------------------------------------


     RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
     TOTAL CATCHMENT AREA(ACRES) =     2.57
     SOIL-LOSS RATE, Fm,(INCH/HR) =  0.030
     LOW LOSS FRACTION = 0.040
     TIME OF CONCENTRATION(MIN.) =  8.70
     SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
     ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
     RETURN FREQUENCY(YEARS) = 100
        5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
       30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
        1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
        3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
        6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
       24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

     TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      1.04
     TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.17

****************************************************************************
  TIME      VOLUME        Q    0.         5.0       10.0       15.0       20.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.05      0.0000      0.00  Q          .          .          .          .
  0.20      0.0012      0.19  Q          .          .          .          .
  0.34      0.0035      0.20  Q          .          .          .          .
  0.49      0.0059      0.20  Q          .          .          .          .
```

0.63	0.0082	0.20	Q	.	.	.	.
0.78	0.0106	0.20	Q	.	.	.	.
0.92	0.0130	0.20	Q	.	.	.	.
1.07	0.0154	0.20	Q	.	.	.	.
1.21	0.0178	0.20	Q	.	.	.	.
1.36	0.0203	0.20	Q	.	.	.	.
1.50	0.0227	0.21	Q	.	.	.	.
1.65	0.0252	0.21	Q	.	.	.	.
1.79	0.0277	0.21	Q	.	.	.	.
1.94	0.0302	0.21	Q	.	.	.	.
2.08	0.0327	0.21	Q	.	.	.	.
2.23	0.0352	0.21	Q	.	.	.	.
2.37	0.0378	0.21	Q	.	.	.	.
2.52	0.0403	0.21	Q	.	.	.	.
2.66	0.0429	0.22	Q	.	.	.	.
2.81	0.0455	0.22	Q	.	.	.	.
2.95	0.0481	0.22	Q	.	.	.	.
3.10	0.0507	0.22	Q	.	.	.	.
3.24	0.0534	0.22	Q	.	.	.	.
3.39	0.0561	0.22	Q	.	.	.	.
3.53	0.0588	0.23	Q	.	.	.	.
3.68	0.0615	0.23	Q	.	.	.	.
3.82	0.0642	0.23	Q	.	.	.	.
3.97	0.0670	0.23	Q	.	.	.	.
4.11	0.0697	0.23	Q	.	.	.	.
4.26	0.0725	0.23	Q	.	.	.	.
4.40	0.0753	0.24	Q	.	.	.	.
4.55	0.0782	0.24	Q	.	.	.	.
4.69	0.0810	0.24	Q	.	.	.	.
4.84	0.0839	0.24	Q	.	.	.	.
4.98	0.0868	0.24	Q	.	.	.	.
5.12	0.0898	0.25	Q	.	.	.	.
5.27	0.0927	0.25	Q	.	.	.	.
5.42	0.0957	0.25	Q	.	.	.	.
5.56	0.0987	0.25	Q	.	.	.	.
5.71	0.1017	0.25	Q	.	.	.	.
5.85	0.1048	0.26	Q	.	.	.	.
6.00	0.1079	0.26	Q	.	.	.	.
6.14	0.1110	0.26	Q	.	.	.	.
6.29	0.1141	0.26	Q	.	.	.	.
6.43	0.1173	0.27	Q	.	.	.	.
6.57	0.1205	0.27	Q	.	.	.	.
6.72	0.1237	0.27	Q	.	.	.	.
6.87	0.1270	0.27	Q	.	.	.	.
7.01	0.1303	0.28	Q	.	.	.	.
7.16	0.1336	0.28	Q	.	.	.	.
7.30	0.1369	0.28	Q	.	.	.	.
7.45	0.1403	0.29	Q	.	.	.	.
7.59	0.1438	0.29	Q	.	.	.	.
7.74	0.1472	0.29	Q	.	.	.	.
7.88	0.1507	0.29	Q	.	.	.	.
8.02	0.1543	0.30	Q	.	.	.	.

8.17	0.1579	0.30	Q	.	.	.	.
8.32	0.1615	0.30	Q	.	.	.	.
8.46	0.1652	0.31	Q	.	.	.	.
8.60	0.1689	0.31	Q	.	.	.	.
8.75	0.1726	0.31	Q	.	.	.	.
8.90	0.1764	0.32	Q	.	.	.	.
9.04	0.1803	0.32	Q	.	.	.	.
9.19	0.1842	0.33	Q	.	.	.	.
9.33	0.1882	0.33	Q	.	.	.	.
9.48	0.1922	0.34	Q	.	.	.	.
9.62	0.1962	0.34	Q	.	.	.	.
9.77	0.2003	0.35	Q	.	.	.	.
9.91	0.2045	0.35	Q	.	.	.	.
10.05	0.2088	0.36	Q	.	.	.	.
10.20	0.2131	0.36	Q	.	.	.	.
10.35	0.2174	0.37	Q	.	.	.	.
10.49	0.2219	0.37	Q	.	.	.	.
10.64	0.2264	0.38	Q	.	.	.	.
10.78	0.2310	0.39	Q	.	.	.	.
10.93	0.2356	0.39	Q	.	.	.	.
11.07	0.2404	0.40	Q	.	.	.	.
11.22	0.2452	0.41	Q	.	.	.	.
11.36	0.2502	0.41	Q	.	.	.	.
11.51	0.2552	0.42	Q	.	.	.	.
11.65	0.2603	0.43	Q	.	.	.	.
11.80	0.2655	0.44	Q	.	.	.	.
11.94	0.2709	0.45	Q	.	.	.	.
12.09	0.2766	0.51	.Q	.	.	.	.
12.23	0.2832	0.59	.Q	.	.	.	.
12.38	0.2903	0.60	.Q	.	.	.	.
12.52	0.2976	0.61	.Q	.	.	.	.
12.66	0.3050	0.63	.Q	.	.	.	.
12.81	0.3127	0.64	.Q	.	.	.	.
12.95	0.3205	0.66	.Q	.	.	.	.
13.10	0.3285	0.67	.Q	.	.	.	.
13.24	0.3367	0.70	.Q	.	.	.	.
13.39	0.3451	0.71	.Q	.	.	.	.
13.53	0.3537	0.74	.Q	.	.	.	.
13.68	0.3627	0.75	.Q	.	.	.	.
13.82	0.3719	0.79	.Q	.	.	.	.
13.97	0.3814	0.80	.Q	.	.	.	.
14.12	0.3913	0.85	.Q	.	.	.	.
14.26	0.4016	0.87	.Q	.	.	.	.
14.40	0.4124	0.92	.Q	.	.	.	.
14.55	0.4236	0.95	.Q	.	.	.	.
14.70	0.4354	1.02	. Q	.	.	.	.
14.84	0.4479	1.06	. Q	.	.	.	.
14.98	0.4612	1.15	. Q	.	.	.	.
15.13	0.4754	1.21	. Q	.	.	.	.
15.27	0.4907	1.36	. Q	.	.	.	.
15.42	0.5075	1.45	. Q	.	.	.	.
15.57	0.5253	1.52	. Q	.	.	.	.

15.71	0.5446	1.71	. Q . . . .
15.85	0.5696	2.46	. Q . . . .
16.00	0.6047	3.39	. Q . . . .
16.15	0.6870	10.36	. . Q . .
16.29	0.7611	2.00	. Q . . . .
16.43	0.7814	1.39	. Q . . . .
16.58	0.7974	1.28	. Q . . . .
16.73	0.8116	1.10	. Q . . . .
16.87	0.8242	0.99	.Q . . . .
17.02	0.8354	0.90	.Q . . . .
17.16	0.8458	0.82	.Q . . . .
17.31	0.8553	0.77	.Q . . . .
17.45	0.8642	0.72	.Q . . . .
17.59	0.8727	0.68	.Q . . . .
17.74	0.8807	0.65	.Q . . . .
17.89	0.8883	0.62	.Q . . . .
18.03	0.8956	0.60	.Q . . . .
18.17	0.9019	0.46	Q . . . .
18.32	0.9072	0.44	Q . . . .
18.47	0.9123	0.42	Q . . . .
18.61	0.9173	0.40	Q . . . .
18.76	0.9220	0.39	Q . . . .
18.90	0.9266	0.38	Q . . . .
19.05	0.9311	0.36	Q . . . .
19.19	0.9354	0.35	Q . . . .
19.33	0.9395	0.34	Q . . . .
19.48	0.9436	0.33	Q . . . .
19.62	0.9476	0.33	Q . . . .
19.77	0.9514	0.32	Q . . . .
19.92	0.9552	0.31	Q . . . .
20.06	0.9588	0.30	Q . . . .
20.20	0.9624	0.30	Q . . . .
20.35	0.9659	0.29	Q . . . .
20.49	0.9694	0.28	Q . . . .
20.64	0.9727	0.28	Q . . . .
20.78	0.9760	0.27	Q . . . .
20.93	0.9792	0.27	Q . . . .
21.08	0.9824	0.26	Q . . . .
21.22	0.9855	0.26	Q . . . .
21.36	0.9886	0.25	Q . . . .
21.51	0.9916	0.25	Q . . . .
21.66	0.9945	0.24	Q . . . .
21.80	0.9974	0.24	Q . . . .
21.94	1.0003	0.24	Q . . . .
22.09	1.0031	0.23	Q . . . .
22.23	1.0059	0.23	Q . . . .
22.38	1.0086	0.23	Q . . . .
22.52	1.0113	0.22	Q . . . .
22.67	1.0140	0.22	Q . . . .
22.82	1.0166	0.22	Q . . . .
22.96	1.0192	0.21	Q . . . .
23.11	1.0217	0.21	Q . . . .

```
 23.25      1.0242      0.21  Q          .          .          .          .
 23.39      1.0267      0.21  Q          .          .          .          .
 23.54      1.0292      0.20  Q          .          .          .          .
 23.68      1.0316      0.20  Q          .          .          .          .
 23.83      1.0340      0.20  Q          .          .          .          .
 23.98      1.0363      0.20  Q          .          .          .          .
 24.12      1.0387      0.19  Q          .          .          .          .
 24.26      1.0398      0.00  Q          .          .          .          .
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-----------------------------------------------------------------------------
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    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                    Duration
        Peak Flow Rate                         (minutes)
    =======================                    =========
              0%                                1444.2
             10%                                 121.8
             20%                                  26.1
             30%                                  17.4
             40%                                   8.7
             50%                                   8.7
             60%                                   8.7
             70%                                   8.7
             80%                                   8.7
             90%                                   8.7

  Problem Descriptions:
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=============================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =     8.700
     DEAD STORAGE(AF) =        0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =        0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =     0.00


                    INFLOW
                      |
                      |
                      |
                      V                  __effective depth
                -------------            |   (and volume)
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```
|            |     |     |
| detention  |     |....V.............
|   basin    |<-->|          outflow
|            |     |.........__________
-------------      |         |    \
      |            | storage |      basin outlet
      V            -----------
   OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) **	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) *
0.000	0.000	0.000**	0.500	0.008	1.080*
1.000	0.016	3.060**	1.500	0.024	5.530*
2.000	0.031	6.930**	2.500	0.039	8.090*
3.000	0.047	9.110**	3.500	0.055	10.020*
4.000	0.063	10.860**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	0.00153	0.01447
3	1.00	-0.00233	0.03433
4	1.50	-0.00913	0.05713
5	2.00	-0.01052	0.07252
6	2.50	-0.00947	0.08747
7	3.00	-0.00758	0.10158
8	3.50	-0.00504	0.11504
9	4.00	-0.00207	0.12807

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.050	0.000	0.00	0.00	0.00	0.000
0.195	0.000	0.19	0.08	0.09	0.001
0.340	0.000	0.20	0.09	0.18	0.001
0.485	0.000	0.20	0.09	0.19	0.001
0.630	0.000	0.20	0.09	0.20	0.001
0.775	0.000	0.20	0.09	0.20	0.001
0.920	0.000	0.20	0.09	0.20	0.001
1.065	0.000	0.20	0.09	0.20	0.001
1.210	0.000	0.20	0.09	0.20	0.001
1.355	0.000	0.20	0.09	0.20	0.002

1.500	0.000	0.21	0.09	0.20	0.002
1.645	0.000	0.21	0.10	0.21	0.002
1.790	0.000	0.21	0.10	0.21	0.002
1.935	0.000	0.21	0.10	0.21	0.002
2.080	0.000	0.21	0.10	0.21	0.002
2.225	0.000	0.21	0.10	0.21	0.002
2.370	0.000	0.21	0.10	0.21	0.002
2.515	0.000	0.21	0.10	0.21	0.002
2.660	0.000	0.22	0.10	0.22	0.002
2.805	0.000	0.22	0.10	0.22	0.002
2.950	0.000	0.22	0.10	0.22	0.002
3.095	0.000	0.22	0.10	0.22	0.002
3.240	0.000	0.22	0.10	0.22	0.002
3.385	0.000	0.22	0.10	0.22	0.002
3.530	0.000	0.23	0.10	0.22	0.002
3.675	0.000	0.23	0.11	0.23	0.002
3.820	0.000	0.23	0.11	0.23	0.002
3.965	0.000	0.23	0.11	0.23	0.002
4.110	0.000	0.23	0.11	0.23	0.002
4.255	0.000	0.23	0.11	0.23	0.002
4.400	0.000	0.24	0.11	0.23	0.002
4.545	0.000	0.24	0.11	0.24	0.002
4.690	0.000	0.24	0.11	0.24	0.002
4.835	0.000	0.24	0.11	0.24	0.002
4.980	0.000	0.24	0.11	0.24	0.002
5.125	0.000	0.25	0.11	0.24	0.002
5.270	0.000	0.25	0.11	0.25	0.002
5.415	0.000	0.25	0.12	0.25	0.002
5.560	0.000	0.25	0.12	0.25	0.002
5.705	0.000	0.25	0.12	0.25	0.002
5.850	0.000	0.26	0.12	0.25	0.002
5.995	0.000	0.26	0.12	0.26	0.002
6.140	0.000	0.26	0.12	0.26	0.002
6.285	0.000	0.26	0.12	0.26	0.002
6.430	0.000	0.27	0.12	0.26	0.002
6.575	0.000	0.27	0.12	0.27	0.002
6.720	0.000	0.27	0.13	0.27	0.002
6.865	0.000	0.27	0.13	0.27	0.002
7.010	0.000	0.28	0.13	0.27	0.002
7.155	0.000	0.28	0.13	0.28	0.002
7.300	0.000	0.28	0.13	0.28	0.002
7.445	0.000	0.29	0.13	0.28	0.002
7.590	0.000	0.29	0.13	0.29	0.002
7.735	0.000	0.29	0.13	0.29	0.002
7.880	0.000	0.29	0.14	0.29	0.002
8.025	0.000	0.30	0.14	0.30	0.002
8.170	0.000	0.30	0.14	0.30	0.002
8.315	0.000	0.30	0.14	0.30	0.002
8.460	0.000	0.31	0.14	0.31	0.002
8.605	0.000	0.31	0.14	0.31	0.002
8.750	0.000	0.31	0.15	0.31	0.002
8.895	0.000	0.32	0.15	0.32	0.002

9.040	0.000	0.32	0.15	0.32	0.002
9.185	0.000	0.33	0.15	0.33	0.002
9.330	0.000	0.33	0.15	0.33	0.002
9.475	0.000	0.34	0.16	0.33	0.002
9.620	0.000	0.34	0.16	0.34	0.003
9.765	0.000	0.35	0.16	0.34	0.003
9.910	0.000	0.35	0.16	0.35	0.003
10.055	0.000	0.36	0.17	0.35	0.003
10.200	0.000	0.36	0.17	0.36	0.003
10.345	0.000	0.37	0.17	0.36	0.003
10.490	0.000	0.37	0.17	0.37	0.003
10.635	0.000	0.38	0.18	0.38	0.003
10.780	0.000	0.39	0.18	0.38	0.003
10.925	0.000	0.39	0.18	0.39	0.003
11.070	0.000	0.40	0.18	0.40	0.003
11.215	0.000	0.41	0.19	0.40	0.003
11.360	0.000	0.41	0.19	0.41	0.003
11.505	0.000	0.42	0.20	0.42	0.003
11.650	0.000	0.43	0.20	0.43	0.003
11.795	0.000	0.44	0.20	0.44	0.003
11.940	0.000	0.45	0.21	0.44	0.003
12.085	0.000	0.51	0.23	0.47	0.004
12.230	0.000	0.59	0.27	0.54	0.004
12.375	0.000	0.60	0.28	0.59	0.004
12.520	0.000	0.61	0.28	0.61	0.005
12.665	0.000	0.63	0.29	0.62	0.005
12.810	0.000	0.64	0.30	0.63	0.005
12.955	0.000	0.66	0.31	0.65	0.005
13.100	0.000	0.67	0.31	0.66	0.005
13.245	0.000	0.70	0.32	0.68	0.005
13.390	0.000	0.71	0.33	0.70	0.005
13.535	0.000	0.74	0.34	0.72	0.005
13.680	0.000	0.75	0.35	0.74	0.006
13.825	0.000	0.79	0.36	0.77	0.006
13.970	0.000	0.80	0.37	0.79	0.006
14.115	0.000	0.85	0.39	0.82	0.006
14.260	0.000	0.87	0.40	0.86	0.006
14.405	0.000	0.92	0.43	0.89	0.007
14.550	0.000	0.95	0.44	0.93	0.007
14.695	0.000	1.02	0.47	0.98	0.008
14.840	0.000	1.06	0.49	1.03	0.008
14.985	0.000	1.15	0.52	1.11	0.008
15.130	0.000	1.21	0.54	1.19	0.009
15.275	0.000	1.36	0.58	1.30	0.009
15.420	0.000	1.45	0.60	1.42	0.010
15.565	0.000	1.52	0.61	1.49	0.010
15.710	0.000	1.71	0.67	1.64	0.011
15.855	0.000	2.46	0.88	2.17	0.014
16.000	0.000	3.39	1.14	3.17	0.018
16.145	0.000	10.36	3.85	7.17	0.061
16.290	0.000	2.00	0.74	6.32	0.012
16.435	0.000	1.39	0.56	1.66	0.009

16.580	0.000	1.28	0.55	1.29	0.009
16.725	0.000	1.10	0.50	1.17	0.008
16.870	0.000	0.99	0.46	1.03	0.007
17.015	0.000	0.90	0.42	0.95	0.007
17.160	0.000	0.82	0.39	0.87	0.006
17.305	0.000	0.77	0.36	0.80	0.006
17.450	0.000	0.72	0.34	0.75	0.005
17.595	0.000	0.68	0.32	0.71	0.005
17.740	0.000	0.65	0.30	0.67	0.005
17.885	0.000	0.62	0.29	0.64	0.005
18.030	0.000	0.60	0.28	0.61	0.004
18.175	0.000	0.46	0.22	0.53	0.003
18.320	0.000	0.44	0.20	0.46	0.003
18.465	0.000	0.42	0.20	0.43	0.003
18.610	0.000	0.40	0.19	0.41	0.003
18.755	0.000	0.39	0.18	0.40	0.003
18.900	0.000	0.38	0.18	0.38	0.003
19.045	0.000	0.36	0.17	0.37	0.003
19.190	0.000	0.35	0.16	0.36	0.003
19.335	0.000	0.34	0.16	0.35	0.003
19.480	0.000	0.33	0.16	0.34	0.002
19.625	0.000	0.33	0.15	0.33	0.002
19.770	0.000	0.32	0.15	0.32	0.002
19.915	0.000	0.31	0.14	0.31	0.002
20.060	0.000	0.30	0.14	0.31	0.002
20.205	0.000	0.30	0.14	0.30	0.002
20.350	0.000	0.29	0.13	0.29	0.002
20.495	0.000	0.28	0.13	0.29	0.002
20.640	0.000	0.28	0.13	0.28	0.002
20.785	0.000	0.27	0.13	0.28	0.002
20.930	0.000	0.27	0.12	0.27	0.002
21.075	0.000	0.26	0.12	0.27	0.002
21.220	0.000	0.26	0.12	0.26	0.002
21.365	0.000	0.25	0.12	0.26	0.002
21.510	0.000	0.25	0.12	0.25	0.002
21.655	0.000	0.24	0.11	0.25	0.002
21.800	0.000	0.24	0.11	0.24	0.002
21.945	0.000	0.24	0.11	0.24	0.002
22.090	0.000	0.23	0.11	0.24	0.002
22.235	0.000	0.23	0.11	0.23	0.002
22.380	0.000	0.23	0.10	0.23	0.002
22.525	0.000	0.22	0.10	0.23	0.002
22.670	0.000	0.22	0.10	0.22	0.002
22.815	0.000	0.22	0.10	0.22	0.002
22.960	0.000	0.21	0.10	0.22	0.002
23.105	0.000	0.21	0.10	0.21	0.002
23.250	0.000	0.21	0.10	0.21	0.002
23.395	0.000	0.21	0.10	0.21	0.002
23.540	0.000	0.20	0.09	0.20	0.002
23.685	0.000	0.20	0.09	0.20	0.001
23.830	0.000	0.20	0.09	0.20	0.001
23.975	0.000	0.20	0.09	0.20	0.001

24.120	0.000	0.19	0.09	0.20	0.001
24.265	0.000	0.00	0.01	0.11	0.000
24.410	0.000	0.00	0.00	0.01	0.000

```
****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                              Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN 15
----------------------------------------------------------------------------


     RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
     TOTAL CATCHMENT AREA(ACRES) =    3.92
     SOIL-LOSS RATE, Fm,(INCH/HR) =  0.030
     LOW LOSS FRACTION = 0.040
     TIME OF CONCENTRATION(MIN.) =  9.20
     SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
     ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
     RETURN FREQUENCY(YEARS) = 100
        5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
       30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
        1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
        3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
        6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
       24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

     TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.59
     TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.25

****************************************************************************
  TIME      VOLUME        Q     0.        5.0       10.0      15.0      20.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.05      0.0000      0.00  Q          .         .         .         .
  0.21      0.0019      0.30  Q          .         .         .         .
  0.36      0.0057      0.30  Q          .         .         .         .
  0.51      0.0094      0.30  Q          .         .         .         .
```

0.67	0.0133	0.30	Q	.	.	.	.
0.82	0.0171	0.30	Q	.	.	.	.
0.97	0.0210	0.31	Q	.	.	.	.
1.13	0.0249	0.31	Q	.	.	.	.
1.28	0.0288	0.31	Q	.	.	.	.
1.43	0.0327	0.31	Q	.	.	.	.
1.59	0.0367	0.31	Q	.	.	.	.
1.74	0.0407	0.32	Q	.	.	.	.
1.89	0.0447	0.32	Q	.	.	.	.
2.05	0.0488	0.32	Q	.	.	.	.
2.20	0.0528	0.32	Q	.	.	.	.
2.35	0.0569	0.33	Q	.	.	.	.
2.51	0.0611	0.33	Q	.	.	.	.
2.66	0.0652	0.33	Q	.	.	.	.
2.81	0.0694	0.33	Q	.	.	.	.
2.97	0.0736	0.33	Q	.	.	.	.
3.12	0.0779	0.34	Q	.	.	.	.
3.27	0.0822	0.34	Q	.	.	.	.
3.43	0.0865	0.34	Q	.	.	.	.
3.58	0.0908	0.35	Q	.	.	.	.
3.73	0.0952	0.35	Q	.	.	.	.
3.89	0.0996	0.35	Q	.	.	.	.
4.04	0.1041	0.35	Q	.	.	.	.
4.19	0.1086	0.36	Q	.	.	.	.
4.35	0.1131	0.36	Q	.	.	.	.
4.50	0.1177	0.36	Q	.	.	.	.
4.65	0.1223	0.36	Q	.	.	.	.
4.81	0.1269	0.37	Q	.	.	.	.
4.96	0.1316	0.37	Q	.	.	.	.
5.11	0.1363	0.37	Q	.	.	.	.
5.27	0.1411	0.38	Q	.	.	.	.
5.42	0.1459	0.38	Q	.	.	.	.
5.57	0.1507	0.38	Q	.	.	.	.
5.73	0.1556	0.39	Q	.	.	.	.
5.88	0.1605	0.39	Q	.	.	.	.
6.03	0.1655	0.40	Q	.	.	.	.
6.19	0.1706	0.40	Q	.	.	.	.
6.34	0.1756	0.40	Q	.	.	.	.
6.49	0.1808	0.41	Q	.	.	.	.
6.65	0.1859	0.41	Q	.	.	.	.
6.80	0.1912	0.41	Q	.	.	.	.
6.95	0.1965	0.42	Q	.	.	.	.
7.11	0.2018	0.42	Q	.	.	.	.
7.26	0.2072	0.43	Q	.	.	.	.
7.41	0.2127	0.43	Q	.	.	.	.
7.57	0.2182	0.44	Q	.	.	.	.
7.72	0.2238	0.44	Q	.	.	.	.
7.87	0.2294	0.45	Q	.	.	.	.
8.03	0.2351	0.45	Q	.	.	.	.
8.18	0.2409	0.46	Q	.	.	.	.
8.33	0.2468	0.46	Q	.	.	.	.
8.49	0.2527	0.47	Q	.	.	.	.

8.64	0.2587	0.48	Q . . . .
8.79	0.2648	0.48	Q . . . .
8.95	0.2709	0.49	Q . . . .
9.10	0.2772	0.50	Q . . . .
9.25	0.2835	0.50	.Q . . . .
9.41	0.2899	0.51	.Q . . . .
9.56	0.2964	0.52	.Q . . . .
9.71	0.3030	0.53	.Q . . . .
9.87	0.3097	0.53	.Q . . . .
10.02	0.3165	0.54	.Q . . . .
10.17	0.3234	0.55	.Q . . . .
10.33	0.3305	0.56	.Q . . . .
10.48	0.3376	0.57	.Q . . . .
10.63	0.3449	0.58	.Q . . . .
10.79	0.3523	0.59	.Q . . . .
10.94	0.3598	0.60	.Q . . . .
11.09	0.3675	0.61	.Q . . . .
11.25	0.3753	0.63	.Q . . . .
11.40	0.3833	0.63	.Q . . . .
11.55	0.3914	0.65	.Q . . . .
11.71	0.3998	0.66	.Q . . . .
11.86	0.4083	0.68	.Q . . . .
12.01	0.4169	0.69	.Q . . . .
12.17	0.4270	0.89	.Q . . . .
12.32	0.4384	0.91	.Q . . . .
12.47	0.4501	0.93	.Q . . . .
12.63	0.4620	0.95	.Q . . . .
12.78	0.4742	0.98	.Q . . . .
12.93	0.4867	1.00	.Q . . . .
13.09	0.4995	1.03	. Q . . . .
13.24	0.5127	1.05	. Q . . . .
13.39	0.5263	1.09	. Q . . . .
13.55	0.5403	1.11	. Q . . . .
13.70	0.5547	1.16	. Q . . . .
13.85	0.5696	1.19	. Q . . . .
14.01	0.5851	1.25	. Q . . . .
14.16	0.6012	1.29	. Q . . . .
14.31	0.6180	1.37	. Q . . . .
14.47	0.6356	1.41	. Q . . . .
14.62	0.6541	1.51	. Q . . . .
14.77	0.6737	1.57	. Q . . . .
14.93	0.6944	1.71	. Q . . . .
15.08	0.7166	1.79	. Q . . . .
15.23	0.7407	2.01	. Q . . . .
15.39	0.7670	2.14	. Q . . . .
15.54	0.7948	2.24	. Q . . . .
15.69	0.8249	2.52	. Q . . . .
15.85	0.8639	3.63	. Q . . . .
16.00	0.9186	5.00	. Q. . . .
16.15	1.0471	15.29	. . . Q .
16.31	1.1626	2.94	. Q . . . .
16.46	1.1949	2.16	. Q . . . .

16.61	1.2206	1.89	. Q	.	.	.	.
16.77	1.2430	1.64	. Q	.	.	.	.
16.92	1.2626	1.46	. Q	.	.	.	.
17.07	1.2803	1.33	. Q	.	.	.	.
17.23	1.2964	1.22	. Q	.	.	.	.
17.38	1.3113	1.14	. Q	.	.	.	.
17.53	1.3253	1.07	. Q	.	.	.	.
17.69	1.3385	1.01	. Q	.	.	.	.
17.84	1.3510	0.96	.Q	.	.	.	.
17.99	1.3630	0.92	.Q	.	.	.	.
18.15	1.3734	0.73	.Q	.	.	.	.
18.30	1.3823	0.67	.Q	.	.	.	.
18.45	1.3906	0.64	.Q	.	.	.	.
18.61	1.3986	0.62	.Q	.	.	.	.
18.76	1.4062	0.59	.Q	.	.	.	.
18.91	1.4136	0.57	.Q	.	.	.	.
19.07	1.4208	0.55	.Q	.	.	.	.
19.22	1.4277	0.54	.Q	.	.	.	.
19.37	1.4344	0.52	.Q	.	.	.	.
19.53	1.4409	0.51	.Q	.	.	.	.
19.68	1.4472	0.49	Q	.	.	.	.
19.83	1.4534	0.48	Q	.	.	.	.
19.99	1.4594	0.47	Q	.	.	.	.
20.14	1.4652	0.46	Q	.	.	.	.
20.29	1.4710	0.45	Q	.	.	.	.
20.45	1.4765	0.44	Q	.	.	.	.
20.60	1.4820	0.43	Q	.	.	.	.
20.75	1.4874	0.42	Q	.	.	.	.
20.91	1.4926	0.41	Q	.	.	.	.
21.06	1.4977	0.40	Q	.	.	.	.
21.21	1.5027	0.39	Q	.	.	.	.
21.37	1.5077	0.39	Q	.	.	.	.
21.52	1.5125	0.38	Q	.	.	.	.
21.67	1.5173	0.37	Q	.	.	.	.
21.83	1.5220	0.37	Q	.	.	.	.
21.98	1.5266	0.36	Q	.	.	.	.
22.13	1.5311	0.35	Q	.	.	.	.
22.29	1.5355	0.35	Q	.	.	.	.
22.44	1.5399	0.34	Q	.	.	.	.
22.59	1.5442	0.34	Q	.	.	.	.
22.75	1.5485	0.33	Q	.	.	.	.
22.90	1.5527	0.33	Q	.	.	.	.
23.05	1.5568	0.32	Q	.	.	.	.
23.21	1.5609	0.32	Q	.	.	.	.
23.36	1.5649	0.32	Q	.	.	.	.
23.51	1.5689	0.31	Q	.	.	.	.
23.67	1.5728	0.31	Q	.	.	.	.
23.82	1.5767	0.30	Q	.	.	.	.
23.97	1.5805	0.30	Q	.	.	.	.
24.13	1.5843	0.30	Q	.	.	.	.
24.28	1.5861	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1444.4
10%	128.8
20%	27.6
30%	18.4
40%	9.2
50%	9.2
60%	9.2
70%	9.2
80%	9.2
90%	9.2

Problem Descriptions:

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 9.200
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

```
          INFLOW
            |
            |
            |
            V                 __effective depth
      -------------           |   (and volume)
      |           |     |     |
      | detention |     |....V.............
      |   basin   |<-->|          outflow
      |           |     |.........________
      -------------     |         |    \
            |           | storage |     basin outlet
            V           -----------
         OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) **	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) *
0.000	0.000	0.000**	0.500	0.010	1.520*
1.000	0.019	4.290**	1.500	0.029	7.880*
2.000	0.038	12.280**	2.500	0.048	14.760*
3.000	0.058	16.880**	3.500	0.067	18.760*
4.000	0.077	20.470**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	0.00037	0.01963
3	1.00	-0.00818	0.04618
4	1.50	-0.02093	0.07893
5	2.00	-0.03981	0.11581
6	2.50	-0.04552	0.14152
7	3.00	-0.04895	0.16495
8	3.50	-0.05187	0.18587
9	4.00	-0.05270	0.20670

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.053	0.000	0.00	0.00	0.00	0.000
0.207	0.000	0.30	0.10	0.15	0.002
0.360	0.000	0.30	0.10	0.29	0.002
0.513	0.000	0.30	0.10	0.30	0.002
0.667	0.000	0.30	0.10	0.30	0.002
0.820	0.000	0.30	0.10	0.30	0.002
0.973	0.000	0.31	0.10	0.31	0.002
1.127	0.000	0.31	0.10	0.31	0.002
1.280	0.000	0.31	0.10	0.31	0.002
1.433	0.000	0.31	0.10	0.31	0.002
1.587	0.000	0.31	0.10	0.31	0.002
1.740	0.000	0.32	0.10	0.32	0.002
1.893	0.000	0.32	0.10	0.32	0.002
2.047	0.000	0.32	0.11	0.32	0.002
2.200	0.000	0.32	0.11	0.32	0.002
2.353	0.000	0.33	0.11	0.32	0.002
2.507	0.000	0.33	0.11	0.33	0.002
2.660	0.000	0.33	0.11	0.33	0.002
2.813	0.000	0.33	0.11	0.33	0.002

2.967	0.000	0.33	0.11	0.33	0.002
3.120	0.000	0.34	0.11	0.34	0.002
3.273	0.000	0.34	0.11	0.34	0.002
3.427	0.000	0.34	0.11	0.34	0.002
3.580	0.000	0.35	0.11	0.34	0.002
3.733	0.000	0.35	0.11	0.35	0.002
3.887	0.000	0.35	0.12	0.35	0.002
4.040	0.000	0.35	0.12	0.35	0.002
4.193	0.000	0.36	0.12	0.35	0.002
4.347	0.000	0.36	0.12	0.36	0.002
4.500	0.000	0.36	0.12	0.36	0.002
4.653	0.000	0.36	0.12	0.36	0.002
4.807	0.000	0.37	0.12	0.37	0.002
4.960	0.000	0.37	0.12	0.37	0.002
5.113	0.000	0.37	0.12	0.37	0.002
5.267	0.000	0.38	0.12	0.38	0.002
5.420	0.000	0.38	0.13	0.38	0.003
5.573	0.000	0.38	0.13	0.38	0.003
5.727	0.000	0.39	0.13	0.39	0.003
5.880	0.000	0.39	0.13	0.39	0.003
6.033	0.000	0.40	0.13	0.39	0.003
6.187	0.000	0.40	0.13	0.40	0.003
6.340	0.000	0.40	0.13	0.40	0.003
6.493	0.000	0.41	0.13	0.40	0.003
6.647	0.000	0.41	0.14	0.41	0.003
6.800	0.000	0.41	0.14	0.41	0.003
6.953	0.000	0.42	0.14	0.42	0.003
7.107	0.000	0.42	0.14	0.42	0.003
7.260	0.000	0.43	0.14	0.43	0.003
7.413	0.000	0.43	0.14	0.43	0.003
7.567	0.000	0.44	0.14	0.44	0.003
7.720	0.000	0.44	0.15	0.44	0.003
7.873	0.000	0.45	0.15	0.45	0.003
8.027	0.000	0.45	0.15	0.45	0.003
8.180	0.000	0.46	0.15	0.46	0.003
8.333	0.000	0.46	0.15	0.46	0.003
8.487	0.000	0.47	0.16	0.47	0.003
8.640	0.000	0.48	0.16	0.47	0.003
8.793	0.000	0.48	0.16	0.48	0.003
8.947	0.000	0.49	0.16	0.49	0.003
9.100	0.000	0.50	0.16	0.49	0.003
9.253	0.000	0.50	0.16	0.50	0.003
9.407	0.000	0.51	0.17	0.51	0.003
9.560	0.000	0.52	0.17	0.51	0.003
9.713	0.000	0.53	0.17	0.52	0.003
9.867	0.000	0.53	0.17	0.53	0.003
10.020	0.000	0.54	0.18	0.54	0.004
10.173	0.000	0.55	0.18	0.55	0.004
10.327	0.000	0.56	0.18	0.55	0.004
10.480	0.000	0.57	0.19	0.56	0.004
10.633	0.000	0.58	0.19	0.57	0.004
10.787	0.000	0.59	0.19	0.58	0.004

10.940	0.000	0.60	0.20	0.59	0.004
11.093	0.000	0.61	0.20	0.61	0.004
11.247	0.000	0.63	0.21	0.62	0.004
11.400	0.000	0.63	0.21	0.63	0.004
11.553	0.000	0.65	0.21	0.64	0.004
11.707	0.000	0.66	0.22	0.66	0.004
11.860	0.000	0.68	0.22	0.67	0.004
12.013	0.000	0.69	0.23	0.69	0.005
12.167	0.000	0.89	0.29	0.79	0.006
12.320	0.000	0.91	0.30	0.90	0.006
12.473	0.000	0.93	0.31	0.92	0.006
12.627	0.000	0.95	0.31	0.94	0.006
12.780	0.000	0.98	0.32	0.96	0.006
12.933	0.000	1.00	0.33	0.99	0.007
13.087	0.000	1.03	0.34	1.01	0.007
13.240	0.000	1.05	0.35	1.04	0.007
13.393	0.000	1.09	0.36	1.07	0.007
13.547	0.000	1.11	0.37	1.10	0.007
13.700	0.000	1.16	0.38	1.14	0.008
13.853	0.000	1.19	0.39	1.18	0.008
14.007	0.000	1.25	0.41	1.22	0.008
14.160	0.000	1.29	0.42	1.27	0.008
14.313	0.000	1.37	0.45	1.33	0.009
14.467	0.000	1.41	0.46	1.39	0.009
14.620	0.000	1.51	0.50	1.46	0.010
14.773	0.000	1.57	0.51	1.55	0.010
14.927	0.000	1.71	0.54	1.67	0.011
15.080	0.000	1.79	0.56	1.80	0.011
15.233	0.000	2.01	0.61	1.98	0.012
15.387	0.000	2.14	0.64	2.22	0.013
15.540	0.000	2.24	0.66	2.37	0.013
15.693	0.000	2.52	0.73	2.62	0.014
15.847	0.000	3.63	1.00	3.54	0.019
16.000	0.000	5.00	1.26	5.22	0.024
16.153	0.000	15.29	3.69	12.79	0.071
16.307	0.000	2.94	0.83	11.38	0.016
16.460	0.000	2.16	0.65	2.85	0.013
16.613	0.000	1.89	0.58	2.15	0.011
16.767	0.000	1.64	0.52	1.80	0.010
16.920	0.000	1.46	0.47	1.53	0.009
17.073	0.000	1.33	0.44	1.38	0.009
17.227	0.000	1.22	0.40	1.28	0.008
17.380	0.000	1.14	0.37	1.18	0.007
17.533	0.000	1.07	0.35	1.11	0.007
17.687	0.000	1.01	0.33	1.04	0.007
17.840	0.000	0.96	0.32	0.99	0.006
17.993	0.000	0.92	0.30	0.94	0.006
18.147	0.000	0.73	0.24	0.83	0.005
18.300	0.000	0.67	0.22	0.70	0.004
18.453	0.000	0.64	0.21	0.66	0.004
18.607	0.000	0.62	0.20	0.63	0.004
18.760	0.000	0.59	0.20	0.61	0.004

18.913	0.000	0.57	0.19	0.58	0.004
19.067	0.000	0.55	0.18	0.56	0.004
19.220	0.000	0.54	0.18	0.55	0.004
19.373	0.000	0.52	0.17	0.53	0.003
19.527	0.000	0.51	0.17	0.51	0.003
19.680	0.000	0.49	0.16	0.50	0.003
19.833	0.000	0.48	0.16	0.49	0.003
19.987	0.000	0.47	0.15	0.47	0.003
20.140	0.000	0.46	0.15	0.46	0.003
20.293	0.000	0.45	0.15	0.45	0.003
20.447	0.000	0.44	0.14	0.44	0.003
20.600	0.000	0.43	0.14	0.43	0.003
20.753	0.000	0.42	0.14	0.42	0.003
20.907	0.000	0.41	0.13	0.41	0.003
21.060	0.000	0.40	0.13	0.40	0.003
21.213	0.000	0.39	0.13	0.40	0.003
21.367	0.000	0.39	0.13	0.39	0.003
21.520	0.000	0.38	0.12	0.38	0.002
21.673	0.000	0.37	0.12	0.38	0.002
21.827	0.000	0.37	0.12	0.37	0.002
21.980	0.000	0.36	0.12	0.36	0.002
22.133	0.000	0.35	0.12	0.36	0.002
22.287	0.000	0.35	0.11	0.35	0.002
22.440	0.000	0.34	0.11	0.35	0.002
22.593	0.000	0.34	0.11	0.34	0.002
22.747	0.000	0.33	0.11	0.34	0.002
22.900	0.000	0.33	0.11	0.33	0.002
23.053	0.000	0.32	0.11	0.33	0.002
23.207	0.000	0.32	0.11	0.32	0.002
23.360	0.000	0.32	0.10	0.32	0.002
23.513	0.000	0.31	0.10	0.31	0.002
23.667	0.000	0.31	0.10	0.31	0.002
23.820	0.000	0.30	0.10	0.31	0.002
23.973	0.000	0.30	0.10	0.30	0.002
24.127	0.000	0.30	0.10	0.30	0.002
24.280	0.000	0.00	0.00	0.15	0.000
24.433	0.000	0.00	0.00	0.00	0.000

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****************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                         Analysis prepared by:



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  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN 16
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    4.77
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.030
    LOW LOSS FRACTION = 0.040
    TIME OF CONCENTRATION(MIN.) =  9.90
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.93
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.31

****************************************************************************
  TIME      VOLUME       Q    0.        5.0       10.0      15.0      20.0
 (HOURS)     (AF)      (CFS)
----------------------------------------------------------------------------
  0.16      0.0025      0.36  Q         .         .         .         .
  0.33      0.0074      0.36  Q         .         .         .         .
  0.49      0.0124      0.36  Q         .         .         .         .
  0.66      0.0173      0.37  Q         .         .         .         .
```

0.82	0.0224	0.37	Q	.	.	.	.
0.99	0.0274	0.37	Q	.	.	.	.
1.15	0.0325	0.37	Q	.	.	.	.
1.32	0.0377	0.38	Q	.	.	.	.
1.48	0.0428	0.38	Q	.	.	.	.
1.65	0.0480	0.38	Q	.	.	.	.
1.81	0.0533	0.39	Q	.	.	.	.
1.98	0.0586	0.39	Q	.	.	.	.
2.14	0.0639	0.39	Q	.	.	.	.
2.31	0.0692	0.39	Q	.	.	.	.
2.47	0.0746	0.40	Q	.	.	.	.
2.64	0.0801	0.40	Q	.	.	.	.
2.80	0.0856	0.40	Q	.	.	.	.
2.97	0.0911	0.41	Q	.	.	.	.
3.13	0.0966	0.41	Q	.	.	.	.
3.30	0.1023	0.41	Q	.	.	.	.
3.46	0.1079	0.42	Q	.	.	.	.
3.63	0.1136	0.42	Q	.	.	.	.
3.79	0.1194	0.42	Q	.	.	.	.
3.96	0.1252	0.43	Q	.	.	.	.
4.12	0.1310	0.43	Q	.	.	.	.
4.29	0.1369	0.44	Q	.	.	.	.
4.45	0.1429	0.44	Q	.	.	.	.
4.62	0.1489	0.44	Q	.	.	.	.
4.78	0.1549	0.45	Q	.	.	.	.
4.95	0.1611	0.45	Q	.	.	.	.
5.11	0.1672	0.45	Q	.	.	.	.
5.28	0.1735	0.46	Q	.	.	.	.
5.44	0.1797	0.46	Q	.	.	.	.
5.61	0.1861	0.47	Q	.	.	.	.
5.77	0.1925	0.47	Q	.	.	.	.
5.94	0.1990	0.48	Q	.	.	.	.
6.10	0.2055	0.48	Q	.	.	.	.
6.27	0.2121	0.49	Q	.	.	.	.
6.43	0.2188	0.49	Q	.	.	.	.
6.60	0.2256	0.50	Q	.	.	.	.
6.76	0.2324	0.50	.Q	.	.	.	.
6.93	0.2393	0.51	.Q	.	.	.	.
7.09	0.2463	0.51	.Q	.	.	.	.
7.26	0.2534	0.52	.Q	.	.	.	.
7.42	0.2605	0.53	.Q	.	.	.	.
7.59	0.2677	0.53	.Q	.	.	.	.
7.75	0.2750	0.54	.Q	.	.	.	.
7.92	0.2825	0.55	.Q	.	.	.	.
8.08	0.2900	0.55	.Q	.	.	.	.
8.24	0.2976	0.56	.Q	.	.	.	.
8.41	0.3053	0.57	.Q	.	.	.	.
8.57	0.3131	0.58	.Q	.	.	.	.
8.74	0.3210	0.58	.Q	.	.	.	.
8.90	0.3290	0.59	.Q	.	.	.	.
9.07	0.3371	0.60	.Q	.	.	.	.
9.24	0.3454	0.61	.Q	.	.	.	.

9.40	0.3538	0.62	.Q . . . .
9.57	0.3623	0.63	.Q . . . .
9.73	0.3709	0.64	.Q . . . .
9.90	0.3797	0.65	.Q . . . .
10.06	0.3887	0.66	.Q . . . .
10.23	0.3978	0.67	.Q . . . .
10.39	0.4070	0.68	.Q . . . .
10.55	0.4164	0.70	.Q . . . .
10.72	0.4260	0.71	.Q . . . .
10.89	0.4358	0.73	.Q . . . .
11.05	0.4458	0.74	.Q . . . .
11.22	0.4560	0.76	.Q . . . .
11.38	0.4664	0.77	.Q . . . .
11.55	0.4770	0.79	.Q . . . .
11.71	0.4879	0.80	.Q . . . .
11.88	0.4990	0.83	.Q . . . .
12.04	0.5104	0.84	.Q . . . .
12.20	0.5236	1.09	. Q . . . .
12.37	0.5386	1.11	. Q . . . .
12.54	0.5540	1.15	. Q . . . .
12.70	0.5697	1.16	. Q . . . .
12.87	0.5859	1.21	. Q . . . .
13.03	0.6025	1.23	. Q . . . .
13.20	0.6196	1.28	. Q . . . .
13.36	0.6372	1.30	. Q . . . .
13.52	0.6553	1.36	. Q . . . .
13.69	0.6741	1.39	. Q . . . .
13.85	0.6936	1.46	. Q . . . .
14.02	0.7138	1.50	. Q . . . .
14.18	0.7350	1.60	. Q . . . .
14.35	0.7572	1.65	. Q . . . .
14.52	0.7805	1.77	. Q . . . .
14.68	0.8051	1.84	. Q . . . .
14.85	0.8313	2.00	. Q . . . .
15.01	0.8592	2.10	. Q . . . .
15.18	0.8896	2.35	. Q . . . .
15.34	0.9227	2.51	. Q . . . .
15.51	0.9576	2.61	. Q . . . .
15.67	0.9954	2.94	. Q . . . .
15.84	1.0442	4.23	. Q . . . .
16.00	1.1127	5.82	.Q . . . .
16.17	1.2738	17.81	. . . . Q .
16.33	1.4186	3.42	. Q . . . .
16.50	1.4603	2.69	. Q . . . .
16.66	1.4937	2.21	. Q . . . .
16.83	1.5218	1.91	. Q . . . .
16.99	1.5465	1.71	. Q . . . .
17.16	1.5687	1.55	. Q . . . .
17.32	1.5890	1.43	. Q . . . .
17.48	1.6078	1.33	. Q . . . .
17.65	1.6254	1.25	. Q . . . .
17.82	1.6421	1.18	. Q . . . .

```
 17.98      1.6578      1.13  . Q        .         .         .         .
 18.14      1.6719      0.94  .Q         .         .         .         .
 18.31      1.6839      0.82  .Q         .         .         .         .
 18.48      1.6947      0.78  .Q         .         .         .         .
 18.64      1.7051      0.75  .Q         .         .         .         .
 18.81      1.7151      0.72  .Q         .         .         .         .
 18.97      1.7247      0.69  .Q         .         .         .         .
 19.14      1.7340      0.67  .Q         .         .         .         .
 19.30      1.7429      0.64  .Q         .         .         .         .
 19.47      1.7516      0.62  .Q         .         .         .         .
 19.63      1.7599      0.61  .Q         .         .         .         .
 19.80      1.7681      0.59  .Q         .         .         .         .
 19.96      1.7760      0.57  .Q         .         .         .         .
 20.12      1.7837      0.56  .Q         .         .         .         .
 20.29      1.7912      0.54  .Q         .         .         .         .
 20.45      1.7985      0.53  .Q         .         .         .         .
 20.62      1.8057      0.52  .Q         .         .         .         .
 20.78      1.8127      0.51  .Q         .         .         .         .
 20.95      1.8195      0.50  Q          .         .         .         .
 21.11      1.8262      0.48  Q          .         .         .         .
 21.28      1.8327      0.48  Q          .         .         .         .
 21.44      1.8391      0.47  Q          .         .         .         .
 21.61      1.8454      0.46  Q          .         .         .         .
 21.77      1.8516      0.45  Q          .         .         .         .
 21.94      1.8576      0.44  Q          .         .         .         .
 22.10      1.8636      0.43  Q          .         .         .         .
 22.27      1.8694      0.43  Q          .         .         .         .
 22.43      1.8752      0.42  Q          .         .         .         .
 22.60      1.8809      0.41  Q          .         .         .         .
 22.77      1.8864      0.41  Q          .         .         .         .
 22.93      1.8919      0.40  Q          .         .         .         .
 23.09      1.8973      0.39  Q          .         .         .         .
 23.26      1.9026      0.39  Q          .         .         .         .
 23.42      1.9079      0.38  Q          .         .         .         .
 23.59      1.9130      0.38  Q          .         .         .         .
 23.75      1.9181      0.37  Q          .         .         .         .
 23.92      1.9232      0.37  Q          .         .         .         .
 24.08      1.9281      0.36  Q          .         .         .         .
 24.25      1.9306      0.00  Q          .         .         .         .
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TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1445.4
10%	138.6
20%	29.7

30%	19.8
40%	9.9
50%	9.9
60%	9.9
70%	9.9
80%	9.9
90%	9.9

Problem Descriptions:

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FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 9.900
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

```
                INFLOW
                  |
                  |
                  |
                  V                 __effective depth
            -------------           |   (and volume)
            |           |     |     |
            | detention |     |....V.............
            |   basin   |<-->|          outflow
            |           |     |.........________
            -------------     |         |    \
                  |           | storage |     basin outlet
                  V           -----------
               OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) **	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) *
0.000	0.000	0.000**	0.500	0.013	1.520*
1.000	0.026	4.290**	1.500	0.039	7.880*
2.000	0.052	12.280**	2.500	0.065	14.760*
3.000	0.079	16.880**	3.500	0.092	18.760*
4.000	0.105	20.470**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	0.00264	0.02336
3	1.00	-0.00325	0.05525
4	1.50	-0.01473	0.09273
5	2.00	-0.03173	0.13573
6	2.50	-0.03564	0.16564
7	3.00	-0.03609	0.19409
8	3.50	-0.03591	0.21991
9	4.00	-0.03457	0.24457

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.160	0.000	0.36	0.11	0.16	0.003
0.325	0.000	0.36	0.12	0.34	0.003
0.490	0.000	0.36	0.12	0.36	0.003
0.655	0.000	0.37	0.12	0.37	0.003
0.820	0.000	0.37	0.12	0.37	0.003
0.985	0.000	0.37	0.12	0.37	0.003
1.150	0.000	0.37	0.12	0.37	0.003
1.315	0.000	0.38	0.12	0.38	0.003
1.480	0.000	0.38	0.12	0.38	0.003
1.645	0.000	0.38	0.13	0.38	0.003
1.810	0.000	0.39	0.13	0.38	0.003
1.975	0.000	0.39	0.13	0.39	0.003
2.140	0.000	0.39	0.13	0.39	0.003
2.305	0.000	0.39	0.13	0.39	0.003
2.470	0.000	0.40	0.13	0.40	0.003
2.635	0.000	0.40	0.13	0.40	0.003
2.800	0.000	0.40	0.13	0.40	0.003
2.965	0.000	0.41	0.13	0.40	0.003
3.130	0.000	0.41	0.13	0.41	0.003
3.295	0.000	0.41	0.14	0.41	0.004
3.460	0.000	0.42	0.14	0.41	0.004
3.625	0.000	0.42	0.14	0.42	0.004
3.790	0.000	0.42	0.14	0.42	0.004
3.955	0.000	0.43	0.14	0.42	0.004
4.120	0.000	0.43	0.14	0.43	0.004
4.285	0.000	0.44	0.14	0.43	0.004
4.450	0.000	0.44	0.14	0.44	0.004
4.615	0.000	0.44	0.15	0.44	0.004
4.780	0.000	0.45	0.15	0.44	0.004
4.945	0.000	0.45	0.15	0.45	0.004
5.110	0.000	0.45	0.15	0.45	0.004

5.275	0.000	0.46	0.15	0.46	0.004
5.440	0.000	0.46	0.15	0.46	0.004
5.605	0.000	0.47	0.15	0.47	0.004
5.770	0.000	0.47	0.16	0.47	0.004
5.935	0.000	0.48	0.16	0.47	0.004
6.100	0.000	0.48	0.16	0.48	0.004
6.265	0.000	0.49	0.16	0.48	0.004
6.430	0.000	0.49	0.16	0.49	0.004
6.595	0.000	0.50	0.16	0.49	0.004
6.760	0.000	0.50	0.17	0.50	0.004
6.925	0.000	0.51	0.17	0.51	0.004
7.090	0.000	0.51	0.17	0.51	0.004
7.255	0.000	0.52	0.17	0.52	0.004
7.420	0.000	0.53	0.17	0.52	0.004
7.585	0.000	0.53	0.18	0.53	0.005
7.750	0.000	0.54	0.18	0.54	0.005
7.915	0.000	0.55	0.18	0.54	0.005
8.080	0.000	0.55	0.18	0.55	0.005
8.245	0.000	0.56	0.18	0.56	0.005
8.410	0.000	0.57	0.19	0.56	0.005
8.575	0.000	0.58	0.19	0.57	0.005
8.740	0.000	0.58	0.19	0.58	0.005
8.905	0.000	0.59	0.19	0.59	0.005
9.070	0.000	0.60	0.20	0.60	0.005
9.235	0.000	0.61	0.20	0.60	0.005
9.400	0.000	0.62	0.20	0.61	0.005
9.565	0.000	0.63	0.21	0.62	0.005
9.730	0.000	0.64	0.21	0.63	0.005
9.895	0.000	0.65	0.21	0.64	0.006
10.060	0.000	0.66	0.22	0.65	0.006
10.225	0.000	0.67	0.22	0.67	0.006
10.390	0.000	0.68	0.22	0.68	0.006
10.555	0.000	0.70	0.23	0.69	0.006
10.720	0.000	0.71	0.23	0.70	0.006
10.885	0.000	0.73	0.24	0.72	0.006
11.050	0.000	0.74	0.24	0.73	0.006
11.215	0.000	0.76	0.25	0.74	0.006
11.380	0.000	0.77	0.25	0.76	0.007
11.545	0.000	0.79	0.26	0.78	0.007
11.710	0.000	0.80	0.26	0.79	0.007
11.875	0.000	0.83	0.27	0.81	0.007
12.040	0.000	0.84	0.28	0.83	0.007
12.205	0.000	1.09	0.35	0.95	0.009
12.370	0.000	1.11	0.36	1.08	0.009
12.535	0.000	1.15	0.38	1.12	0.010
12.700	0.000	1.16	0.38	1.15	0.010
12.865	0.000	1.21	0.40	1.18	0.010
13.030	0.000	1.23	0.40	1.21	0.010
13.195	0.000	1.28	0.42	1.25	0.011
13.360	0.000	1.30	0.43	1.29	0.011
13.525	0.000	1.36	0.45	1.33	0.012
13.690	0.000	1.39	0.46	1.37	0.012

13.855	0.000	1.46	0.48	1.42	0.012
14.020	0.000	1.50	0.49	1.48	0.013
14.185	0.000	1.60	0.52	1.56	0.013
14.350	0.000	1.65	0.53	1.64	0.014
14.515	0.000	1.77	0.55	1.72	0.014
14.680	0.000	1.84	0.56	1.82	0.015
14.845	0.000	2.00	0.59	1.94	0.015
15.010	0.000	2.10	0.61	2.07	0.016
15.175	0.000	2.35	0.66	2.25	0.017
15.340	0.000	2.51	0.68	2.46	0.018
15.505	0.000	2.61	0.70	2.58	0.018
15.670	0.000	2.94	0.77	2.81	0.020
15.835	0.000	4.23	1.03	3.76	0.027
16.000	0.000	5.82	1.32	5.56	0.034
16.165	0.000	17.81	3.97	13.48	0.104
16.330	0.000	3.42	0.87	11.95	0.023
16.495	0.000	2.69	0.71	3.11	0.018
16.660	0.000	2.21	0.61	2.40	0.016
16.825	0.000	1.91	0.56	2.00	0.015
16.990	0.000	1.71	0.53	1.78	0.014
17.155	0.000	1.55	0.50	1.60	0.013
17.320	0.000	1.43	0.47	1.48	0.012
17.485	0.000	1.33	0.44	1.39	0.011
17.650	0.000	1.25	0.42	1.30	0.011
17.815	0.000	1.18	0.39	1.23	0.010
17.980	0.000	1.13	0.37	1.16	0.010
18.145	0.000	0.94	0.32	1.05	0.008
18.310	0.000	0.82	0.27	0.90	0.007
18.475	0.000	0.78	0.26	0.81	0.007
18.640	0.000	0.75	0.25	0.77	0.006
18.805	0.000	0.72	0.24	0.74	0.006
18.970	0.000	0.69	0.23	0.71	0.006
19.135	0.000	0.67	0.22	0.68	0.006
19.300	0.000	0.64	0.21	0.66	0.006
19.465	0.000	0.62	0.21	0.64	0.005
19.630	0.000	0.61	0.20	0.62	0.005
19.795	0.000	0.59	0.19	0.60	0.005
19.960	0.000	0.57	0.19	0.58	0.005
20.125	0.000	0.56	0.18	0.57	0.005
20.290	0.000	0.54	0.18	0.55	0.005
20.455	0.000	0.53	0.17	0.54	0.005
20.620	0.000	0.52	0.17	0.53	0.004
20.785	0.000	0.51	0.17	0.51	0.004
20.950	0.000	0.50	0.16	0.50	0.004
21.115	0.000	0.48	0.16	0.49	0.004
21.280	0.000	0.48	0.16	0.48	0.004
21.445	0.000	0.47	0.15	0.47	0.004
21.610	0.000	0.46	0.15	0.46	0.004
21.775	0.000	0.45	0.15	0.45	0.004
21.940	0.000	0.44	0.15	0.45	0.004
22.105	0.000	0.43	0.14	0.44	0.004
22.270	0.000	0.43	0.14	0.43	0.004

22.435	0.000	0.42	0.14	0.42	0.004
22.600	0.000	0.41	0.14	0.42	0.004
22.765	0.000	0.41	0.13	0.41	0.003
22.930	0.000	0.40	0.13	0.40	0.003
23.095	0.000	0.39	0.13	0.40	0.003
23.260	0.000	0.39	0.13	0.39	0.003
23.425	0.000	0.38	0.13	0.39	0.003
23.590	0.000	0.38	0.12	0.38	0.003
23.755	0.000	0.37	0.12	0.37	0.003
23.920	0.000	0.37	0.12	0.37	0.003
24.085	0.000	0.36	0.12	0.36	0.003
24.250	0.000	0.00	0.01	0.20	0.000
24.415	0.000	0.00	0.00	0.02	0.000

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****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                              Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN 17
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =     4.41
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.030
    LOW LOSS FRACTION = 0.040
    TIME OF CONCENTRATION(MIN.) = 10.50
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      1.79
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.28

****************************************************************************
  TIME      VOLUME        Q     0.         5.0       10.0       15.0       20.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.08      0.0010      0.33  Q          .          .          .          .
  0.25      0.0059      0.33  Q          .          .          .          .
  0.43      0.0107      0.34  Q          .          .          .          .
  0.60      0.0156      0.34  Q          .          .          .          .
```

0.77	0.0205	0.34	Q	.	.	.	.
0.95	0.0255	0.34	Q	.	.	.	.
1.12	0.0304	0.35	Q	.	.	.	.
1.30	0.0355	0.35	Q	.	.	.	.
1.48	0.0405	0.35	Q	.	.	.	.
1.65	0.0456	0.35	Q	.	.	.	.
1.83	0.0508	0.36	Q	.	.	.	.
2.00	0.0560	0.36	Q	.	.	.	.
2.17	0.0612	0.36	Q	.	.	.	.
2.35	0.0664	0.36	Q	.	.	.	.
2.53	0.0717	0.37	Q	.	.	.	.
2.70	0.0771	0.37	Q	.	.	.	.
2.88	0.0825	0.37	Q	.	.	.	.
3.05	0.0879	0.38	Q	.	.	.	.
3.22	0.0934	0.38	Q	.	.	.	.
3.40	0.0989	0.38	Q	.	.	.	.
3.58	0.1045	0.39	Q	.	.	.	.
3.75	0.1101	0.39	Q	.	.	.	.
3.92	0.1158	0.39	Q	.	.	.	.
4.10	0.1215	0.40	Q	.	.	.	.
4.28	0.1273	0.40	Q	.	.	.	.
4.45	0.1331	0.40	Q	.	.	.	.
4.62	0.1390	0.41	Q	.	.	.	.
4.80	0.1450	0.41	Q	.	.	.	.
4.97	0.1510	0.42	Q	.	.	.	.
5.15	0.1570	0.42	Q	.	.	.	.
5.32	0.1632	0.43	Q	.	.	.	.
5.50	0.1693	0.43	Q	.	.	.	.
5.68	0.1756	0.44	Q	.	.	.	.
5.85	0.1819	0.44	Q	.	.	.	.
6.03	0.1883	0.44	Q	.	.	.	.
6.20	0.1947	0.45	Q	.	.	.	.
6.38	0.2013	0.45	Q	.	.	.	.
6.55	0.2079	0.46	Q	.	.	.	.
6.72	0.2145	0.46	Q	.	.	.	.
6.90	0.2213	0.47	Q	.	.	.	.
7.07	0.2281	0.48	Q	.	.	.	.
7.25	0.2350	0.48	Q	.	.	.	.
7.43	0.2420	0.49	Q	.	.	.	.
7.60	0.2491	0.49	Q	.	.	.	.
7.78	0.2563	0.50	.Q	.	.	.	.
7.95	0.2636	0.51	.Q	.	.	.	.
8.12	0.2710	0.51	.Q	.	.	.	.
8.30	0.2784	0.52	.Q	.	.	.	.
8.48	0.2860	0.53	.Q	.	.	.	.
8.65	0.2937	0.53	.Q	.	.	.	.
8.82	0.3015	0.55	.Q	.	.	.	.
9.00	0.3094	0.55	.Q	.	.	.	.
9.18	0.3175	0.56	.Q	.	.	.	.
9.35	0.3257	0.57	.Q	.	.	.	.
9.52	0.3340	0.58	.Q	.	.	.	.
9.70	0.3424	0.59	.Q	.	.	.	.

9.88	0.3510	0.60	.Q . . . .
10.05	0.3597	0.61	.Q . . . .
10.23	0.3686	0.62	.Q . . . .
10.40	0.3777	0.63	.Q . . . .
10.57	0.3870	0.65	.Q . . . .
10.75	0.3964	0.66	.Q . . . .
10.93	0.4060	0.67	.Q . . . .
11.10	0.4158	0.68	.Q . . . .
11.27	0.4259	0.70	.Q . . . .
11.45	0.4361	0.72	.Q . . . .
11.62	0.4467	0.74	.Q . . . .
11.80	0.4574	0.75	.Q . . . .
11.98	0.4685	0.78	.Q . . . .
12.15	0.4802	0.85	.Q . . . .
12.32	0.4938	1.03	. Q . . . .
12.50	0.5088	1.04	. Q . . . .
12.68	0.5241	1.08	. Q . . . .
12.85	0.5399	1.10	. Q . . . .
13.02	0.5562	1.14	. Q . . . .
13.20	0.5729	1.17	. Q . . . .
13.38	0.5901	1.22	. Q . . . .
13.55	0.6080	1.25	. Q . . . .
13.73	0.6265	1.31	. Q . . . .
13.90	0.6457	1.35	. Q . . . .
14.07	0.6658	1.43	. Q . . . .
14.25	0.6868	1.48	. Q . . . .
14.43	0.7090	1.59	. Q . . . .
14.60	0.7324	1.65	. Q . . . .
14.77	0.7573	1.79	. Q . . . .
14.95	0.7838	1.88	. Q . . . .
15.12	0.8126	2.10	. Q . . . .
15.30	0.8441	2.25	. Q . . . .
15.48	0.8779	2.42	. Q . . . .
15.65	0.9144	2.62	. Q . . . .
15.82	0.9606	3.77	. Q . . . .
16.00	1.0254	5.19	. Q . . .
16.17	1.1780	15.90	. . . .Q .
16.35	1.3151	3.05	. Q . . . .
16.52	1.3547	2.43	. Q . . . .
16.70	1.3866	1.98	. Q . . . .
16.88	1.4133	1.72	. Q . . . .
17.05	1.4368	1.53	. Q . . . .
17.23	1.4579	1.39	. Q . . . .
17.40	1.4772	1.28	. Q . . . .
17.58	1.4950	1.19	. Q . . . .
17.75	1.5118	1.12	. Q . . . .
17.92	1.5276	1.06	. Q . . . .
18.10	1.5425	1.01	. Q . . . .
18.27	1.5554	0.76	.Q . . . .
18.45	1.5662	0.73	.Q . . . .
18.62	1.5764	0.69	.Q . . . .
18.80	1.5863	0.67	.Q . . . .

18.98	1.5957	0.64	.Q	.	.	.	.
19.15	1.6048	0.62	.Q	.	.	.	.
19.33	1.6135	0.59	.Q	.	.	.	.
19.50	1.6220	0.57	.Q	.	.	.	.
19.67	1.6301	0.56	.Q	.	.	.	.
19.85	1.6381	0.54	.Q	.	.	.	.
20.02	1.6458	0.52	.Q	.	.	.	.
20.20	1.6532	0.51	.Q	.	.	.	.
20.38	1.6605	0.50	Q	.	.	.	.
20.55	1.6676	0.48	Q	.	.	.	.
20.73	1.6745	0.47	Q	.	.	.	.
20.90	1.6813	0.46	Q	.	.	.	.
21.08	1.6879	0.45	Q	.	.	.	.
21.25	1.6943	0.44	Q	.	.	.	.
21.42	1.7006	0.43	Q	.	.	.	.
21.60	1.7068	0.42	Q	.	.	.	.
21.77	1.7129	0.41	Q	.	.	.	.
21.95	1.7188	0.41	Q	.	.	.	.
22.12	1.7247	0.40	Q	.	.	.	.
22.30	1.7304	0.39	Q	.	.	.	.
22.48	1.7360	0.39	Q	.	.	.	.
22.65	1.7415	0.38	Q	.	.	.	.
22.83	1.7470	0.37	Q	.	.	.	.
23.00	1.7523	0.37	Q	.	.	.	.
23.17	1.7576	0.36	Q	.	.	.	.
23.35	1.7628	0.36	Q	.	.	.	.
23.52	1.7679	0.35	Q	.	.	.	.
23.70	1.7729	0.34	Q	.	.	.	.
23.88	1.7778	0.34	Q	.	.	.	.
24.05	1.7827	0.34	Q	.	.	.	.
24.23	1.7852	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1449.0
10%	147.0
20%	31.5
30%	21.0
40%	10.5
50%	10.5
60%	10.5
70%	10.5
80%	10.5
90%	10.5

Problem Descriptions:

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==============================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =   10.500
     DEAD STORAGE(AF) =        0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =        0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =    0.00


                    INFLOW
                      |
                      |
                      |
                      V                 __effective depth
                -------------           |   (and volume)
                |           |     |     |
                | detention |     |....V.............
                |   basin   |<-->|          outflow
                |           |     |.........__________
                -------------     |         |    \
                      |           | storage |     basin outlet
                      V           -----------
                   OUTFLOW


     DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
     TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES =   9
     *BASIN-DEPTH  STORAGE    OUTFLOW  **BASIN-DEPTH  STORAGE    OUTFLOW  *
     *   (FEET)  (ACRE-FEET)   (CFS)   **   (FEET)  (ACRE-FEET)   (CFS)   *
     *      0.000      0.000      0.000**      0.500      0.011      1.520*
     *      1.000      0.022      4.290**      1.500      0.033      7.880*
     *      2.000      0.044     12.280**      2.500      0.055     14.760*
     *      3.000      0.065     16.880**      3.500      0.076     18.760*
     *      4.000      0.087     20.470**
------------------------------------------------------------------------------
     BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:
      INTERVAL   DEPTH   {S-O*DT/2}   {S+O*DT/2}
       NUMBER   (FEET)   (ACRE-FEET)  (ACRE-FEET)
          1      0.00       0.00000      0.00000
          2      0.50       0.00001      0.02199
          3      1.00      -0.00902      0.05302
          4      1.50      -0.02398      0.08998
          5      2.00      -0.04480      0.13280
          6      2.50      -0.05174      0.16174
```

7	3.00	-0.05707	0.18707
8	3.50	-0.05966	0.21166
9	4.00	-0.06103	0.23503

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.075	0.000	0.33	0.11	0.17	0.002
0.250	0.000	0.33	0.11	0.33	0.002
0.425	0.000	0.34	0.11	0.34	0.002
0.600	0.000	0.34	0.11	0.34	0.002
0.775	0.000	0.34	0.11	0.34	0.002
0.950	0.000	0.34	0.11	0.34	0.002
1.125	0.000	0.35	0.11	0.35	0.003
1.300	0.000	0.35	0.11	0.35	0.003
1.475	0.000	0.35	0.12	0.35	0.003
1.650	0.000	0.35	0.12	0.35	0.003
1.825	0.000	0.36	0.12	0.36	0.003
2.000	0.000	0.36	0.12	0.36	0.003
2.175	0.000	0.36	0.12	0.36	0.003
2.350	0.000	0.36	0.12	0.36	0.003
2.525	0.000	0.37	0.12	0.37	0.003
2.700	0.000	0.37	0.12	0.37	0.003
2.875	0.000	0.37	0.12	0.37	0.003
3.050	0.000	0.38	0.12	0.38	0.003
3.225	0.000	0.38	0.13	0.38	0.003
3.400	0.000	0.38	0.13	0.38	0.003
3.575	0.000	0.39	0.13	0.39	0.003
3.750	0.000	0.39	0.13	0.39	0.003
3.925	0.000	0.39	0.13	0.39	0.003
4.100	0.000	0.40	0.13	0.40	0.003
4.275	0.000	0.40	0.13	0.40	0.003
4.450	0.000	0.40	0.13	0.40	0.003
4.625	0.000	0.41	0.13	0.41	0.003
4.800	0.000	0.41	0.14	0.41	0.003
4.975	0.000	0.42	0.14	0.41	0.003
5.150	0.000	0.42	0.14	0.42	0.003
5.325	0.000	0.43	0.14	0.42	0.003
5.500	0.000	0.43	0.14	0.43	0.003
5.675	0.000	0.44	0.14	0.43	0.003
5.850	0.000	0.44	0.14	0.44	0.003
6.025	0.000	0.44	0.15	0.44	0.003
6.200	0.000	0.45	0.15	0.45	0.003
6.375	0.000	0.45	0.15	0.45	0.003
6.550	0.000	0.46	0.15	0.46	0.003
6.725	0.000	0.46	0.15	0.46	0.003

6.900	0.000	0.47	0.15	0.47	0.003
7.075	0.000	0.48	0.16	0.47	0.003
7.250	0.000	0.48	0.16	0.48	0.003
7.425	0.000	0.49	0.16	0.48	0.004
7.600	0.000	0.49	0.16	0.49	0.004
7.775	0.000	0.50	0.16	0.50	0.004
7.950	0.000	0.51	0.17	0.50	0.004
8.125	0.000	0.51	0.17	0.51	0.004
8.300	0.000	0.52	0.17	0.52	0.004
8.475	0.000	0.53	0.17	0.52	0.004
8.650	0.000	0.53	0.18	0.53	0.004
8.825	0.000	0.55	0.18	0.54	0.004
9.000	0.000	0.55	0.18	0.55	0.004
9.175	0.000	0.56	0.18	0.56	0.004
9.350	0.000	0.57	0.19	0.57	0.004
9.525	0.000	0.58	0.19	0.57	0.004
9.700	0.000	0.59	0.19	0.58	0.004
9.875	0.000	0.60	0.20	0.59	0.004
10.050	0.000	0.61	0.20	0.60	0.004
10.225	0.000	0.62	0.20	0.62	0.005
10.400	0.000	0.63	0.21	0.63	0.005
10.575	0.000	0.65	0.21	0.64	0.005
10.750	0.000	0.66	0.22	0.65	0.005
10.925	0.000	0.67	0.22	0.67	0.005
11.100	0.000	0.68	0.23	0.68	0.005
11.275	0.000	0.70	0.23	0.69	0.005
11.450	0.000	0.72	0.24	0.71	0.005
11.625	0.000	0.74	0.24	0.73	0.005
11.800	0.000	0.75	0.25	0.74	0.005
11.975	0.000	0.78	0.26	0.76	0.006
12.150	0.000	0.85	0.28	0.81	0.006
12.325	0.000	1.03	0.34	0.94	0.007
12.500	0.000	1.04	0.34	1.03	0.008
12.675	0.000	1.08	0.36	1.06	0.008
12.850	0.000	1.10	0.36	1.09	0.008
13.025	0.000	1.14	0.38	1.12	0.008
13.200	0.000	1.17	0.38	1.16	0.008
13.375	0.000	1.22	0.40	1.19	0.009
13.550	0.000	1.25	0.41	1.23	0.009
13.725	0.000	1.31	0.43	1.28	0.009
13.900	0.000	1.35	0.44	1.33	0.010
14.075	0.000	1.43	0.47	1.39	0.010
14.250	0.000	1.48	0.49	1.45	0.011
14.425	0.000	1.59	0.52	1.54	0.011
14.600	0.000	1.65	0.53	1.64	0.012
14.775	0.000	1.79	0.56	1.78	0.012
14.950	0.000	1.88	0.58	1.93	0.013
15.125	0.000	2.10	0.64	2.13	0.014
15.300	0.000	2.25	0.67	2.37	0.015
15.475	0.000	2.42	0.71	2.57	0.016
15.650	0.000	2.62	0.76	2.81	0.017
15.825	0.000	3.77	1.02	3.69	0.022

16.000	0.000	5.19	1.30	5.43	0.029
16.175	0.000	15.90	3.89	13.27	0.085
16.350	0.000	3.05	0.86	11.80	0.019
16.525	0.000	2.43	0.71	3.09	0.016
16.700	0.000	1.98	0.61	2.40	0.013
16.875	0.000	1.72	0.55	1.94	0.012
17.050	0.000	1.53	0.50	1.65	0.011
17.225	0.000	1.39	0.46	1.46	0.010
17.400	0.000	1.28	0.42	1.33	0.009
17.575	0.000	1.19	0.39	1.24	0.009
17.750	0.000	1.12	0.37	1.16	0.008
17.925	0.000	1.06	0.35	1.09	0.008
18.100	0.000	1.01	0.33	1.04	0.007
18.275	0.000	0.76	0.25	0.89	0.006
18.450	0.000	0.73	0.24	0.75	0.005
18.625	0.000	0.69	0.23	0.71	0.005
18.800	0.000	0.67	0.22	0.68	0.005
18.975	0.000	0.64	0.21	0.65	0.005
19.150	0.000	0.62	0.20	0.63	0.004
19.325	0.000	0.59	0.20	0.60	0.004
19.500	0.000	0.57	0.19	0.58	0.004
19.675	0.000	0.56	0.18	0.57	0.004
19.850	0.000	0.54	0.18	0.55	0.004
20.025	0.000	0.52	0.17	0.53	0.004
20.200	0.000	0.51	0.17	0.52	0.004
20.375	0.000	0.50	0.16	0.50	0.004
20.550	0.000	0.48	0.16	0.49	0.004
20.725	0.000	0.47	0.16	0.48	0.003
20.900	0.000	0.46	0.15	0.47	0.003
21.075	0.000	0.45	0.15	0.46	0.003
21.250	0.000	0.44	0.15	0.45	0.003
21.425	0.000	0.43	0.14	0.44	0.003
21.600	0.000	0.42	0.14	0.43	0.003
21.775	0.000	0.41	0.14	0.42	0.003
21.950	0.000	0.41	0.13	0.41	0.003
22.125	0.000	0.40	0.13	0.40	0.003
22.300	0.000	0.39	0.13	0.40	0.003
22.475	0.000	0.39	0.13	0.39	0.003
22.650	0.000	0.38	0.12	0.38	0.003
22.825	0.000	0.37	0.12	0.38	0.003
23.000	0.000	0.37	0.12	0.37	0.003
23.175	0.000	0.36	0.12	0.36	0.003
23.350	0.000	0.36	0.12	0.36	0.003
23.525	0.000	0.35	0.12	0.35	0.003
23.700	0.000	0.34	0.11	0.35	0.002
23.875	0.000	0.34	0.11	0.34	0.002
24.050	0.000	0.34	0.11	0.34	0.002
24.225	0.000	0.00	0.00	0.17	0.000
24.400	0.000	0.00	0.00	0.00	0.000

```
****************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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             Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                         Analysis prepared by:



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----------------------------------------------------------------------------

 Problem Descriptions:
  EL TORO DEVELOPMENT
  100 YEAR STORM - PROPOSED CONDITION
  BASIN 18
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =     3.63
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.030
    LOW LOSS FRACTION = 0.040
    TIME OF CONCENTRATION(MIN.) =  8.50
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.47
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.23

****************************************************************************
  TIME      VOLUME        Q    0.        5.0       10.0      15.0      20.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.13      0.0016      0.27  Q          .         .         .         .
  0.28      0.0048      0.28  Q          .         .         .         .
  0.42      0.0081      0.28  Q          .         .         .         .
  0.56      0.0113      0.28  Q          .         .         .         .
```

0.70	0.0146	0.28	Q	.	.	.	.
0.84	0.0179	0.28	Q	.	.	.	.
0.98	0.0212	0.28	Q	.	.	.	.
1.12	0.0245	0.29	Q	.	.	.	.
1.27	0.0279	0.29	Q	.	.	.	.
1.41	0.0312	0.29	Q	.	.	.	.
1.55	0.0346	0.29	Q	.	.	.	.
1.69	0.0381	0.29	Q	.	.	.	.
1.83	0.0415	0.29	Q	.	.	.	.
1.98	0.0449	0.30	Q	.	.	.	.
2.12	0.0484	0.30	Q	.	.	.	.
2.26	0.0519	0.30	Q	.	.	.	.
2.40	0.0554	0.30	Q	.	.	.	.
2.54	0.0590	0.30	Q	.	.	.	.
2.68	0.0625	0.31	Q	.	.	.	.
2.83	0.0661	0.31	Q	.	.	.	.
2.97	0.0698	0.31	Q	.	.	.	.
3.11	0.0734	0.31	Q	.	.	.	.
3.25	0.0771	0.31	Q	.	.	.	.
3.39	0.0807	0.32	Q	.	.	.	.
3.53	0.0845	0.32	Q	.	.	.	.
3.67	0.0882	0.32	Q	.	.	.	.
3.82	0.0920	0.32	Q	.	.	.	.
3.96	0.0958	0.33	Q	.	.	.	.
4.10	0.0996	0.33	Q	.	.	.	.
4.24	0.1034	0.33	Q	.	.	.	.
4.38	0.1073	0.33	Q	.	.	.	.
4.53	0.1112	0.34	Q	.	.	.	.
4.67	0.1152	0.34	Q	.	.	.	.
4.81	0.1192	0.34	Q	.	.	.	.
4.95	0.1232	0.34	Q	.	.	.	.
5.09	0.1272	0.35	Q	.	.	.	.
5.23	0.1313	0.35	Q	.	.	.	.
5.38	0.1354	0.35	Q	.	.	.	.
5.52	0.1395	0.35	Q	.	.	.	.
5.66	0.1437	0.36	Q	.	.	.	.
5.80	0.1479	0.36	Q	.	.	.	.
5.94	0.1521	0.36	Q	.	.	.	.
6.08	0.1564	0.37	Q	.	.	.	.
6.22	0.1607	0.37	Q	.	.	.	.
6.37	0.1651	0.37	Q	.	.	.	.
6.51	0.1695	0.38	Q	.	.	.	.
6.65	0.1739	0.38	Q	.	.	.	.
6.79	0.1784	0.39	Q	.	.	.	.
6.93	0.1829	0.39	Q	.	.	.	.
7.07	0.1875	0.39	Q	.	.	.	.
7.22	0.1921	0.40	Q	.	.	.	.
7.36	0.1967	0.40	Q	.	.	.	.
7.50	0.2014	0.40	Q	.	.	.	.
7.64	0.2062	0.41	Q	.	.	.	.
7.78	0.2110	0.41	Q	.	.	.	.
7.93	0.2159	0.42	Q	.	.	.	.

8.07	0.2208	0.42	Q	.	.	.	.
8.21	0.2257	0.43	Q	.	.	.	.
8.35	0.2308	0.43	Q	.	.	.	.
8.49	0.2358	0.44	Q	.	.	.	.
8.63	0.2410	0.44	Q	.	.	.	.
8.77	0.2462	0.45	Q	.	.	.	.
8.92	0.2514	0.45	Q	.	.	.	.
9.06	0.2568	0.46	Q	.	.	.	.
9.20	0.2621	0.46	Q	.	.	.	.
9.34	0.2676	0.47	Q	.	.	.	.
9.48	0.2731	0.47	Q	.	.	.	.
9.62	0.2788	0.48	Q	.	.	.	.
9.77	0.2844	0.49	Q	.	.	.	.
9.91	0.2902	0.50	Q	.	.	.	.
10.05	0.2961	0.50	.Q	.	.	.	.
10.19	0.3020	0.51	.Q	.	.	.	.
10.33	0.3080	0.52	.Q	.	.	.	.
10.48	0.3142	0.53	.Q	.	.	.	.
10.62	0.3204	0.53	.Q	.	.	.	.
10.76	0.3267	0.55	.Q	.	.	.	.
10.90	0.3331	0.55	.Q	.	.	.	.
11.04	0.3397	0.56	.Q	.	.	.	.
11.18	0.3463	0.57	.Q	.	.	.	.
11.32	0.3531	0.59	.Q	.	.	.	.
11.47	0.3600	0.59	.Q	.	.	.	.
11.61	0.3670	0.61	.Q	.	.	.	.
11.75	0.3742	0.62	.Q	.	.	.	.
11.89	0.3815	0.63	.Q	.	.	.	.
12.03	0.3890	0.64	.Q	.	.	.	.
12.18	0.3976	0.83	.Q	.	.	.	.
12.32	0.4074	0.84	.Q	.	.	.	.
12.46	0.4174	0.86	.Q	.	.	.	.
12.60	0.4276	0.88	.Q	.	.	.	.
12.74	0.4380	0.90	.Q	.	.	.	.
12.88	0.4486	0.92	.Q	.	.	.	.
13.02	0.4595	0.95	.Q	.	.	.	.
13.17	0.4707	0.96	.Q	.	.	.	.
13.31	0.4821	1.00	.Q	.	.	.	.
13.45	0.4939	1.01	. Q	.	.	.	.
13.59	0.5060	1.05	. Q	.	.	.	.
13.73	0.5185	1.08	. Q	.	.	.	.
13.88	0.5313	1.12	. Q	.	.	.	.
14.02	0.5446	1.15	. Q	.	.	.	.
14.16	0.5585	1.21	. Q	.	.	.	.
14.30	0.5729	1.25	. Q	.	.	.	.
14.44	0.5879	1.32	. Q	.	.	.	.
14.58	0.6037	1.36	. Q	.	.	.	.
14.73	0.6202	1.46	. Q	.	.	.	.
14.87	0.6376	1.52	. Q	.	.	.	.
15.01	0.6561	1.65	. Q	.	.	.	.
15.15	0.6759	1.73	. Q	.	.	.	.
15.29	0.6974	1.94	. Q	.	.	.	.

15.43	0.7208	2.06	. Q . . . .
15.57	0.7455	2.17	. Q . . . .
15.72	0.7726	2.45	. Q . . . .
15.86	0.8076	3.53	. Q . . . .
16.00	0.8566	4.85	. Q. . . .
16.14	0.9718	14.83	. . . Q. .
16.28	1.0754	2.86	. Q . . . .
16.42	1.1037	1.97	. Q . . . .
16.57	1.1259	1.83	. Q . . . .
16.71	1.1459	1.58	. Q . . . .
16.85	1.1633	1.41	. Q . . . .
16.99	1.1791	1.28	. Q . . . .
17.13	1.1935	1.18	. Q . . . .
17.27	1.2069	1.10	. Q . . . .
17.42	1.2193	1.03	. Q . . . .
17.56	1.2311	0.98	.Q . . . .
17.70	1.2423	0.93	.Q . . . .
17.84	1.2529	0.89	.Q . . . .
17.98	1.2631	0.85	.Q . . . .
18.12	1.2723	0.71	.Q . . . .
18.27	1.2801	0.63	.Q . . . .
18.41	1.2873	0.60	.Q . . . .
18.55	1.2942	0.58	.Q . . . .
18.69	1.3008	0.56	.Q . . . .
18.83	1.3073	0.54	.Q . . . .
18.98	1.3135	0.52	.Q . . . .
19.12	1.3195	0.51	.Q . . . .
19.26	1.3254	0.49	Q . . . .
19.40	1.3311	0.48	Q . . . .
19.54	1.3366	0.47	Q . . . .
19.68	1.3420	0.45	Q . . . .
19.83	1.3472	0.44	Q . . . .
19.97	1.3524	0.43	Q . . . .
20.11	1.3574	0.42	Q . . . .
20.25	1.3623	0.41	Q . . . .
20.39	1.3671	0.41	Q . . . .
20.53	1.3718	0.40	Q . . . .
20.67	1.3764	0.39	Q . . . .
20.82	1.3810	0.38	Q . . . .
20.96	1.3854	0.38	Q . . . .
21.10	1.3898	0.37	Q . . . .
21.24	1.3940	0.36	Q . . . .
21.38	1.3982	0.36	Q . . . .
21.52	1.4024	0.35	Q . . . .
21.67	1.4064	0.34	Q . . . .
21.81	1.4104	0.34	Q . . . .
21.95	1.4144	0.33	Q . . . .
22.09	1.4183	0.33	Q . . . .
22.23	1.4221	0.32	Q . . . .
22.38	1.4259	0.32	Q . . . .
22.52	1.4296	0.32	Q . . . .
22.66	1.4332	0.31	Q . . . .

```
 22.80      1.4369      0.31  Q          .          .          .          .
 22.94      1.4404      0.30  Q          .          .          .          .
 23.08      1.4440      0.30  Q          .          .          .          .
 23.23      1.4474      0.30  Q          .          .          .          .
 23.37      1.4509      0.29  Q          .          .          .          .
 23.51      1.4543      0.29  Q          .          .          .          .
 23.65      1.4576      0.28  Q          .          .          .          .
 23.79      1.4609      0.28  Q          .          .          .          .
 23.93      1.4642      0.28  Q          .          .          .          .
 24.08      1.4674      0.27  Q          .          .          .          .
 24.22      1.4690      0.00  Q          .          .          .          .
 ------------------------------------------------------------------------------
-------------------------------------------------------------------------------
-
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                  Duration
        Peak Flow Rate                       (minutes)
    ========================                 =========
              0%                              1445.0
             10%                               119.0
             20%                                25.5
             30%                                17.0
             40%                                 8.5
             50%                                 8.5
             60%                                 8.5
             70%                                 8.5
             80%                                 8.5
             90%                                 8.5

  Problem Descriptions:
   EL TORO DEVELOPMENT
   100 YEAR STORM - PROPOSED CONDITION
   BASIN 18


===============================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =     8.500
     DEAD STORAGE(AF) =        0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =        0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =     0.00


                    INFLOW
                      |
                      |
```

```
                 |
                 V                    __effective depth
        -------------                 |   (and volume)
        |           |     |           |
        | detention |     |....V.............
        |   basin   |<-->|          outflow
        |           |     |.........__________
        -------------     |         |    \
                 |        | storage |     basin outlet
                 V        -----------
              OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS)	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS)
* 0.000	0.000	0.000**	0.500	0.007	1.520*
* 1.000	0.015	4.290**	1.500	0.022	7.880*
* 2.000	0.030	12.280**	2.500	0.037	14.760*
* 3.000	0.044	16.880**	3.500	0.052	18.760*
* 4.000	0.059	20.470**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	-0.00190	0.01590
3	1.00	-0.01011	0.04011
4	1.50	-0.02413	0.06813
5	2.00	-0.04189	0.10189
6	2.50	-0.04940	0.12340
7	3.00	-0.05482	0.14282
8	3.50	-0.05782	0.16182
9	4.00	-0.06083	0.17883

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.133	0.000	0.27	0.10	0.15	0.001
0.275	0.000	0.28	0.10	0.31	0.001
0.417	0.000	0.28	0.10	0.31	0.001
0.558	0.000	0.28	0.10	0.31	0.001
0.700	0.000	0.28	0.10	0.31	0.001
0.842	0.000	0.28	0.10	0.31	0.001
0.983	0.000	0.28	0.10	0.32	0.001

1.125	0.000	0.29	0.11	0.32	0.001
1.267	0.000	0.29	0.11	0.32	0.001
1.408	0.000	0.29	0.11	0.32	0.001
1.550	0.000	0.29	0.11	0.32	0.001
1.692	0.000	0.29	0.11	0.33	0.002
1.833	0.000	0.29	0.11	0.33	0.002
1.975	0.000	0.30	0.11	0.33	0.002
2.117	0.000	0.30	0.11	0.33	0.002
2.258	0.000	0.30	0.11	0.33	0.002
2.400	0.000	0.30	0.11	0.34	0.002
2.542	0.000	0.30	0.11	0.34	0.002
2.683	0.000	0.31	0.11	0.34	0.002
2.825	0.000	0.31	0.11	0.34	0.002
2.967	0.000	0.31	0.11	0.35	0.002
3.108	0.000	0.31	0.11	0.35	0.002
3.250	0.000	0.31	0.12	0.35	0.002
3.392	0.000	0.32	0.12	0.35	0.002
3.533	0.000	0.32	0.12	0.36	0.002
3.675	0.000	0.32	0.12	0.36	0.002
3.817	0.000	0.32	0.12	0.36	0.002
3.958	0.000	0.33	0.12	0.36	0.002
4.100	0.000	0.33	0.12	0.37	0.002
4.242	0.000	0.33	0.12	0.37	0.002
4.383	0.000	0.33	0.12	0.37	0.002
4.525	0.000	0.34	0.12	0.37	0.002
4.667	0.000	0.34	0.12	0.38	0.002
4.808	0.000	0.34	0.13	0.38	0.002
4.950	0.000	0.34	0.13	0.38	0.002
5.092	0.000	0.35	0.13	0.39	0.002
5.233	0.000	0.35	0.13	0.39	0.002
5.375	0.000	0.35	0.13	0.39	0.002
5.517	0.000	0.35	0.13	0.40	0.002
5.658	0.000	0.36	0.13	0.40	0.002
5.800	0.000	0.36	0.13	0.40	0.002
5.942	0.000	0.36	0.13	0.41	0.002
6.083	0.000	0.37	0.13	0.41	0.002
6.225	0.000	0.37	0.14	0.41	0.002
6.367	0.000	0.37	0.14	0.42	0.002
6.508	0.000	0.38	0.14	0.42	0.002
6.650	0.000	0.38	0.14	0.42	0.002
6.792	0.000	0.39	0.14	0.43	0.002
6.933	0.000	0.39	0.14	0.43	0.002
7.075	0.000	0.39	0.14	0.44	0.002
7.217	0.000	0.40	0.15	0.44	0.002
7.358	0.000	0.40	0.15	0.45	0.002
7.500	0.000	0.40	0.15	0.45	0.002
7.642	0.000	0.41	0.15	0.45	0.002
7.783	0.000	0.41	0.15	0.46	0.002
7.925	0.000	0.42	0.15	0.46	0.002
8.067	0.000	0.42	0.15	0.47	0.002
8.208	0.000	0.43	0.16	0.47	0.002
8.350	0.000	0.43	0.16	0.48	0.002

8.492	0.000	0.44	0.16	0.49	0.002
8.633	0.000	0.44	0.16	0.49	0.002
8.775	0.000	0.45	0.16	0.50	0.002
8.917	0.000	0.45	0.17	0.50	0.002
9.058	0.000	0.46	0.17	0.51	0.002
9.200	0.000	0.46	0.17	0.52	0.002
9.342	0.000	0.47	0.17	0.52	0.002
9.483	0.000	0.47	0.17	0.53	0.002
9.625	0.000	0.48	0.18	0.54	0.002
9.767	0.000	0.49	0.18	0.54	0.003
9.908	0.000	0.50	0.18	0.55	0.003
10.050	0.000	0.50	0.18	0.56	0.003
10.192	0.000	0.51	0.19	0.57	0.003
10.333	0.000	0.52	0.19	0.58	0.003
10.475	0.000	0.53	0.19	0.59	0.003
10.617	0.000	0.53	0.20	0.59	0.003
10.758	0.000	0.55	0.20	0.60	0.003
10.900	0.000	0.55	0.20	0.61	0.003
11.042	0.000	0.56	0.21	0.62	0.003
11.183	0.000	0.57	0.21	0.64	0.003
11.325	0.000	0.59	0.22	0.65	0.003
11.467	0.000	0.59	0.22	0.66	0.003
11.608	0.000	0.61	0.22	0.67	0.003
11.750	0.000	0.62	0.23	0.69	0.003
11.892	0.000	0.63	0.23	0.70	0.003
12.033	0.000	0.64	0.24	0.71	0.003
12.175	0.000	0.83	0.31	0.82	0.004
12.317	0.000	0.84	0.31	0.94	0.004
12.458	0.000	0.86	0.32	0.95	0.004
12.600	0.000	0.88	0.32	0.97	0.005
12.742	0.000	0.90	0.33	1.00	0.005
12.883	0.000	0.92	0.34	1.02	0.005
13.025	0.000	0.95	0.35	1.04	0.005
13.167	0.000	0.96	0.35	1.07	0.005
13.308	0.000	1.00	0.37	1.10	0.005
13.450	0.000	1.01	0.37	1.12	0.005
13.592	0.000	1.05	0.39	1.16	0.005
13.733	0.000	1.08	0.40	1.19	0.006
13.875	0.000	1.12	0.41	1.23	0.006
14.017	0.000	1.15	0.42	1.27	0.006
14.158	0.000	1.21	0.45	1.32	0.006
14.300	0.000	1.25	0.46	1.38	0.006
14.442	0.000	1.32	0.49	1.44	0.007
14.583	0.000	1.36	0.50	1.50	0.007
14.725	0.000	1.46	0.52	1.59	0.007
14.867	0.000	1.52	0.54	1.69	0.008
15.008	0.000	1.65	0.57	1.82	0.008
15.150	0.000	1.73	0.59	1.97	0.008
15.292	0.000	1.94	0.64	2.16	0.009
15.433	0.000	2.06	0.67	2.38	0.010
15.575	0.000	2.17	0.70	2.53	0.010
15.717	0.000	2.45	0.76	2.80	0.011

15.858	0.000	3.53	1.02	3.71	0.015
16.000	0.000	4.85	1.30	5.43	0.019
16.142	0.000	14.83	3.85	13.19	0.057
16.283	0.000	2.86	0.86	11.74	0.013
16.425	0.000	1.97	0.65	2.94	0.009
16.567	0.000	1.83	0.61	2.24	0.009
16.708	0.000	1.58	0.55	1.98	0.008
16.850	0.000	1.41	0.51	1.70	0.007
16.992	0.000	1.28	0.47	1.51	0.007
17.133	0.000	1.18	0.43	1.38	0.006
17.275	0.000	1.10	0.40	1.28	0.006
17.417	0.000	1.03	0.38	1.19	0.005
17.558	0.000	0.98	0.36	1.13	0.005
17.700	0.000	0.93	0.34	1.07	0.005
17.842	0.000	0.89	0.33	1.02	0.005
17.983	0.000	0.85	0.31	0.97	0.004
18.125	0.000	0.71	0.26	0.88	0.004
18.267	0.000	0.63	0.23	0.75	0.003
18.408	0.000	0.60	0.22	0.69	0.003
18.550	0.000	0.58	0.21	0.66	0.003
18.692	0.000	0.56	0.21	0.64	0.003
18.833	0.000	0.54	0.20	0.61	0.003
18.975	0.000	0.52	0.19	0.59	0.003
19.117	0.000	0.51	0.19	0.58	0.003
19.258	0.000	0.49	0.18	0.56	0.003
19.400	0.000	0.48	0.18	0.54	0.002
19.542	0.000	0.47	0.17	0.53	0.002
19.683	0.000	0.45	0.17	0.52	0.002
19.825	0.000	0.44	0.16	0.50	0.002
19.967	0.000	0.43	0.16	0.49	0.002
20.108	0.000	0.42	0.16	0.48	0.002
20.250	0.000	0.41	0.15	0.47	0.002
20.392	0.000	0.41	0.15	0.46	0.002
20.533	0.000	0.40	0.15	0.45	0.002
20.675	0.000	0.39	0.14	0.44	0.002
20.817	0.000	0.38	0.14	0.43	0.002
20.958	0.000	0.38	0.14	0.42	0.002
21.100	0.000	0.37	0.14	0.42	0.002
21.242	0.000	0.36	0.13	0.41	0.002
21.383	0.000	0.36	0.13	0.40	0.002
21.525	0.000	0.35	0.13	0.40	0.002
21.667	0.000	0.34	0.13	0.39	0.002
21.808	0.000	0.34	0.12	0.38	0.002
21.950	0.000	0.33	0.12	0.38	0.002
22.092	0.000	0.33	0.12	0.37	0.002
22.233	0.000	0.32	0.12	0.37	0.002
22.375	0.000	0.32	0.12	0.36	0.002
22.517	0.000	0.32	0.12	0.36	0.002
22.658	0.000	0.31	0.11	0.35	0.002
22.800	0.000	0.31	0.11	0.35	0.002
22.942	0.000	0.30	0.11	0.34	0.002
23.083	0.000	0.30	0.11	0.34	0.002

23.225	0.000	0.30	0.11	0.33	0.002
23.367	0.000	0.29	0.11	0.33	0.002
23.508	0.000	0.29	0.11	0.32	0.001
23.650	0.000	0.28	0.10	0.32	0.001
23.792	0.000	0.28	0.10	0.32	0.001
23.933	0.000	0.28	0.10	0.31	0.001
24.075	0.000	0.27	0.10	0.31	0.001
24.217	0.000	0.00	0.00	0.15	0.000
24.358	0.000	0.00	0.00	0.00	0.000

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****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                              Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  EL TORO DEVELOPMENT
  100 YEAR STORM - PROPOSED CONDITION
  BASIN 19
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    3.64
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.060
    LOW LOSS FRACTION = 0.100
    TIME OF CONCENTRATION(MIN.) =  9.00
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.40
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.31

****************************************************************************
  TIME      VOLUME       Q    0.        5.0       10.0      15.0      20.0
 (HOURS)     (AF)      (CFS)
----------------------------------------------------------------------------
  0.10      0.0000      0.00  Q         .         .         .         .
  0.25      0.0016      0.26  Q         .         .         .         .
  0.40      0.0048      0.26  Q         .         .         .         .
  0.55      0.0081      0.26  Q         .         .         .         .
```

0.70	0.0113	0.26	Q	.	.	.	.
0.85	0.0146	0.27	Q	.	.	.	.
1.00	0.0179	0.27	Q	.	.	.	.
1.15	0.0212	0.27	Q	.	.	.	.
1.30	0.0245	0.27	Q	.	.	.	.
1.45	0.0279	0.27	Q	.	.	.	.
1.60	0.0313	0.27	Q	.	.	.	.
1.75	0.0347	0.28	Q	.	.	.	.
1.90	0.0381	0.28	Q	.	.	.	.
2.05	0.0416	0.28	Q	.	.	.	.
2.20	0.0450	0.28	Q	.	.	.	.
2.35	0.0485	0.28	Q	.	.	.	.
2.50	0.0521	0.28	Q	.	.	.	.
2.65	0.0556	0.29	Q	.	.	.	.
2.80	0.0592	0.29	Q	.	.	.	.
2.95	0.0628	0.29	Q	.	.	.	.
3.10	0.0664	0.29	Q	.	.	.	.
3.25	0.0700	0.30	Q	.	.	.	.
3.40	0.0737	0.30	Q	.	.	.	.
3.55	0.0774	0.30	Q	.	.	.	.
3.70	0.0811	0.30	Q	.	.	.	.
3.85	0.0849	0.30	Q	.	.	.	.
4.00	0.0887	0.31	Q	.	.	.	.
4.15	0.0925	0.31	Q	.	.	.	.
4.30	0.0963	0.31	Q	.	.	.	.
4.45	0.1002	0.31	Q	.	.	.	.
4.60	0.1041	0.32	Q	.	.	.	.
4.75	0.1080	0.32	Q	.	.	.	.
4.90	0.1120	0.32	Q	.	.	.	.
5.05	0.1160	0.32	Q	.	.	.	.
5.20	0.1201	0.33	Q	.	.	.	.
5.35	0.1241	0.33	Q	.	.	.	.
5.50	0.1282	0.33	Q	.	.	.	.
5.65	0.1324	0.34	Q	.	.	.	.
5.80	0.1366	0.34	Q	.	.	.	.
5.95	0.1408	0.34	Q	.	.	.	.
6.10	0.1451	0.34	Q	.	.	.	.
6.25	0.1494	0.35	Q	.	.	.	.
6.40	0.1537	0.35	Q	.	.	.	.
6.55	0.1581	0.36	Q	.	.	.	.
6.70	0.1625	0.36	Q	.	.	.	.
6.85	0.1670	0.36	Q	.	.	.	.
7.00	0.1715	0.37	Q	.	.	.	.
7.15	0.1761	0.37	Q	.	.	.	.
7.30	0.1807	0.37	Q	.	.	.	.
7.45	0.1853	0.38	Q	.	.	.	.
7.60	0.1901	0.38	Q	.	.	.	.
7.75	0.1948	0.39	Q	.	.	.	.
7.90	0.1996	0.39	Q	.	.	.	.
8.05	0.2045	0.40	Q	.	.	.	.
8.20	0.2095	0.40	Q	.	.	.	.
8.35	0.2144	0.41	Q	.	.	.	.

8.50	0.2195	0.41	Q . . . .
8.65	0.2246	0.42	Q . . . .
8.80	0.2298	0.42	Q . . . .
8.95	0.2350	0.43	Q . . . .
9.10	0.2404	0.43	Q . . . .
9.25	0.2457	0.44	Q . . . .
9.40	0.2512	0.44	Q . . . .
9.55	0.2567	0.45	Q . . . .
9.70	0.2624	0.46	Q . . . .
9.85	0.2681	0.46	Q . . . .
10.00	0.2739	0.47	Q . . . .
10.15	0.2797	0.48	Q . . . .
10.30	0.2857	0.48	Q . . . .
10.45	0.2918	0.49	Q . . . .
10.60	0.2980	0.50	.Q . . . .
10.75	0.3042	0.51	.Q . . . .
10.90	0.3106	0.52	.Q . . . .
11.05	0.3171	0.53	.Q . . . .
11.20	0.3237	0.54	.Q . . . .
11.35	0.3305	0.55	.Q . . . .
11.50	0.3374	0.56	.Q . . . .
11.65	0.3444	0.57	.Q . . . .
11.80	0.3516	0.58	.Q . . . .
11.95	0.3589	0.60	.Q . . . .
12.10	0.3664	0.61	.Q . . . .
12.25	0.3751	0.79	.Q . . . .
12.40	0.3849	0.80	.Q . . . .
12.55	0.3950	0.82	.Q . . . .
12.70	0.4053	0.84	.Q . . . .
12.85	0.4158	0.86	.Q . . . .
13.00	0.4266	0.88	.Q . . . .
13.15	0.4376	0.91	.Q . . . .
13.30	0.4490	0.92	.Q . . . .
13.45	0.4607	0.96	.Q . . . .
13.60	0.4727	0.98	.Q . . . .
13.75	0.4851	1.02	. Q . . . .
13.90	0.4980	1.05	. Q . . . .
14.05	0.5113	1.10	. Q . . . .
14.20	0.5252	1.14	. Q . . . .
14.35	0.5397	1.20	. Q . . . .
14.50	0.5549	1.24	. Q . . . .
14.65	0.5709	1.33	. Q . . . .
14.80	0.5877	1.38	. Q . . . .
14.95	0.6056	1.51	. Q . . . .
15.10	0.6247	1.58	. Q . . . .
15.25	0.6454	1.77	. Q . . . .
15.40	0.6682	1.90	. Q . . . .
15.55	0.6924	2.00	. Q . . . .
15.70	0.7188	2.27	. Q . . . .
15.85	0.7535	3.32	. Q . . . .
16.00	0.8026	4.60	. Q. . . .
16.15	0.9196	14.28	. . . Q . .

16.30	1.0247	2.67	. Q	.	.	.	.
16.45	1.0529	1.88	. Q	.	.	.	.
16.60	1.0749	1.67	. Q	.	.	.	.
16.75	1.0942	1.44	. Q	.	.	.	.
16.90	1.1111	1.28	. Q	.	.	.	.
17.05	1.1263	1.17	. Q	.	.	.	.
17.20	1.1402	1.07	. Q	.	.	.	.
17.35	1.1531	1.00	. Q	.	.	.	.
17.50	1.1651	0.94	.Q	.	.	.	.
17.65	1.1765	0.89	.Q	.	.	.	.
17.80	1.1873	0.85	.Q	.	.	.	.
17.95	1.1976	0.81	.Q	.	.	.	.
18.10	1.2074	0.78	.Q	.	.	.	.
18.25	1.2159	0.59	.Q	.	.	.	.
18.40	1.2231	0.57	.Q	.	.	.	.
18.55	1.2300	0.54	.Q	.	.	.	.
18.70	1.2366	0.52	.Q	.	.	.	.
18.85	1.2430	0.51	.Q	.	.	.	.
19.00	1.2492	0.49	Q	.	.	.	.
19.15	1.2551	0.47	Q	.	.	.	.
19.30	1.2609	0.46	Q	.	.	.	.
19.45	1.2665	0.45	Q	.	.	.	.
19.60	1.2720	0.43	Q	.	.	.	.
19.75	1.2773	0.42	Q	.	.	.	.
19.90	1.2825	0.41	Q	.	.	.	.
20.05	1.2876	0.40	Q	.	.	.	.
20.20	1.2925	0.39	Q	.	.	.	.
20.35	1.2973	0.38	Q	.	.	.	.
20.50	1.3020	0.38	Q	.	.	.	.
20.65	1.3066	0.37	Q	.	.	.	.
20.80	1.3112	0.36	Q	.	.	.	.
20.95	1.3156	0.35	Q	.	.	.	.
21.10	1.3199	0.35	Q	.	.	.	.
21.25	1.3242	0.34	Q	.	.	.	.
21.40	1.3284	0.33	Q	.	.	.	.
21.55	1.3325	0.33	Q	.	.	.	.
21.70	1.3365	0.32	Q	.	.	.	.
21.85	1.3405	0.32	Q	.	.	.	.
22.00	1.3444	0.31	Q	.	.	.	.
22.15	1.3483	0.31	Q	.	.	.	.
22.30	1.3520	0.30	Q	.	.	.	.
22.45	1.3558	0.30	Q	.	.	.	.
22.60	1.3594	0.29	Q	.	.	.	.
22.75	1.3631	0.29	Q	.	.	.	.
22.90	1.3666	0.29	Q	.	.	.	.
23.05	1.3701	0.28	Q	.	.	.	.
23.20	1.3736	0.28	Q	.	.	.	.
23.35	1.3770	0.27	Q	.	.	.	.
23.50	1.3804	0.27	Q	.	.	.	.
23.65	1.3838	0.27	Q	.	.	.	.
23.80	1.3871	0.26	Q	.	.	.	.
23.95	1.3903	0.26	Q	.	.	.	.

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 24.10      1.3935      0.26  Q          .          .          .          .
 24.25      1.3951      0.00  Q          .          .          .          .
 ----------------------------------------------------------------------------
-----------------------------------------------------------------------------
-
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                  Duration
        Peak Flow Rate                       (minutes)
    ========================                 =========
               0%                             1440.0
              10%                              117.0
              20%                               27.0
              30%                               18.0
              40%                                9.0
              50%                                9.0
              60%                                9.0
              70%                                9.0
              80%                                9.0
              90%                                9.0

  Problem Descriptions:
   EL TORO DEVELOPMENT
   100 YEAR STORM - PROPOSED CONDITION
   BASIN 19


=============================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =     9.000
     DEAD STORAGE(AF) =        0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =        0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =     0.00


                    INFLOW
                      |
                      |
                      |
                      V                 __effective depth
                -------------           |   (and volume)
                |           |     |     |
                | detention |     |....V.............
                |   basin   |<-->|          outflow
                |           |     |.........________
                -------------     |         |    \
                      |           | storage |      basin outlet
```

```
                    V          -----------
                 OUTFLOW


DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES =   9
*BASIN-DEPTH  STORAGE    OUTFLOW  **BASIN-DEPTH  STORAGE    OUTFLOW  *
*   (FEET)  (ACRE-FEET)   (CFS)   **   (FEET)  (ACRE-FEET)   (CFS)   *
*      0.000      0.000      0.000**      0.500      0.008      1.520*
*      1.000      0.017      4.290**      1.500      0.025      7.880*
*      2.000      0.033     12.280**      2.500      0.041     14.760*
*      3.000      0.050     16.880**      3.500      0.058     18.760*
*      4.000      0.066     20.470**
-------------------------------------------------------------------------
BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:
 INTERVAL   DEPTH   {S-O*DT/2}   {S+O*DT/2}
  NUMBER   (FEET)   (ACRE-FEET)  (ACRE-FEET)
      1     0.00       0.00000      0.00000
      2     0.50      -0.00142      0.01742
      3     1.00      -0.00959      0.04359
      4     1.50      -0.02384      0.07384
      5     2.00      -0.04312      0.10912
      6     2.50      -0.05049      0.13249
      7     3.00      -0.05463      0.15463
      8     3.50      -0.05828      0.17428
      9     4.00      -0.06088      0.19288
WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)
-------------------------------------------------------------------------
DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES
      OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE
      AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

   TIME  DEAD-STORAGE  INFLOW  EFFECTIVE  OUTFLOW  EFFECTIVE
  (HRS)   FILLED(AF)   (CFS)  DEPTH(FT)   (CFS)   VOLUME(AF)
-------------------------------------------------------------------------
  0.100       0.000     0.00      0.00     0.00      0.000
  0.250       0.000     0.26      0.09     0.14      0.001
  0.400       0.000     0.26      0.09     0.28      0.001
  0.550       0.000     0.26      0.09     0.28      0.001
  0.700       0.000     0.26      0.09     0.28      0.001
  0.850       0.000     0.27      0.09     0.29      0.002
  1.000       0.000     0.27      0.09     0.29      0.002
  1.150       0.000     0.27      0.10     0.29      0.002
  1.300       0.000     0.27      0.10     0.29      0.002
  1.450       0.000     0.27      0.10     0.29      0.002
  1.600       0.000     0.27      0.10     0.30      0.002
  1.750       0.000     0.28      0.10     0.30      0.002
  1.900       0.000     0.28      0.10     0.30      0.002
  2.050       0.000     0.28      0.10     0.30      0.002
  2.200       0.000     0.28      0.10     0.30      0.002
  2.350       0.000     0.28      0.10     0.30      0.002
```

2.500	0.000	0.28	0.10	0.31	0.002
2.650	0.000	0.29	0.10	0.31	0.002
2.800	0.000	0.29	0.10	0.31	0.002
2.950	0.000	0.29	0.10	0.31	0.002
3.100	0.000	0.29	0.10	0.32	0.002
3.250	0.000	0.30	0.11	0.32	0.002
3.400	0.000	0.30	0.11	0.32	0.002
3.550	0.000	0.30	0.11	0.32	0.002
3.700	0.000	0.30	0.11	0.33	0.002
3.850	0.000	0.30	0.11	0.33	0.002
4.000	0.000	0.31	0.11	0.33	0.002
4.150	0.000	0.31	0.11	0.33	0.002
4.300	0.000	0.31	0.11	0.34	0.002
4.450	0.000	0.31	0.11	0.34	0.002
4.600	0.000	0.32	0.11	0.34	0.002
4.750	0.000	0.32	0.11	0.34	0.002
4.900	0.000	0.32	0.11	0.35	0.002
5.050	0.000	0.32	0.12	0.35	0.002
5.200	0.000	0.33	0.12	0.35	0.002
5.350	0.000	0.33	0.12	0.36	0.002
5.500	0.000	0.33	0.12	0.36	0.002
5.650	0.000	0.34	0.12	0.36	0.002
5.800	0.000	0.34	0.12	0.37	0.002
5.950	0.000	0.34	0.12	0.37	0.002
6.100	0.000	0.34	0.12	0.37	0.002
6.250	0.000	0.35	0.12	0.38	0.002
6.400	0.000	0.35	0.13	0.38	0.002
6.550	0.000	0.36	0.13	0.38	0.002
6.700	0.000	0.36	0.13	0.39	0.002
6.850	0.000	0.36	0.13	0.39	0.002
7.000	0.000	0.37	0.13	0.39	0.002
7.150	0.000	0.37	0.13	0.40	0.002
7.300	0.000	0.37	0.13	0.40	0.002
7.450	0.000	0.38	0.13	0.41	0.002
7.600	0.000	0.38	0.14	0.41	0.002
7.750	0.000	0.39	0.14	0.42	0.002
7.900	0.000	0.39	0.14	0.42	0.002
8.050	0.000	0.40	0.14	0.43	0.002
8.200	0.000	0.40	0.14	0.43	0.002
8.350	0.000	0.41	0.14	0.44	0.002
8.500	0.000	0.41	0.15	0.44	0.002
8.650	0.000	0.42	0.15	0.45	0.002
8.800	0.000	0.42	0.15	0.45	0.002
8.950	0.000	0.43	0.15	0.46	0.002
9.100	0.000	0.43	0.15	0.46	0.002
9.250	0.000	0.44	0.16	0.47	0.002
9.400	0.000	0.44	0.16	0.48	0.003
9.550	0.000	0.45	0.16	0.48	0.003
9.700	0.000	0.46	0.16	0.49	0.003
9.850	0.000	0.46	0.17	0.50	0.003
10.000	0.000	0.47	0.17	0.51	0.003
10.150	0.000	0.48	0.17	0.51	0.003

10.300	0.000	0.48	0.17	0.52	0.003
10.450	0.000	0.49	0.18	0.53	0.003
10.600	0.000	0.50	0.18	0.54	0.003
10.750	0.000	0.51	0.18	0.55	0.003
10.900	0.000	0.52	0.18	0.56	0.003
11.050	0.000	0.53	0.19	0.57	0.003
11.200	0.000	0.54	0.19	0.58	0.003
11.350	0.000	0.55	0.20	0.59	0.003
11.500	0.000	0.56	0.20	0.60	0.003
11.650	0.000	0.57	0.20	0.61	0.003
11.800	0.000	0.58	0.21	0.63	0.003
11.950	0.000	0.60	0.21	0.64	0.003
12.100	0.000	0.61	0.22	0.65	0.003
12.250	0.000	0.79	0.28	0.76	0.004
12.400	0.000	0.80	0.28	0.86	0.005
12.550	0.000	0.82	0.29	0.88	0.005
12.700	0.000	0.84	0.30	0.90	0.005
12.850	0.000	0.86	0.31	0.92	0.005
13.000	0.000	0.88	0.31	0.94	0.005
13.150	0.000	0.91	0.32	0.97	0.005
13.300	0.000	0.92	0.33	0.99	0.005
13.450	0.000	0.96	0.34	1.02	0.005
13.600	0.000	0.98	0.35	1.05	0.006
13.750	0.000	1.02	0.36	1.08	0.006
13.900	0.000	1.05	0.37	1.12	0.006
14.050	0.000	1.10	0.39	1.16	0.006
14.200	0.000	1.14	0.40	1.21	0.006
14.350	0.000	1.20	0.43	1.27	0.007
14.500	0.000	1.24	0.44	1.32	0.007
14.650	0.000	1.33	0.47	1.39	0.008
14.800	0.000	1.38	0.49	1.47	0.008
14.950	0.000	1.51	0.52	1.57	0.008
15.100	0.000	1.58	0.54	1.70	0.009
15.250	0.000	1.77	0.59	1.87	0.010
15.400	0.000	1.90	0.62	2.08	0.010
15.550	0.000	2.00	0.64	2.23	0.011
15.700	0.000	2.27	0.71	2.48	0.012
15.850	0.000	3.32	0.95	3.34	0.016
16.000	0.000	4.60	1.22	4.96	0.021
16.150	0.000	14.28	3.57	12.45	0.059
16.300	0.000	2.67	0.80	11.10	0.013
16.450	0.000	1.88	0.61	2.66	0.010
16.600	0.000	1.67	0.56	2.00	0.009
16.750	0.000	1.44	0.51	1.71	0.008
16.900	0.000	1.28	0.46	1.48	0.007
17.050	0.000	1.17	0.42	1.33	0.007
17.200	0.000	1.07	0.38	1.21	0.006
17.350	0.000	1.00	0.36	1.12	0.006
17.500	0.000	0.94	0.34	1.05	0.005
17.650	0.000	0.89	0.32	0.99	0.005
17.800	0.000	0.85	0.30	0.94	0.005
17.950	0.000	0.81	0.29	0.90	0.005

18.100	0.000	0.78	0.28	0.86	0.004
18.250	0.000	0.59	0.21	0.74	0.003
18.400	0.000	0.57	0.20	0.63	0.003
18.550	0.000	0.54	0.19	0.60	0.003
18.700	0.000	0.52	0.19	0.58	0.003
18.850	0.000	0.51	0.18	0.56	0.003
19.000	0.000	0.49	0.17	0.54	0.003
19.150	0.000	0.47	0.17	0.52	0.003
19.300	0.000	0.46	0.16	0.51	0.003
19.450	0.000	0.45	0.16	0.49	0.003
19.600	0.000	0.43	0.15	0.48	0.002
19.750	0.000	0.42	0.15	0.46	0.002
19.900	0.000	0.41	0.15	0.45	0.002
20.050	0.000	0.40	0.14	0.44	0.002
20.200	0.000	0.39	0.14	0.43	0.002
20.350	0.000	0.38	0.14	0.42	0.002
20.500	0.000	0.38	0.13	0.41	0.002
20.650	0.000	0.37	0.13	0.40	0.002
20.800	0.000	0.36	0.13	0.39	0.002
20.950	0.000	0.35	0.13	0.39	0.002
21.100	0.000	0.35	0.12	0.38	0.002
21.250	0.000	0.34	0.12	0.37	0.002
21.400	0.000	0.33	0.12	0.37	0.002
21.550	0.000	0.33	0.12	0.36	0.002
21.700	0.000	0.32	0.11	0.35	0.002
21.850	0.000	0.32	0.11	0.35	0.002
22.000	0.000	0.31	0.11	0.34	0.002
22.150	0.000	0.31	0.11	0.34	0.002
22.300	0.000	0.30	0.11	0.33	0.002
22.450	0.000	0.30	0.11	0.33	0.002
22.600	0.000	0.29	0.10	0.32	0.002
22.750	0.000	0.29	0.10	0.32	0.002
22.900	0.000	0.29	0.10	0.31	0.002
23.050	0.000	0.28	0.10	0.31	0.002
23.200	0.000	0.28	0.10	0.30	0.002
23.350	0.000	0.27	0.10	0.30	0.002
23.500	0.000	0.27	0.10	0.30	0.002
23.650	0.000	0.27	0.10	0.29	0.002
23.800	0.000	0.26	0.09	0.29	0.002
23.950	0.000	0.26	0.09	0.28	0.001
24.100	0.000	0.26	0.09	0.28	0.001
24.250	0.000	0.00	0.00	0.14	0.000
24.400	0.000	0.00	0.00	0.00	0.000

```
****************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                         Analysis prepared by:



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----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN 20
----------------------------------------------------------------------------


     RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
     TOTAL CATCHMENT AREA(ACRES) =    2.70
     SOIL-LOSS RATE, Fm,(INCH/HR) =  0.060
     LOW LOSS FRACTION = 0.100
     TIME OF CONCENTRATION(MIN.) = 10.80
     SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
     ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
     RETURN FREQUENCY(YEARS) = 100
        5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
       30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
        1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
        3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
        6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
       24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

     TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.04
     TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.23

****************************************************************************
  TIME      VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)     (AF)      (CFS)
----------------------------------------------------------------------------
  0.16      0.0014      0.19  Q         .         .         .         .
  0.34      0.0043      0.19  Q         .         .         .         .
  0.52      0.0072      0.19  Q         .         .         .         .
  0.70      0.0100      0.20  Q         .         .         .         .
```

0.88	0.0130	0.20	Q	.	.	.	.
1.06	0.0159	0.20	Q	.	.	.	.
1.24	0.0189	0.20	Q	.	.	.	.
1.42	0.0218	0.20	Q	.	.	.	.
1.60	0.0248	0.20	Q	.	.	.	.
1.78	0.0279	0.20	Q	.	.	.	.
1.96	0.0309	0.21	Q	.	.	.	.
2.14	0.0340	0.21	Q	.	.	.	.
2.32	0.0371	0.21	Q	.	.	.	.
2.50	0.0402	0.21	Q	.	.	.	.
2.68	0.0434	0.21	Q	.	.	.	.
2.86	0.0466	0.21	Q	.	.	.	.
3.04	0.0498	0.22	Q	.	.	.	.
3.22	0.0530	0.22	Q	.	.	.	.
3.40	0.0563	0.22	Q	.	.	.	.
3.58	0.0596	0.22	Q	.	.	.	.
3.76	0.0629	0.22	Q	.	.	.	.
3.94	0.0662	0.23	Q	.	.	.	.
4.12	0.0696	0.23	Q	.	.	.	.
4.30	0.0730	0.23	Q	.	.	.	.
4.48	0.0765	0.23	Q	.	.	.	.
4.66	0.0800	0.24	Q	.	.	.	.
4.84	0.0835	0.24	Q	.	.	.	.
5.02	0.0870	0.24	Q	.	.	.	.
5.20	0.0906	0.24	Q	.	.	.	.
5.38	0.0942	0.25	Q	.	.	.	.
5.56	0.0979	0.25	Q	.	.	.	.
5.74	0.1016	0.25	.Q	.	.	.	.
5.92	0.1053	0.25	.Q	.	.	.	.
6.10	0.1091	0.26	.Q	.	.	.	.
6.28	0.1129	0.26	.Q	.	.	.	.
6.46	0.1168	0.26	.Q	.	.	.	.
6.64	0.1207	0.26	.Q	.	.	.	.
6.82	0.1247	0.27	.Q	.	.	.	.
7.00	0.1287	0.27	.Q	.	.	.	.
7.18	0.1328	0.28	.Q	.	.	.	.
7.36	0.1369	0.28	.Q	.	.	.	.
7.54	0.1410	0.28	.Q	.	.	.	.
7.72	0.1453	0.28	.Q	.	.	.	.
7.90	0.1495	0.29	.Q	.	.	.	.
8.08	0.1539	0.29	.Q	.	.	.	.
8.26	0.1583	0.30	.Q	.	.	.	.
8.44	0.1627	0.30	.Q	.	.	.	.
8.62	0.1673	0.31	.Q	.	.	.	.
8.80	0.1719	0.31	.Q	.	.	.	.
8.98	0.1765	0.32	.Q	.	.	.	.
9.16	0.1813	0.32	.Q	.	.	.	.
9.34	0.1861	0.33	.Q	.	.	.	.
9.52	0.1910	0.33	.Q	.	.	.	.
9.70	0.1960	0.34	.Q	.	.	.	.
9.88	0.2010	0.34	.Q	.	.	.	.
10.06	0.2062	0.35	.Q	.	.	.	.

10.24	0.2115	0.36	.Q . . . .
10.42	0.2168	0.37	.Q . . . .
10.60	0.2223	0.37	.Q . . . .
10.78	0.2279	0.38	.Q . . . .
10.96	0.2336	0.39	.Q . . . .
11.14	0.2394	0.40	.Q . . . .
11.32	0.2454	0.40	.Q . . . .
11.50	0.2515	0.42	.Q . . . .
11.68	0.2577	0.42	.Q . . . .
11.86	0.2641	0.44	.Q . . . .
12.04	0.2707	0.45	.Q . . . .
12.22	0.2783	0.58	. Q . . . .
12.40	0.2870	0.59	. Q . . . .
12.58	0.2960	0.61	. Q . . . .
12.76	0.3052	0.62	. Q . . . .
12.94	0.3146	0.65	. Q . . . .
13.12	0.3243	0.66	. Q . . . .
13.30	0.3344	0.69	. Q . . . .
13.48	0.3447	0.71	. Q . . . .
13.66	0.3555	0.74	. Q . . . .
13.84	0.3667	0.76	. Q . . . .
14.02	0.3784	0.81	. Q . . . .
14.20	0.3906	0.84	. Q . . . .
14.38	0.4035	0.90	. Q . . . .
14.56	0.4171	0.93	. Q . . . .
14.74	0.4315	1.01	. Q . . . .
14.92	0.4470	1.06	. Q . . . .
15.10	0.4637	1.19	. Q . . . .
15.28	0.4821	1.27	. Q . . . .
15.46	0.5020	1.41	. Q . . . .
15.64	0.5236	1.50	. Q . . . .
15.82	0.5511	2.20	. Q . . . .
16.00	0.5901	3.05	. . Q . . .
16.18	0.6835	9.50	. . . . Q .
16.36	0.7673	1.76	. Q . . . .
16.54	0.7907	1.38	. Q . . . .
16.72	0.8093	1.12	. Q . . . .
16.90	0.8248	0.97	. Q . . . .
17.08	0.8385	0.87	. Q . . . .
17.26	0.8508	0.78	. Q . . . .
17.44	0.8620	0.72	. Q . . . .
17.62	0.8724	0.67	. Q . . . .
17.80	0.8821	0.63	. Q . . . .
17.98	0.8913	0.60	. Q . . . .
18.16	0.8994	0.49	.Q . . . .
18.34	0.9063	0.43	.Q . . . .
18.52	0.9125	0.41	.Q . . . .
18.70	0.9185	0.39	.Q . . . .
18.88	0.9242	0.38	.Q . . . .
19.06	0.9297	0.36	.Q . . . .
19.24	0.9349	0.35	.Q . . . .
19.42	0.9400	0.33	.Q . . . .

19.60	0.9449	0.32	.Q	.	.	.	.
19.78	0.9497	0.31	.Q	.	.	.	.
19.96	0.9543	0.30	.Q	.	.	.	.
20.14	0.9587	0.30	.Q	.	.	.	.
20.32	0.9631	0.29	.Q	.	.	.	.
20.50	0.9673	0.28	.Q	.	.	.	.
20.68	0.9714	0.27	.Q	.	.	.	.
20.86	0.9754	0.27	.Q	.	.	.	.
21.04	0.9793	0.26	.Q	.	.	.	.
21.22	0.9831	0.25	.Q	.	.	.	.
21.40	0.9869	0.25	Q	.	.	.	.
21.58	0.9906	0.24	Q	.	.	.	.
21.76	0.9941	0.24	Q	.	.	.	.
21.94	0.9977	0.23	Q	.	.	.	.
22.12	1.0011	0.23	Q	.	.	.	.
22.30	1.0045	0.23	Q	.	.	.	.
22.48	1.0078	0.22	Q	.	.	.	.
22.66	1.0111	0.22	Q	.	.	.	.
22.84	1.0143	0.21	Q	.	.	.	.
23.02	1.0174	0.21	Q	.	.	.	.
23.20	1.0205	0.21	Q	.	.	.	.
23.38	1.0236	0.20	Q	.	.	.	.
23.56	1.0266	0.20	Q	.	.	.	.
23.74	1.0295	0.20	Q	.	.	.	.
23.92	1.0325	0.19	Q	.	.	.	.
24.10	1.0353	0.19	Q	.	.	.	.
24.28	1.0368	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1447.2
10%	140.4
20%	32.4
30%	21.6
40%	10.8
50%	10.8
60%	10.8
70%	10.8
80%	10.8
90%	10.8

Problem Descriptions:

```
==============================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =   10.800
     DEAD STORAGE(AF) =       0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =       0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =    0.00


                  INFLOW
                    |
                    |
                    |
                    V                  __effective depth
               -------------           |   (and volume)
               |           |     |     |
               | detention |     |....V.............
               |   basin   |<-->|          outflow
               |           |     |.........________
               -------------     |         |   \
                    |            | storage |     basin outlet
                    V            -----------
                 OUTFLOW


     DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
     TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES =   9
     *BASIN-DEPTH  STORAGE    OUTFLOW  **BASIN-DEPTH  STORAGE    OUTFLOW  *
     *   (FEET)  (ACRE-FEET)   (CFS)   **   (FEET)  (ACRE-FEET)   (CFS)   *
     *      0.000      0.000      0.000**      0.500      0.008      1.080*
     *      1.000      0.016      3.060**      1.500      0.024      5.530*
     *      2.000      0.031      6.930**      2.500      0.039      8.090*
     *      3.000      0.047      9.110**      3.500      0.055     10.020*
     *      4.000      0.063     10.860**
------------------------------------------------------------------------------
     BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:
      INTERVAL   DEPTH   {S-O*DT/2}   {S+O*DT/2}
       NUMBER   (FEET)   (ACRE-FEET)  (ACRE-FEET)
          1     0.00       0.00000      0.00000
          2     0.50      -0.00003      0.01603
          3     1.00      -0.00676      0.03876
          4     1.50      -0.01713      0.06513
          5     2.00      -0.02055      0.08255
          6     2.50      -0.02117      0.09917
          7     3.00      -0.02076      0.11476
          8     3.50      -0.01953      0.12953
          9     4.00      -0.01778      0.14378
     WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)
```

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.160	0.000	0.19	0.09	0.10	0.001
0.340	0.000	0.19	0.09	0.19	0.001
0.520	0.000	0.19	0.09	0.19	0.001
0.700	0.000	0.20	0.09	0.19	0.001
0.880	0.000	0.20	0.09	0.20	0.001
1.060	0.000	0.20	0.09	0.20	0.001
1.240	0.000	0.20	0.09	0.20	0.001
1.420	0.000	0.20	0.09	0.20	0.001
1.600	0.000	0.20	0.09	0.20	0.002
1.780	0.000	0.20	0.09	0.20	0.002
1.960	0.000	0.21	0.10	0.21	0.002
2.140	0.000	0.21	0.10	0.21	0.002
2.320	0.000	0.21	0.10	0.21	0.002
2.500	0.000	0.21	0.10	0.21	0.002
2.680	0.000	0.21	0.10	0.21	0.002
2.860	0.000	0.21	0.10	0.21	0.002
3.040	0.000	0.22	0.10	0.22	0.002
3.220	0.000	0.22	0.10	0.22	0.002
3.400	0.000	0.22	0.10	0.22	0.002
3.580	0.000	0.22	0.10	0.22	0.002
3.760	0.000	0.22	0.10	0.22	0.002
3.940	0.000	0.23	0.11	0.23	0.002
4.120	0.000	0.23	0.11	0.23	0.002
4.300	0.000	0.23	0.11	0.23	0.002
4.480	0.000	0.23	0.11	0.23	0.002
4.660	0.000	0.24	0.11	0.23	0.002
4.840	0.000	0.24	0.11	0.24	0.002
5.020	0.000	0.24	0.11	0.24	0.002
5.200	0.000	0.24	0.11	0.24	0.002
5.380	0.000	0.25	0.11	0.24	0.002
5.560	0.000	0.25	0.11	0.25	0.002
5.740	0.000	0.25	0.12	0.25	0.002
5.920	0.000	0.25	0.12	0.25	0.002
6.100	0.000	0.26	0.12	0.25	0.002
6.280	0.000	0.26	0.12	0.26	0.002
6.460	0.000	0.26	0.12	0.26	0.002
6.640	0.000	0.26	0.12	0.26	0.002
6.820	0.000	0.27	0.12	0.27	0.002
7.000	0.000	0.27	0.13	0.27	0.002
7.180	0.000	0.28	0.13	0.27	0.002
7.360	0.000	0.28	0.13	0.28	0.002
7.540	0.000	0.28	0.13	0.28	0.002
7.720	0.000	0.28	0.13	0.28	0.002

7.900	0.000	0.29	0.13	0.29	0.002
8.080	0.000	0.29	0.14	0.29	0.002
8.260	0.000	0.30	0.14	0.30	0.002
8.440	0.000	0.30	0.14	0.30	0.002
8.620	0.000	0.31	0.14	0.30	0.002
8.800	0.000	0.31	0.14	0.31	0.002
8.980	0.000	0.32	0.15	0.31	0.002
9.160	0.000	0.32	0.15	0.32	0.002
9.340	0.000	0.33	0.15	0.32	0.002
9.520	0.000	0.33	0.15	0.33	0.002
9.700	0.000	0.34	0.16	0.34	0.003
9.880	0.000	0.34	0.16	0.34	0.003
10.060	0.000	0.35	0.16	0.35	0.003
10.240	0.000	0.36	0.17	0.35	0.003
10.420	0.000	0.37	0.17	0.36	0.003
10.600	0.000	0.37	0.17	0.37	0.003
10.780	0.000	0.38	0.18	0.38	0.003
10.960	0.000	0.39	0.18	0.38	0.003
11.140	0.000	0.40	0.18	0.39	0.003
11.320	0.000	0.40	0.19	0.40	0.003
11.500	0.000	0.42	0.19	0.41	0.003
11.680	0.000	0.42	0.20	0.42	0.003
11.860	0.000	0.44	0.20	0.43	0.003
12.040	0.000	0.45	0.21	0.44	0.003
12.220	0.000	0.58	0.27	0.51	0.004
12.400	0.000	0.59	0.27	0.59	0.004
12.580	0.000	0.61	0.28	0.60	0.005
12.760	0.000	0.62	0.29	0.62	0.005
12.940	0.000	0.65	0.30	0.64	0.005
13.120	0.000	0.66	0.31	0.66	0.005
13.300	0.000	0.69	0.32	0.68	0.005
13.480	0.000	0.71	0.33	0.70	0.005
13.660	0.000	0.74	0.34	0.73	0.006
13.840	0.000	0.76	0.35	0.75	0.006
14.020	0.000	0.81	0.37	0.79	0.006
14.200	0.000	0.84	0.39	0.82	0.006
14.380	0.000	0.90	0.42	0.87	0.007
14.560	0.000	0.93	0.43	0.92	0.007
14.740	0.000	1.01	0.47	0.97	0.008
14.920	0.000	1.06	0.49	1.04	0.008
15.100	0.000	1.19	0.54	1.15	0.009
15.280	0.000	1.27	0.56	1.28	0.009
15.460	0.000	1.41	0.61	1.42	0.010
15.640	0.000	1.50	0.64	1.57	0.010
15.820	0.000	2.20	0.87	2.08	0.014
16.000	0.000	3.05	1.13	3.11	0.018
16.180	0.000	9.50	3.92	7.20	0.062
16.360	0.000	1.76	0.72	6.34	0.012
16.540	0.000	1.38	0.60	1.72	0.010
16.720	0.000	1.12	0.51	1.30	0.008
16.900	0.000	0.97	0.45	1.05	0.007
17.080	0.000	0.87	0.40	0.92	0.006

17.260	0.000	0.78	0.36	0.83	0.006
17.440	0.000	0.72	0.34	0.75	0.005
17.620	0.000	0.67	0.31	0.70	0.005
17.800	0.000	0.63	0.29	0.66	0.005
17.980	0.000	0.60	0.28	0.62	0.004
18.160	0.000	0.49	0.23	0.55	0.004
18.340	0.000	0.43	0.20	0.46	0.003
18.520	0.000	0.41	0.19	0.42	0.003
18.700	0.000	0.39	0.18	0.40	0.003
18.880	0.000	0.38	0.17	0.38	0.003
19.060	0.000	0.36	0.17	0.37	0.003
19.240	0.000	0.35	0.16	0.35	0.003
19.420	0.000	0.33	0.16	0.34	0.002
19.600	0.000	0.32	0.15	0.33	0.002
19.780	0.000	0.31	0.15	0.32	0.002
19.960	0.000	0.30	0.14	0.31	0.002
20.140	0.000	0.30	0.14	0.30	0.002
20.320	0.000	0.29	0.13	0.29	0.002
20.500	0.000	0.28	0.13	0.28	0.002
20.680	0.000	0.27	0.13	0.28	0.002
20.860	0.000	0.27	0.12	0.27	0.002
21.040	0.000	0.26	0.12	0.26	0.002
21.220	0.000	0.25	0.12	0.26	0.002
21.400	0.000	0.25	0.12	0.25	0.002
21.580	0.000	0.24	0.11	0.25	0.002
21.760	0.000	0.24	0.11	0.24	0.002
21.940	0.000	0.23	0.11	0.24	0.002
22.120	0.000	0.23	0.11	0.23	0.002
22.300	0.000	0.23	0.10	0.23	0.002
22.480	0.000	0.22	0.10	0.22	0.002
22.660	0.000	0.22	0.10	0.22	0.002
22.840	0.000	0.21	0.10	0.22	0.002
23.020	0.000	0.21	0.10	0.21	0.002
23.200	0.000	0.21	0.10	0.21	0.002
23.380	0.000	0.20	0.09	0.21	0.002
23.560	0.000	0.20	0.09	0.20	0.001
23.740	0.000	0.20	0.09	0.20	0.001
23.920	0.000	0.19	0.09	0.20	0.001
24.100	0.000	0.19	0.09	0.19	0.001
24.280	0.000	0.00	0.00	0.10	0.000
24.460	0.000	0.00	0.00	0.00	0.000

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                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                              Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN A
----------------------------------------------------------------------------


     RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
     TOTAL CATCHMENT AREA(ACRES) =     2.77
     SOIL-LOSS RATE, Fm,(INCH/HR) =  0.260
     LOW LOSS FRACTION = 0.390
     TIME OF CONCENTRATION(MIN.) = 12.50
     SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
     ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
     RETURN FREQUENCY(YEARS) = 100
        5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
       30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
        1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
        3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
        6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
       24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

     TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      0.77
     TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.53

****************************************************************************
  TIME      VOLUME        Q     0.         2.5        5.0        7.5       10.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.17      0.0011      0.13  Q          .          .          .          .
  0.38      0.0034      0.13  Q          .          .          .          .
  0.58      0.0058      0.13  Q          .          .          .          .
  0.79      0.0081      0.14  Q          .          .          .          .
```

1.00	0.0104	0.14	Q	.	.	.	.
1.21	0.0128	0.14	Q	.	.	.	.
1.42	0.0152	0.14	Q	.	.	.	.
1.62	0.0176	0.14	Q	.	.	.	.
1.83	0.0201	0.14	Q	.	.	.	.
2.04	0.0225	0.14	Q	.	.	.	.
2.25	0.0250	0.14	Q	.	.	.	.
2.46	0.0275	0.15	Q	.	.	.	.
2.67	0.0301	0.15	Q	.	.	.	.
2.88	0.0326	0.15	Q	.	.	.	.
3.08	0.0352	0.15	Q	.	.	.	.
3.29	0.0378	0.15	Q	.	.	.	.
3.50	0.0404	0.15	Q	.	.	.	.
3.71	0.0431	0.16	Q	.	.	.	.
3.92	0.0458	0.16	Q	.	.	.	.
4.12	0.0485	0.16	Q	.	.	.	.
4.33	0.0512	0.16	Q	.	.	.	.
4.54	0.0540	0.16	Q	.	.	.	.
4.75	0.0568	0.16	Q	.	.	.	.
4.96	0.0597	0.17	Q	.	.	.	.
5.17	0.0626	0.17	Q	.	.	.	.
5.38	0.0655	0.17	Q	.	.	.	.
5.58	0.0684	0.17	Q	.	.	.	.
5.79	0.0714	0.17	Q	.	.	.	.
6.00	0.0744	0.18	Q	.	.	.	.
6.21	0.0775	0.18	Q	.	.	.	.
6.42	0.0806	0.18	Q	.	.	.	.
6.62	0.0837	0.18	Q	.	.	.	.
6.83	0.0869	0.19	Q	.	.	.	.
7.04	0.0901	0.19	Q	.	.	.	.
7.25	0.0934	0.19	Q	.	.	.	.
7.46	0.0967	0.19	Q	.	.	.	.
7.67	0.1001	0.20	Q	.	.	.	.
7.88	0.1035	0.20	Q	.	.	.	.
8.08	0.1070	0.20	Q	.	.	.	.
8.29	0.1105	0.21	Q	.	.	.	.
8.50	0.1141	0.21	Q	.	.	.	.
8.71	0.1178	0.21	Q	.	.	.	.
8.92	0.1215	0.22	Q	.	.	.	.
9.12	0.1253	0.22	Q	.	.	.	.
9.33	0.1292	0.23	Q	.	.	.	.
9.54	0.1331	0.23	Q	.	.	.	.
9.75	0.1371	0.23	Q	.	.	.	.
9.96	0.1412	0.24	Q	.	.	.	.
10.17	0.1454	0.24	Q	.	.	.	.
10.38	0.1497	0.25	.Q	.	.	.	.
10.58	0.1541	0.26	.Q	.	.	.	.
10.79	0.1585	0.26	.Q	.	.	.	.
11.00	0.1631	0.27	.Q	.	.	.	.
11.21	0.1678	0.28	.Q	.	.	.	.
11.42	0.1727	0.28	.Q	.	.	.	.
11.62	0.1776	0.29	.Q	.	.	.	.

11.83	0.1827	0.30	.Q . . . .
12.04	0.1880	0.31	.Q . . . .
12.25	0.1940	0.38	.Q . . . .
12.46	0.2009	0.42	.Q . . . .
12.67	0.2081	0.42	.Q . . . .
12.88	0.2156	0.44	.Q . . . .
13.08	0.2233	0.45	.Q . . . .
13.29	0.2314	0.48	.Q . . . .
13.50	0.2397	0.49	.Q . . . .
13.71	0.2484	0.52	. Q . . . .
13.92	0.2575	0.54	. Q . . . .
14.12	0.2670	0.58	. Q . . . .
14.33	0.2771	0.60	. Q . . . .
14.54	0.2879	0.65	. Q . . . .
14.75	0.2994	0.68	. Q . . . .
14.96	0.3119	0.77	. Q . . . .
15.17	0.3255	0.82	. Q . . . .
15.38	0.3409	0.97	. Q . . . .
15.58	0.3576	0.97	. Q . . . .
15.79	0.3793	1.55	. Q . . . .
16.00	0.4130	2.36	. Q. . . .
16.21	0.5060	8.44	. . . . Q .
16.42	0.5885	1.15	. Q . . . .
16.62	0.6060	0.88	. Q . . . .
16.83	0.6198	0.72	. Q . . . .
17.04	0.6314	0.62	. Q . . . .
17.25	0.6416	0.55	. Q . . . .
17.46	0.6507	0.50	. Q . . . .
17.67	0.6590	0.47	.Q . . . .
17.88	0.6668	0.43	.Q . . . .
18.08	0.6740	0.41	.Q . . . .
18.29	0.6802	0.31	.Q . . . .
18.50	0.6853	0.29	.Q . . . .
18.71	0.6901	0.27	.Q . . . .
18.92	0.6947	0.26	.Q . . . .
19.12	0.6991	0.25	Q . . . .
19.33	0.7033	0.24	Q . . . .
19.54	0.7073	0.23	Q . . . .
19.75	0.7111	0.22	Q . . . .
19.96	0.7149	0.21	Q . . . .
20.17	0.7185	0.21	Q . . . .
20.38	0.7219	0.20	Q . . . .
20.58	0.7253	0.19	Q . . . .
20.79	0.7286	0.19	Q . . . .
21.00	0.7318	0.18	Q . . . .
21.21	0.7349	0.18	Q . . . .
21.42	0.7379	0.17	Q . . . .
21.62	0.7408	0.17	Q . . . .
21.83	0.7437	0.17	Q . . . .
22.04	0.7465	0.16	Q . . . .
22.25	0.7493	0.16	Q . . . .
22.46	0.7520	0.15	Q . . . .

22.67	0.7546	0.15	Q	.	.	.	.
22.88	0.7572	0.15	Q	.	.	.	.
23.08	0.7597	0.15	Q	.	.	.	.
23.29	0.7622	0.14	Q	.	.	.	.
23.50	0.7646	0.14	Q	.	.	.	.
23.71	0.7670	0.14	Q	.	.	.	.
23.92	0.7694	0.14	Q	.	.	.	.
24.12	0.7717	0.13	Q	.	.	.	.
24.33	0.7729	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1450.0
10%	87.5
20%	25.0
30%	12.5
40%	12.5
50%	12.5
60%	12.5
70%	12.5
80%	12.5
90%	12.5

Problem Descriptions:

==========

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 12.500
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

```
INFLOW
  |
  |
  |
  V                __effective depth
```

```
-------------          |   (and volume)
|           |     |    |
| detention |     |....V.............
|   basin   |<-->|          outflow
|           |     |.........________
-------------     |          |   \
      |           | storage |     basin outlet
      V           -----------
   OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) **	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) *
0.000	0.000	0.000**	0.500	0.007	1.080*
1.000	0.015	3.060**	1.500	0.022	5.530*
2.000	0.030	6.930**	2.500	0.037	8.090*
3.000	0.044	9.110**	3.500	0.052	10.020*
4.000	0.059	10.860**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	-0.00230	0.01630
3	1.00	-0.01134	0.04134
4	1.50	-0.02561	0.06961
5	2.00	-0.02966	0.08966
6	2.50	-0.03265	0.10665
7	3.00	-0.03443	0.12243
8	3.50	-0.03426	0.13826
9	4.00	-0.03449	0.15249

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.167	0.000	0.13	0.07	0.08	0.001
0.375	0.000	0.13	0.07	0.15	0.001
0.583	0.000	0.13	0.07	0.15	0.001
0.792	0.000	0.14	0.07	0.15	0.001
1.000	0.000	0.14	0.07	0.16	0.001
1.208	0.000	0.14	0.07	0.16	0.001
1.417	0.000	0.14	0.07	0.16	0.001
1.625	0.000	0.14	0.07	0.16	0.001
1.833	0.000	0.14	0.08	0.16	0.001

2.042	0.000	0.14	0.08	0.16	0.001
2.250	0.000	0.14	0.08	0.16	0.001
2.458	0.000	0.15	0.08	0.17	0.001
2.667	0.000	0.15	0.08	0.17	0.001
2.875	0.000	0.15	0.08	0.17	0.001
3.083	0.000	0.15	0.08	0.17	0.001
3.292	0.000	0.15	0.08	0.17	0.001
3.500	0.000	0.15	0.08	0.17	0.001
3.708	0.000	0.16	0.08	0.18	0.001
3.917	0.000	0.16	0.08	0.18	0.001
4.125	0.000	0.16	0.08	0.18	0.001
4.333	0.000	0.16	0.08	0.18	0.001
4.542	0.000	0.16	0.09	0.18	0.001
4.750	0.000	0.16	0.09	0.19	0.001
4.958	0.000	0.17	0.09	0.19	0.001
5.167	0.000	0.17	0.09	0.19	0.001
5.375	0.000	0.17	0.09	0.19	0.001
5.583	0.000	0.17	0.09	0.20	0.001
5.792	0.000	0.17	0.09	0.20	0.001
6.000	0.000	0.18	0.09	0.20	0.001
6.208	0.000	0.18	0.09	0.20	0.001
6.417	0.000	0.18	0.10	0.21	0.001
6.625	0.000	0.18	0.10	0.21	0.001
6.833	0.000	0.19	0.10	0.21	0.001
7.042	0.000	0.19	0.10	0.21	0.001
7.250	0.000	0.19	0.10	0.22	0.001
7.458	0.000	0.19	0.10	0.22	0.001
7.667	0.000	0.20	0.10	0.22	0.001
7.875	0.000	0.20	0.11	0.23	0.001
8.083	0.000	0.20	0.11	0.23	0.002
8.292	0.000	0.21	0.11	0.23	0.002
8.500	0.000	0.21	0.11	0.24	0.002
8.708	0.000	0.21	0.11	0.24	0.002
8.917	0.000	0.22	0.11	0.25	0.002
9.125	0.000	0.22	0.12	0.25	0.002
9.333	0.000	0.23	0.12	0.26	0.002
9.542	0.000	0.23	0.12	0.26	0.002
9.750	0.000	0.23	0.12	0.27	0.002
9.958	0.000	0.24	0.13	0.27	0.002
10.167	0.000	0.24	0.13	0.28	0.002
10.375	0.000	0.25	0.13	0.28	0.002
10.583	0.000	0.26	0.14	0.29	0.002
10.792	0.000	0.26	0.14	0.30	0.002
11.000	0.000	0.27	0.14	0.30	0.002
11.208	0.000	0.28	0.15	0.31	0.002
11.417	0.000	0.28	0.15	0.32	0.002
11.625	0.000	0.29	0.16	0.33	0.002
11.833	0.000	0.30	0.16	0.34	0.002
12.042	0.000	0.31	0.16	0.35	0.002
12.250	0.000	0.38	0.20	0.40	0.003
12.458	0.000	0.42	0.22	0.46	0.003
12.667	0.000	0.42	0.22	0.48	0.003

12.875	0.000	0.44	0.23	0.50	0.003
13.083	0.000	0.45	0.24	0.51	0.003
13.292	0.000	0.48	0.25	0.53	0.004
13.500	0.000	0.49	0.26	0.55	0.004
13.708	0.000	0.52	0.27	0.58	0.004
13.917	0.000	0.54	0.28	0.60	0.004
14.125	0.000	0.58	0.30	0.63	0.004
14.333	0.000	0.60	0.32	0.67	0.004
14.542	0.000	0.65	0.34	0.71	0.005
14.750	0.000	0.68	0.36	0.76	0.005
14.958	0.000	0.77	0.40	0.83	0.006
15.167	0.000	0.82	0.43	0.90	0.006
15.375	0.000	0.97	0.51	1.02	0.007
15.583	0.000	0.97	0.51	1.11	0.007
15.792	0.000	1.55	0.71	1.51	0.010
16.000	0.000	2.36	0.99	2.46	0.015
16.208	0.000	8.44	3.75	6.72	0.055
16.417	0.000	1.15	0.57	5.90	0.008
16.625	0.000	0.88	0.47	1.18	0.007
16.833	0.000	0.72	0.38	0.92	0.005
17.042	0.000	0.62	0.33	0.77	0.005
17.250	0.000	0.55	0.29	0.67	0.004
17.458	0.000	0.50	0.27	0.60	0.004
17.667	0.000	0.47	0.25	0.55	0.003
17.875	0.000	0.43	0.23	0.51	0.003
18.083	0.000	0.41	0.22	0.48	0.003
18.292	0.000	0.31	0.16	0.41	0.002
18.500	0.000	0.29	0.15	0.34	0.002
18.708	0.000	0.27	0.14	0.32	0.002
18.917	0.000	0.26	0.14	0.30	0.002
19.125	0.000	0.25	0.13	0.29	0.002
19.333	0.000	0.24	0.13	0.28	0.002
19.542	0.000	0.23	0.12	0.27	0.002
19.750	0.000	0.22	0.12	0.26	0.002
19.958	0.000	0.21	0.11	0.25	0.002
20.167	0.000	0.21	0.11	0.24	0.002
20.375	0.000	0.20	0.11	0.23	0.001
20.583	0.000	0.19	0.10	0.22	0.001
20.792	0.000	0.19	0.10	0.22	0.001
21.000	0.000	0.18	0.10	0.21	0.001
21.208	0.000	0.18	0.09	0.21	0.001
21.417	0.000	0.17	0.09	0.20	0.001
21.625	0.000	0.17	0.09	0.20	0.001
21.833	0.000	0.17	0.09	0.19	0.001
22.042	0.000	0.16	0.09	0.19	0.001
22.250	0.000	0.16	0.08	0.18	0.001
22.458	0.000	0.15	0.08	0.18	0.001
22.667	0.000	0.15	0.08	0.17	0.001
22.875	0.000	0.15	0.08	0.17	0.001
23.083	0.000	0.15	0.08	0.17	0.001
23.292	0.000	0.14	0.08	0.16	0.001
23.500	0.000	0.14	0.07	0.16	0.001

23.708	0.000	0.14	0.07	0.16	0.001
23.917	0.000	0.14	0.07	0.16	0.001
24.125	0.000	0.13	0.07	0.15	0.001
24.333	0.000	0.00	0.00	0.08	0.000
24.542	0.000	0.00	0.00	0.00	0.000

```
****************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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             Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                         Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN B
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    0.90
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.260
    LOW LOSS FRACTION = 0.390
    TIME OF CONCENTRATION(MIN.) = 12.70
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.25
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.17

****************************************************************************
  TIME      VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)     (AF)      (CFS)
----------------------------------------------------------------------------
  0.13      0.0002      0.04  Q         .         .         .         .
  0.34      0.0010      0.04  Q         .         .         .         .
  0.55      0.0017      0.04  Q         .         .         .         .
  0.76      0.0025      0.04  Q         .         .         .         .
```

0.97	0.0033	0.04	Q	.	.	.	.
1.18	0.0041	0.04	Q	.	.	.	.
1.40	0.0049	0.05	Q	.	.	.	.
1.61	0.0057	0.05	Q	.	.	.	.
1.82	0.0065	0.05	Q	.	.	.	.
2.03	0.0073	0.05	Q	.	.	.	.
2.24	0.0081	0.05	Q	.	.	.	.
2.45	0.0089	0.05	Q	.	.	.	.
2.67	0.0098	0.05	Q	.	.	.	.
2.88	0.0106	0.05	Q	.	.	.	.
3.09	0.0115	0.05	Q	.	.	.	.
3.30	0.0123	0.05	Q	.	.	.	.
3.51	0.0132	0.05	Q	.	.	.	.
3.72	0.0141	0.05	Q	.	.	.	.
3.94	0.0150	0.05	Q	.	.	.	.
4.15	0.0158	0.05	Q	.	.	.	.
4.36	0.0168	0.05	Q	.	.	.	.
4.57	0.0177	0.05	Q	.	.	.	.
4.78	0.0186	0.05	Q	.	.	.	.
4.99	0.0195	0.05	Q	.	.	.	.
5.21	0.0205	0.05	Q	.	.	.	.
5.42	0.0215	0.06	Q	.	.	.	.
5.63	0.0224	0.06	Q	.	.	.	.
5.84	0.0234	0.06	Q	.	.	.	.
6.05	0.0244	0.06	Q	.	.	.	.
6.26	0.0254	0.06	Q	.	.	.	.
6.47	0.0265	0.06	Q	.	.	.	.
6.69	0.0275	0.06	Q	.	.	.	.
6.90	0.0286	0.06	Q	.	.	.	.
7.11	0.0296	0.06	Q	.	.	.	.
7.32	0.0307	0.06	Q	.	.	.	.
7.53	0.0318	0.06	Q	.	.	.	.
7.75	0.0329	0.06	Q	.	.	.	.
7.96	0.0341	0.07	Q	.	.	.	.
8.17	0.0352	0.07	Q	.	.	.	.
8.38	0.0364	0.07	Q	.	.	.	.
8.59	0.0376	0.07	Q	.	.	.	.
8.80	0.0388	0.07	Q	.	.	.	.
9.02	0.0401	0.07	Q	.	.	.	.
9.23	0.0413	0.07	Q	.	.	.	.
9.44	0.0426	0.07	Q	.	.	.	.
9.65	0.0439	0.08	Q	.	.	.	.
9.86	0.0453	0.08	Q	.	.	.	.
10.07	0.0466	0.08	Q	.	.	.	.
10.28	0.0480	0.08	Q	.	.	.	.
10.50	0.0495	0.08	Q	.	.	.	.
10.71	0.0509	0.09	Q	.	.	.	.
10.92	0.0524	0.09	Q	.	.	.	.
11.13	0.0540	0.09	Q	.	.	.	.
11.34	0.0555	0.09	Q	.	.	.	.
11.55	0.0572	0.09	Q	.	.	.	.
11.77	0.0588	0.10	Q	.	.	.	.

11.98	0.0605	0.10	Q	.	.	.	.
12.19	0.0624	0.11	Q	.	.	.	.
12.40	0.0646	0.13	Q	.	.	.	.
12.61	0.0669	0.14	Q	.	.	.	.
12.82	0.0694	0.14	Q	.	.	.	.
13.04	0.0719	0.15	Q	.	.	.	.
13.25	0.0745	0.15	Q	.	.	.	.
13.46	0.0773	0.16	Q	.	.	.	.
13.67	0.0801	0.17	Q	.	.	.	.
13.88	0.0831	0.17	Q	.	.	.	.
14.10	0.0862	0.19	Q	.	.	.	.
14.31	0.0895	0.19	Q	.	.	.	.
14.52	0.0930	0.21	Q	.	.	.	.
14.73	0.0968	0.22	Q	.	.	.	.
14.94	0.1009	0.25	Q	.	.	.	.
15.15	0.1054	0.26	.Q	.	.	.	.
15.37	0.1104	0.31	.Q	.	.	.	.
15.58	0.1159	0.32	.Q	.	.	.	.
15.79	0.1230	0.50	.Q	.	.	.	.
16.00	0.1340	0.76	. Q	.	.	.	.
16.21	0.1643	2.71	.	Q	.	.	.
16.42	0.1913	0.37	.Q	.	.	.	.
16.64	0.1970	0.28	.Q	.	.	.	.
16.85	0.2015	0.23	Q	.	.	.	.
17.06	0.2053	0.20	Q	.	.	.	.
17.27	0.2086	0.18	Q	.	.	.	.
17.48	0.2116	0.16	Q	.	.	.	.
17.69	0.2144	0.15	Q	.	.	.	.
17.91	0.2169	0.14	Q	.	.	.	.
18.12	0.2193	0.13	Q	.	.	.	.
18.33	0.2213	0.10	Q	.	.	.	.
18.54	0.2229	0.09	Q	.	.	.	.
18.75	0.2245	0.09	Q	.	.	.	.
18.96	0.2260	0.08	Q	.	.	.	.
19.17	0.2275	0.08	Q	.	.	.	.
19.39	0.2288	0.08	Q	.	.	.	.
19.60	0.2301	0.07	Q	.	.	.	.
19.81	0.2314	0.07	Q	.	.	.	.
20.02	0.2326	0.07	Q	.	.	.	.
20.23	0.2338	0.07	Q	.	.	.	.
20.44	0.2349	0.06	Q	.	.	.	.
20.66	0.2360	0.06	Q	.	.	.	.
20.87	0.2371	0.06	Q	.	.	.	.
21.08	0.2381	0.06	Q	.	.	.	.
21.29	0.2392	0.06	Q	.	.	.	.
21.50	0.2401	0.06	Q	.	.	.	.
21.72	0.2411	0.05	Q	.	.	.	.
21.93	0.2421	0.05	Q	.	.	.	.
22.14	0.2430	0.05	Q	.	.	.	.
22.35	0.2439	0.05	Q	.	.	.	.
22.56	0.2447	0.05	Q	.	.	.	.
22.77	0.2456	0.05	Q	.	.	.	.

22.98	0.2465	0.05	Q	.	.	.	.
23.20	0.2473	0.05	Q	.	.	.	.
23.41	0.2481	0.05	Q	.	.	.	.
23.62	0.2489	0.05	Q	.	.	.	.
23.83	0.2497	0.04	Q	.	.	.	.
24.04	0.2504	0.04	Q	.	.	.	.
24.25	0.2508	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1447.8
10%	88.9
20%	25.4
30%	12.7
40%	12.7
50%	12.7
60%	12.7
70%	12.7
80%	12.7
90%	12.7

Problem Descriptions:

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 12.700
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

```
          INFLOW
            |
            |
            |
            V                 __effective depth
     -------------            |   (and volume)
     |           |     |      |
```

```
| detention |     |....V.............
|   basin   |<-->|          outflow
|           |     |.........________
-------------     |         |   \
      |           | storage |     basin outlet
      V           -----------
   OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) **	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) *
* 0.000	0.000	0.000**	0.500	0.003	0.580*
* 1.000	0.005	1.370**	1.500	0.008	1.820*
* 2.000	0.010	2.170**	2.500	0.013	2.470*
* 3.000	0.016	2.740**	3.500	0.018	2.990*
* 4.000	0.021	3.220**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	-0.00207	0.00807
3	1.00	-0.00698	0.01698
4	1.50	-0.00792	0.02392
5	2.00	-0.00898	0.02898
6	2.50	-0.00860	0.03460
7	3.00	-0.00797	0.03997
8	3.50	-0.00815	0.04415
9	4.00	-0.00716	0.04916

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.125	0.000	0.04	0.05	0.03	0.000
0.337	0.000	0.04	0.05	0.05	0.000
0.548	0.000	0.04	0.05	0.05	0.000
0.760	0.000	0.04	0.05	0.06	0.000
0.972	0.000	0.04	0.05	0.06	0.000
1.183	0.000	0.04	0.05	0.06	0.000
1.395	0.000	0.05	0.05	0.06	0.000
1.607	0.000	0.05	0.05	0.06	0.000
1.818	0.000	0.05	0.05	0.06	0.000
2.030	0.000	0.05	0.05	0.06	0.000
2.242	0.000	0.05	0.05	0.06	0.000

2.453	0.000	0.05	0.05	0.06	0.000
2.665	0.000	0.05	0.05	0.06	0.000
2.877	0.000	0.05	0.05	0.06	0.000
3.088	0.000	0.05	0.05	0.06	0.000
3.300	0.000	0.05	0.05	0.06	0.000
3.512	0.000	0.05	0.05	0.06	0.000
3.723	0.000	0.05	0.05	0.06	0.000
3.935	0.000	0.05	0.06	0.06	0.000
4.147	0.000	0.05	0.06	0.06	0.000
4.358	0.000	0.05	0.06	0.07	0.000
4.570	0.000	0.05	0.06	0.07	0.000
4.782	0.000	0.05	0.06	0.07	0.000
4.993	0.000	0.05	0.06	0.07	0.000
5.205	0.000	0.05	0.06	0.07	0.000
5.417	0.000	0.06	0.06	0.07	0.000
5.628	0.000	0.06	0.06	0.07	0.000
5.840	0.000	0.06	0.06	0.07	0.000
6.052	0.000	0.06	0.06	0.07	0.000
6.263	0.000	0.06	0.06	0.07	0.000
6.475	0.000	0.06	0.06	0.07	0.000
6.687	0.000	0.06	0.06	0.07	0.000
6.898	0.000	0.06	0.07	0.08	0.000
7.110	0.000	0.06	0.07	0.08	0.000
7.322	0.000	0.06	0.07	0.08	0.000
7.533	0.000	0.06	0.07	0.08	0.000
7.745	0.000	0.06	0.07	0.08	0.000
7.957	0.000	0.07	0.07	0.08	0.000
8.168	0.000	0.07	0.07	0.08	0.000
8.380	0.000	0.07	0.07	0.08	0.000
8.592	0.000	0.07	0.07	0.09	0.000
8.803	0.000	0.07	0.08	0.09	0.000
9.015	0.000	0.07	0.08	0.09	0.000
9.227	0.000	0.07	0.08	0.09	0.000
9.438	0.000	0.07	0.08	0.09	0.000
9.650	0.000	0.08	0.08	0.09	0.000
9.862	0.000	0.08	0.08	0.10	0.001
10.073	0.000	0.08	0.09	0.10	0.001
10.285	0.000	0.08	0.09	0.10	0.001
10.497	0.000	0.08	0.09	0.10	0.001
10.708	0.000	0.09	0.09	0.11	0.001
10.920	0.000	0.09	0.09	0.11	0.001
11.132	0.000	0.09	0.10	0.11	0.001
11.343	0.000	0.09	0.10	0.11	0.001
11.555	0.000	0.09	0.10	0.12	0.001
11.767	0.000	0.10	0.10	0.12	0.001
11.978	0.000	0.10	0.11	0.12	0.001
12.190	0.000	0.11	0.12	0.13	0.001
12.402	0.000	0.13	0.15	0.15	0.001
12.613	0.000	0.14	0.15	0.17	0.001
12.825	0.000	0.14	0.15	0.18	0.001
13.037	0.000	0.15	0.16	0.18	0.001
13.248	0.000	0.15	0.17	0.19	0.001

13.460	0.000	0.16	0.17	0.20	0.001
13.672	0.000	0.17	0.18	0.20	0.001
13.883	0.000	0.17	0.19	0.21	0.001
14.095	0.000	0.19	0.20	0.22	0.001
14.307	0.000	0.19	0.21	0.24	0.001
14.518	0.000	0.21	0.23	0.25	0.001
14.730	0.000	0.22	0.24	0.27	0.001
14.942	0.000	0.25	0.27	0.29	0.002
15.153	0.000	0.26	0.29	0.32	0.002
15.365	0.000	0.31	0.34	0.36	0.002
15.577	0.000	0.32	0.34	0.39	0.002
15.788	0.000	0.50	0.54	0.52	0.003
16.000	0.000	0.76	0.79	0.84	0.004
16.212	0.000	2.71	3.83	2.09	0.020
16.423	0.000	0.37	0.40	1.80	0.002
16.635	0.000	0.28	0.31	0.41	0.002
16.847	0.000	0.23	0.25	0.32	0.002
17.058	0.000	0.20	0.22	0.27	0.001
17.270	0.000	0.18	0.19	0.24	0.001
17.482	0.000	0.16	0.18	0.21	0.001
17.693	0.000	0.15	0.16	0.20	0.001
17.905	0.000	0.14	0.15	0.18	0.001
18.117	0.000	0.13	0.14	0.17	0.001
18.328	0.000	0.10	0.11	0.14	0.001
18.540	0.000	0.09	0.10	0.12	0.001
18.752	0.000	0.09	0.10	0.11	0.001
18.963	0.000	0.08	0.09	0.11	0.001
19.175	0.000	0.08	0.09	0.10	0.001
19.387	0.000	0.08	0.08	0.10	0.000
19.598	0.000	0.07	0.08	0.09	0.000
19.810	0.000	0.07	0.08	0.09	0.000
20.022	0.000	0.07	0.07	0.09	0.000
20.233	0.000	0.07	0.07	0.08	0.000
20.445	0.000	0.06	0.07	0.08	0.000
20.657	0.000	0.06	0.07	0.08	0.000
20.868	0.000	0.06	0.07	0.08	0.000
21.080	0.000	0.06	0.06	0.07	0.000
21.292	0.000	0.06	0.06	0.07	0.000
21.503	0.000	0.06	0.06	0.07	0.000
21.715	0.000	0.05	0.06	0.07	0.000
21.927	0.000	0.05	0.06	0.07	0.000
22.138	0.000	0.05	0.06	0.07	0.000
22.350	0.000	0.05	0.06	0.06	0.000
22.562	0.000	0.05	0.05	0.06	0.000
22.773	0.000	0.05	0.05	0.06	0.000
22.985	0.000	0.05	0.05	0.06	0.000
23.197	0.000	0.05	0.05	0.06	0.000
23.408	0.000	0.05	0.05	0.06	0.000
23.620	0.000	0.05	0.05	0.06	0.000
23.832	0.000	0.04	0.05	0.06	0.000
24.043	0.000	0.04	0.05	0.06	0.000
24.255	0.000	0.00	0.00	0.03	0.000

24.467	0.000	0.00	0.00	0.00	0.000

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****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                              Analysis prepared by:



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----------------------------------------------------------------------------

 Problem Descriptions:
  EL TORO DEVELOPMENT
  100 YEAR STORM - PROPOSED CONDITION
  BASIN C
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =     0.59
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.260
    LOW LOSS FRACTION = 0.390
    TIME OF CONCENTRATION(MIN.) = 14.50
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      0.16
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.11

****************************************************************************
  TIME      VOLUME        Q    0.         2.5        5.0        7.5       10.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.05      0.0000       0.00  Q          .          .          .          .
  0.29      0.0003       0.03  Q          .          .          .          .
  0.53      0.0009       0.03  Q          .          .          .          .
  0.77      0.0014       0.03  Q          .          .          .          .
```

1.02	0.0020	0.03	Q	.	.	.	.
1.26	0.0026	0.03	Q	.	.	.	.
1.50	0.0032	0.03	Q	.	.	.	.
1.74	0.0038	0.03	Q	.	.	.	.
1.98	0.0044	0.03	Q	.	.	.	.
2.22	0.0050	0.03	Q	.	.	.	.
2.47	0.0056	0.03	Q	.	.	.	.
2.71	0.0062	0.03	Q	.	.	.	.
2.95	0.0069	0.03	Q	.	.	.	.
3.19	0.0075	0.03	Q	.	.	.	.
3.43	0.0082	0.03	Q	.	.	.	.
3.67	0.0088	0.03	Q	.	.	.	.
3.92	0.0095	0.03	Q	.	.	.	.
4.16	0.0102	0.03	Q	.	.	.	.
4.40	0.0108	0.03	Q	.	.	.	.
4.64	0.0115	0.03	Q	.	.	.	.
4.88	0.0122	0.04	Q	.	.	.	.
5.12	0.0129	0.04	Q	.	.	.	.
5.37	0.0136	0.04	Q	.	.	.	.
5.61	0.0144	0.04	Q	.	.	.	.
5.85	0.0151	0.04	Q	.	.	.	.
6.09	0.0159	0.04	Q	.	.	.	.
6.33	0.0166	0.04	Q	.	.	.	.
6.57	0.0174	0.04	Q	.	.	.	.
6.82	0.0182	0.04	Q	.	.	.	.
7.06	0.0190	0.04	Q	.	.	.	.
7.30	0.0198	0.04	Q	.	.	.	.
7.54	0.0206	0.04	Q	.	.	.	.
7.78	0.0214	0.04	Q	.	.	.	.
8.02	0.0223	0.04	Q	.	.	.	.
8.27	0.0232	0.04	Q	.	.	.	.
8.51	0.0241	0.04	Q	.	.	.	.
8.75	0.0250	0.05	Q	.	.	.	.
8.99	0.0259	0.05	Q	.	.	.	.
9.23	0.0268	0.05	Q	.	.	.	.
9.48	0.0278	0.05	Q	.	.	.	.
9.72	0.0288	0.05	Q	.	.	.	.
9.96	0.0298	0.05	Q	.	.	.	.
10.20	0.0308	0.05	Q	.	.	.	.
10.44	0.0319	0.05	Q	.	.	.	.
10.68	0.0330	0.05	Q	.	.	.	.
10.93	0.0341	0.06	Q	.	.	.	.
11.17	0.0352	0.06	Q	.	.	.	.
11.41	0.0364	0.06	Q	.	.	.	.
11.65	0.0376	0.06	Q	.	.	.	.
11.89	0.0389	0.06	Q	.	.	.	.
12.13	0.0402	0.07	Q	.	.	.	.
12.38	0.0417	0.09	Q	.	.	.	.
12.62	0.0435	0.09	Q	.	.	.	.
12.86	0.0453	0.09	Q	.	.	.	.
13.10	0.0472	0.10	Q	.	.	.	.
13.34	0.0492	0.10	Q	.	.	.	.

13.58	0.0513	0.11	Q		.	.	.	.
13.82	0.0535	0.11	Q		.	.	.	.
14.07	0.0558	0.12	Q		.	.	.	.
14.31	0.0582	0.13	Q		.	.	.	.
14.55	0.0609	0.13	Q		.	.	.	.
14.79	0.0637	0.15	Q		.	.	.	.
15.03	0.0668	0.16	Q		.	.	.	.
15.27	0.0703	0.19	Q		.	.	.	.
15.52	0.0743	0.21	Q		.	.	.	.
15.76	0.0793	0.29	.Q		.	.	.	.
16.00	0.0867	0.45	.Q		.	.	.	.
16.24	0.1075	1.64	.	Q	.	.	.	.
16.48	0.1260	0.21	Q		.	.	.	.
16.73	0.1299	0.17	Q		.	.	.	.
16.97	0.1330	0.14	Q		.	.	.	.
17.21	0.1357	0.12	Q		.	.	.	.
17.45	0.1380	0.11	Q		.	.	.	.
17.69	0.1401	0.10	Q		.	.	.	.
17.93	0.1420	0.09	Q		.	.	.	.
18.17	0.1437	0.08	Q		.	.	.	.
18.42	0.1452	0.06	Q		.	.	.	.
18.66	0.1464	0.06	Q		.	.	.	.
18.90	0.1475	0.06	Q		.	.	.	.
19.14	0.1486	0.05	Q		.	.	.	.
19.38	0.1496	0.05	Q		.	.	.	.
19.62	0.1506	0.05	Q		.	.	.	.
19.87	0.1516	0.05	Q		.	.	.	.
20.11	0.1525	0.04	Q		.	.	.	.
20.35	0.1534	0.04	Q		.	.	.	.
20.59	0.1542	0.04	Q		.	.	.	.
20.83	0.1550	0.04	Q		.	.	.	.
21.08	0.1558	0.04	Q		.	.	.	.
21.32	0.1565	0.04	Q		.	.	.	.
21.56	0.1573	0.04	Q		.	.	.	.
21.80	0.1580	0.04	Q		.	.	.	.
22.04	0.1587	0.03	Q		.	.	.	.
22.28	0.1594	0.03	Q		.	.	.	.
22.52	0.1600	0.03	Q		.	.	.	.
22.77	0.1607	0.03	Q		.	.	.	.
23.01	0.1613	0.03	Q		.	.	.	.
23.25	0.1619	0.03	Q		.	.	.	.
23.49	0.1625	0.03	Q		.	.	.	.
23.73	0.1631	0.03	Q		.	.	.	.
23.98	0.1637	0.03	Q		.	.	.	.
24.22	0.1643	0.03	Q		.	.	.	.
24.46	0.1646	0.00	Q		.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1450.0
10%	101.5
20%	29.0
30%	14.5
40%	14.5
50%	14.5
60%	14.5
70%	14.5
80%	14.5
90%	14.5

Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN C

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==============================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =   14.500
     DEAD STORAGE(AF) =       0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =       0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =    0.00


                 INFLOW
                   |
                   |
                   |
                   V                 __effective depth
             -------------           |   (and volume)
             |           |     |     |
             | detention |     |....V.............
             |   basin   |<-->|          outflow
             |           |     |.........__________
             -------------     |         |    \
                   |           | storage |     basin outlet
                   V           -----------
                OUTFLOW


     DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
     TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES =    9
     *BASIN-DEPTH  STORAGE    OUTFLOW  **BASIN-DEPTH  STORAGE    OUTFLOW  *
     *   (FEET)  (ACRE-FEET)   (CFS)   **   (FEET)  (ACRE-FEET)   (CFS)   *
```

*	0.000	0.000	0.000**	0.500	0.004	0.240*
*	1.000	0.008	0.380**	1.500	0.012	0.490*
*	2.000	0.016	0.570**	2.500	0.020	0.640*
*	3.000	0.024	0.710**	3.500	0.027	0.770*
*	4.000	0.031	0.820**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	0.00160	0.00640
3	1.00	0.00421	0.01179
4	1.50	0.00711	0.01689
5	2.00	0.01031	0.02169
6	2.50	0.01361	0.02639
7	3.00	0.01691	0.03109
8	3.50	0.01931	0.03469
9	4.00	0.02281	0.03919

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.050	0.000	0.00	0.00	0.00	0.000
0.292	0.000	0.03	0.04	0.01	0.000
0.533	0.000	0.03	0.06	0.02	0.000
0.775	0.000	0.03	0.06	0.03	0.000
1.017	0.000	0.03	0.06	0.03	0.000
1.258	0.000	0.03	0.06	0.03	0.000
1.500	0.000	0.03	0.06	0.03	0.000
1.742	0.000	0.03	0.06	0.03	0.001
1.983	0.000	0.03	0.06	0.03	0.001
2.225	0.000	0.03	0.06	0.03	0.001
2.467	0.000	0.03	0.06	0.03	0.001
2.708	0.000	0.03	0.07	0.03	0.001
2.950	0.000	0.03	0.07	0.03	0.001
3.192	0.000	0.03	0.07	0.03	0.001
3.433	0.000	0.03	0.07	0.03	0.001
3.675	0.000	0.03	0.07	0.03	0.001
3.917	0.000	0.03	0.07	0.03	0.001
4.158	0.000	0.03	0.07	0.03	0.001
4.400	0.000	0.03	0.07	0.03	0.001
4.642	0.000	0.03	0.07	0.03	0.001
4.883	0.000	0.04	0.07	0.03	0.001
5.125	0.000	0.04	0.07	0.04	0.001
5.367	0.000	0.04	0.07	0.04	0.001
5.608	0.000	0.04	0.08	0.04	0.001

5.850	0.000	0.04	0.08	0.04	0.001
6.092	0.000	0.04	0.08	0.04	0.001
6.333	0.000	0.04	0.08	0.04	0.001
6.575	0.000	0.04	0.08	0.04	0.001
6.817	0.000	0.04	0.08	0.04	0.001
7.058	0.000	0.04	0.08	0.04	0.001
7.300	0.000	0.04	0.08	0.04	0.001
7.542	0.000	0.04	0.09	0.04	0.001
7.783	0.000	0.04	0.09	0.04	0.001
8.025	0.000	0.04	0.09	0.04	0.001
8.267	0.000	0.04	0.09	0.04	0.001
8.508	0.000	0.04	0.09	0.04	0.001
8.750	0.000	0.05	0.09	0.04	0.001
8.992	0.000	0.05	0.10	0.05	0.001
9.233	0.000	0.05	0.10	0.05	0.001
9.475	0.000	0.05	0.10	0.05	0.001
9.717	0.000	0.05	0.10	0.05	0.001
9.958	0.000	0.05	0.11	0.05	0.001
10.200	0.000	0.05	0.11	0.05	0.001
10.442	0.000	0.05	0.11	0.05	0.001
10.683	0.000	0.05	0.11	0.05	0.001
10.925	0.000	0.06	0.12	0.06	0.001
11.167	0.000	0.06	0.12	0.06	0.001
11.408	0.000	0.06	0.12	0.06	0.001
11.650	0.000	0.06	0.13	0.06	0.001
11.892	0.000	0.06	0.13	0.06	0.001
12.133	0.000	0.07	0.14	0.06	0.001
12.375	0.000	0.09	0.17	0.07	0.001
12.617	0.000	0.09	0.18	0.08	0.001
12.858	0.000	0.09	0.19	0.09	0.002
13.100	0.000	0.10	0.20	0.09	0.002
13.342	0.000	0.10	0.21	0.10	0.002
13.583	0.000	0.11	0.22	0.10	0.002
13.825	0.000	0.11	0.23	0.11	0.002
14.067	0.000	0.12	0.24	0.11	0.002
14.308	0.000	0.13	0.26	0.12	0.002
14.550	0.000	0.13	0.28	0.13	0.002
14.792	0.000	0.15	0.30	0.14	0.002
15.033	0.000	0.16	0.33	0.15	0.003
15.275	0.000	0.19	0.38	0.17	0.003
15.517	0.000	0.21	0.42	0.19	0.003
15.758	0.000	0.29	0.57	0.23	0.005
16.000	0.000	0.45	0.92	0.31	0.007
16.242	0.000	1.64	3.70	0.57	0.029
16.483	0.000	0.21	2.35	0.70	0.019
16.725	0.000	0.17	1.42	0.55	0.011
16.967	0.000	0.14	0.79	0.40	0.006
17.208	0.000	0.12	0.43	0.26	0.003
17.450	0.000	0.11	0.28	0.17	0.002
17.692	0.000	0.10	0.22	0.12	0.002
17.933	0.000	0.09	0.20	0.10	0.002
18.175	0.000	0.08	0.18	0.09	0.001

18.417	0.000	0.06	0.14	0.08	0.001
18.658	0.000	0.06	0.13	0.07	0.001
18.900	0.000	0.06	0.12	0.06	0.001
19.142	0.000	0.05	0.11	0.06	0.001
19.383	0.000	0.05	0.11	0.05	0.001
19.625	0.000	0.05	0.10	0.05	0.001
19.867	0.000	0.05	0.10	0.05	0.001
20.108	0.000	0.04	0.09	0.05	0.001
20.350	0.000	0.04	0.09	0.04	0.001
20.592	0.000	0.04	0.09	0.04	0.001
20.833	0.000	0.04	0.08	0.04	0.001
21.075	0.000	0.04	0.08	0.04	0.001
21.317	0.000	0.04	0.08	0.04	0.001
21.558	0.000	0.04	0.08	0.04	0.001
21.800	0.000	0.04	0.07	0.04	0.001
22.042	0.000	0.03	0.07	0.04	0.001
22.283	0.000	0.03	0.07	0.03	0.001
22.525	0.000	0.03	0.07	0.03	0.001
22.767	0.000	0.03	0.07	0.03	0.001
23.008	0.000	0.03	0.07	0.03	0.001
23.250	0.000	0.03	0.06	0.03	0.001
23.492	0.000	0.03	0.06	0.03	0.001
23.733	0.000	0.03	0.06	0.03	0.000
23.975	0.000	0.03	0.06	0.03	0.000
24.217	0.000	0.03	0.06	0.03	0.000
24.458	0.000	0.00	0.01	0.02	0.000
24.700	0.000	0.00	0.00	0.00	0.000

```
****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                              Analysis prepared by:



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----------------------------------------------------------------------------

 Problem Descriptions:
  EL TORO DEVELOPMENT
  100 YEAR STORM - PROPOSED CONDITION
  BASIN D
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =     1.19
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.260
    LOW LOSS FRACTION = 0.390
    TIME OF CONCENTRATION(MIN.) = 18.70
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.33
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.23

****************************************************************************
  TIME      VOLUME        Q    0.         2.5        5.0        7.5       10.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.10      0.0002      0.06  Q          .          .          .          .
  0.42      0.0017      0.06  Q          .          .          .          .
  0.73      0.0032      0.06  Q          .          .          .          .
  1.04      0.0047      0.06  Q          .          .          .          .
```

1.35	0.0062	0.06	Q	.	.	.	.
1.66	0.0078	0.06	Q	.	.	.	.
1.97	0.0094	0.06	Q	.	.	.	.
2.29	0.0109	0.06	Q	.	.	.	.
2.60	0.0126	0.06	Q	.	.	.	.
2.91	0.0142	0.06	Q	.	.	.	.
3.22	0.0159	0.07	Q	.	.	.	.
3.53	0.0175	0.07	Q	.	.	.	.
3.84	0.0192	0.07	Q	.	.	.	.
4.16	0.0210	0.07	Q	.	.	.	.
4.47	0.0228	0.07	Q	.	.	.	.
4.78	0.0245	0.07	Q	.	.	.	.
5.09	0.0264	0.07	Q	.	.	.	.
5.40	0.0282	0.07	Q	.	.	.	.
5.71	0.0301	0.07	Q	.	.	.	.
6.03	0.0321	0.08	Q	.	.	.	.
6.34	0.0340	0.08	Q	.	.	.	.
6.65	0.0360	0.08	Q	.	.	.	.
6.96	0.0381	0.08	Q	.	.	.	.
7.27	0.0402	0.08	Q	.	.	.	.
7.58	0.0423	0.08	Q	.	.	.	.
7.90	0.0445	0.09	Q	.	.	.	.
8.21	0.0467	0.09	Q	.	.	.	.
8.52	0.0490	0.09	Q	.	.	.	.
8.83	0.0513	0.09	Q	.	.	.	.
9.14	0.0538	0.09	Q	.	.	.	.
9.45	0.0562	0.10	Q	.	.	.	.
9.77	0.0588	0.10	Q	.	.	.	.
10.08	0.0614	0.10	Q	.	.	.	.
10.39	0.0641	0.11	Q	.	.	.	.
10.70	0.0669	0.11	Q	.	.	.	.
11.01	0.0698	0.11	Q	.	.	.	.
11.32	0.0729	0.12	Q	.	.	.	.
11.64	0.0760	0.12	Q	.	.	.	.
11.95	0.0793	0.13	Q	.	.	.	.
12.26	0.0828	0.14	Q	.	.	.	.
12.57	0.0870	0.18	Q	.	.	.	.
12.88	0.0917	0.19	Q	.	.	.	.
13.20	0.0967	0.20	Q	.	.	.	.
13.51	0.1019	0.21	Q	.	.	.	.
13.82	0.1074	0.23	Q	.	.	.	.
14.13	0.1134	0.24	Q	.	.	.	.
14.44	0.1198	0.27	.Q	.	.	.	.
14.75	0.1269	0.28	.Q	.	.	.	.
15.07	0.1349	0.33	.Q	.	.	.	.
15.38	0.1440	0.37	.Q	.	.	.	.
15.69	0.1548	0.47	.Q	.	.	.	.
16.00	0.1704	0.74	. Q	.	.	.	.
16.31	0.2160	2.80	.	.Q	.	.	.
16.62	0.2575	0.41	.Q	.	.	.	.
16.93	0.2668	0.31	.Q	.	.	.	.
17.25	0.2739	0.25	.Q	.	.	.	.

17.56	0.2799	0.22	Q	.	.	.	.
17.87	0.2852	0.19	Q	.	.	.	.
18.18	0.2899	0.17	Q	.	.	.	.
18.49	0.2938	0.13	Q	.	.	.	.
18.81	0.2969	0.12	Q	.	.	.	.
19.12	0.2998	0.11	Q	.	.	.	.
19.43	0.3026	0.10	Q	.	.	.	.
19.74	0.3051	0.10	Q	.	.	.	.
20.05	0.3075	0.09	Q	.	.	.	.
20.36	0.3098	0.09	Q	.	.	.	.
20.67	0.3120	0.08	Q	.	.	.	.
20.99	0.3141	0.08	Q	.	.	.	.
21.30	0.3161	0.08	Q	.	.	.	.
21.61	0.3180	0.07	Q	.	.	.	.
21.92	0.3199	0.07	Q	.	.	.	.
22.23	0.3217	0.07	Q	.	.	.	.
22.55	0.3234	0.07	Q	.	.	.	.
22.86	0.3251	0.06	Q	.	.	.	.
23.17	0.3267	0.06	Q	.	.	.	.
23.48	0.3283	0.06	Q	.	.	.	.
23.79	0.3299	0.06	Q	.	.	.	.
24.10	0.3314	0.06	Q	.	.	.	.
24.42	0.3321	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1458.6
10%	149.6
20%	37.4
30%	18.7
40%	18.7
50%	18.7
60%	18.7
70%	18.7
80%	18.7
90%	18.7

Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN D

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 18.700
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

```
                INFLOW
                  |
                  |
                  |
                  V                 __effective depth
            -------------           |   (and volume)
            |           |     |     |
            | detention |     |....V.............
            |   basin   |<-->|          outflow
            |           |     |.........________
            -------------     |         |    \
                  |           | storage |     basin outlet
                  V           -----------
              OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS)	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS)
0.000	0.000	0.000**	0.500	0.011	0.240*
1.000	0.022	0.380**	1.500	0.033	0.490*
2.000	0.044	0.570**	2.500	0.055	0.640*
3.000	0.065	0.710**	3.500	0.076	0.770*
4.000	0.087	0.820**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	0.00791	0.01409
3	1.00	0.01711	0.02689
4	1.50	0.02669	0.03931
5	2.00	0.03666	0.05134
6	2.50	0.04676	0.06324
7	3.00	0.05586	0.07414
8	3.50	0.06608	0.08592
9	4.00	0.07644	0.09756

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES
OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE

AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.105	0.000	0.06	0.05	0.01	0.001
0.417	0.000	0.06	0.08	0.03	0.002
0.728	0.000	0.06	0.10	0.04	0.002
1.040	0.000	0.06	0.11	0.05	0.002
1.352	0.000	0.06	0.12	0.05	0.003
1.663	0.000	0.06	0.12	0.06	0.003
1.975	0.000	0.06	0.12	0.06	0.003
2.287	0.000	0.06	0.13	0.06	0.003
2.598	0.000	0.06	0.13	0.06	0.003
2.910	0.000	0.06	0.13	0.06	0.003
3.222	0.000	0.07	0.13	0.06	0.003
3.533	0.000	0.07	0.13	0.06	0.003
3.845	0.000	0.07	0.14	0.07	0.003
4.157	0.000	0.07	0.14	0.07	0.003
4.468	0.000	0.07	0.14	0.07	0.003
4.780	0.000	0.07	0.14	0.07	0.003
5.092	0.000	0.07	0.15	0.07	0.003
5.403	0.000	0.07	0.15	0.07	0.003
5.715	0.000	0.07	0.15	0.07	0.003
6.027	0.000	0.08	0.15	0.07	0.003
6.338	0.000	0.08	0.16	0.07	0.003
6.650	0.000	0.08	0.16	0.08	0.004
6.962	0.000	0.08	0.16	0.08	0.004
7.273	0.000	0.08	0.17	0.08	0.004
7.585	0.000	0.08	0.17	0.08	0.004
7.897	0.000	0.09	0.17	0.08	0.004
8.208	0.000	0.09	0.18	0.08	0.004
8.520	0.000	0.09	0.18	0.09	0.004
8.832	0.000	0.09	0.19	0.09	0.004
9.143	0.000	0.09	0.19	0.09	0.004
9.455	0.000	0.10	0.20	0.09	0.004
9.767	0.000	0.10	0.20	0.10	0.004
10.078	0.000	0.10	0.21	0.10	0.005
10.390	0.000	0.11	0.21	0.10	0.005
10.702	0.000	0.11	0.22	0.10	0.005
11.013	0.000	0.11	0.23	0.11	0.005
11.325	0.000	0.12	0.24	0.11	0.005
11.637	0.000	0.12	0.25	0.12	0.005
11.948	0.000	0.13	0.26	0.12	0.006
12.260	0.000	0.14	0.28	0.13	0.006
12.572	0.000	0.18	0.32	0.14	0.007
12.883	0.000	0.19	0.35	0.16	0.008
13.195	0.000	0.20	0.38	0.17	0.008
13.507	0.000	0.21	0.40	0.19	0.009
13.818	0.000	0.23	0.43	0.20	0.009
14.130	0.000	0.24	0.46	0.21	0.010
14.442	0.000	0.27	0.50	0.23	0.011

14.753	0.000	0.28	0.54	0.25	0.012
15.065	0.000	0.33	0.63	0.26	0.014
15.377	0.000	0.37	0.72	0.29	0.016
15.688	0.000	0.47	0.89	0.33	0.020
16.000	0.000	0.74	1.29	0.40	0.028
16.312	0.000	2.80	3.89	0.63	0.085
16.623	0.000	0.41	3.45	0.79	0.075
16.935	0.000	0.31	2.95	0.73	0.064
17.247	0.000	0.25	2.42	0.67	0.053
17.558	0.000	0.22	1.97	0.60	0.043
17.870	0.000	0.19	1.57	0.53	0.035
18.182	0.000	0.17	1.23	0.47	0.027
18.493	0.000	0.13	0.92	0.39	0.020
18.805	0.000	0.12	0.68	0.32	0.015
19.117	0.000	0.11	0.50	0.26	0.011
19.428	0.000	0.10	0.37	0.21	0.008
19.740	0.000	0.10	0.30	0.16	0.007
20.052	0.000	0.09	0.25	0.13	0.005
20.363	0.000	0.09	0.22	0.11	0.005
20.675	0.000	0.08	0.20	0.10	0.004
20.987	0.000	0.08	0.18	0.09	0.004
21.298	0.000	0.08	0.17	0.09	0.004
21.610	0.000	0.07	0.16	0.08	0.004
21.922	0.000	0.07	0.16	0.08	0.003
22.233	0.000	0.07	0.15	0.07	0.003
22.545	0.000	0.07	0.15	0.07	0.003
22.857	0.000	0.06	0.14	0.07	0.003
23.168	0.000	0.06	0.14	0.07	0.003
23.480	0.000	0.06	0.13	0.06	0.003
23.792	0.000	0.06	0.13	0.06	0.003
24.103	0.000	0.06	0.12	0.06	0.003
24.415	0.000	0.00	0.07	0.05	0.002
24.727	0.000	0.00	0.04	0.03	0.001

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****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                              Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  EL TORO DEVELOPMENT
  100 YEAR STORM - PROPOSED CONDITION
  BASIN E1
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =     0.56
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.260
    LOW LOSS FRACTION = 0.390
    TIME OF CONCENTRATION(MIN.) = 14.00
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      0.16
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.11

****************************************************************************
  TIME      VOLUME        Q    0.         2.5        5.0        7.5       10.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.13      0.0000      0.00  Q          .          .          .          .
  0.37      0.0003      0.03  Q          .          .          .          .
  0.60      0.0008      0.03  Q          .          .          .          .
  0.83      0.0013      0.03  Q          .          .          .          .
```

1.07	0.0018	0.03	Q	.	.	.	.
1.30	0.0024	0.03	Q	.	.	.	.
1.53	0.0029	0.03	Q	.	.	.	.
1.77	0.0035	0.03	Q	.	.	.	.
2.00	0.0040	0.03	Q	.	.	.	.
2.23	0.0046	0.03	Q	.	.	.	.
2.47	0.0052	0.03	Q	.	.	.	.
2.70	0.0057	0.03	Q	.	.	.	.
2.93	0.0063	0.03	Q	.	.	.	.
3.17	0.0069	0.03	Q	.	.	.	.
3.40	0.0075	0.03	Q	.	.	.	.
3.63	0.0081	0.03	Q	.	.	.	.
3.87	0.0087	0.03	Q	.	.	.	.
4.10	0.0093	0.03	Q	.	.	.	.
4.33	0.0099	0.03	Q	.	.	.	.
4.57	0.0106	0.03	Q	.	.	.	.
4.80	0.0112	0.03	Q	.	.	.	.
5.03	0.0118	0.03	Q	.	.	.	.
5.27	0.0125	0.03	Q	.	.	.	.
5.50	0.0132	0.03	Q	.	.	.	.
5.73	0.0138	0.03	Q	.	.	.	.
5.97	0.0145	0.04	Q	.	.	.	.
6.20	0.0152	0.04	Q	.	.	.	.
6.43	0.0159	0.04	Q	.	.	.	.
6.67	0.0166	0.04	Q	.	.	.	.
6.90	0.0173	0.04	Q	.	.	.	.
7.13	0.0181	0.04	Q	.	.	.	.
7.37	0.0188	0.04	Q	.	.	.	.
7.60	0.0196	0.04	Q	.	.	.	.
7.83	0.0204	0.04	Q	.	.	.	.
8.07	0.0211	0.04	Q	.	.	.	.
8.30	0.0219	0.04	Q	.	.	.	.
8.53	0.0227	0.04	Q	.	.	.	.
8.77	0.0236	0.04	Q	.	.	.	.
9.00	0.0244	0.04	Q	.	.	.	.
9.23	0.0253	0.05	Q	.	.	.	.
9.47	0.0262	0.05	Q	.	.	.	.
9.70	0.0271	0.05	Q	.	.	.	.
9.93	0.0280	0.05	Q	.	.	.	.
10.17	0.0289	0.05	Q	.	.	.	.
10.40	0.0299	0.05	Q	.	.	.	.
10.63	0.0309	0.05	Q	.	.	.	.
10.87	0.0319	0.05	Q	.	.	.	.
11.10	0.0330	0.06	Q	.	.	.	.
11.33	0.0340	0.06	Q	.	.	.	.
11.57	0.0352	0.06	Q	.	.	.	.
11.80	0.0363	0.06	Q	.	.	.	.
12.03	0.0375	0.06	Q	.	.	.	.
12.27	0.0388	0.08	Q	.	.	.	.
12.50	0.0404	0.08	Q	.	.	.	.
12.73	0.0420	0.09	Q	.	.	.	.
12.97	0.0437	0.09	Q	.	.	.	.

13.20	0.0455	0.09	Q		.	.	.	.
13.43	0.0474	0.10	Q		.	.	.	.
13.67	0.0493	0.10	Q		.	.	.	.
13.90	0.0513	0.11	Q		.	.	.	.
14.13	0.0535	0.11	Q		.	.	.	.
14.37	0.0558	0.12	Q		.	.	.	.
14.60	0.0582	0.13	Q		.	.	.	.
14.83	0.0609	0.15	Q		.	.	.	.
15.07	0.0638	0.16	Q		.	.	.	.
15.30	0.0671	0.18	Q		.	.	.	.
15.53	0.0707	0.20	Q		.	.	.	.
15.77	0.0754	0.28	.Q		.	.	.	.
16.00	0.0824	0.44	.Q		.	.	.	.
16.23	0.1019	1.59	.	Q	.	.	.	.
16.47	0.1192	0.21	Q		.	.	.	.
16.70	0.1229	0.17	Q		.	.	.	.
16.93	0.1258	0.14	Q		.	.	.	.
17.17	0.1283	0.12	Q		.	.	.	.
17.40	0.1304	0.11	Q		.	.	.	.
17.63	0.1324	0.10	Q		.	.	.	.
17.87	0.1342	0.09	Q		.	.	.	.
18.10	0.1358	0.08	Q		.	.	.	.
18.33	0.1372	0.06	Q		.	.	.	.
18.57	0.1383	0.06	Q		.	.	.	.
18.80	0.1394	0.05	Q		.	.	.	.
19.03	0.1404	0.05	Q		.	.	.	.
19.27	0.1414	0.05	Q		.	.	.	.
19.50	0.1423	0.05	Q		.	.	.	.
19.73	0.1432	0.04	Q		.	.	.	.
19.97	0.1441	0.04	Q		.	.	.	.
20.20	0.1449	0.04	Q		.	.	.	.
20.43	0.1457	0.04	Q		.	.	.	.
20.67	0.1464	0.04	Q		.	.	.	.
20.90	0.1472	0.04	Q		.	.	.	.
21.13	0.1479	0.04	Q		.	.	.	.
21.37	0.1486	0.04	Q		.	.	.	.
21.60	0.1492	0.03	Q		.	.	.	.
21.83	0.1499	0.03	Q		.	.	.	.
22.07	0.1505	0.03	Q		.	.	.	.
22.30	0.1511	0.03	Q		.	.	.	.
22.53	0.1518	0.03	Q		.	.	.	.
22.77	0.1523	0.03	Q		.	.	.	.
23.00	0.1529	0.03	Q		.	.	.	.
23.23	0.1535	0.03	Q		.	.	.	.
23.47	0.1540	0.03	Q		.	.	.	.
23.70	0.1546	0.03	Q		.	.	.	.
23.93	0.1551	0.03	Q		.	.	.	.
24.17	0.1557	0.03	Q		.	.	.	.
24.40	0.1559	0.00	Q		.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1442.0
10%	98.0
20%	28.0
30%	14.0
40%	14.0
50%	14.0
60%	14.0
70%	14.0
80%	14.0
90%	14.0

Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN E1

==========

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 14.000
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

```
                INFLOW
                  |
                  |
                  |
                  V                 __effective depth
            -------------           |   (and volume)
            |           |     |     |
            | detention |     |....V.............
            |   basin   |<-->|          outflow
            |           |     |.........________
            -------------     |         |    \
                  |           | storage |     basin outlet
                  V           -----------
               OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:

TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) **	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) *
0.000	0.000	0.000**	0.500	0.003	0.240*
1.000	0.007	0.380**	1.500	0.010	0.490*
2.000	0.013	0.570**	2.500	0.016	0.640*
3.000	0.020	0.710**	3.500	0.023	0.770*
4.000	0.026	0.820**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	0.00069	0.00531
3	1.00	0.00334	0.01066
4	1.50	0.00528	0.01472
5	2.00	0.00750	0.01850
6	2.50	0.00983	0.02217
7	3.00	0.01315	0.02685
8	3.50	0.01558	0.03042
9	4.00	0.01809	0.03391

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.133	0.000	0.00	0.00	0.00	0.000
0.367	0.000	0.03	0.05	0.01	0.000
0.600	0.000	0.03	0.06	0.03	0.000
0.833	0.000	0.03	0.06	0.03	0.000
1.067	0.000	0.03	0.06	0.03	0.000
1.300	0.000	0.03	0.06	0.03	0.000
1.533	0.000	0.03	0.06	0.03	0.000
1.767	0.000	0.03	0.06	0.03	0.000
2.000	0.000	0.03	0.06	0.03	0.000
2.233	0.000	0.03	0.06	0.03	0.000
2.467	0.000	0.03	0.06	0.03	0.000
2.700	0.000	0.03	0.06	0.03	0.000
2.933	0.000	0.03	0.06	0.03	0.000
3.167	0.000	0.03	0.06	0.03	0.000
3.400	0.000	0.03	0.06	0.03	0.000
3.633	0.000	0.03	0.07	0.03	0.000
3.867	0.000	0.03	0.07	0.03	0.000
4.100	0.000	0.03	0.07	0.03	0.000
4.333	0.000	0.03	0.07	0.03	0.000
4.567	0.000	0.03	0.07	0.03	0.000
4.800	0.000	0.03	0.07	0.03	0.000

5.033	0.000	0.03	0.07	0.03	0.000
5.267	0.000	0.03	0.07	0.03	0.000
5.500	0.000	0.03	0.07	0.03	0.000
5.733	0.000	0.03	0.07	0.03	0.000
5.967	0.000	0.04	0.07	0.04	0.000
6.200	0.000	0.04	0.07	0.04	0.000
6.433	0.000	0.04	0.08	0.04	0.000
6.667	0.000	0.04	0.08	0.04	0.000
6.900	0.000	0.04	0.08	0.04	0.000
7.133	0.000	0.04	0.08	0.04	0.000
7.367	0.000	0.04	0.08	0.04	0.000
7.600	0.000	0.04	0.08	0.04	0.000
7.833	0.000	0.04	0.08	0.04	0.001
8.067	0.000	0.04	0.09	0.04	0.001
8.300	0.000	0.04	0.09	0.04	0.001
8.533	0.000	0.04	0.09	0.04	0.001
8.767	0.000	0.04	0.09	0.04	0.001
9.000	0.000	0.04	0.09	0.04	0.001
9.233	0.000	0.05	0.09	0.04	0.001
9.467	0.000	0.05	0.10	0.05	0.001
9.700	0.000	0.05	0.10	0.05	0.001
9.933	0.000	0.05	0.10	0.05	0.001
10.167	0.000	0.05	0.10	0.05	0.001
10.400	0.000	0.05	0.11	0.05	0.001
10.633	0.000	0.05	0.11	0.05	0.001
10.867	0.000	0.05	0.11	0.05	0.001
11.100	0.000	0.06	0.11	0.05	0.001
11.333	0.000	0.06	0.12	0.06	0.001
11.567	0.000	0.06	0.12	0.06	0.001
11.800	0.000	0.06	0.12	0.06	0.001
12.033	0.000	0.06	0.13	0.06	0.001
12.267	0.000	0.08	0.16	0.07	0.001
12.500	0.000	0.08	0.17	0.08	0.001
12.733	0.000	0.09	0.18	0.08	0.001
12.967	0.000	0.09	0.19	0.09	0.001
13.200	0.000	0.09	0.19	0.09	0.001
13.433	0.000	0.10	0.20	0.10	0.001
13.667	0.000	0.10	0.21	0.10	0.001
13.900	0.000	0.11	0.23	0.10	0.001
14.133	0.000	0.11	0.23	0.11	0.001
14.367	0.000	0.12	0.26	0.12	0.002
14.600	0.000	0.13	0.27	0.13	0.002
14.833	0.000	0.15	0.30	0.14	0.002
15.067	0.000	0.16	0.32	0.15	0.002
15.300	0.000	0.18	0.37	0.17	0.002
15.533	0.000	0.20	0.41	0.19	0.002
15.767	0.000	0.28	0.57	0.23	0.004
16.000	0.000	0.44	0.89	0.30	0.006
16.233	0.000	1.59	3.92	0.58	0.026
16.467	0.000	0.21	2.44	0.72	0.016
16.700	0.000	0.17	1.26	0.53	0.009
16.933	0.000	0.14	0.66	0.36	0.004

17.167	0.000	0.12	0.36	0.23	0.002
17.400	0.000	0.11	0.24	0.14	0.001
17.633	0.000	0.10	0.20	0.11	0.001
17.867	0.000	0.09	0.19	0.09	0.001
18.100	0.000	0.08	0.17	0.09	0.001
18.333	0.000	0.06	0.13	0.07	0.001
18.567	0.000	0.06	0.12	0.06	0.001
18.800	0.000	0.05	0.11	0.06	0.001
19.033	0.000	0.05	0.11	0.05	0.001
19.267	0.000	0.05	0.10	0.05	0.001
19.500	0.000	0.05	0.10	0.05	0.001
19.733	0.000	0.04	0.09	0.05	0.001
19.967	0.000	0.04	0.09	0.04	0.001
20.200	0.000	0.04	0.09	0.04	0.001
20.433	0.000	0.04	0.08	0.04	0.001
20.667	0.000	0.04	0.08	0.04	0.000
20.900	0.000	0.04	0.08	0.04	0.000
21.133	0.000	0.04	0.08	0.04	0.000
21.367	0.000	0.04	0.07	0.04	0.000
21.600	0.000	0.03	0.07	0.03	0.000
21.833	0.000	0.03	0.07	0.03	0.000
22.067	0.000	0.03	0.07	0.03	0.000
22.300	0.000	0.03	0.07	0.03	0.000
22.533	0.000	0.03	0.06	0.03	0.000
22.767	0.000	0.03	0.06	0.03	0.000
23.000	0.000	0.03	0.06	0.03	0.000
23.233	0.000	0.03	0.06	0.03	0.000
23.467	0.000	0.03	0.06	0.03	0.000
23.700	0.000	0.03	0.06	0.03	0.000
23.933	0.000	0.03	0.06	0.03	0.000
24.167	0.000	0.03	0.06	0.03	0.000
24.400	0.000	0.00	0.01	0.02	0.000
24.633	0.000	0.00	0.00	0.00	0.000

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****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                              Analysis prepared by:



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----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN E2
----------------------------------------------------------------------------


     RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
     TOTAL CATCHMENT AREA(ACRES) =     0.56
     SOIL-LOSS RATE, Fm,(INCH/HR) =  0.260
     LOW LOSS FRACTION = 0.390
     TIME OF CONCENTRATION(MIN.) = 14.00
     SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
     ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
     RETURN FREQUENCY(YEARS) = 100
        5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
       30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
        1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
        3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
        6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
       24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

     TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      0.16
     TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.11

****************************************************************************
  TIME      VOLUME        Q    0.         2.5        5.0        7.5       10.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.13      0.0000       0.00  Q          .          .          .          .
  0.37      0.0003       0.03  Q          .          .          .          .
  0.60      0.0008       0.03  Q          .          .          .          .
  0.83      0.0013       0.03  Q          .          .          .          .
```

1.07	0.0018	0.03	Q	.	.	.	.
1.30	0.0024	0.03	Q	.	.	.	.
1.53	0.0029	0.03	Q	.	.	.	.
1.77	0.0035	0.03	Q	.	.	.	.
2.00	0.0040	0.03	Q	.	.	.	.
2.23	0.0046	0.03	Q	.	.	.	.
2.47	0.0052	0.03	Q	.	.	.	.
2.70	0.0057	0.03	Q	.	.	.	.
2.93	0.0063	0.03	Q	.	.	.	.
3.17	0.0069	0.03	Q	.	.	.	.
3.40	0.0075	0.03	Q	.	.	.	.
3.63	0.0081	0.03	Q	.	.	.	.
3.87	0.0087	0.03	Q	.	.	.	.
4.10	0.0093	0.03	Q	.	.	.	.
4.33	0.0099	0.03	Q	.	.	.	.
4.57	0.0106	0.03	Q	.	.	.	.
4.80	0.0112	0.03	Q	.	.	.	.
5.03	0.0118	0.03	Q	.	.	.	.
5.27	0.0125	0.03	Q	.	.	.	.
5.50	0.0132	0.03	Q	.	.	.	.
5.73	0.0138	0.03	Q	.	.	.	.
5.97	0.0145	0.04	Q	.	.	.	.
6.20	0.0152	0.04	Q	.	.	.	.
6.43	0.0159	0.04	Q	.	.	.	.
6.67	0.0166	0.04	Q	.	.	.	.
6.90	0.0173	0.04	Q	.	.	.	.
7.13	0.0181	0.04	Q	.	.	.	.
7.37	0.0188	0.04	Q	.	.	.	.
7.60	0.0196	0.04	Q	.	.	.	.
7.83	0.0204	0.04	Q	.	.	.	.
8.07	0.0211	0.04	Q	.	.	.	.
8.30	0.0219	0.04	Q	.	.	.	.
8.53	0.0227	0.04	Q	.	.	.	.
8.77	0.0236	0.04	Q	.	.	.	.
9.00	0.0244	0.04	Q	.	.	.	.
9.23	0.0253	0.05	Q	.	.	.	.
9.47	0.0262	0.05	Q	.	.	.	.
9.70	0.0271	0.05	Q	.	.	.	.
9.93	0.0280	0.05	Q	.	.	.	.
10.17	0.0289	0.05	Q	.	.	.	.
10.40	0.0299	0.05	Q	.	.	.	.
10.63	0.0309	0.05	Q	.	.	.	.
10.87	0.0319	0.05	Q	.	.	.	.
11.10	0.0330	0.06	Q	.	.	.	.
11.33	0.0340	0.06	Q	.	.	.	.
11.57	0.0352	0.06	Q	.	.	.	.
11.80	0.0363	0.06	Q	.	.	.	.
12.03	0.0375	0.06	Q	.	.	.	.
12.27	0.0388	0.08	Q	.	.	.	.
12.50	0.0404	0.08	Q	.	.	.	.
12.73	0.0420	0.09	Q	.	.	.	.
12.97	0.0437	0.09	Q	.	.	.	.

13.20	0.0455	0.09	Q		.	.	.	.
13.43	0.0474	0.10	Q		.	.	.	.
13.67	0.0493	0.10	Q		.	.	.	.
13.90	0.0513	0.11	Q		.	.	.	.
14.13	0.0535	0.11	Q		.	.	.	.
14.37	0.0558	0.12	Q		.	.	.	.
14.60	0.0582	0.13	Q		.	.	.	.
14.83	0.0609	0.15	Q		.	.	.	.
15.07	0.0638	0.16	Q		.	.	.	.
15.30	0.0671	0.18	Q		.	.	.	.
15.53	0.0707	0.20	Q		.	.	.	.
15.77	0.0754	0.28	.Q		.	.	.	.
16.00	0.0824	0.44	.Q		.	.	.	.
16.23	0.1019	1.59	.	Q	.	.	.	.
16.47	0.1192	0.21	Q		.	.	.	.
16.70	0.1229	0.17	Q		.	.	.	.
16.93	0.1258	0.14	Q		.	.	.	.
17.17	0.1283	0.12	Q		.	.	.	.
17.40	0.1304	0.11	Q		.	.	.	.
17.63	0.1324	0.10	Q		.	.	.	.
17.87	0.1342	0.09	Q		.	.	.	.
18.10	0.1358	0.08	Q		.	.	.	.
18.33	0.1372	0.06	Q		.	.	.	.
18.57	0.1383	0.06	Q		.	.	.	.
18.80	0.1394	0.05	Q		.	.	.	.
19.03	0.1404	0.05	Q		.	.	.	.
19.27	0.1414	0.05	Q		.	.	.	.
19.50	0.1423	0.05	Q		.	.	.	.
19.73	0.1432	0.04	Q		.	.	.	.
19.97	0.1441	0.04	Q		.	.	.	.
20.20	0.1449	0.04	Q		.	.	.	.
20.43	0.1457	0.04	Q		.	.	.	.
20.67	0.1464	0.04	Q		.	.	.	.
20.90	0.1472	0.04	Q		.	.	.	.
21.13	0.1479	0.04	Q		.	.	.	.
21.37	0.1486	0.04	Q		.	.	.	.
21.60	0.1492	0.03	Q		.	.	.	.
21.83	0.1499	0.03	Q		.	.	.	.
22.07	0.1505	0.03	Q		.	.	.	.
22.30	0.1511	0.03	Q		.	.	.	.
22.53	0.1518	0.03	Q		.	.	.	.
22.77	0.1523	0.03	Q		.	.	.	.
23.00	0.1529	0.03	Q		.	.	.	.
23.23	0.1535	0.03	Q		.	.	.	.
23.47	0.1540	0.03	Q		.	.	.	.
23.70	0.1546	0.03	Q		.	.	.	.
23.93	0.1551	0.03	Q		.	.	.	.
24.17	0.1557	0.03	Q		.	.	.	.
24.40	0.1559	0.00	Q		.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1442.0
10%	98.0
20%	28.0
30%	14.0
40%	14.0
50%	14.0
60%	14.0
70%	14.0
80%	14.0
90%	14.0

Problem Descriptions:

==========

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 14.000
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

```
                INFLOW
                  |
                  |
                  |
                  V                 __effective depth
            -------------           |   (and volume)
            |           |     |     |
            | detention |     |....V.............
            |   basin   |<-->|          outflow
            |           |     |.........________
            -------------     |         |    \
                  |           | storage |     basin outlet
                  V           -----------
               OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:

TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) **	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) *
0.000	0.000	0.000**	0.500	0.002	0.470*
1.000	0.004	0.820**	1.500	0.007	1.060*
2.000	0.009	1.250**	2.500	0.011	1.420*
3.000	0.013	1.570**	3.500	0.015	1.700*
4.000	0.017	1.830**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	-0.00253	0.00653
3	1.00	-0.00391	0.01191
4	1.50	-0.00322	0.01722
5	2.00	-0.00305	0.02105
6	2.50	-0.00269	0.02469
7	3.00	-0.00214	0.02814
8	3.50	-0.00139	0.03139
9	4.00	-0.00064	0.03464

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.133	0.000	0.00	0.00	0.00	0.000
0.367	0.000	0.03	0.04	0.02	0.000
0.600	0.000	0.03	0.04	0.04	0.000
0.833	0.000	0.03	0.04	0.04	0.000
1.067	0.000	0.03	0.04	0.04	0.000
1.300	0.000	0.03	0.04	0.04	0.000
1.533	0.000	0.03	0.04	0.04	0.000
1.767	0.000	0.03	0.04	0.04	0.000
2.000	0.000	0.03	0.04	0.04	0.000
2.233	0.000	0.03	0.04	0.04	0.000
2.467	0.000	0.03	0.04	0.04	0.000
2.700	0.000	0.03	0.04	0.04	0.000
2.933	0.000	0.03	0.04	0.04	0.000
3.167	0.000	0.03	0.05	0.04	0.000
3.400	0.000	0.03	0.05	0.04	0.000
3.633	0.000	0.03	0.05	0.04	0.000
3.867	0.000	0.03	0.05	0.04	0.000
4.100	0.000	0.03	0.05	0.04	0.000
4.333	0.000	0.03	0.05	0.04	0.000
4.567	0.000	0.03	0.05	0.05	0.000
4.800	0.000	0.03	0.05	0.05	0.000

5.033	0.000	0.03	0.05	0.05	0.000
5.267	0.000	0.03	0.05	0.05	0.000
5.500	0.000	0.03	0.05	0.05	0.000
5.733	0.000	0.03	0.05	0.05	0.000
5.967	0.000	0.04	0.05	0.05	0.000
6.200	0.000	0.04	0.05	0.05	0.000
6.433	0.000	0.04	0.05	0.05	0.000
6.667	0.000	0.04	0.05	0.05	0.000
6.900	0.000	0.04	0.06	0.05	0.000
7.133	0.000	0.04	0.06	0.05	0.000
7.367	0.000	0.04	0.06	0.05	0.000
7.600	0.000	0.04	0.06	0.05	0.000
7.833	0.000	0.04	0.06	0.06	0.000
8.067	0.000	0.04	0.06	0.06	0.000
8.300	0.000	0.04	0.06	0.06	0.000
8.533	0.000	0.04	0.06	0.06	0.000
8.767	0.000	0.04	0.06	0.06	0.000
9.000	0.000	0.04	0.07	0.06	0.000
9.233	0.000	0.05	0.07	0.06	0.000
9.467	0.000	0.05	0.07	0.06	0.000
9.700	0.000	0.05	0.07	0.06	0.000
9.933	0.000	0.05	0.07	0.07	0.000
10.167	0.000	0.05	0.07	0.07	0.000
10.400	0.000	0.05	0.07	0.07	0.000
10.633	0.000	0.05	0.08	0.07	0.000
10.867	0.000	0.05	0.08	0.07	0.000
11.100	0.000	0.06	0.08	0.08	0.000
11.333	0.000	0.06	0.08	0.08	0.000
11.567	0.000	0.06	0.09	0.08	0.000
11.800	0.000	0.06	0.09	0.08	0.000
12.033	0.000	0.06	0.09	0.09	0.000
12.267	0.000	0.08	0.11	0.10	0.000
12.500	0.000	0.08	0.12	0.11	0.000
12.733	0.000	0.09	0.13	0.12	0.001
12.967	0.000	0.09	0.13	0.12	0.001
13.200	0.000	0.09	0.14	0.13	0.001
13.433	0.000	0.10	0.15	0.13	0.001
13.667	0.000	0.10	0.15	0.14	0.001
13.900	0.000	0.11	0.16	0.15	0.001
14.133	0.000	0.11	0.17	0.15	0.001
14.367	0.000	0.12	0.18	0.16	0.001
14.600	0.000	0.13	0.19	0.18	0.001
14.833	0.000	0.15	0.22	0.19	0.001
15.067	0.000	0.16	0.23	0.21	0.001
15.300	0.000	0.18	0.27	0.24	0.001
15.533	0.000	0.20	0.29	0.26	0.001
15.767	0.000	0.28	0.42	0.33	0.002
16.000	0.000	0.44	0.68	0.50	0.003
16.233	0.000	1.59	3.38	1.13	0.015
16.467	0.000	0.21	0.31	0.98	0.001
16.700	0.000	0.17	0.25	0.26	0.001
16.933	0.000	0.14	0.20	0.21	0.001

17.167	0.000	0.12	0.18	0.18	0.001
17.400	0.000	0.11	0.16	0.16	0.001
17.633	0.000	0.10	0.14	0.14	0.001
17.867	0.000	0.09	0.13	0.13	0.001
18.100	0.000	0.08	0.12	0.12	0.000
18.333	0.000	0.06	0.09	0.10	0.000
18.567	0.000	0.06	0.09	0.08	0.000
18.800	0.000	0.05	0.08	0.08	0.000
19.033	0.000	0.05	0.08	0.07	0.000
19.267	0.000	0.05	0.07	0.07	0.000
19.500	0.000	0.05	0.07	0.07	0.000
19.733	0.000	0.04	0.07	0.06	0.000
19.967	0.000	0.04	0.06	0.06	0.000
20.200	0.000	0.04	0.06	0.06	0.000
20.433	0.000	0.04	0.06	0.06	0.000
20.667	0.000	0.04	0.06	0.05	0.000
20.900	0.000	0.04	0.06	0.05	0.000
21.133	0.000	0.04	0.05	0.05	0.000
21.367	0.000	0.04	0.05	0.05	0.000
21.600	0.000	0.03	0.05	0.05	0.000
21.833	0.000	0.03	0.05	0.05	0.000
22.067	0.000	0.03	0.05	0.05	0.000
22.300	0.000	0.03	0.05	0.04	0.000
22.533	0.000	0.03	0.05	0.04	0.000
22.767	0.000	0.03	0.04	0.04	0.000
23.000	0.000	0.03	0.04	0.04	0.000
23.233	0.000	0.03	0.04	0.04	0.000
23.467	0.000	0.03	0.04	0.04	0.000
23.700	0.000	0.03	0.04	0.04	0.000
23.933	0.000	0.03	0.04	0.04	0.000
24.167	0.000	0.03	0.04	0.04	0.000
24.400	0.000	0.00	0.00	0.02	0.000
24.633	0.000	0.00	0.00	0.00	0.000

```
****************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                         Analysis prepared by:



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----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN F
----------------------------------------------------------------------------


     RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
     TOTAL CATCHMENT AREA(ACRES) =    0.87
     SOIL-LOSS RATE, Fm,(INCH/HR) =  0.260
     LOW LOSS FRACTION = 0.390
     TIME OF CONCENTRATION(MIN.) = 16.80
     SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
     ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
     RETURN FREQUENCY(YEARS) = 100
        5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
       30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
        1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
        3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
        6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
       24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

     TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.24
     TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.17

****************************************************************************
  TIME      VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)     (AF)      (CFS)
----------------------------------------------------------------------------
  0.04      0.0000      0.00  Q         .         .         .         .
  0.32      0.0005      0.04  Q         .         .         .         .
  0.60      0.0015      0.04  Q         .         .         .         .
  0.88      0.0024      0.04  Q         .         .         .         .
```

1.16	0.0034	0.04	Q	.	.	.	.
1.44	0.0044	0.04	Q	.	.	.	.
1.72	0.0055	0.04	Q	.	.	.	.
2.00	0.0065	0.04	Q	.	.	.	.
2.28	0.0075	0.05	Q	.	.	.	.
2.56	0.0086	0.05	Q	.	.	.	.
2.84	0.0097	0.05	Q	.	.	.	.
3.12	0.0108	0.05	Q	.	.	.	.
3.40	0.0119	0.05	Q	.	.	.	.
3.68	0.0130	0.05	Q	.	.	.	.
3.96	0.0141	0.05	Q	.	.	.	.
4.24	0.0153	0.05	Q	.	.	.	.
4.52	0.0164	0.05	Q	.	.	.	.
4.80	0.0176	0.05	Q	.	.	.	.
5.08	0.0188	0.05	Q	.	.	.	.
5.36	0.0200	0.05	Q	.	.	.	.
5.64	0.0213	0.05	Q	.	.	.	.
5.92	0.0225	0.05	Q	.	.	.	.
6.20	0.0238	0.06	Q	.	.	.	.
6.48	0.0251	0.06	Q	.	.	.	.
6.76	0.0265	0.06	Q	.	.	.	.
7.04	0.0278	0.06	Q	.	.	.	.
7.32	0.0292	0.06	Q	.	.	.	.
7.60	0.0306	0.06	Q	.	.	.	.
7.88	0.0320	0.06	Q	.	.	.	.
8.16	0.0335	0.06	Q	.	.	.	.
8.44	0.0350	0.07	Q	.	.	.	.
8.72	0.0365	0.07	Q	.	.	.	.
9.00	0.0381	0.07	Q	.	.	.	.
9.28	0.0397	0.07	Q	.	.	.	.
9.56	0.0414	0.07	Q	.	.	.	.
9.84	0.0431	0.07	Q	.	.	.	.
10.12	0.0448	0.08	Q	.	.	.	.
10.40	0.0466	0.08	Q	.	.	.	.
10.68	0.0484	0.08	Q	.	.	.	.
10.96	0.0503	0.08	Q	.	.	.	.
11.24	0.0523	0.09	Q	.	.	.	.
11.52	0.0544	0.09	Q	.	.	.	.
11.80	0.0565	0.09	Q	.	.	.	.
12.08	0.0587	0.10	Q	.	.	.	.
12.36	0.0613	0.13	Q	.	.	.	.
12.64	0.0643	0.13	Q	.	.	.	.
12.92	0.0674	0.14	Q	.	.	.	.
13.20	0.0707	0.14	Q	.	.	.	.
13.48	0.0741	0.15	Q	.	.	.	.
13.76	0.0778	0.16	Q	.	.	.	.
14.04	0.0816	0.17	Q	.	.	.	.
14.32	0.0858	0.18	Q	.	.	.	.
14.60	0.0903	0.21	Q	.	.	.	.
14.88	0.0952	0.22	Q	.	.	.	.
15.16	0.1007	0.26	.Q	.	.	.	.
15.44	0.1071	0.29	.Q	.	.	.	.

```
 15.72      0.1148      0.38  .Q          .         .         .         .
 16.00      0.1260      0.59  . Q         .         .         .         .
 16.28      0.1582      2.20  .         Q .         .         .         .
 16.56      0.1872      0.31  .Q          .         .         .         .
 16.84      0.1935      0.24  Q           .         .         .         .
 17.12      0.1984      0.19  Q           .         .         .         .
 17.40      0.2026      0.17  Q           .         .         .         .
 17.68      0.2063      0.15  Q           .         .         .         .
 17.96      0.2095      0.14  Q           .         .         .         .
 18.24      0.2124      0.11  Q           .         .         .         .
 18.52      0.2147      0.09  Q           .         .         .         .
 18.80      0.2168      0.09  Q           .         .         .         .
 19.08      0.2187      0.08  Q           .         .         .         .
 19.36      0.2205      0.08  Q           .         .         .         .
 19.64      0.2222      0.07  Q           .         .         .         .
 19.92      0.2238      0.07  Q           .         .         .         .
 20.20      0.2253      0.06  Q           .         .         .         .
 20.48      0.2268      0.06  Q           .         .         .         .
 20.76      0.2282      0.06  Q           .         .         .         .
 21.04      0.2295      0.06  Q           .         .         .         .
 21.32      0.2308      0.06  Q           .         .         .         .
 21.60      0.2321      0.05  Q           .         .         .         .
 21.88      0.2333      0.05  Q           .         .         .         .
 22.16      0.2345      0.05  Q           .         .         .         .
 22.44      0.2357      0.05  Q           .         .         .         .
 22.72      0.2368      0.05  Q           .         .         .         .
 23.00      0.2379      0.05  Q           .         .         .         .
 23.28      0.2389      0.05  Q           .         .         .         .
 23.56      0.2400      0.04  Q           .         .         .         .
 23.84      0.2410      0.04  Q           .         .         .         .
 24.12      0.2420      0.04  Q           .         .         .         .
 24.40      0.2424      0.00  Q           .         .         .         .
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-----------------------------------------------------------------------------
-
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TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1444.8
10%	134.4
20%	33.6
30%	16.8
40%	16.8
50%	16.8
60%	16.8
70%	16.8
80%	16.8
90%	16.8

Problem Descriptions:

```
==============================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =   16.800
     DEAD STORAGE(AF) =       0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =       0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =    0.00


                    INFLOW
                      |
                      |
                      |
                      V                 __effective depth
                -------------           |   (and volume)
                |           |     |     |
                | detention |     |....V.............
                |   basin   |<-->|          outflow
                |           |     |.........________
                -------------     |         |    \
                      |           | storage |     basin outlet
                      V           -----------
                   OUTFLOW


     DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
     TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES =   9
     *BASIN-DEPTH  STORAGE    OUTFLOW  **BASIN-DEPTH  STORAGE    OUTFLOW  *
     *   (FEET)  (ACRE-FEET)   (CFS)   **   (FEET)  (ACRE-FEET)   (CFS)   *
     *      0.000      0.000      0.000**      0.500      0.004      0.470*
     *      1.000      0.008      0.820**      1.500      0.012      1.060*
     *      2.000      0.016      1.250**      2.500      0.020      1.420*
     *      3.000      0.024      1.570**      3.500      0.027      1.700*
     *      4.000      0.031      1.830**
------------------------------------------------------------------------------
     BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:
      INTERVAL   DEPTH   {S-O*DT/2}   {S+O*DT/2}
       NUMBER   (FEET)   (ACRE-FEET)  (ACRE-FEET)
          1      0.00       0.00000      0.00000
          2      0.50      -0.00144      0.00944
          3      1.00      -0.00149      0.01749
          4      1.50      -0.00026      0.02426
          5      2.00       0.00154      0.03046
```

6	2.50	0.00357	0.03643
7	3.00	0.00583	0.04217
8	3.50	0.00733	0.04667
9	4.00	0.00983	0.05217

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.040	0.000	0.00	0.00	0.00	0.000
0.320	0.000	0.04	0.05	0.02	0.000
0.600	0.000	0.04	0.05	0.05	0.000
0.880	0.000	0.04	0.05	0.05	0.000
1.160	0.000	0.04	0.05	0.05	0.000
1.440	0.000	0.04	0.05	0.05	0.000
1.720	0.000	0.04	0.05	0.05	0.000
2.000	0.000	0.04	0.05	0.05	0.000
2.280	0.000	0.05	0.06	0.05	0.000
2.560	0.000	0.05	0.06	0.05	0.000
2.840	0.000	0.05	0.06	0.05	0.000
3.120	0.000	0.05	0.06	0.05	0.000
3.400	0.000	0.05	0.06	0.05	0.000
3.680	0.000	0.05	0.06	0.06	0.000
3.960	0.000	0.05	0.06	0.06	0.000
4.240	0.000	0.05	0.06	0.06	0.000
4.520	0.000	0.05	0.06	0.06	0.000
4.800	0.000	0.05	0.06	0.06	0.001
5.080	0.000	0.05	0.06	0.06	0.001
5.360	0.000	0.05	0.06	0.06	0.001
5.640	0.000	0.05	0.07	0.06	0.001
5.920	0.000	0.05	0.07	0.06	0.001
6.200	0.000	0.06	0.07	0.06	0.001
6.480	0.000	0.06	0.07	0.07	0.001
6.760	0.000	0.06	0.07	0.07	0.001
7.040	0.000	0.06	0.07	0.07	0.001
7.320	0.000	0.06	0.07	0.07	0.001
7.600	0.000	0.06	0.08	0.07	0.001
7.880	0.000	0.06	0.08	0.07	0.001
8.160	0.000	0.06	0.08	0.07	0.001
8.440	0.000	0.07	0.08	0.07	0.001
8.720	0.000	0.07	0.08	0.08	0.001
9.000	0.000	0.07	0.08	0.08	0.001
9.280	0.000	0.07	0.09	0.08	0.001
9.560	0.000	0.07	0.09	0.08	0.001
9.840	0.000	0.07	0.09	0.08	0.001
10.120	0.000	0.08	0.09	0.09	0.001
10.400	0.000	0.08	0.10	0.09	0.001

10.680	0.000	0.08	0.10	0.09	0.001
10.960	0.000	0.08	0.10	0.09	0.001
11.240	0.000	0.09	0.11	0.10	0.001
11.520	0.000	0.09	0.11	0.10	0.001
11.800	0.000	0.09	0.12	0.11	0.001
12.080	0.000	0.10	0.12	0.11	0.001
12.360	0.000	0.13	0.16	0.13	0.001
12.640	0.000	0.13	0.16	0.15	0.001
12.920	0.000	0.14	0.17	0.16	0.001
13.200	0.000	0.14	0.18	0.16	0.001
13.480	0.000	0.15	0.19	0.17	0.002
13.760	0.000	0.16	0.20	0.18	0.002
14.040	0.000	0.17	0.21	0.19	0.002
14.320	0.000	0.18	0.23	0.21	0.002
14.600	0.000	0.21	0.25	0.22	0.002
14.880	0.000	0.22	0.27	0.25	0.002
15.160	0.000	0.26	0.32	0.28	0.003
15.440	0.000	0.29	0.35	0.32	0.003
15.720	0.000	0.38	0.46	0.38	0.004
16.000	0.000	0.59	0.76	0.54	0.006
16.280	0.000	2.20	3.88	1.23	0.030
16.560	0.000	0.31	0.93	1.28	0.007
16.840	0.000	0.24	0.29	0.52	0.002
17.120	0.000	0.19	0.24	0.25	0.002
17.400	0.000	0.17	0.20	0.21	0.002
17.680	0.000	0.15	0.18	0.18	0.001
17.960	0.000	0.14	0.17	0.16	0.001
18.240	0.000	0.11	0.14	0.14	0.001
18.520	0.000	0.09	0.11	0.12	0.001
18.800	0.000	0.09	0.10	0.10	0.001
19.080	0.000	0.08	0.10	0.10	0.001
19.360	0.000	0.08	0.09	0.09	0.001
19.640	0.000	0.07	0.09	0.08	0.001
19.920	0.000	0.07	0.08	0.08	0.001
20.200	0.000	0.06	0.08	0.08	0.001
20.480	0.000	0.06	0.08	0.07	0.001
20.760	0.000	0.06	0.07	0.07	0.001
21.040	0.000	0.06	0.07	0.07	0.001
21.320	0.000	0.06	0.07	0.07	0.001
21.600	0.000	0.05	0.07	0.06	0.001
21.880	0.000	0.05	0.06	0.06	0.001
22.160	0.000	0.05	0.06	0.06	0.000
22.440	0.000	0.05	0.06	0.06	0.000
22.720	0.000	0.05	0.06	0.06	0.000
23.000	0.000	0.05	0.06	0.05	0.000
23.280	0.000	0.05	0.06	0.05	0.000
23.560	0.000	0.04	0.05	0.05	0.000
23.840	0.000	0.04	0.05	0.05	0.000
24.120	0.000	0.04	0.05	0.05	0.000
24.400	0.000	0.00	0.00	0.02	0.000
24.680	0.000	0.00	0.00	0.00	0.000

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****************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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             Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                         Analysis prepared by:


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----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN G
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =     0.82
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.260
    LOW LOSS FRACTION = 0.390
    TIME OF CONCENTRATION(MIN.) = 16.50
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      0.23
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.16

****************************************************************************
  TIME      VOLUME        Q    0.         2.5        5.0        7.5       10.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.05      0.0000      0.00  Q          .          .          .          .
  0.32      0.0004      0.04  Q          .          .          .          .
  0.60      0.0014      0.04  Q          .          .          .          .
  0.88      0.0023      0.04  Q          .          .          .          .
```

1.15	0.0032	0.04	Q	.	.	.	.
1.42	0.0041	0.04	Q	.	.	.	.
1.70	0.0051	0.04	Q	.	.	.	.
1.98	0.0060	0.04	Q	.	.	.	.
2.25	0.0070	0.04	Q	.	.	.	.
2.53	0.0080	0.04	Q	.	.	.	.
2.80	0.0090	0.04	Q	.	.	.	.
3.08	0.0100	0.04	Q	.	.	.	.
3.35	0.0110	0.04	Q	.	.	.	.
3.62	0.0120	0.05	Q	.	.	.	.
3.90	0.0131	0.05	Q	.	.	.	.
4.18	0.0141	0.05	Q	.	.	.	.
4.45	0.0152	0.05	Q	.	.	.	.
4.72	0.0163	0.05	Q	.	.	.	.
5.00	0.0174	0.05	Q	.	.	.	.
5.28	0.0185	0.05	Q	.	.	.	.
5.55	0.0197	0.05	Q	.	.	.	.
5.82	0.0208	0.05	Q	.	.	.	.
6.10	0.0220	0.05	Q	.	.	.	.
6.38	0.0232	0.05	Q	.	.	.	.
6.65	0.0244	0.05	Q	.	.	.	.
6.93	0.0257	0.06	Q	.	.	.	.
7.20	0.0269	0.06	Q	.	.	.	.
7.47	0.0282	0.06	Q	.	.	.	.
7.75	0.0295	0.06	Q	.	.	.	.
8.02	0.0309	0.06	Q	.	.	.	.
8.30	0.0323	0.06	Q	.	.	.	.
8.57	0.0337	0.06	Q	.	.	.	.
8.85	0.0351	0.06	Q	.	.	.	.
9.12	0.0366	0.07	Q	.	.	.	.
9.40	0.0381	0.07	Q	.	.	.	.
9.68	0.0396	0.07	Q	.	.	.	.
9.95	0.0412	0.07	Q	.	.	.	.
10.23	0.0428	0.07	Q	.	.	.	.
10.50	0.0445	0.07	Q	.	.	.	.
10.77	0.0462	0.08	Q	.	.	.	.
11.05	0.0480	0.08	Q	.	.	.	.
11.32	0.0499	0.08	Q	.	.	.	.
11.60	0.0518	0.09	Q	.	.	.	.
11.88	0.0538	0.09	Q	.	.	.	.
12.15	0.0558	0.09	Q	.	.	.	.
12.43	0.0583	0.12	Q	.	.	.	.
12.70	0.0611	0.13	Q	.	.	.	.
12.98	0.0640	0.13	Q	.	.	.	.
13.25	0.0671	0.14	Q	.	.	.	.
13.52	0.0703	0.15	Q	.	.	.	.
13.80	0.0737	0.15	Q	.	.	.	.
14.07	0.0773	0.17	Q	.	.	.	.
14.35	0.0812	0.17	Q	.	.	.	.
14.62	0.0854	0.20	Q	.	.	.	.
14.90	0.0900	0.21	Q	.	.	.	.
15.18	0.0952	0.25	Q	.	.	.	.

```
 15.45      0.1011      0.27  .Q        .         .         .         .
 15.73      0.1083      0.36  .Q        .         .         .         .
 16.00      0.1188      0.57  . Q       .         .         .         .
 16.27      0.1490      2.09  .       Q .         .         .         .
 16.55      0.1761      0.29  .Q        .         .         .         .
 16.83      0.1820      0.23  Q         .         .         .         .
 17.10      0.1866      0.18  Q         .         .         .         .
 17.38      0.1905      0.16  Q         .         .         .         .
 17.65      0.1939      0.14  Q         .         .         .         .
 17.92      0.1970      0.13  Q         .         .         .         .
 18.20      0.1998      0.11  Q         .         .         .         .
 18.48      0.2021      0.09  Q         .         .         .         .
 18.75      0.2040      0.08  Q         .         .         .         .
 19.02      0.2058      0.08  Q         .         .         .         .
 19.30      0.2074      0.07  Q         .         .         .         .
 19.58      0.2090      0.07  Q         .         .         .         .
 19.85      0.2105      0.06  Q         .         .         .         .
 20.12      0.2120      0.06  Q         .         .         .         .
 20.40      0.2133      0.06  Q         .         .         .         .
 20.67      0.2147      0.06  Q         .         .         .         .
 20.95      0.2159      0.05  Q         .         .         .         .
 21.23      0.2172      0.05  Q         .         .         .         .
 21.50      0.2183      0.05  Q         .         .         .         .
 21.77      0.2195      0.05  Q         .         .         .         .
 22.05      0.2206      0.05  Q         .         .         .         .
 22.33      0.2217      0.05  Q         .         .         .         .
 22.60      0.2227      0.05  Q         .         .         .         .
 22.88      0.2237      0.04  Q         .         .         .         .
 23.15      0.2247      0.04  Q         .         .         .         .
 23.42      0.2257      0.04  Q         .         .         .         .
 23.70      0.2266      0.04  Q         .         .         .         .
 23.98      0.2275      0.04  Q         .         .         .         .
 24.25      0.2284      0.04  Q         .         .         .         .
 24.52      0.2289      0.00  Q         .         .         .         .
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TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1452.0
10%	115.5
20%	33.0
30%	16.5
40%	16.5
50%	16.5
60%	16.5
70%	16.5

80%	16.5
90%	16.5

Problem Descriptions:

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==============================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =   16.500
     DEAD STORAGE(AF) =       0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =       0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =    0.00


                    INFLOW
                      |
                      |
                      |
                      V                 __effective depth
                -------------           |   (and volume)
                |           |     |     |
                | detention |     |....V.............
                |   basin   |<-->|          outflow
                |           |     |.........________
                -------------     |         |    \
                      |           | storage |     basin outlet
                      V           -----------
                   OUTFLOW


     DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
     TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES =   9
     *BASIN-DEPTH  STORAGE    OUTFLOW  **BASIN-DEPTH  STORAGE    OUTFLOW  *
     *   (FEET)  (ACRE-FEET)   (CFS)   **   (FEET)  (ACRE-FEET)   (CFS)   *
     *      0.000      0.000      0.000**      0.500      0.003      0.470*
     *      1.000      0.007      0.820**      1.500      0.010      1.060*
     *      2.000      0.014      1.250**      2.500      0.017      1.420*
     *      3.000      0.021      1.570**      3.500      0.024      1.700*
     *      4.000      0.028      1.830**
------------------------------------------------------------------------------
     BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:
      INTERVAL   DEPTH   {S-O*DT/2}   {S+O*DT/2}
       NUMBER   (FEET)   (ACRE-FEET)  (ACRE-FEET)
           1     0.00       0.00000      0.00000
           2     0.50      -0.00234      0.00834
           3     1.00      -0.00232      0.01632
```

4	1.50	-0.00205	0.02205
5	2.00	-0.00020	0.02820
6	2.50	0.00086	0.03314
7	3.00	0.00316	0.03884
8	3.50	0.00468	0.04332
9	4.00	0.00720	0.04880

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.050	0.000	0.00	0.00	0.00	0.000
0.325	0.000	0.04	0.05	0.03	0.000
0.600	0.000	0.04	0.05	0.05	0.000
0.875	0.000	0.04	0.06	0.05	0.000
1.150	0.000	0.04	0.06	0.05	0.000
1.425	0.000	0.04	0.06	0.05	0.000
1.700	0.000	0.04	0.06	0.05	0.000
1.975	0.000	0.04	0.06	0.05	0.000
2.250	0.000	0.04	0.06	0.05	0.000
2.525	0.000	0.04	0.06	0.06	0.000
2.800	0.000	0.04	0.06	0.06	0.000
3.075	0.000	0.04	0.06	0.06	0.000
3.350	0.000	0.04	0.06	0.06	0.000
3.625	0.000	0.05	0.06	0.06	0.000
3.900	0.000	0.05	0.06	0.06	0.000
4.175	0.000	0.05	0.06	0.06	0.000
4.450	0.000	0.05	0.06	0.06	0.000
4.725	0.000	0.05	0.07	0.06	0.000
5.000	0.000	0.05	0.07	0.06	0.000
5.275	0.000	0.05	0.07	0.06	0.000
5.550	0.000	0.05	0.07	0.06	0.000
5.825	0.000	0.05	0.07	0.07	0.000
6.100	0.000	0.05	0.07	0.07	0.000
6.375	0.000	0.05	0.07	0.07	0.000
6.650	0.000	0.05	0.07	0.07	0.000
6.925	0.000	0.06	0.08	0.07	0.000
7.200	0.000	0.06	0.08	0.07	0.000
7.475	0.000	0.06	0.08	0.07	0.000
7.750	0.000	0.06	0.08	0.07	0.000
8.025	0.000	0.06	0.08	0.08	0.000
8.300	0.000	0.06	0.08	0.08	0.000
8.575	0.000	0.06	0.09	0.08	0.001
8.850	0.000	0.06	0.09	0.08	0.001
9.125	0.000	0.07	0.09	0.08	0.001
9.400	0.000	0.07	0.09	0.08	0.001
9.675	0.000	0.07	0.09	0.09	0.001

9.950	0.000	0.07	0.10	0.09	0.001
10.225	0.000	0.07	0.10	0.09	0.001
10.500	0.000	0.07	0.10	0.09	0.001
10.775	0.000	0.08	0.11	0.10	0.001
11.050	0.000	0.08	0.11	0.10	0.001
11.325	0.000	0.08	0.11	0.10	0.001
11.600	0.000	0.09	0.12	0.11	0.001
11.875	0.000	0.09	0.12	0.11	0.001
12.150	0.000	0.09	0.13	0.12	0.001
12.425	0.000	0.12	0.17	0.14	0.001
12.700	0.000	0.13	0.17	0.16	0.001
12.975	0.000	0.13	0.18	0.17	0.001
13.250	0.000	0.14	0.19	0.17	0.001
13.525	0.000	0.15	0.20	0.18	0.001
13.800	0.000	0.15	0.21	0.19	0.001
14.075	0.000	0.17	0.23	0.20	0.001
14.350	0.000	0.17	0.24	0.22	0.001
14.625	0.000	0.20	0.27	0.24	0.002
14.900	0.000	0.21	0.28	0.26	0.002
15.175	0.000	0.25	0.34	0.29	0.002
15.450	0.000	0.27	0.37	0.33	0.002
15.725	0.000	0.36	0.49	0.41	0.003
16.000	0.000	0.57	0.78	0.56	0.005
16.275	0.000	2.09	3.89	1.23	0.027
16.550	0.000	0.29	0.81	1.24	0.005
16.825	0.000	0.23	0.31	0.49	0.002
17.100	0.000	0.18	0.25	0.26	0.002
17.375	0.000	0.16	0.22	0.22	0.001
17.650	0.000	0.14	0.19	0.19	0.001
17.925	0.000	0.13	0.18	0.17	0.001
18.200	0.000	0.11	0.16	0.16	0.001
18.475	0.000	0.09	0.12	0.13	0.001
18.750	0.000	0.08	0.11	0.11	0.001
19.025	0.000	0.08	0.10	0.10	0.001
19.300	0.000	0.07	0.10	0.09	0.001
19.575	0.000	0.07	0.09	0.09	0.001
19.850	0.000	0.06	0.09	0.08	0.001
20.125	0.000	0.06	0.08	0.08	0.001
20.400	0.000	0.06	0.08	0.08	0.000
20.675	0.000	0.06	0.08	0.07	0.000
20.950	0.000	0.05	0.07	0.07	0.000
21.225	0.000	0.05	0.07	0.07	0.000
21.500	0.000	0.05	0.07	0.07	0.000
21.775	0.000	0.05	0.07	0.06	0.000
22.050	0.000	0.05	0.07	0.06	0.000
22.325	0.000	0.05	0.06	0.06	0.000
22.600	0.000	0.05	0.06	0.06	0.000
22.875	0.000	0.04	0.06	0.06	0.000
23.150	0.000	0.04	0.06	0.06	0.000
23.425	0.000	0.04	0.06	0.05	0.000
23.700	0.000	0.04	0.06	0.05	0.000
23.975	0.000	0.04	0.05	0.05	0.000

24.250	0.000	0.04	0.05	0.05	0.000
24.525	0.000	0.00	0.00	0.03	0.000
24.800	0.000	0.00	0.00	0.00	0.000

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****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                              Analysis prepared by:



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----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN H
----------------------------------------------------------------------------


     RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
     TOTAL CATCHMENT AREA(ACRES) =     0.66
     SOIL-LOSS RATE, Fm,(INCH/HR) =  0.260
     LOW LOSS FRACTION = 0.390
     TIME OF CONCENTRATION(MIN.) = 15.00
     SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
     ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
     RETURN FREQUENCY(YEARS) = 100
        5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
       30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
        1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
        3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
        6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
       24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

     TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      0.18
     TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.13

****************************************************************************
  TIME      VOLUME        Q     0.         2.5        5.0        7.5       10.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.25      0.0003      0.03  Q          .          .          .          .
  0.50      0.0010      0.03  Q          .          .          .          .
  0.75      0.0017      0.03  Q          .          .          .          .
  1.00      0.0023      0.03  Q          .          .          .          .
```

1.25	0.0030	0.03	Q	.	.	.	.
1.50	0.0037	0.03	Q	.	.	.	.
1.75	0.0044	0.03	Q	.	.	.	.
2.00	0.0051	0.03	Q	.	.	.	.
2.25	0.0058	0.03	Q	.	.	.	.
2.50	0.0065	0.03	Q	.	.	.	.
2.75	0.0072	0.04	Q	.	.	.	.
3.00	0.0080	0.04	Q	.	.	.	.
3.25	0.0087	0.04	Q	.	.	.	.
3.50	0.0095	0.04	Q	.	.	.	.
3.75	0.0102	0.04	Q	.	.	.	.
4.00	0.0110	0.04	Q	.	.	.	.
4.25	0.0118	0.04	Q	.	.	.	.
4.50	0.0126	0.04	Q	.	.	.	.
4.75	0.0134	0.04	Q	.	.	.	.
5.00	0.0142	0.04	Q	.	.	.	.
5.25	0.0150	0.04	Q	.	.	.	.
5.50	0.0158	0.04	Q	.	.	.	.
5.75	0.0167	0.04	Q	.	.	.	.
6.00	0.0175	0.04	Q	.	.	.	.
6.25	0.0184	0.04	Q	.	.	.	.
6.50	0.0193	0.04	Q	.	.	.	.
6.75	0.0202	0.04	Q	.	.	.	.
7.00	0.0211	0.04	Q	.	.	.	.
7.25	0.0221	0.05	Q	.	.	.	.
7.50	0.0230	0.05	Q	.	.	.	.
7.75	0.0240	0.05	Q	.	.	.	.
8.00	0.0250	0.05	Q	.	.	.	.
8.25	0.0260	0.05	Q	.	.	.	.
8.50	0.0270	0.05	Q	.	.	.	.
8.75	0.0280	0.05	Q	.	.	.	.
9.00	0.0291	0.05	Q	.	.	.	.
9.25	0.0302	0.05	Q	.	.	.	.
9.50	0.0313	0.05	Q	.	.	.	.
9.75	0.0324	0.06	Q	.	.	.	.
10.00	0.0336	0.06	Q	.	.	.	.
10.25	0.0348	0.06	Q	.	.	.	.
10.50	0.0360	0.06	Q	.	.	.	.
10.75	0.0373	0.06	Q	.	.	.	.
11.00	0.0386	0.06	Q	.	.	.	.
11.25	0.0400	0.07	Q	.	.	.	.
11.50	0.0413	0.07	Q	.	.	.	.
11.75	0.0428	0.07	Q	.	.	.	.
12.00	0.0443	0.07	Q	.	.	.	.
12.25	0.0460	0.10	Q	.	.	.	.
12.50	0.0480	0.10	Q	.	.	.	.
12.75	0.0501	0.10	Q	.	.	.	.
13.00	0.0523	0.11	Q	.	.	.	.
13.25	0.0545	0.11	Q	.	.	.	.
13.50	0.0569	0.12	Q	.	.	.	.
13.75	0.0593	0.12	Q	.	.	.	.
14.00	0.0620	0.13	Q	.	.	.	.

14.25	0.0647	0.14	Q		.	.	.	.
14.50	0.0677	0.15	Q		.	.	.	.
14.75	0.0710	0.17	Q		.	.	.	.
15.00	0.0745	0.18	Q		.	.	.	.
15.25	0.0785	0.21	Q		.	.	.	.
15.50	0.0831	0.23	Q		.	.	.	.
15.75	0.0887	0.32	.Q		.	.	.	.
16.00	0.0971	0.49	.Q		.	.	.	.
16.25	0.1206	1.79	.	Q	.	.	.	.
16.50	0.1415	0.23	Q		.	.	.	.
16.75	0.1459	0.19	Q		.	.	.	.
17.00	0.1495	0.16	Q		.	.	.	.
17.25	0.1525	0.13	Q		.	.	.	.
17.50	0.1552	0.12	Q		.	.	.	.
17.75	0.1575	0.11	Q		.	.	.	.
18.00	0.1597	0.10	Q		.	.	.	.
18.25	0.1615	0.07	Q		.	.	.	.
18.50	0.1630	0.07	Q		.	.	.	.
18.75	0.1644	0.07	Q		.	.	.	.
19.00	0.1657	0.06	Q		.	.	.	.
19.25	0.1669	0.06	Q		.	.	.	.
19.50	0.1681	0.06	Q		.	.	.	.
19.75	0.1692	0.05	Q		.	.	.	.
20.00	0.1703	0.05	Q		.	.	.	.
20.25	0.1713	0.05	Q		.	.	.	.
20.50	0.1723	0.05	Q		.	.	.	.
20.75	0.1732	0.05	Q		.	.	.	.
21.00	0.1741	0.04	Q		.	.	.	.
21.25	0.1750	0.04	Q		.	.	.	.
21.50	0.1759	0.04	Q		.	.	.	.
21.75	0.1767	0.04	Q		.	.	.	.
22.00	0.1775	0.04	Q		.	.	.	.
22.25	0.1783	0.04	Q		.	.	.	.
22.50	0.1791	0.04	Q		.	.	.	.
22.75	0.1798	0.04	Q		.	.	.	.
23.00	0.1806	0.04	Q		.	.	.	.
23.25	0.1813	0.03	Q		.	.	.	.
23.50	0.1820	0.03	Q		.	.	.	.
23.75	0.1827	0.03	Q		.	.	.	.
24.00	0.1833	0.03	Q		.	.	.	.
24.25	0.1837	0.00	Q		.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1440.0

10%	105.0
20%	30.0
30%	15.0
40%	15.0
50%	15.0
60%	15.0
70%	15.0
80%	15.0
90%	15.0

Problem Descriptions:

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==============================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =   15.000
     DEAD STORAGE(AF) =        0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =       0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =    0.00


                 INFLOW
                   |
                   |
                   |
                   |
                   V                 __effective depth
             -------------           |   (and volume)
             |           |     |     |
             | detention |     |....V.............
             |   basin   |<-->|          outflow
             |           |     |.........________
             -------------     |          |    \
                   |           | storage |      basin outlet
                   V           -----------
                OUTFLOW


     DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
     TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES =   9
     *BASIN-DEPTH  STORAGE    OUTFLOW  **BASIN-DEPTH  STORAGE    OUTFLOW  *
     *   (FEET)  (ACRE-FEET)   (CFS)   **   (FEET)  (ACRE-FEET)   (CFS)   *
     *      0.000      0.000      0.000**      0.500      0.003      0.470*
     *      1.000      0.005      0.820**      1.500      0.008      1.060*
     *      2.000      0.010      1.250**      2.500      0.013      1.420*
     *      3.000      0.016      1.570**      3.500      0.018      1.700*
     *      4.000      0.021      1.830**
```

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	-0.00186	0.00786
3	1.00	-0.00347	0.01347
4	1.50	-0.00295	0.01895
5	2.00	-0.00291	0.02291
6	2.50	-0.00167	0.02767
7	3.00	-0.00022	0.03222
8	3.50	0.00044	0.03556
9	4.00	0.00210	0.03990

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.250	0.000	0.03	0.04	0.02	0.000
0.500	0.000	0.03	0.04	0.04	0.000
0.750	0.000	0.03	0.04	0.04	0.000
1.000	0.000	0.03	0.04	0.04	0.000
1.250	0.000	0.03	0.04	0.04	0.000
1.500	0.000	0.03	0.04	0.04	0.000
1.750	0.000	0.03	0.04	0.04	0.000
2.000	0.000	0.03	0.04	0.04	0.000
2.250	0.000	0.03	0.05	0.04	0.000
2.500	0.000	0.03	0.05	0.04	0.000
2.750	0.000	0.04	0.05	0.04	0.000
3.000	0.000	0.04	0.05	0.04	0.000
3.250	0.000	0.04	0.05	0.04	0.000
3.500	0.000	0.04	0.05	0.04	0.000
3.750	0.000	0.04	0.05	0.05	0.000
4.000	0.000	0.04	0.05	0.05	0.000
4.250	0.000	0.04	0.05	0.05	0.000
4.500	0.000	0.04	0.05	0.05	0.000
4.750	0.000	0.04	0.05	0.05	0.000
5.000	0.000	0.04	0.05	0.05	0.000
5.250	0.000	0.04	0.05	0.05	0.000
5.500	0.000	0.04	0.05	0.05	0.000
5.750	0.000	0.04	0.05	0.05	0.000
6.000	0.000	0.04	0.06	0.05	0.000
6.250	0.000	0.04	0.06	0.05	0.000
6.500	0.000	0.04	0.06	0.05	0.000
6.750	0.000	0.04	0.06	0.05	0.000
7.000	0.000	0.04	0.06	0.05	0.000
7.250	0.000	0.05	0.06	0.06	0.000

7.500	0.000	0.05	0.06	0.06	0.000
7.750	0.000	0.05	0.06	0.06	0.000
8.000	0.000	0.05	0.06	0.06	0.000
8.250	0.000	0.05	0.06	0.06	0.000
8.500	0.000	0.05	0.07	0.06	0.000
8.750	0.000	0.05	0.07	0.06	0.000
9.000	0.000	0.05	0.07	0.06	0.000
9.250	0.000	0.05	0.07	0.07	0.000
9.500	0.000	0.05	0.07	0.07	0.000
9.750	0.000	0.06	0.07	0.07	0.000
10.000	0.000	0.06	0.08	0.07	0.000
10.250	0.000	0.06	0.08	0.07	0.000
10.500	0.000	0.06	0.08	0.07	0.000
10.750	0.000	0.06	0.08	0.08	0.000
11.000	0.000	0.06	0.08	0.08	0.001
11.250	0.000	0.07	0.09	0.08	0.001
11.500	0.000	0.07	0.09	0.08	0.001
11.750	0.000	0.07	0.09	0.09	0.001
12.000	0.000	0.07	0.10	0.09	0.001
12.250	0.000	0.10	0.13	0.10	0.001
12.500	0.000	0.10	0.13	0.12	0.001
12.750	0.000	0.10	0.14	0.12	0.001
13.000	0.000	0.11	0.14	0.13	0.001
13.250	0.000	0.11	0.15	0.13	0.001
13.500	0.000	0.12	0.15	0.14	0.001
13.750	0.000	0.12	0.16	0.15	0.001
14.000	0.000	0.13	0.17	0.16	0.001
14.250	0.000	0.14	0.19	0.17	0.001
14.500	0.000	0.15	0.19	0.18	0.001
14.750	0.000	0.17	0.22	0.19	0.001
15.000	0.000	0.18	0.23	0.21	0.001
15.250	0.000	0.21	0.27	0.24	0.002
15.500	0.000	0.23	0.31	0.27	0.002
15.750	0.000	0.32	0.42	0.34	0.002
16.000	0.000	0.49	0.70	0.50	0.004
16.250	0.000	1.79	3.67	1.18	0.019
16.500	0.000	0.23	0.37	1.05	0.002
16.750	0.000	0.19	0.25	0.29	0.002
17.000	0.000	0.16	0.21	0.21	0.001
17.250	0.000	0.13	0.18	0.18	0.001
17.500	0.000	0.12	0.16	0.16	0.001
17.750	0.000	0.11	0.14	0.14	0.001
18.000	0.000	0.10	0.13	0.13	0.001
18.250	0.000	0.07	0.10	0.11	0.001
18.500	0.000	0.07	0.09	0.09	0.001
18.750	0.000	0.07	0.09	0.08	0.001
19.000	0.000	0.06	0.08	0.08	0.000
19.250	0.000	0.06	0.08	0.07	0.000
19.500	0.000	0.06	0.07	0.07	0.000
19.750	0.000	0.05	0.07	0.07	0.000
20.000	0.000	0.05	0.07	0.06	0.000
20.250	0.000	0.05	0.06	0.06	0.000

20.500	0.000	0.05	0.06	0.06	0.000
20.750	0.000	0.05	0.06	0.06	0.000
21.000	0.000	0.04	0.06	0.05	0.000
21.250	0.000	0.04	0.06	0.05	0.000
21.500	0.000	0.04	0.05	0.05	0.000
21.750	0.000	0.04	0.05	0.05	0.000
22.000	0.000	0.04	0.05	0.05	0.000
22.250	0.000	0.04	0.05	0.05	0.000
22.500	0.000	0.04	0.05	0.05	0.000
22.750	0.000	0.04	0.05	0.04	0.000
23.000	0.000	0.04	0.05	0.04	0.000
23.250	0.000	0.03	0.05	0.04	0.000
23.500	0.000	0.03	0.04	0.04	0.000
23.750	0.000	0.03	0.04	0.04	0.000
24.000	0.000	0.03	0.04	0.04	0.000
24.250	0.000	0.00	0.00	0.02	0.000
24.500	0.000	0.00	0.00	0.00	0.000

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                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                              Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN I
----------------------------------------------------------------------------


     RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
     TOTAL CATCHMENT AREA(ACRES) =     0.83
     SOIL-LOSS RATE, Fm,(INCH/HR) =  0.260
     LOW LOSS FRACTION = 0.390
     TIME OF CONCENTRATION(MIN.) = 16.70
     SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
     ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
     RETURN FREQUENCY(YEARS) = 100
        5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
       30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
        1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
        3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
        6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
       24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

     TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      0.23
     TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.16

****************************************************************************
  TIME      VOLUME        Q     0.         2.5        5.0        7.5       10.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.13      0.0002      0.04  Q          .          .          .          .
  0.41      0.0011      0.04  Q          .          .          .          .
  0.69      0.0021      0.04  Q          .          .          .          .
  0.97      0.0030      0.04  Q          .          .          .          .
```

1.25	0.0040	0.04	Q	.	.	.	.
1.53	0.0049	0.04	Q	.	.	.	.
1.80	0.0059	0.04	Q	.	.	.	.
2.08	0.0069	0.04	Q	.	.	.	.
2.36	0.0079	0.04	Q	.	.	.	.
2.64	0.0089	0.04	Q	.	.	.	.
2.92	0.0099	0.04	Q	.	.	.	.
3.20	0.0109	0.05	Q	.	.	.	.
3.47	0.0120	0.05	Q	.	.	.	.
3.75	0.0130	0.05	Q	.	.	.	.
4.03	0.0141	0.05	Q	.	.	.	.
4.31	0.0152	0.05	Q	.	.	.	.
4.59	0.0163	0.05	Q	.	.	.	.
4.87	0.0174	0.05	Q	.	.	.	.
5.14	0.0186	0.05	Q	.	.	.	.
5.42	0.0197	0.05	Q	.	.	.	.
5.70	0.0209	0.05	Q	.	.	.	.
5.98	0.0221	0.05	Q	.	.	.	.
6.26	0.0234	0.05	Q	.	.	.	.
6.54	0.0246	0.05	Q	.	.	.	.
6.81	0.0259	0.06	Q	.	.	.	.
7.09	0.0271	0.06	Q	.	.	.	.
7.37	0.0285	0.06	Q	.	.	.	.
7.65	0.0298	0.06	Q	.	.	.	.
7.93	0.0312	0.06	Q	.	.	.	.
8.21	0.0326	0.06	Q	.	.	.	.
8.48	0.0340	0.06	Q	.	.	.	.
8.76	0.0355	0.06	Q	.	.	.	.
9.04	0.0370	0.07	Q	.	.	.	.
9.32	0.0385	0.07	Q	.	.	.	.
9.60	0.0401	0.07	Q	.	.	.	.
9.88	0.0417	0.07	Q	.	.	.	.
10.15	0.0433	0.07	Q	.	.	.	.
10.43	0.0450	0.07	Q	.	.	.	.
10.71	0.0468	0.08	Q	.	.	.	.
10.99	0.0486	0.08	Q	.	.	.	.
11.27	0.0505	0.08	Q	.	.	.	.
11.55	0.0524	0.09	Q	.	.	.	.
11.82	0.0544	0.09	Q	.	.	.	.
12.10	0.0565	0.09	Q	.	.	.	.
12.38	0.0590	0.12	Q	.	.	.	.
12.66	0.0619	0.13	Q	.	.	.	.
12.94	0.0649	0.13	Q	.	.	.	.
13.22	0.0680	0.14	Q	.	.	.	.
13.49	0.0712	0.15	Q	.	.	.	.
13.77	0.0747	0.15	Q	.	.	.	.
14.05	0.0784	0.17	Q	.	.	.	.
14.33	0.0823	0.18	Q	.	.	.	.
14.61	0.0866	0.20	Q	.	.	.	.
14.89	0.0913	0.21	Q	.	.	.	.
15.16	0.0966	0.25	Q	.	.	.	.
15.44	0.1026	0.28	.Q	.	.	.	.

```
 15.72      0.1099      0.36  .Q          .          .          .          .
 16.00      0.1206      0.57  . Q         .          .          .          .
 16.28      0.1513      2.10  .         Q .          .          .          .
 16.56      0.1788      0.29  .Q          .          .          .          .
 16.83      0.1848      0.23  Q           .          .          .          .
 17.11      0.1896      0.19  Q           .          .          .          .
 17.39      0.1935      0.16  Q           .          .          .          .
 17.67      0.1970      0.14  Q           .          .          .          .
 17.95      0.2001      0.13  Q           .          .          .          .
 18.23      0.2029      0.11  Q           .          .          .          .
 18.51      0.2051      0.09  Q           .          .          .          .
 18.78      0.2071      0.08  Q           .          .          .          .
 19.06      0.2089      0.08  Q           .          .          .          .
 19.34      0.2106      0.07  Q           .          .          .          .
 19.62      0.2122      0.07  Q           .          .          .          .
 19.90      0.2137      0.06  Q           .          .          .          .
 20.17      0.2152      0.06  Q           .          .          .          .
 20.45      0.2166      0.06  Q           .          .          .          .
 20.73      0.2179      0.06  Q           .          .          .          .
 21.01      0.2192      0.06  Q           .          .          .          .
 21.29      0.2205      0.05  Q           .          .          .          .
 21.57      0.2217      0.05  Q           .          .          .          .
 21.85      0.2228      0.05  Q           .          .          .          .
 22.12      0.2240      0.05  Q           .          .          .          .
 22.40      0.2251      0.05  Q           .          .          .          .
 22.68      0.2261      0.05  Q           .          .          .          .
 22.96      0.2271      0.04  Q           .          .          .          .
 23.24      0.2282      0.04  Q           .          .          .          .
 23.52      0.2291      0.04  Q           .          .          .          .
 23.79      0.2301      0.04  Q           .          .          .          .
 24.07      0.2310      0.04  Q           .          .          .          .
 24.35      0.2315      0.00  Q           .          .          .          .
 ------------------------------------------------------------------------------
------------------------------------------------------------------------------
---
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                    Duration
        Peak Flow Rate                         (minutes)
    =======================                    =========
              0%                                1452.9
             10%                                 133.6
             20%                                  33.4
             30%                                  16.7
             40%                                  16.7
             50%                                  16.7
             60%                                  16.7
             70%                                  16.7
             80%                                  16.7
             90%                                  16.7
```

Problem Descriptions:

```
==============================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =    16.700
     DEAD STORAGE(AF) =        0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =        0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =     0.00


                  INFLOW
                    |
                    |
                    |
                    V                 __effective depth
               -------------          |   (and volume)
               |           |     |    |
               | detention |     |....V.............
               |   basin   |<-->|          outflow
               |           |     |.........________
               -------------     |         |    \
                    |            | storage |      basin outlet
                    V            -----------
                 OUTFLOW


     DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
     TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES =    9
     *BASIN-DEPTH  STORAGE    OUTFLOW  **BASIN-DEPTH  STORAGE    OUTFLOW  *
     *   (FEET)  (ACRE-FEET)   (CFS)   **   (FEET)  (ACRE-FEET)   (CFS)   *
     *      0.000      0.000      0.000**      0.500      0.003      0.470*
     *      1.000      0.007      0.820**      1.500      0.010      1.060*
     *      2.000      0.014      1.250**      2.500      0.017      1.420*
     *      3.000      0.021      1.570**      3.500      0.024      1.700*
     *      4.003      0.028      1.830**
------------------------------------------------------------------------------
     BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:
      INTERVAL   DEPTH   {S-O*DT/2}   {S+O*DT/2}
       NUMBER   (FEET)   (ACRE-FEET)  (ACRE-FEET)
          1      0.00       0.00000      0.00000
          2      0.50      -0.00241      0.00841
          3      1.00      -0.00243      0.01643
          4      1.50      -0.00219      0.02219
          5      2.00      -0.00038      0.02838
```

6	2.50	0.00067	0.03333
7	3.00	0.00294	0.03906
8	3.50	0.00445	0.04355
9	4.00	0.00695	0.04905

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.135	0.000	0.04	0.05	0.03	0.000
0.413	0.000	0.04	0.05	0.05	0.000
0.692	0.000	0.04	0.06	0.05	0.000
0.970	0.000	0.04	0.06	0.05	0.000
1.248	0.000	0.04	0.06	0.05	0.000
1.527	0.000	0.04	0.06	0.05	0.000
1.805	0.000	0.04	0.06	0.05	0.000
2.083	0.000	0.04	0.06	0.05	0.000
2.362	0.000	0.04	0.06	0.06	0.000
2.640	0.000	0.04	0.06	0.06	0.000
2.918	0.000	0.04	0.06	0.06	0.000
3.197	0.000	0.05	0.06	0.06	0.000
3.475	0.000	0.05	0.06	0.06	0.000
3.753	0.000	0.05	0.06	0.06	0.000
4.032	0.000	0.05	0.06	0.06	0.000
4.310	0.000	0.05	0.07	0.06	0.000
4.588	0.000	0.05	0.07	0.06	0.000
4.867	0.000	0.05	0.07	0.06	0.000
5.145	0.000	0.05	0.07	0.06	0.000
5.423	0.000	0.05	0.07	0.06	0.000
5.702	0.000	0.05	0.07	0.07	0.000
5.980	0.000	0.05	0.07	0.07	0.000
6.258	0.000	0.05	0.07	0.07	0.000
6.537	0.000	0.05	0.07	0.07	0.000
6.815	0.000	0.06	0.08	0.07	0.000
7.093	0.000	0.06	0.08	0.07	0.000
7.372	0.000	0.06	0.08	0.07	0.000
7.650	0.000	0.06	0.08	0.07	0.000
7.928	0.000	0.06	0.08	0.08	0.000
8.207	0.000	0.06	0.08	0.08	0.001
8.485	0.000	0.06	0.09	0.08	0.001
8.763	0.000	0.06	0.09	0.08	0.001
9.042	0.000	0.07	0.09	0.08	0.001
9.320	0.000	0.07	0.09	0.09	0.001
9.598	0.000	0.07	0.10	0.09	0.001
9.877	0.000	0.07	0.10	0.09	0.001
10.155	0.000	0.07	0.10	0.09	0.001
10.433	0.000	0.07	0.10	0.10	0.001

10.712	0.000	0.08	0.11	0.10	0.001
10.990	0.000	0.08	0.11	0.10	0.001
11.268	0.000	0.08	0.11	0.10	0.001
11.547	0.000	0.09	0.12	0.11	0.001
11.825	0.000	0.09	0.12	0.11	0.001
12.103	0.000	0.09	0.13	0.12	0.001
12.382	0.000	0.12	0.17	0.14	0.001
12.660	0.000	0.13	0.17	0.16	0.001
12.938	0.000	0.13	0.18	0.17	0.001
13.217	0.000	0.14	0.19	0.17	0.001
13.495	0.000	0.15	0.20	0.18	0.001
13.773	0.000	0.15	0.21	0.19	0.001
14.052	0.000	0.17	0.23	0.21	0.001
14.330	0.000	0.18	0.24	0.22	0.001
14.608	0.000	0.20	0.27	0.24	0.002
14.887	0.000	0.21	0.29	0.26	0.002
15.165	0.000	0.25	0.34	0.29	0.002
15.443	0.000	0.28	0.38	0.34	0.002
15.722	0.000	0.36	0.49	0.41	0.003
16.000	0.000	0.57	0.79	0.57	0.005
16.278	0.000	2.10	3.94	1.24	0.028
16.557	0.000	0.29	0.81	1.25	0.005
16.835	0.000	0.23	0.31	0.49	0.002
17.113	0.000	0.19	0.25	0.27	0.002
17.392	0.000	0.16	0.22	0.22	0.001
17.670	0.000	0.14	0.19	0.19	0.001
17.948	0.000	0.13	0.18	0.17	0.001
18.227	0.000	0.11	0.15	0.15	0.001
18.505	0.000	0.09	0.12	0.13	0.001
18.783	0.000	0.08	0.11	0.11	0.001
19.062	0.000	0.08	0.10	0.10	0.001
19.340	0.000	0.07	0.10	0.10	0.001
19.618	0.000	0.07	0.09	0.09	0.001
19.897	0.000	0.06	0.09	0.09	0.001
20.175	0.000	0.06	0.08	0.08	0.001
20.453	0.000	0.06	0.08	0.08	0.000
20.732	0.000	0.06	0.08	0.07	0.000
21.010	0.000	0.06	0.08	0.07	0.000
21.288	0.000	0.05	0.07	0.07	0.000
21.567	0.000	0.05	0.07	0.07	0.000
21.845	0.000	0.05	0.07	0.06	0.000
22.123	0.000	0.05	0.07	0.06	0.000
22.402	0.000	0.05	0.06	0.06	0.000
22.680	0.000	0.05	0.06	0.06	0.000
22.958	0.000	0.04	0.06	0.06	0.000
23.237	0.000	0.04	0.06	0.06	0.000
23.515	0.000	0.04	0.06	0.05	0.000
23.793	0.000	0.04	0.06	0.05	0.000
24.072	0.000	0.04	0.06	0.05	0.000
24.350	0.000	0.00	0.00	0.03	0.000
24.628	0.000	0.00	0.00	0.00	0.000

```
****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                              Analysis prepared by:



****************************************************************************
----------------------------------------------------------------------------

  Problem Descriptions:
EL TORO DEVELOPMENT
100 YEAR STORM - PROPOSED CONDITION
BASIN J
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =     0.94
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.260
    LOW LOSS FRACTION = 0.390
    TIME OF CONCENTRATION(MIN.) = 17.40
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      0.26
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.18

****************************************************************************
  TIME      VOLUME        Q     0.         2.5        5.0        7.5       10.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
  0.05      0.0000       0.00  Q          .          .          .          .
  0.34      0.0005       0.05  Q          .          .          .          .
  0.63      0.0016       0.05  Q          .          .          .          .
  0.92      0.0027       0.05  Q          .          .          .          .
```

1.21	0.0039	0.05	Q	.	.	.	.
1.50	0.0050	0.05	Q	.	.	.	.
1.79	0.0061	0.05	Q	.	.	.	.
2.08	0.0073	0.05	Q	.	.	.	.
2.37	0.0085	0.05	Q	.	.	.	.
2.66	0.0097	0.05	Q	.	.	.	.
2.95	0.0109	0.05	Q	.	.	.	.
3.24	0.0121	0.05	Q	.	.	.	.
3.53	0.0133	0.05	Q	.	.	.	.
3.82	0.0146	0.05	Q	.	.	.	.
4.11	0.0159	0.05	Q	.	.	.	.
4.40	0.0171	0.05	Q	.	.	.	.
4.69	0.0185	0.06	Q	.	.	.	.
4.98	0.0198	0.06	Q	.	.	.	.
5.27	0.0212	0.06	Q	.	.	.	.
5.56	0.0225	0.06	Q	.	.	.	.
5.85	0.0239	0.06	Q	.	.	.	.
6.14	0.0254	0.06	Q	.	.	.	.
6.43	0.0268	0.06	Q	.	.	.	.
6.72	0.0283	0.06	Q	.	.	.	.
7.01	0.0298	0.06	Q	.	.	.	.
7.30	0.0314	0.06	Q	.	.	.	.
7.59	0.0329	0.07	Q	.	.	.	.
7.88	0.0345	0.07	Q	.	.	.	.
8.17	0.0362	0.07	Q	.	.	.	.
8.46	0.0379	0.07	Q	.	.	.	.
8.75	0.0396	0.07	Q	.	.	.	.
9.04	0.0413	0.07	Q	.	.	.	.
9.33	0.0431	0.08	Q	.	.	.	.
9.62	0.0450	0.08	Q	.	.	.	.
9.91	0.0469	0.08	Q	.	.	.	.
10.20	0.0489	0.08	Q	.	.	.	.
10.49	0.0509	0.09	Q	.	.	.	.
10.78	0.0530	0.09	Q	.	.	.	.
11.07	0.0551	0.09	Q	.	.	.	.
11.36	0.0574	0.09	Q	.	.	.	.
11.65	0.0597	0.10	Q	.	.	.	.
11.94	0.0621	0.10	Q	.	.	.	.
12.23	0.0649	0.13	Q	.	.	.	.
12.52	0.0681	0.14	Q	.	.	.	.
12.81	0.0715	0.15	Q	.	.	.	.
13.10	0.0751	0.15	Q	.	.	.	.
13.39	0.0789	0.16	Q	.	.	.	.
13.68	0.0829	0.17	Q	.	.	.	.
13.97	0.0871	0.18	Q	.	.	.	.
14.26	0.0917	0.19	Q	.	.	.	.
14.55	0.0966	0.22	Q	.	.	.	.
14.84	0.1020	0.23	Q	.	.	.	.
15.13	0.1081	0.27	.Q	.	.	.	.
15.42	0.1150	0.31	.Q	.	.	.	.
15.71	0.1234	0.39	.Q	.	.	.	.
16.00	0.1356	0.62	. Q	.	.	.	.

16.29	0.1708	2.32	.	Q.	.	.	.
16.58	0.2026	0.33	.Q	.	.	.	.
16.87	0.2096	0.25	.Q	.	.	.	.
17.16	0.2150	0.21	Q	.	.	.	.
17.45	0.2196	0.18	Q	.	.	.	.
17.74	0.2236	0.16	Q	.	.	.	.
18.03	0.2272	0.14	Q	.	.	.	.
18.32	0.2302	0.11	Q	.	.	.	.
18.61	0.2326	0.10	Q	.	.	.	.
18.90	0.2349	0.09	Q	.	.	.	.
19.19	0.2370	0.08	Q	.	.	.	.
19.48	0.2389	0.08	Q	.	.	.	.
19.77	0.2408	0.08	Q	.	.	.	.
20.06	0.2425	0.07	Q	.	.	.	.
20.35	0.2442	0.07	Q	.	.	.	.
20.64	0.2458	0.07	Q	.	.	.	.
20.93	0.2474	0.06	Q	.	.	.	.
21.22	0.2488	0.06	Q	.	.	.	.
21.51	0.2503	0.06	Q	.	.	.	.
21.80	0.2517	0.06	Q	.	.	.	.
22.09	0.2530	0.05	Q	.	.	.	.
22.38	0.2543	0.05	Q	.	.	.	.
22.67	0.2555	0.05	Q	.	.	.	.
22.96	0.2568	0.05	Q	.	.	.	.
23.25	0.2580	0.05	Q	.	.	.	.
23.54	0.2591	0.05	Q	.	.	.	.
23.83	0.2602	0.05	Q	.	.	.	.
24.12	0.2614	0.05	Q	.	.	.	.
24.41	0.2619	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1444.2
10%	139.2
20%	34.8
30%	17.4
40%	17.4
50%	17.4
60%	17.4
70%	17.4
80%	17.4
90%	17.4

Problem Descriptions:

```
==============================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =   17.400
     DEAD STORAGE(AF) =       0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =       0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =    0.00


                 INFLOW
                   |
                   |
                   |
                   V                 __effective depth
             -------------           |   (and volume)
             |           |     |     |
             | detention |     |....V.............
             |   basin   |<-->|          outflow
             |           |     |.........________
             -------------     |         |    \
                   |           | storage |     basin outlet
                   V           -----------
                OUTFLOW


     DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
     TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES =   9
     *BASIN-DEPTH  STORAGE    OUTFLOW  **BASIN-DEPTH  STORAGE    OUTFLOW  *
     *   (FEET)  (ACRE-FEET)   (CFS)   **   (FEET)  (ACRE-FEET)   (CFS)   *
     *      0.000      0.000      0.000**      0.500      0.004      0.580*
     *      1.000      0.008      1.370**      1.500      0.012      1.820*
     *      2.000      0.016      2.170**      2.500      0.020      2.470*
     *      3.000      0.024      2.740**      3.500      0.027      2.990*
     *      4.000      0.031      3.220**
-------------------------------------------------------------------------------
     BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:
      INTERVAL   DEPTH   {S-O*DT/2}   {S+O*DT/2}
       NUMBER   (FEET)   (ACRE-FEET)  (ACRE-FEET)
           1     0.00       0.00000      0.00000
           2     0.50      -0.00295      0.01095
           3     1.00      -0.00842      0.02442
           4     1.50      -0.00981      0.03381
           5     2.00      -0.01000      0.04200
           6     2.50      -0.00960      0.04960
           7     3.00      -0.00883      0.05683
           8     3.50      -0.00883      0.06283
```

9 4.00 -0.00759 0.06959

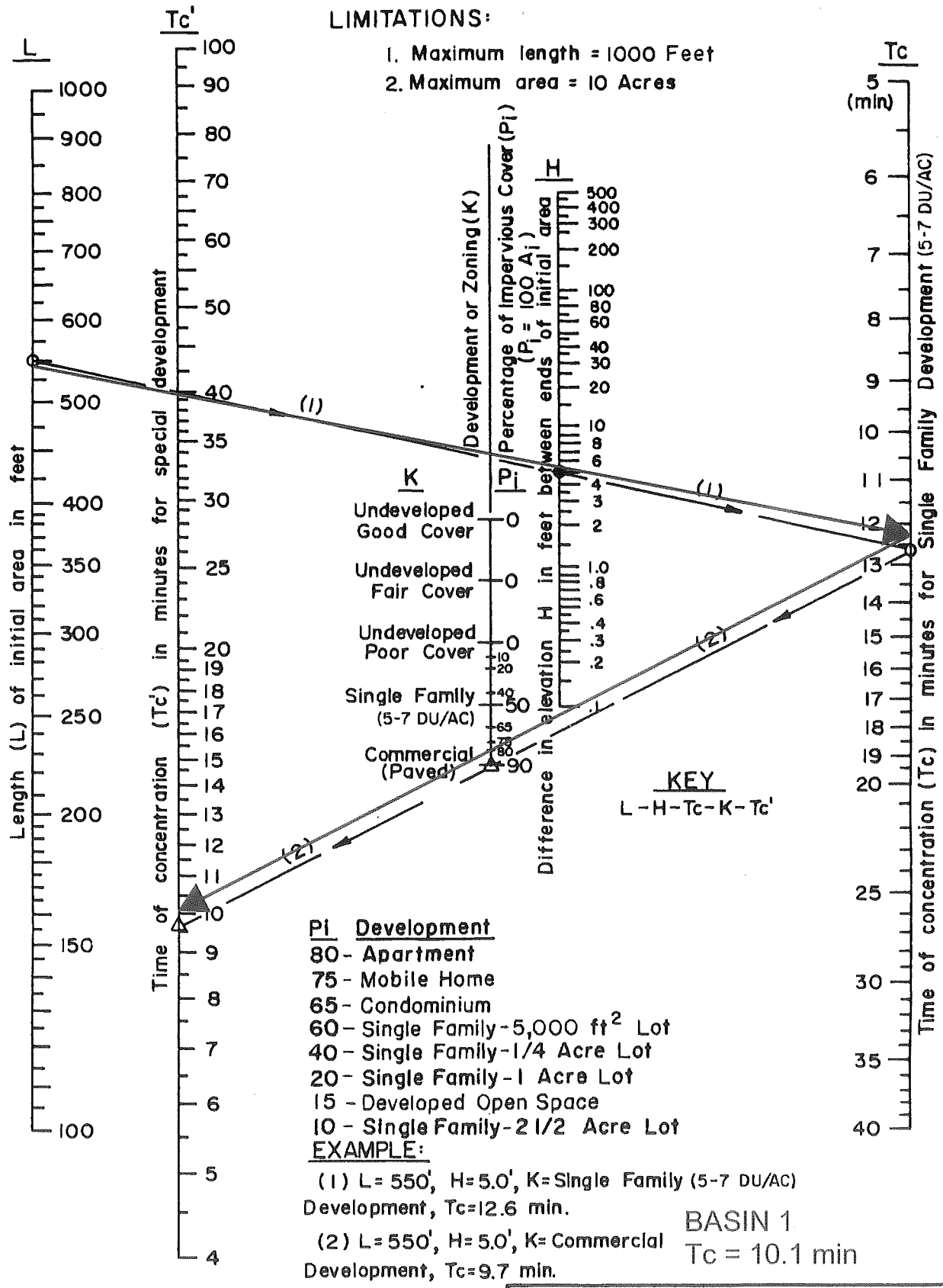
WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.050	0.000	0.00	0.00	0.00	0.000
0.340	0.000	0.05	0.05	0.03	0.000
0.630	0.000	0.05	0.05	0.06	0.000
0.920	0.000	0.05	0.05	0.06	0.000
1.210	0.000	0.05	0.05	0.06	0.000
1.500	0.000	0.05	0.05	0.06	0.000
1.790	0.000	0.05	0.05	0.06	0.000
2.080	0.000	0.05	0.05	0.06	0.000
2.370	0.000	0.05	0.05	0.06	0.000
2.660	0.000	0.05	0.05	0.06	0.000
2.950	0.000	0.05	0.06	0.06	0.000
3.240	0.000	0.05	0.06	0.06	0.000
3.530	0.000	0.05	0.06	0.07	0.000
3.820	0.000	0.05	0.06	0.07	0.000
4.110	0.000	0.05	0.06	0.07	0.000
4.400	0.000	0.05	0.06	0.07	0.000
4.690	0.000	0.06	0.06	0.07	0.000
4.980	0.000	0.06	0.06	0.07	0.000
5.270	0.000	0.06	0.06	0.07	0.001
5.560	0.000	0.06	0.06	0.07	0.001
5.850	0.000	0.06	0.06	0.07	0.001
6.140	0.000	0.06	0.07	0.08	0.001
6.430	0.000	0.06	0.07	0.08	0.001
6.720	0.000	0.06	0.07	0.08	0.001
7.010	0.000	0.06	0.07	0.08	0.001
7.300	0.000	0.06	0.07	0.08	0.001
7.590	0.000	0.07	0.07	0.08	0.001
7.880	0.000	0.07	0.07	0.09	0.001
8.170	0.000	0.07	0.08	0.09	0.001
8.460	0.000	0.07	0.08	0.09	0.001
8.750	0.000	0.07	0.08	0.09	0.001
9.040	0.000	0.07	0.08	0.09	0.001
9.330	0.000	0.08	0.08	0.10	0.001
9.620	0.000	0.08	0.09	0.10	0.001
9.910	0.000	0.08	0.09	0.10	0.001
10.200	0.000	0.08	0.09	0.10	0.001
10.490	0.000	0.09	0.09	0.11	0.001
10.780	0.000	0.09	0.10	0.11	0.001
11.070	0.000	0.09	0.10	0.11	0.001
11.360	0.000	0.09	0.10	0.12	0.001
11.650	0.000	0.10	0.11	0.12	0.001

11.940	0.000	0.10	0.11	0.13	0.001
12.230	0.000	0.13	0.14	0.15	0.001
12.520	0.000	0.14	0.15	0.17	0.001
12.810	0.000	0.15	0.16	0.18	0.001
13.100	0.000	0.15	0.17	0.19	0.001
13.390	0.000	0.16	0.18	0.20	0.001
13.680	0.000	0.17	0.19	0.21	0.001
13.970	0.000	0.18	0.20	0.22	0.002
14.260	0.000	0.19	0.21	0.24	0.002
14.550	0.000	0.22	0.24	0.26	0.002
14.840	0.000	0.23	0.26	0.29	0.002
15.130	0.000	0.27	0.30	0.32	0.002
15.420	0.000	0.31	0.33	0.37	0.003
15.710	0.000	0.39	0.43	0.44	0.003
16.000	0.000	0.62	0.65	0.66	0.005
16.290	0.000	2.32	2.91	1.75	0.023
16.580	0.000	0.33	0.36	1.56	0.003
16.870	0.000	0.25	0.28	0.37	0.002
17.160	0.000	0.21	0.23	0.29	0.002
17.450	0.000	0.18	0.19	0.24	0.002
17.740	0.000	0.16	0.17	0.21	0.001
18.030	0.000	0.14	0.16	0.19	0.001
18.320	0.000	0.11	0.11	0.16	0.001
18.610	0.000	0.10	0.11	0.13	0.001
18.900	0.000	0.09	0.10	0.12	0.001
19.190	0.000	0.08	0.09	0.11	0.001
19.480	0.000	0.08	0.09	0.10	0.001
19.770	0.000	0.08	0.08	0.10	0.001
20.060	0.000	0.07	0.08	0.09	0.001
20.350	0.000	0.07	0.07	0.09	0.001
20.640	0.000	0.07	0.07	0.09	0.001
20.930	0.000	0.06	0.07	0.08	0.001
21.220	0.000	0.06	0.07	0.08	0.001
21.510	0.000	0.06	0.06	0.08	0.001
21.800	0.000	0.06	0.06	0.07	0.000
22.090	0.000	0.05	0.06	0.07	0.000
22.380	0.000	0.05	0.06	0.07	0.000
22.670	0.000	0.05	0.06	0.07	0.000
22.960	0.000	0.05	0.06	0.06	0.000
23.250	0.000	0.05	0.05	0.06	0.000
23.540	0.000	0.05	0.05	0.06	0.000
23.830	0.000	0.05	0.05	0.06	0.000
24.120	0.000	0.05	0.05	0.06	0.000
24.410	0.000	0.00	0.00	0.03	0.000
24.700	0.000	0.00	0.00	0.00	0.000

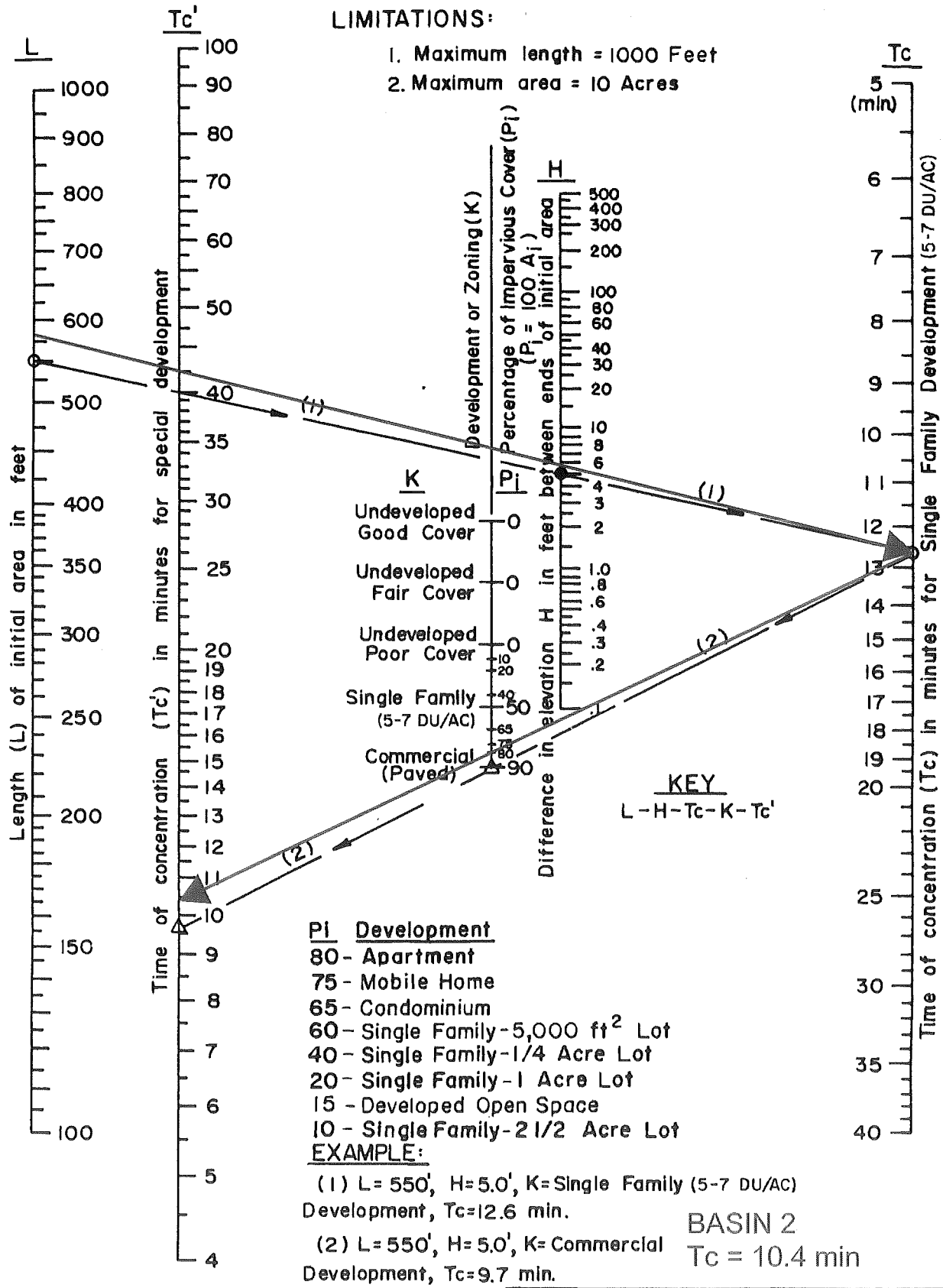


ORANGE COUNTY

HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1



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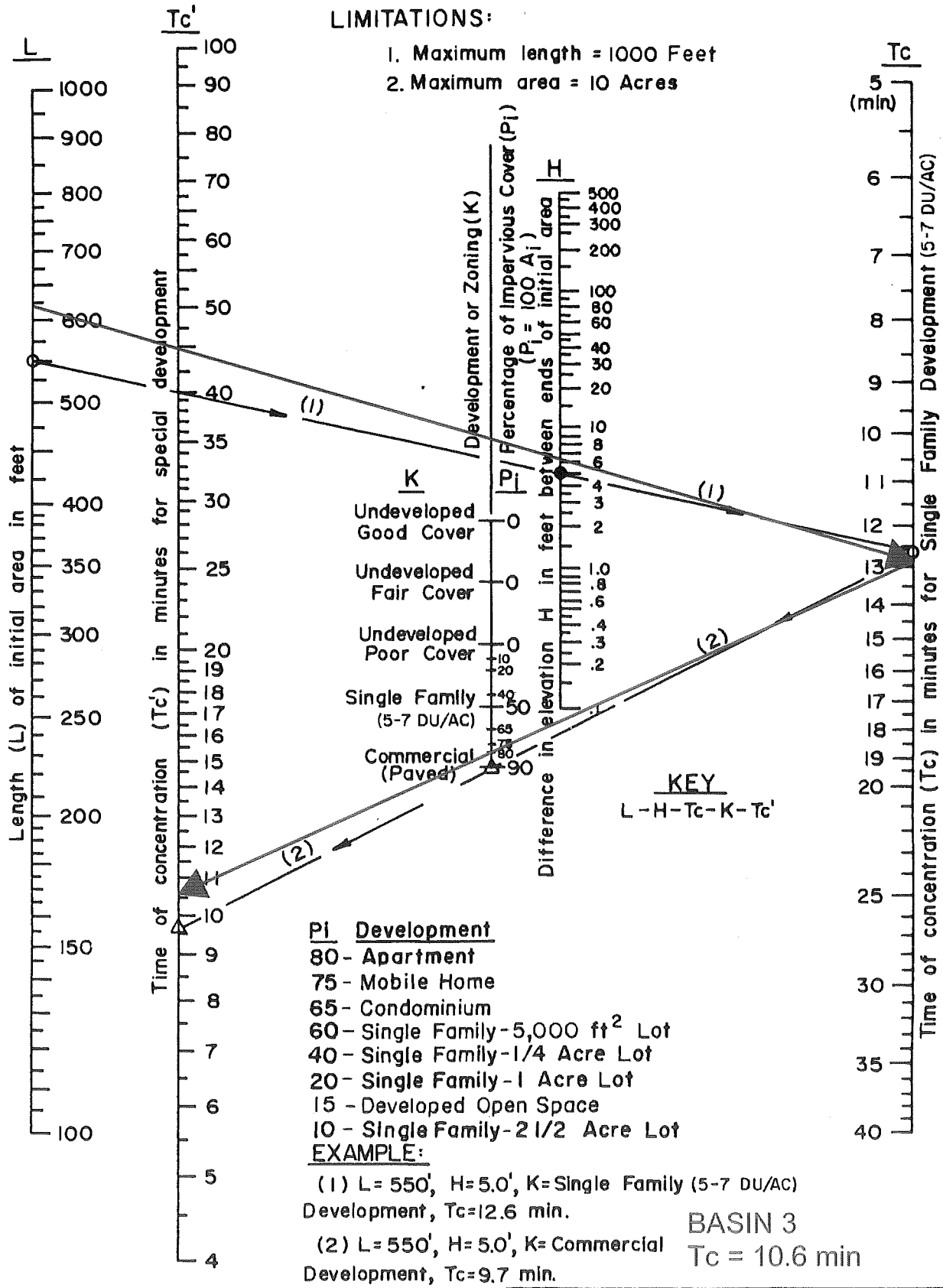

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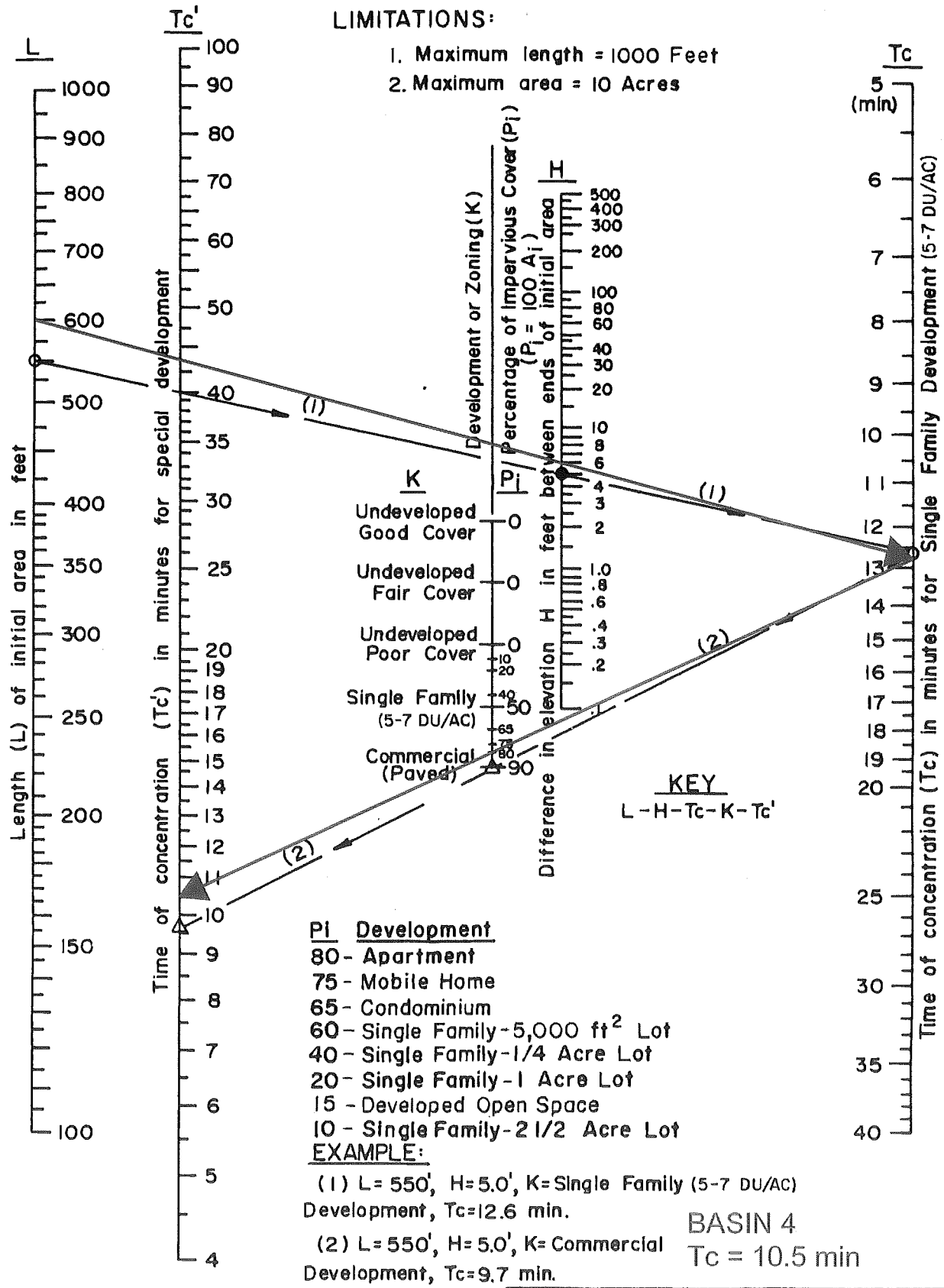

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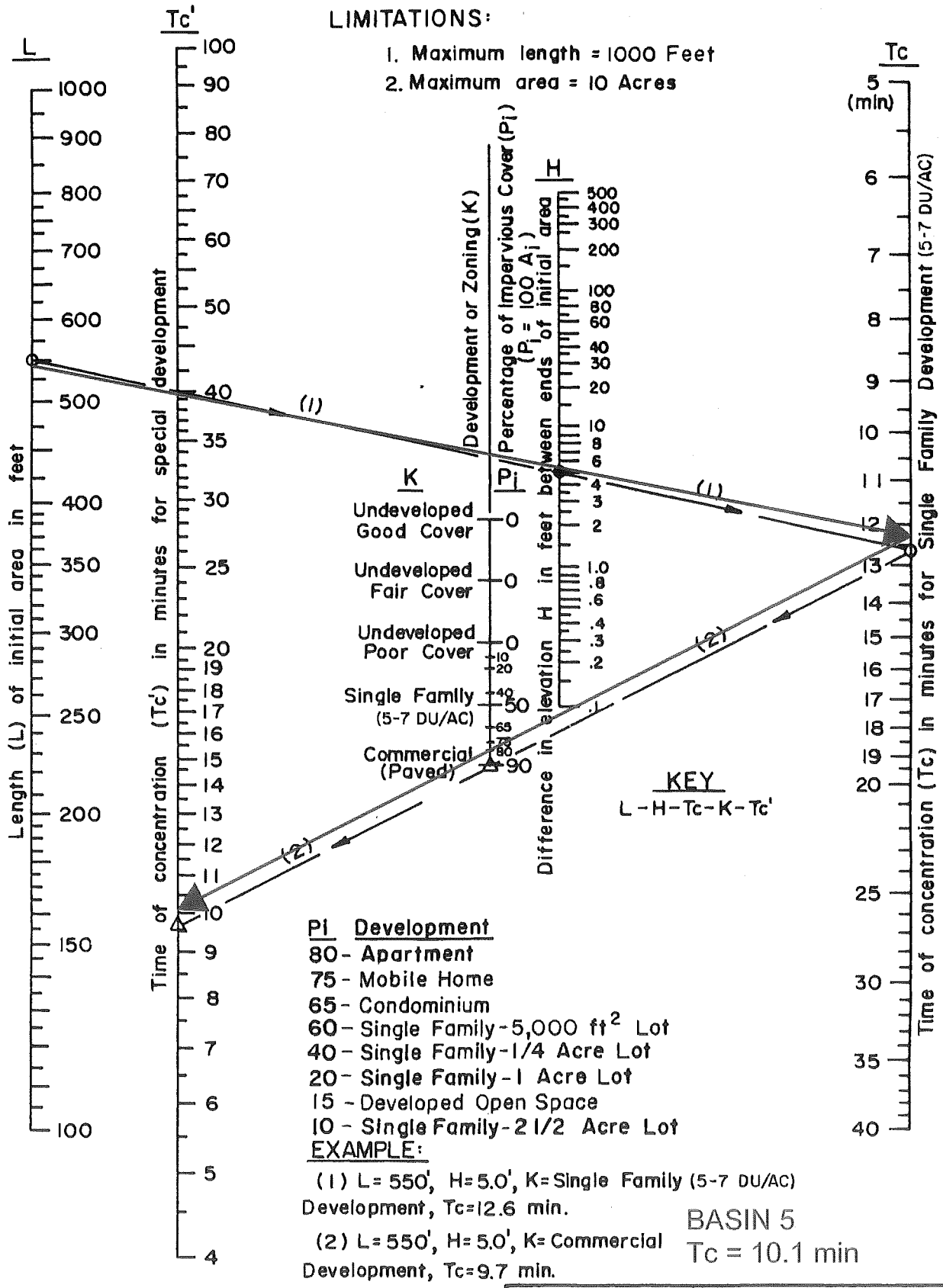

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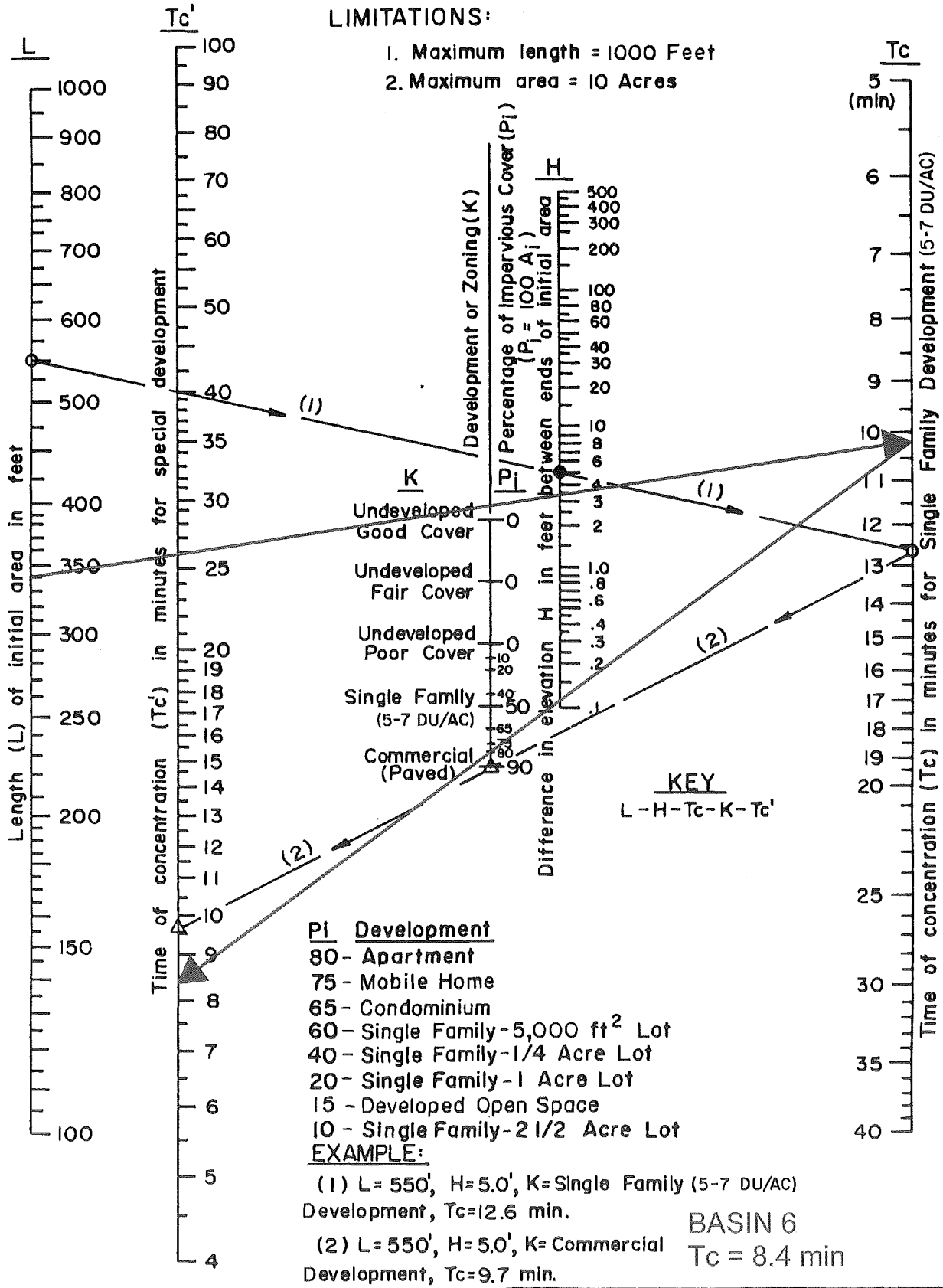

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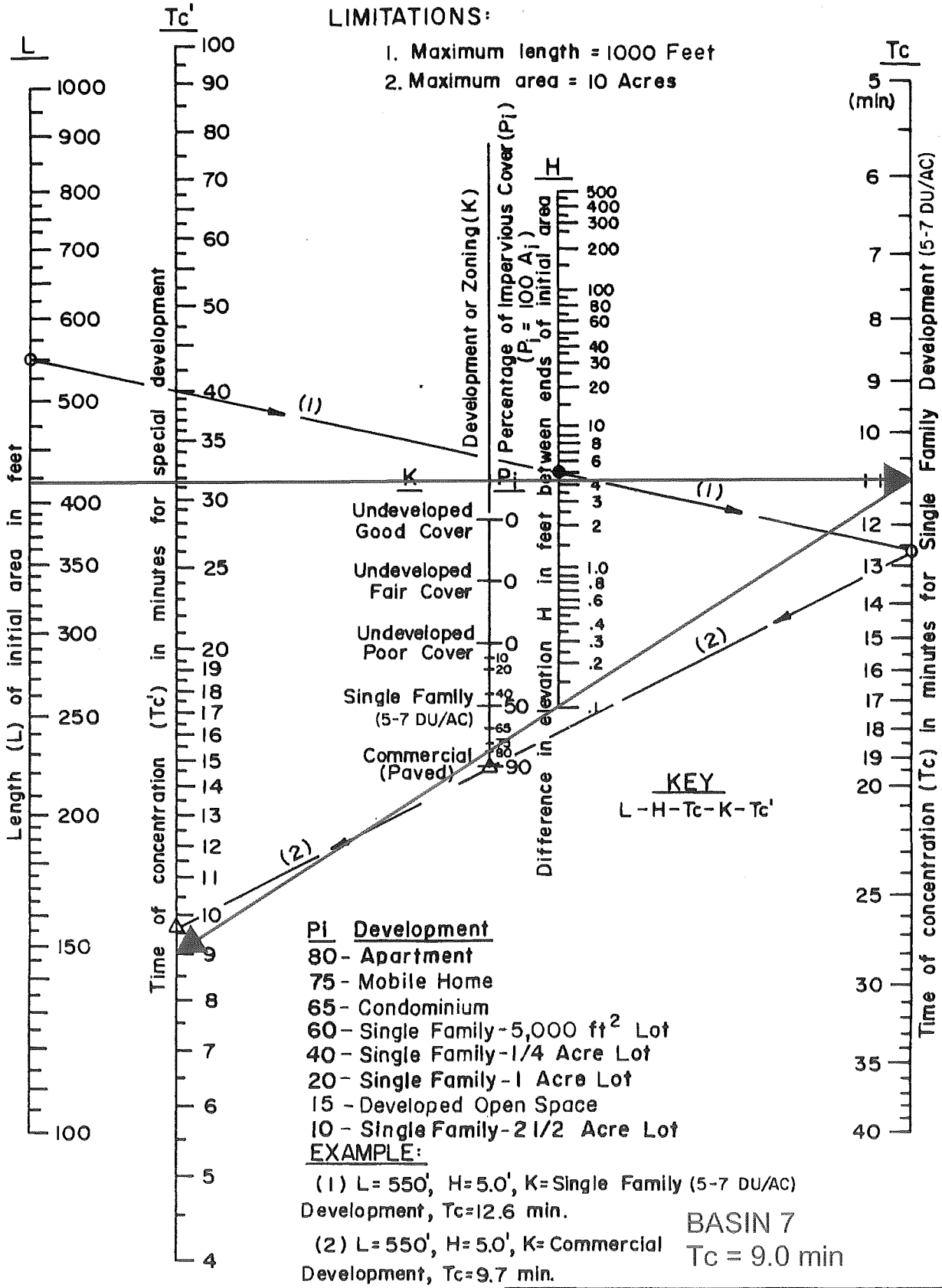

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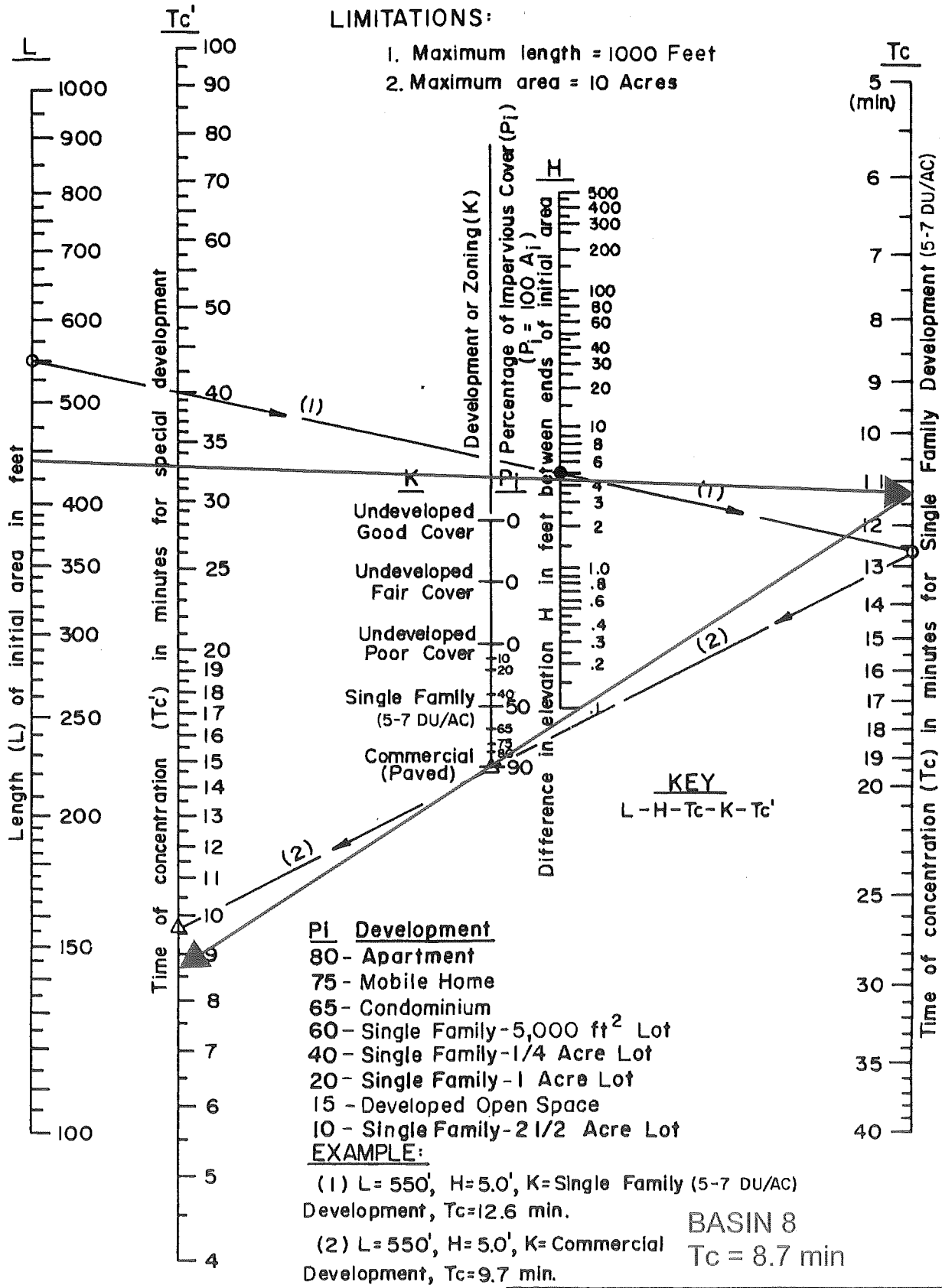

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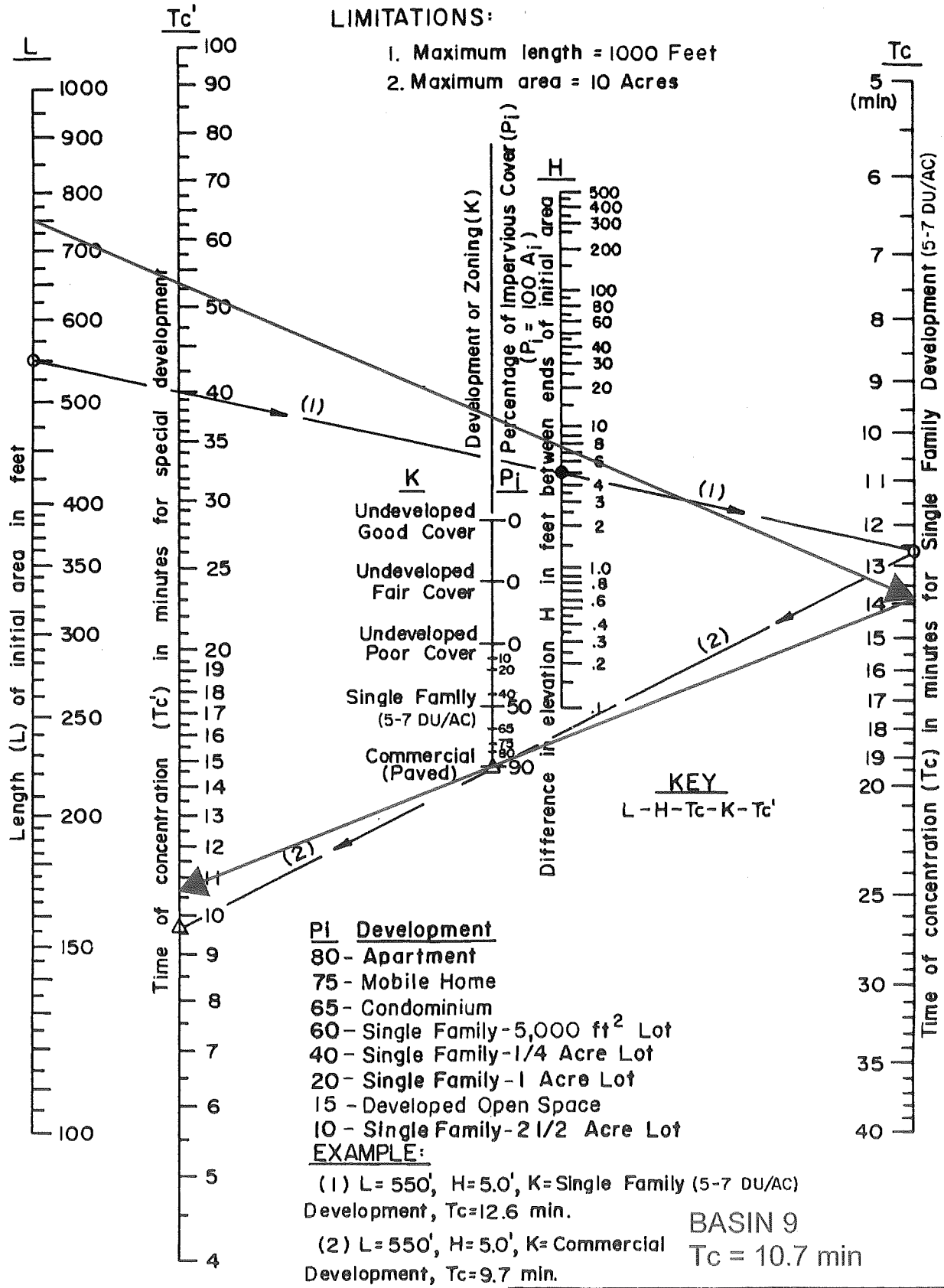

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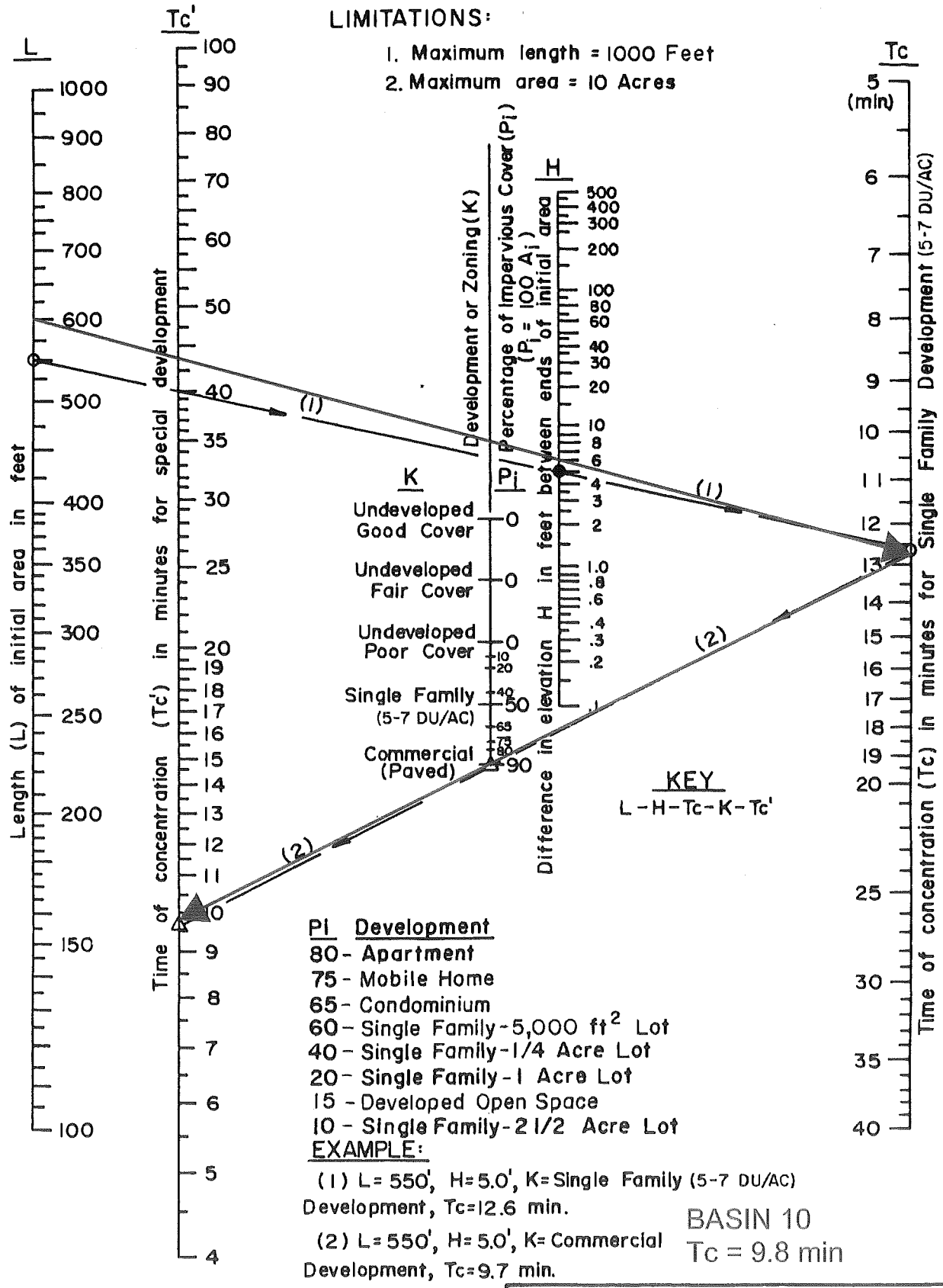

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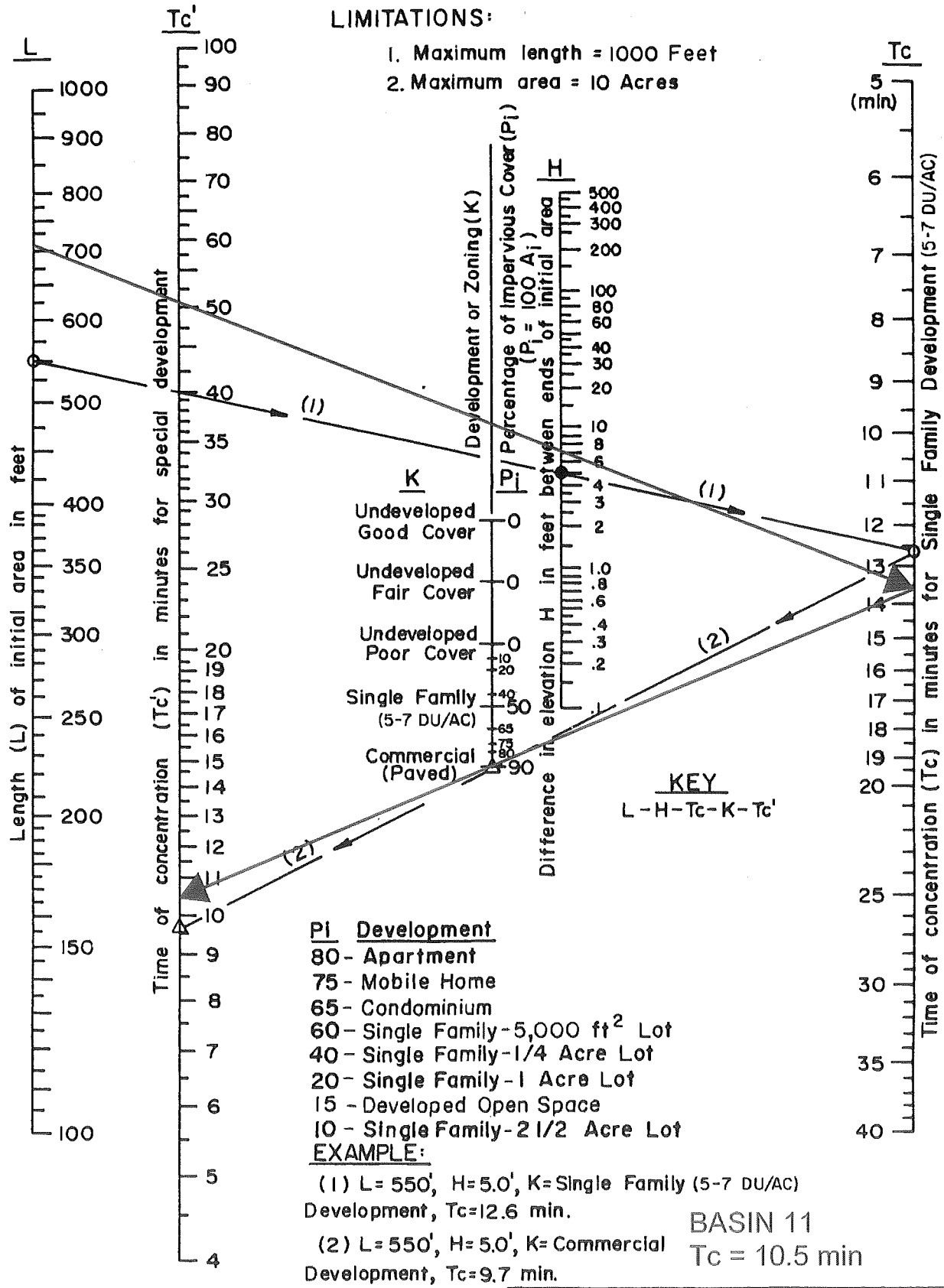

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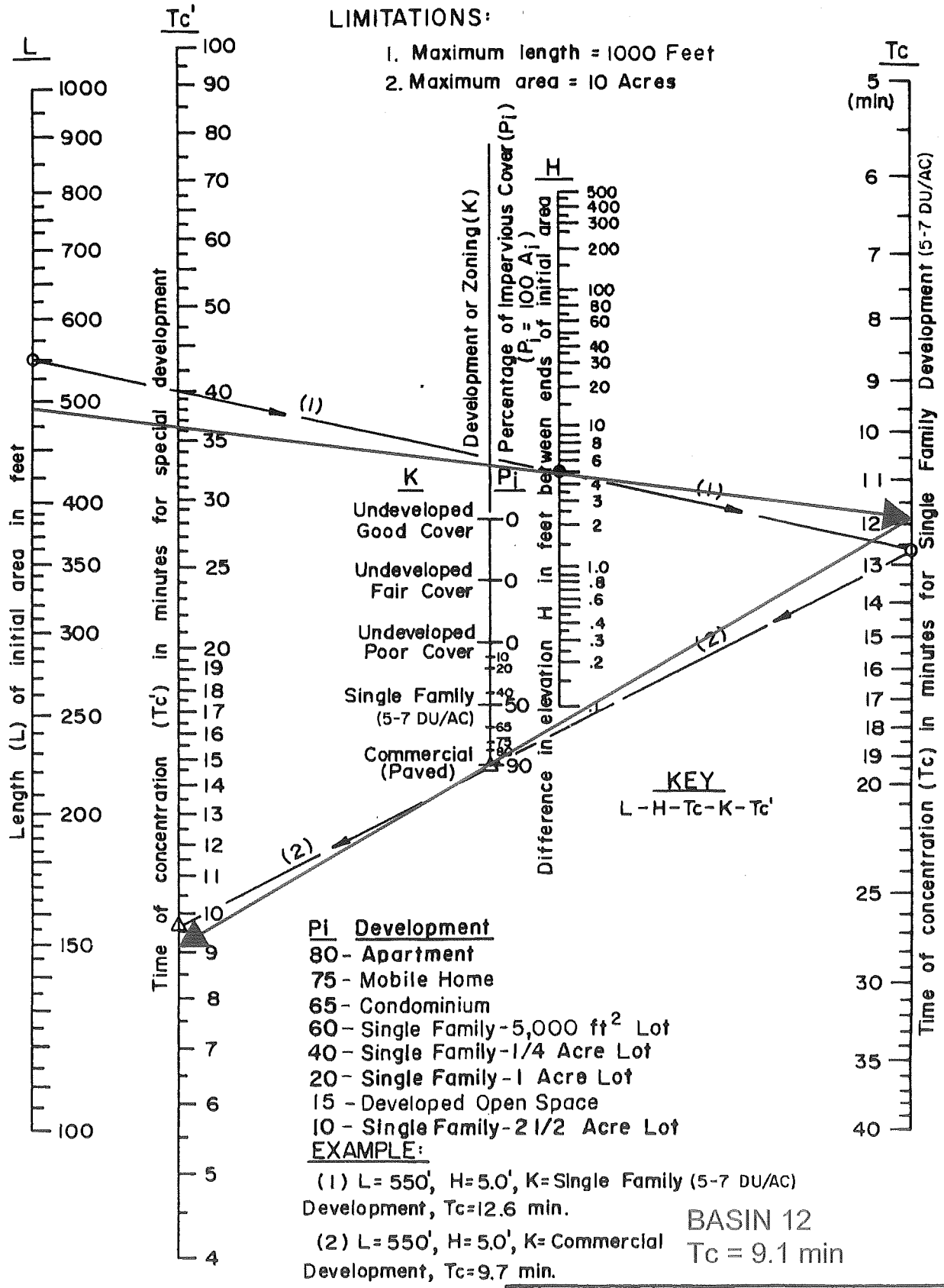

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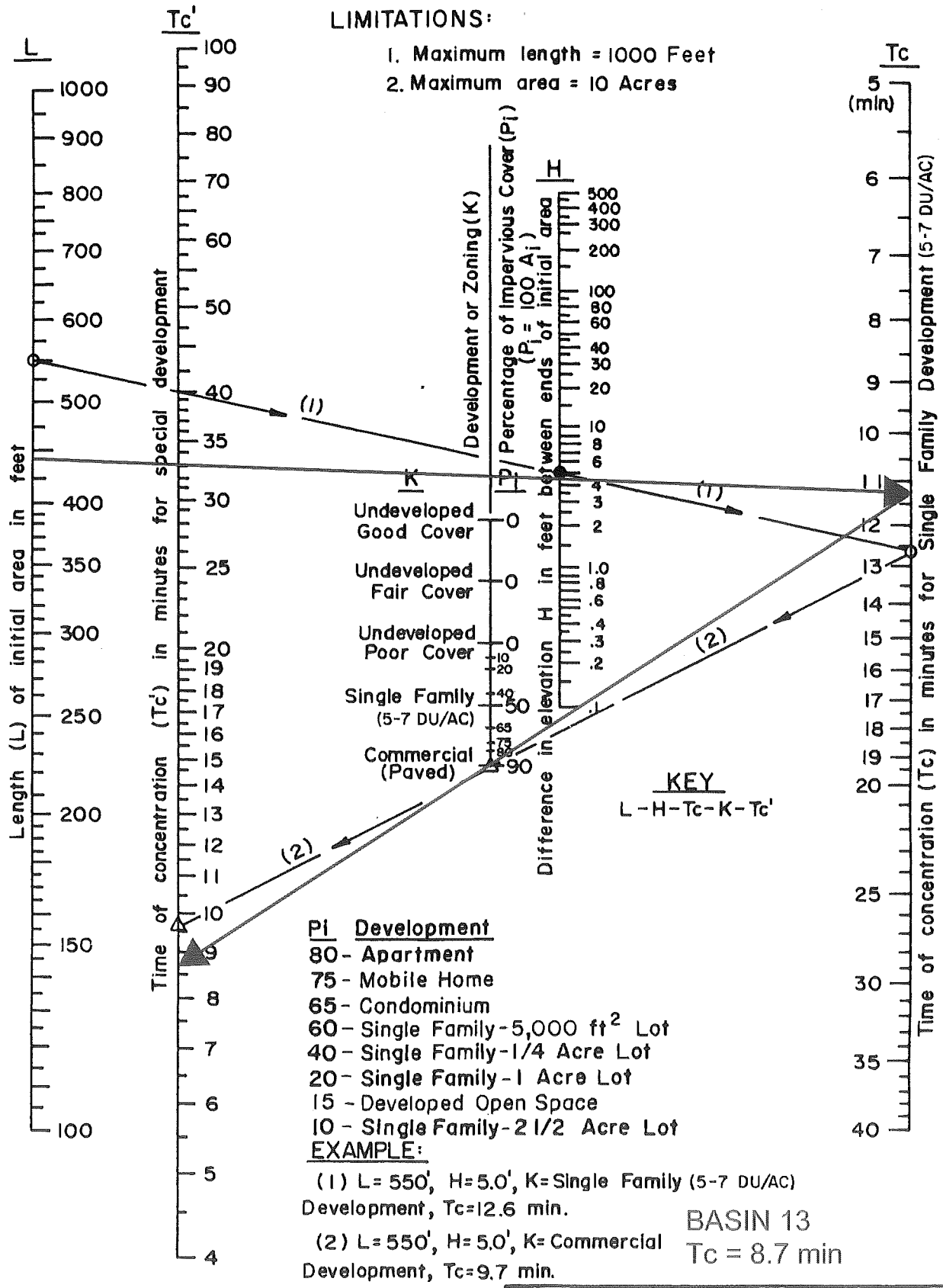

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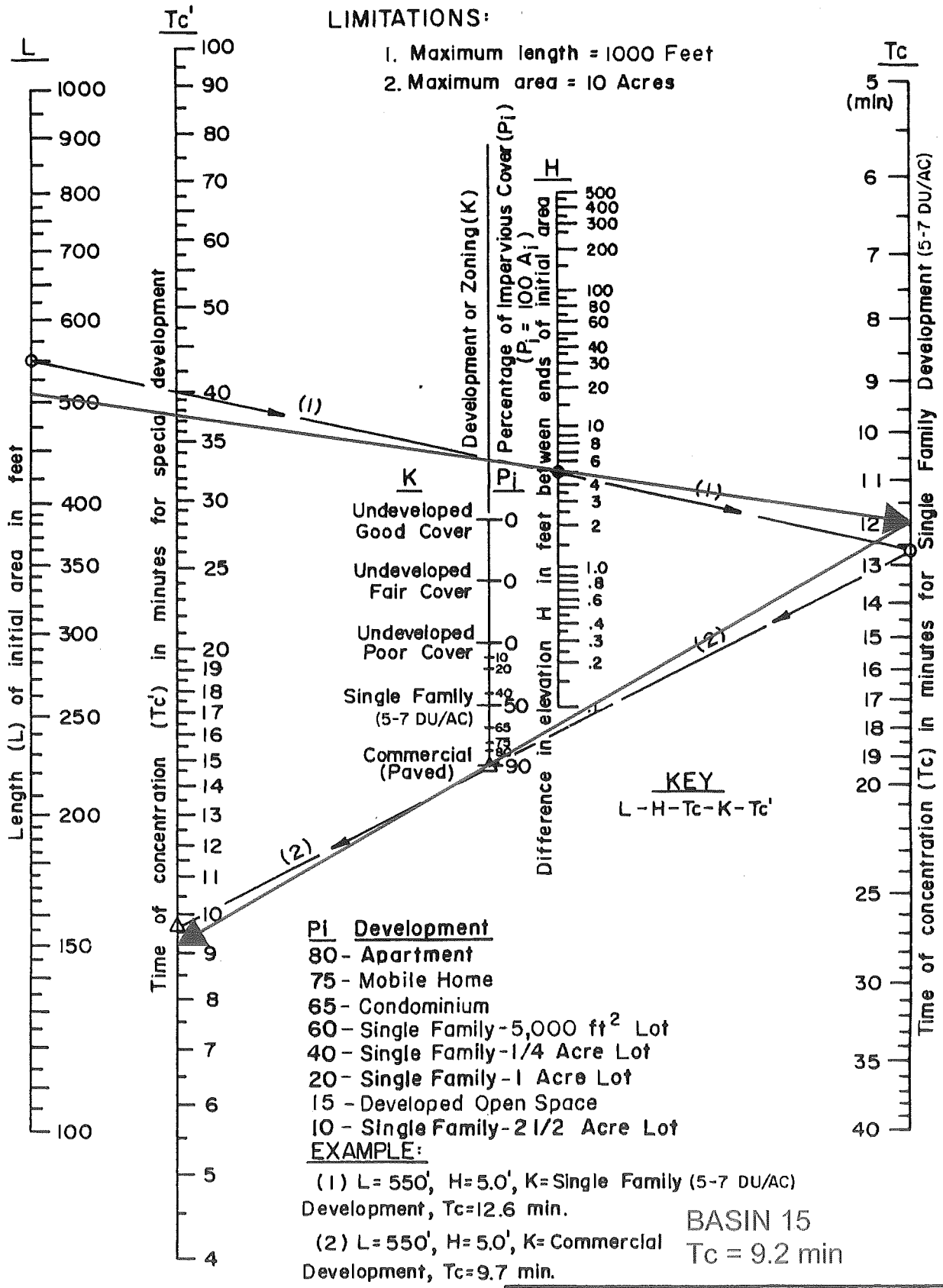

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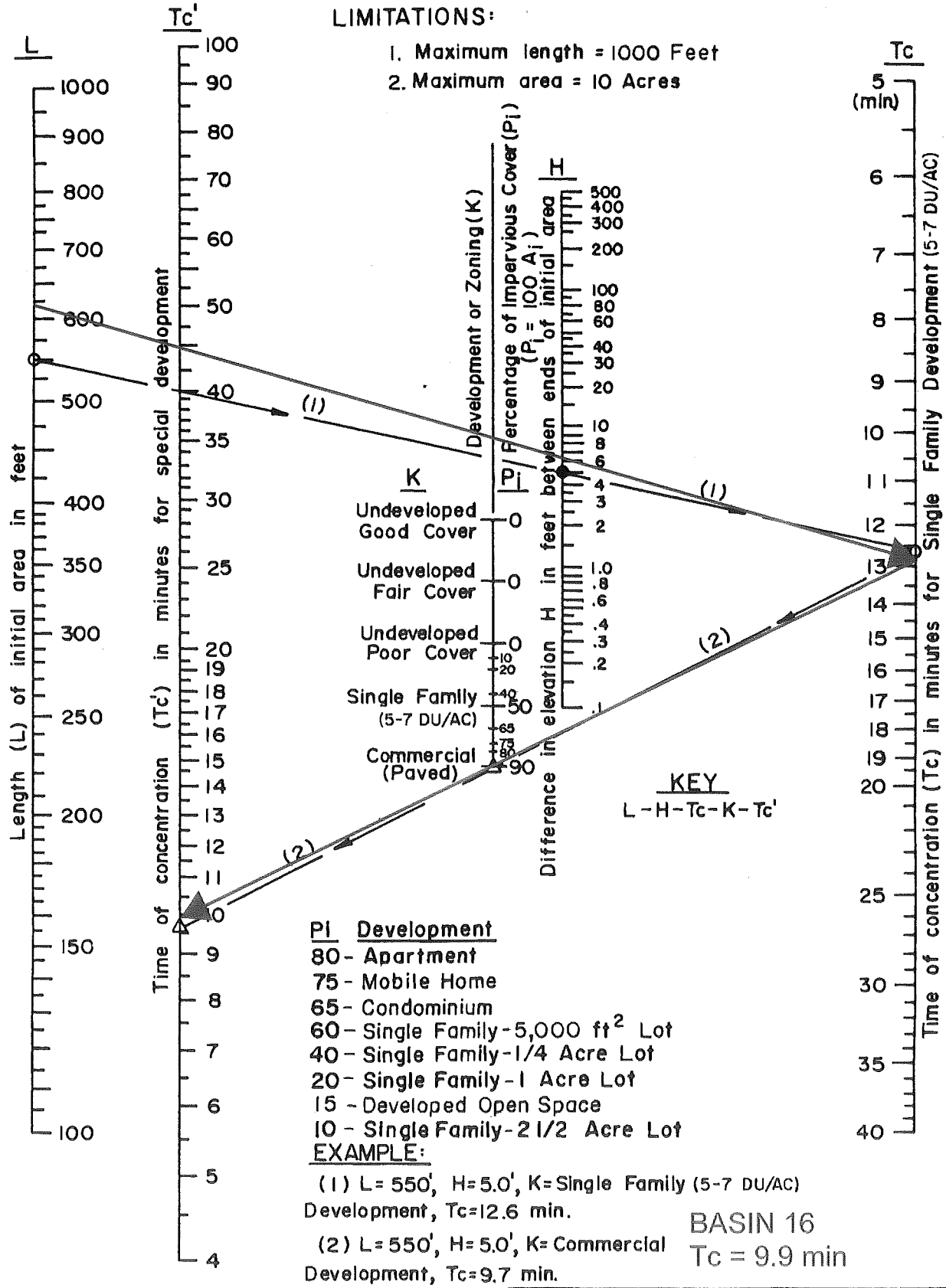

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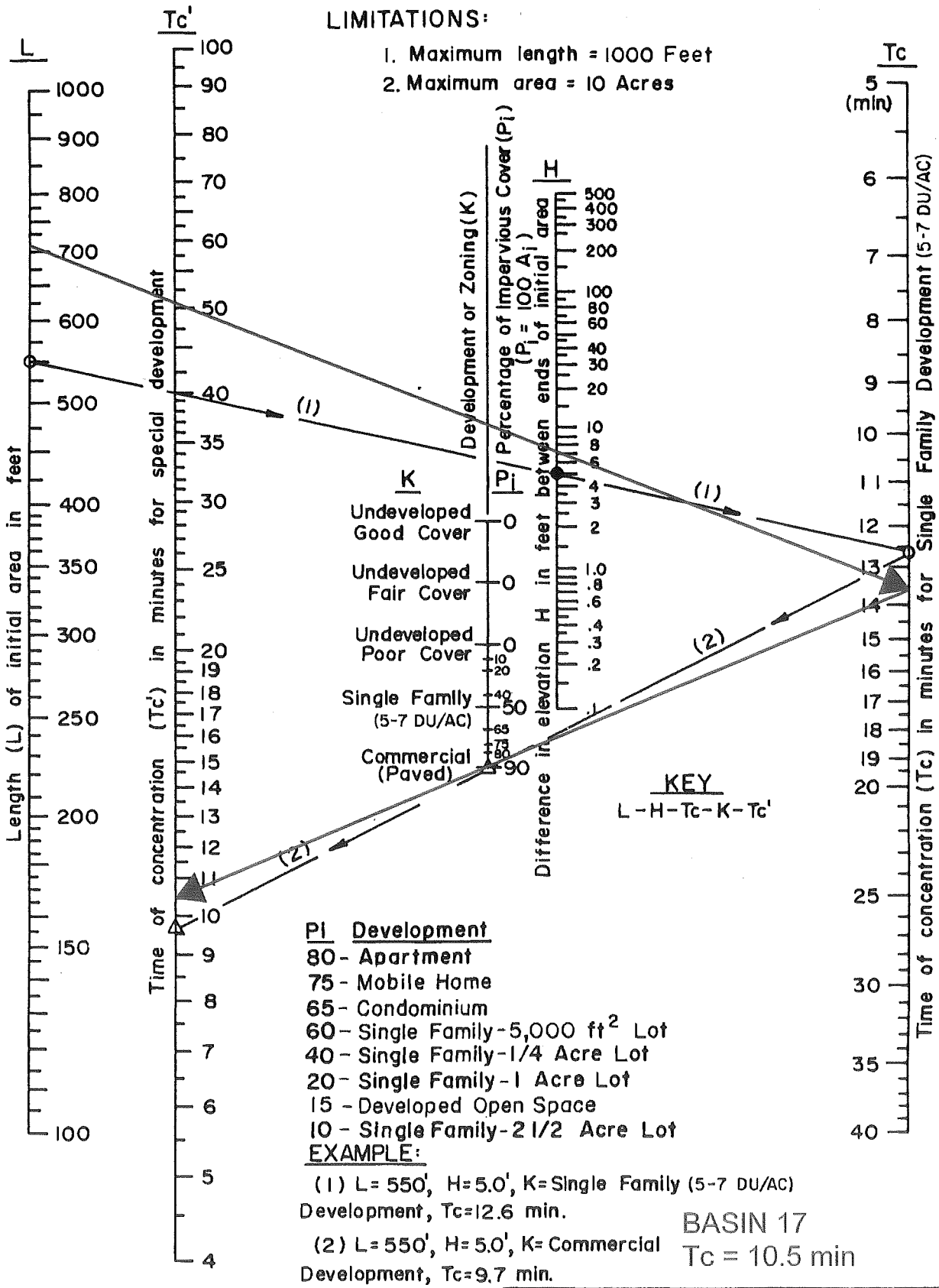

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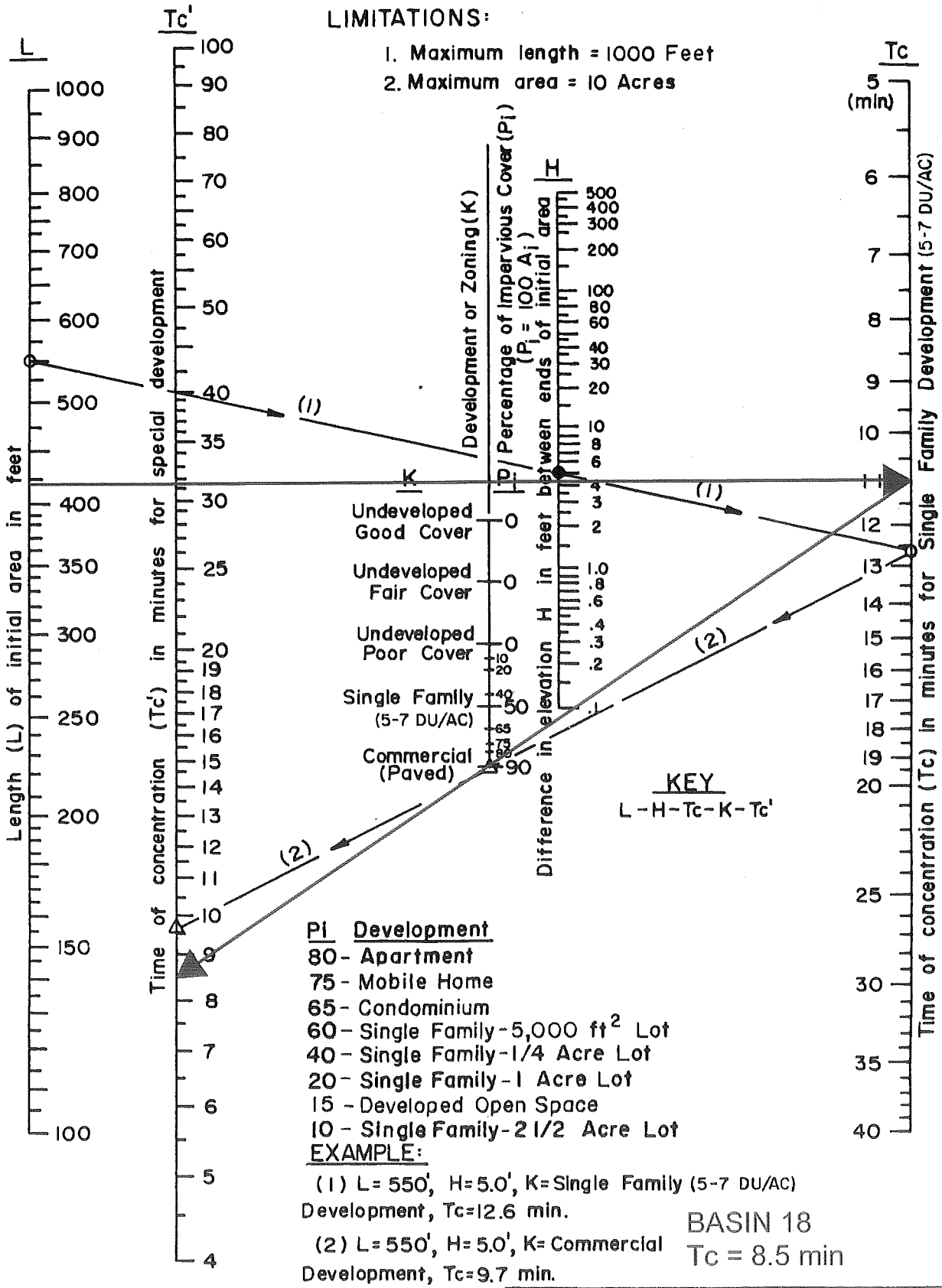

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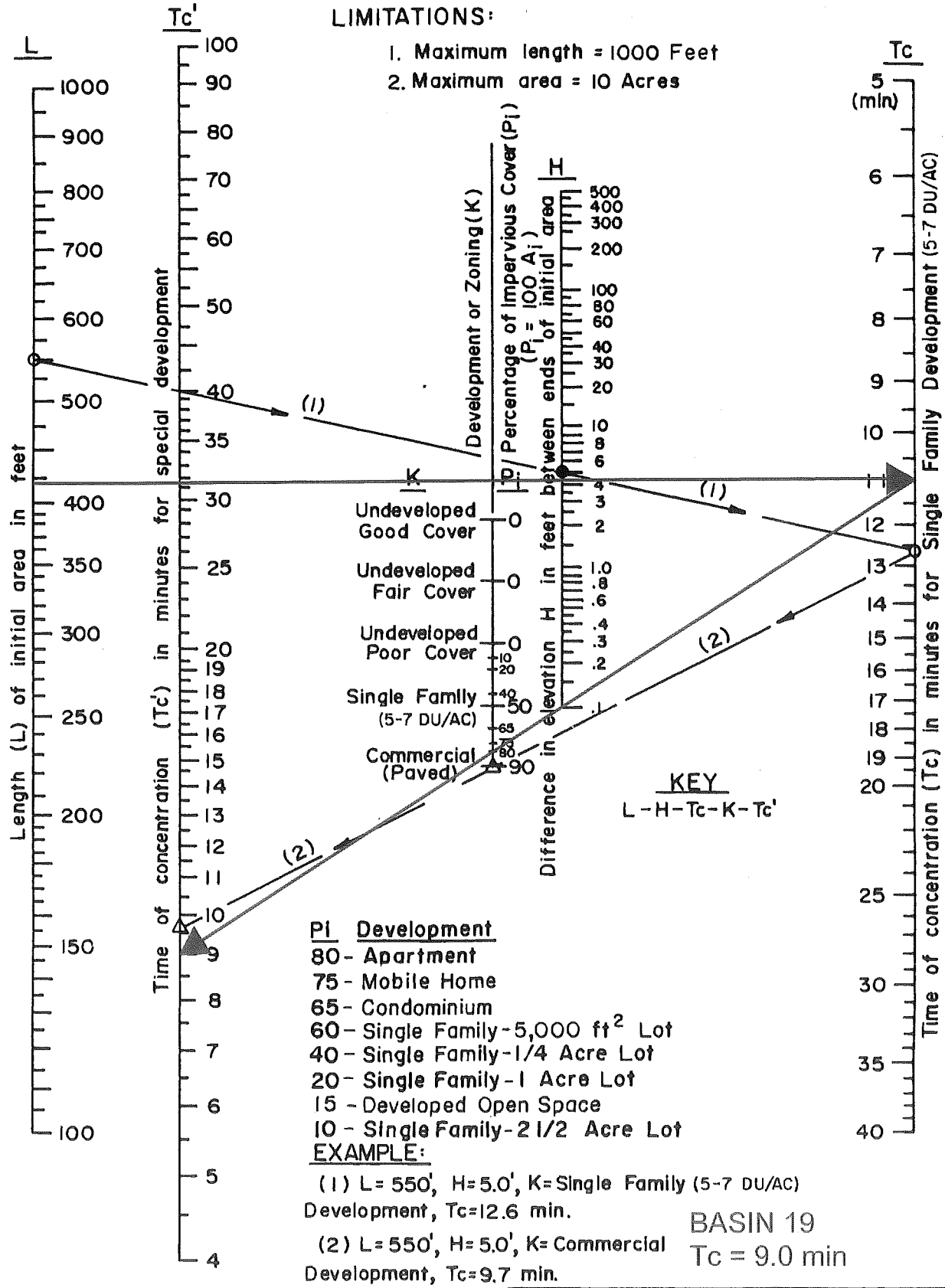

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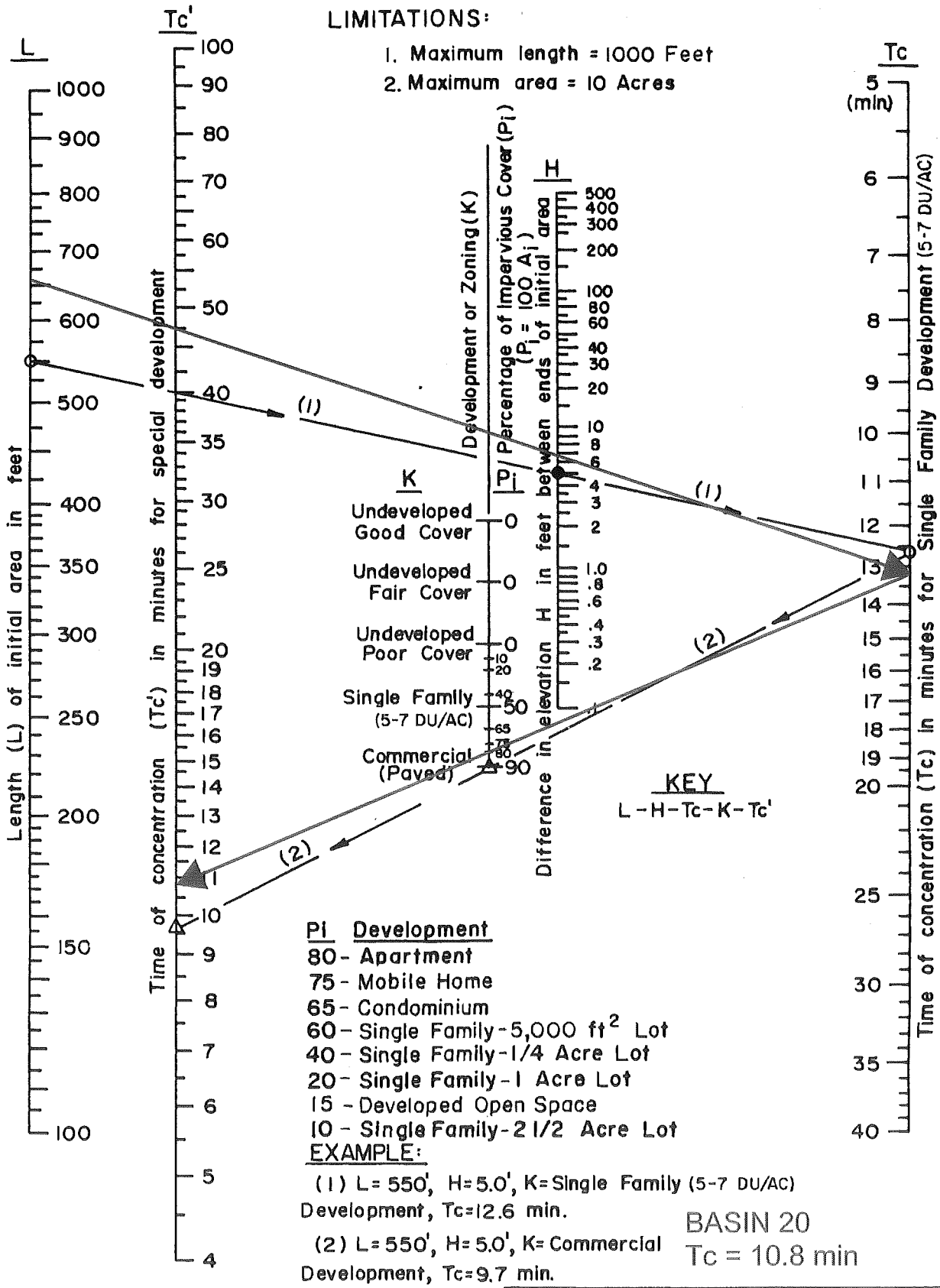

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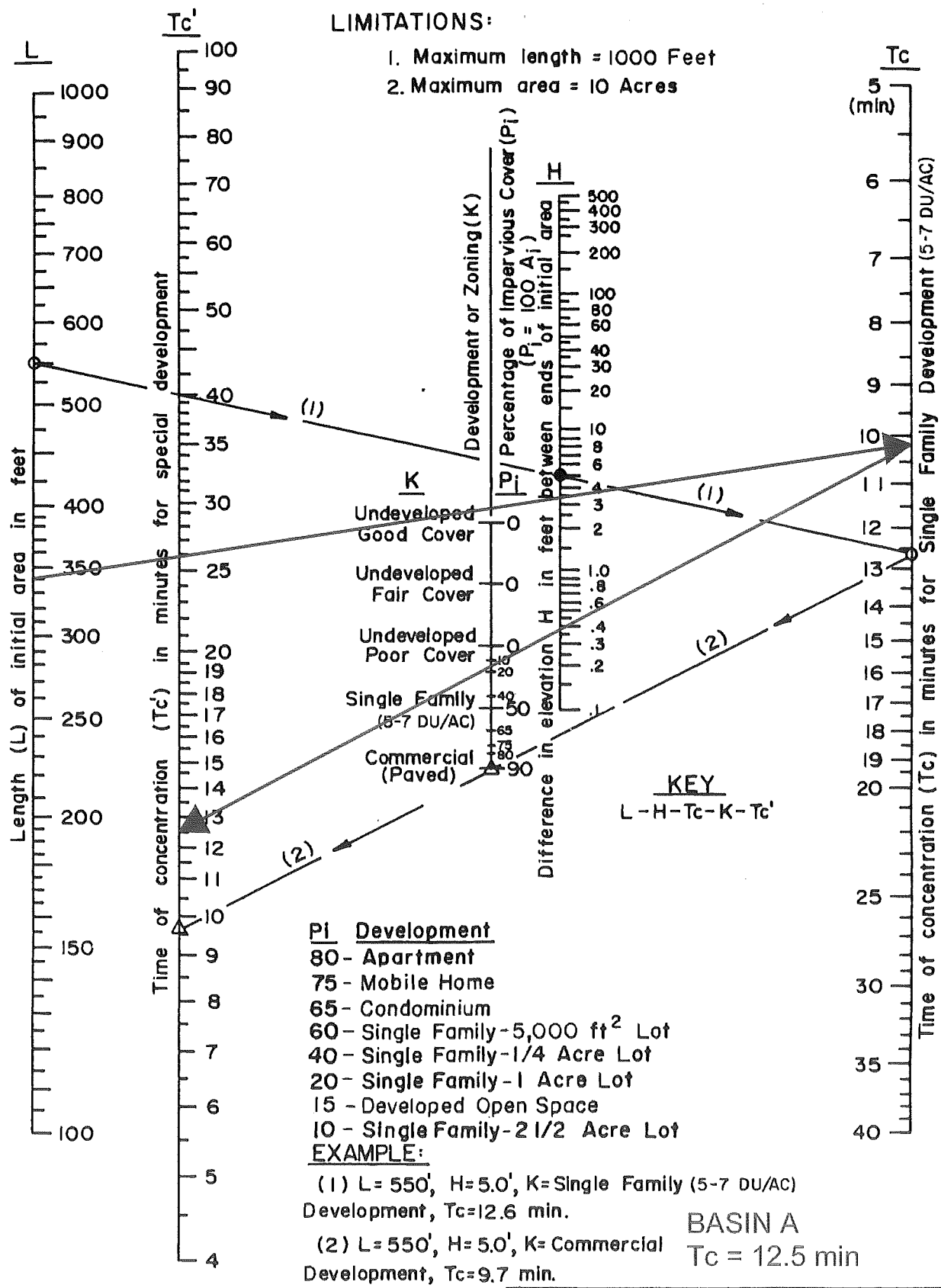

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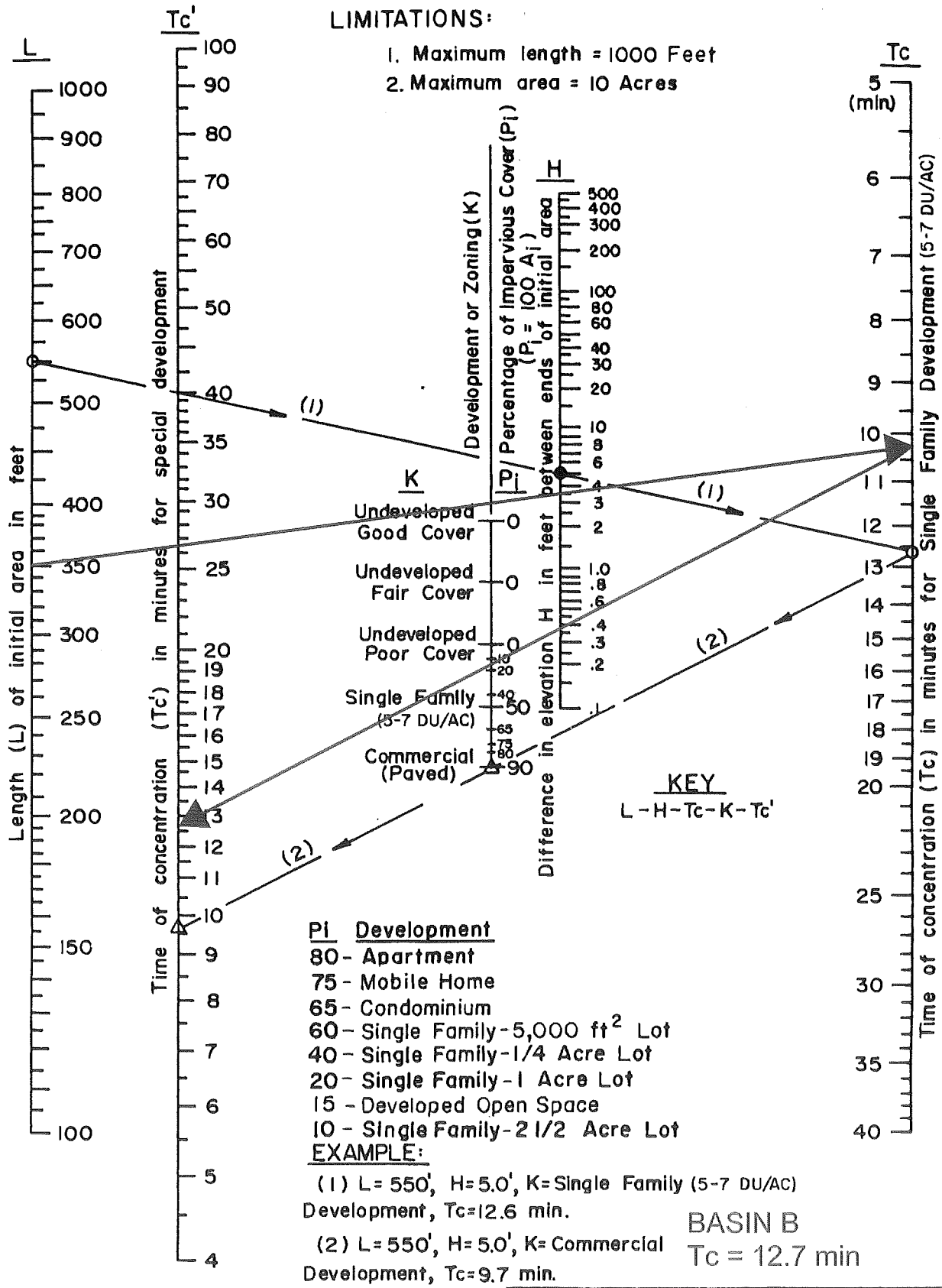

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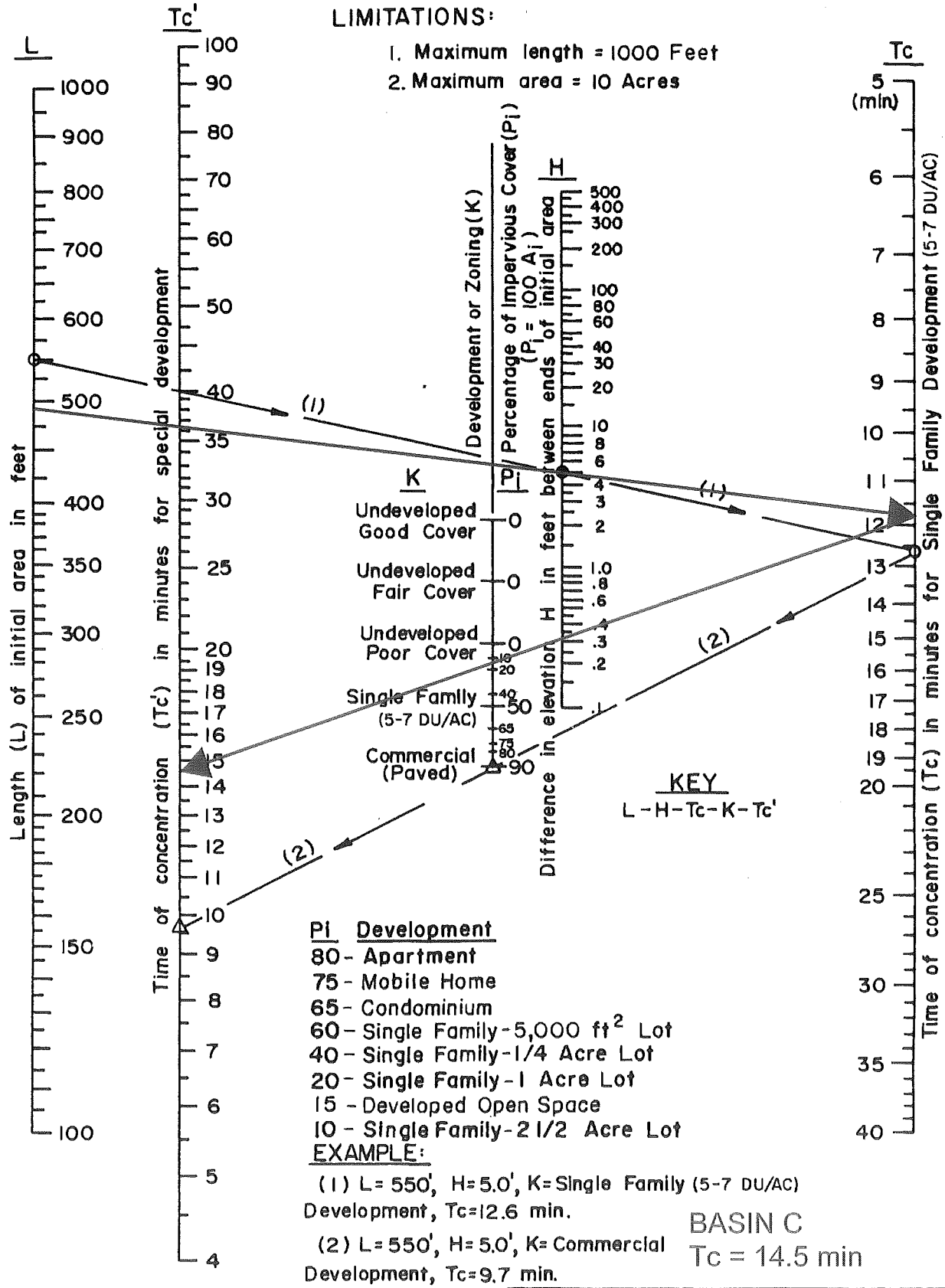

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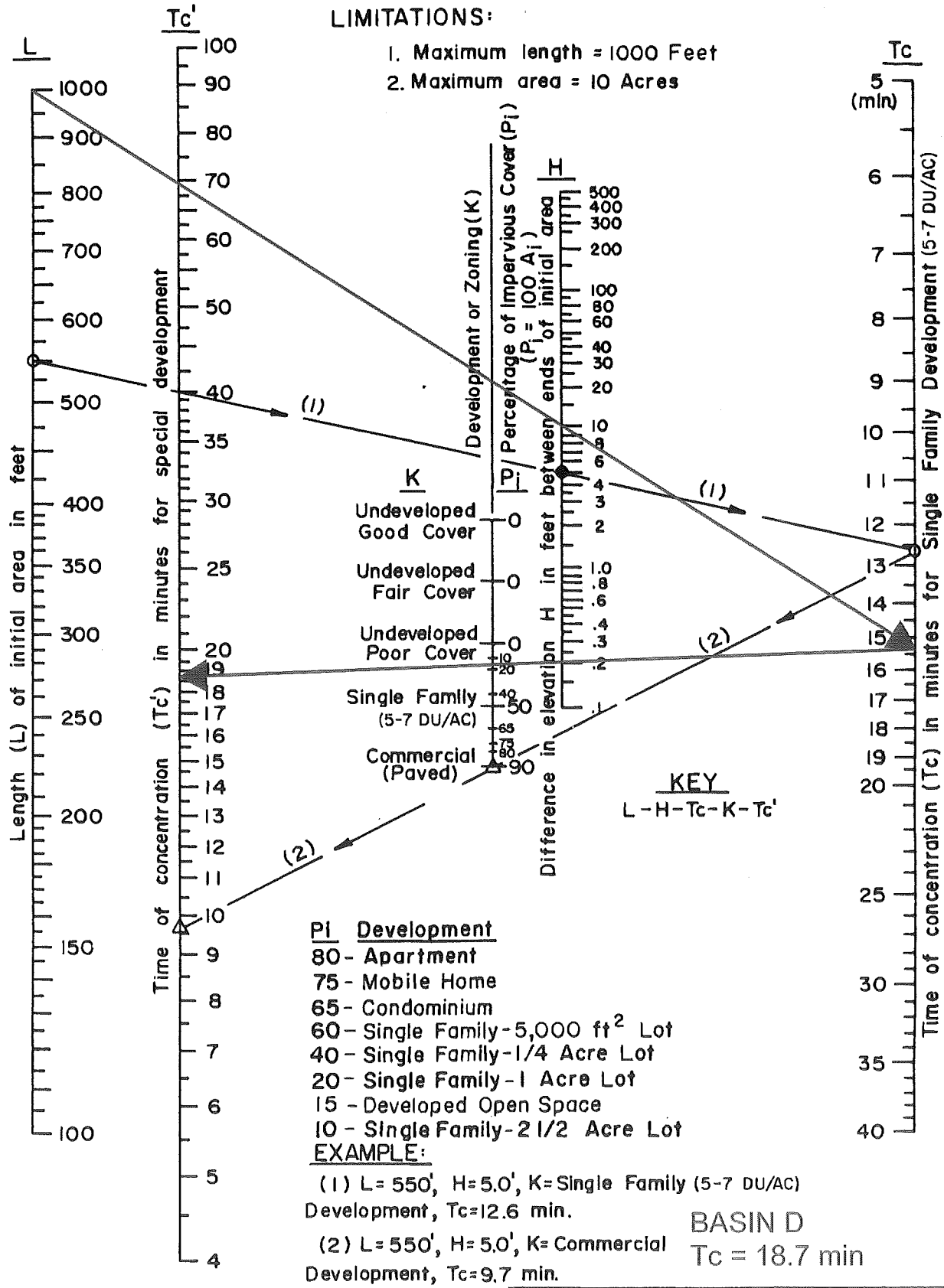

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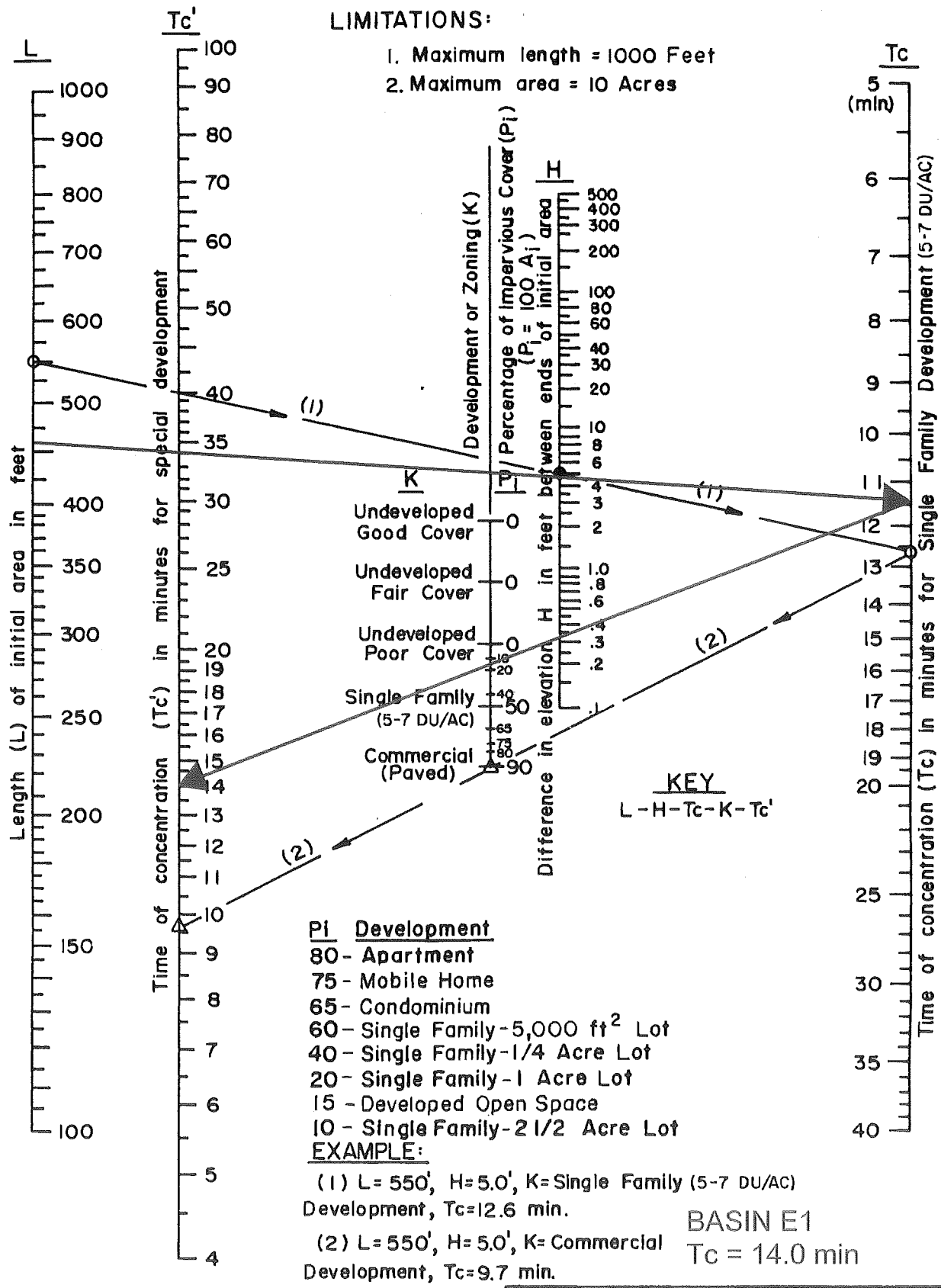

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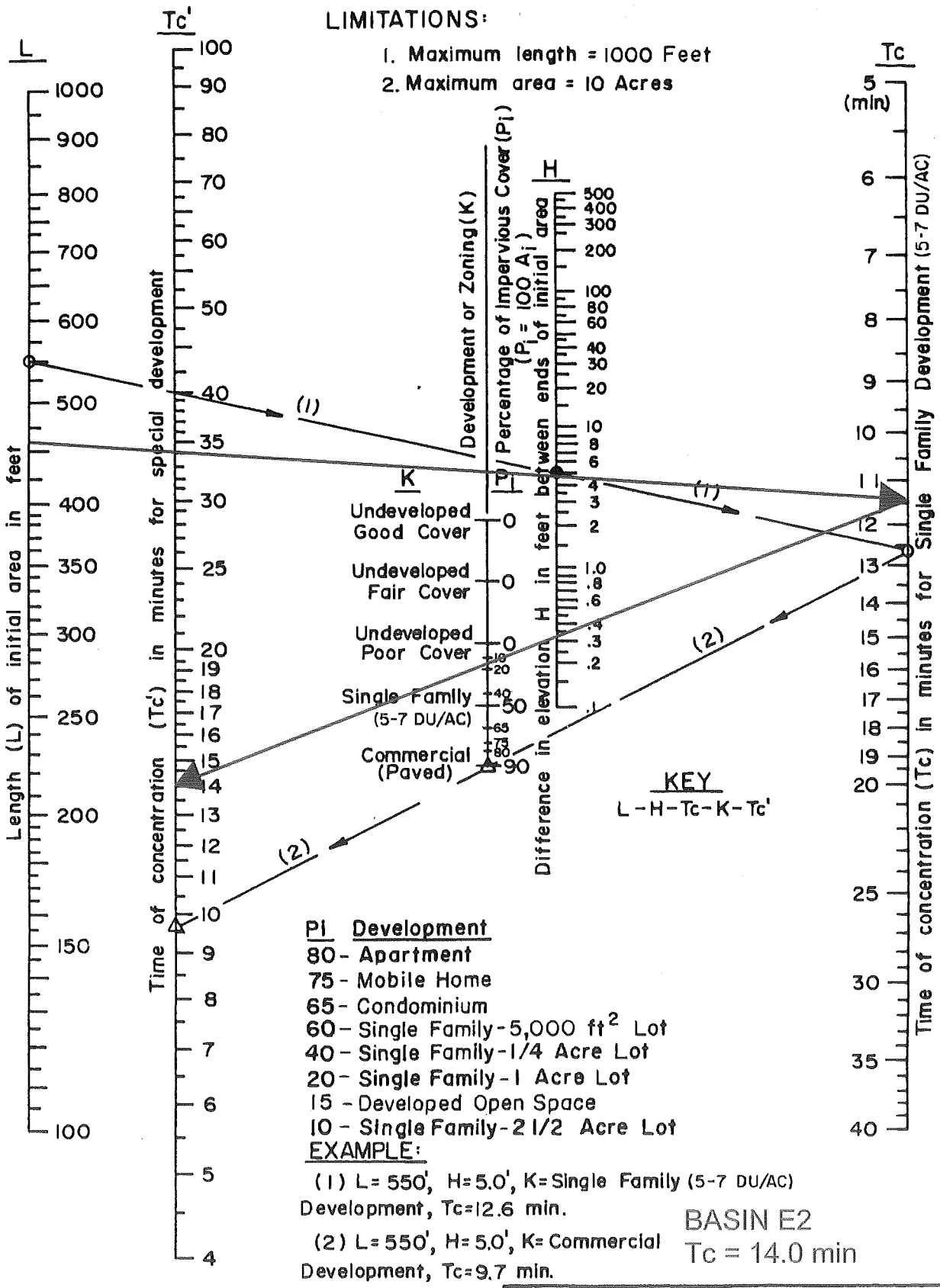

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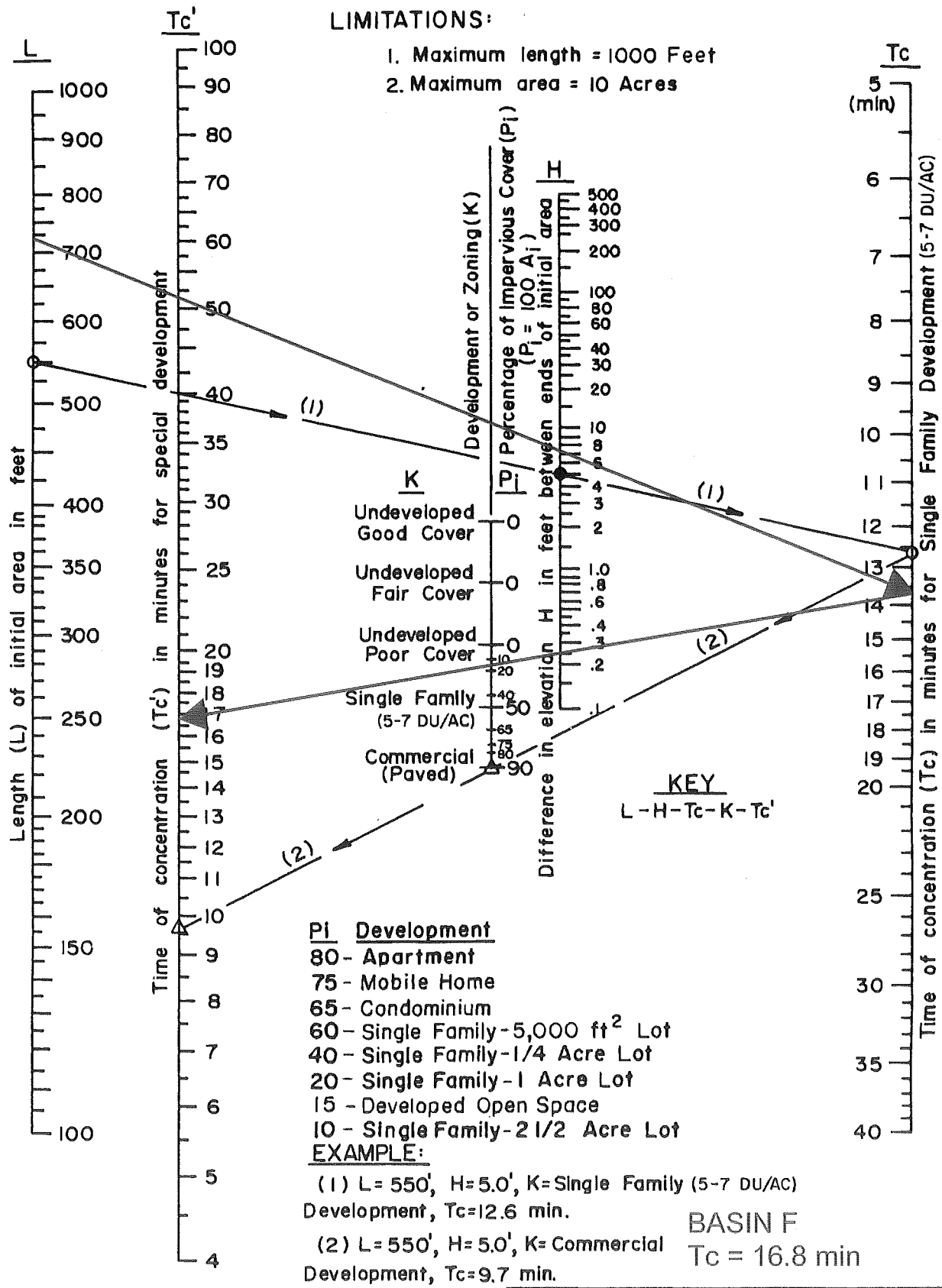

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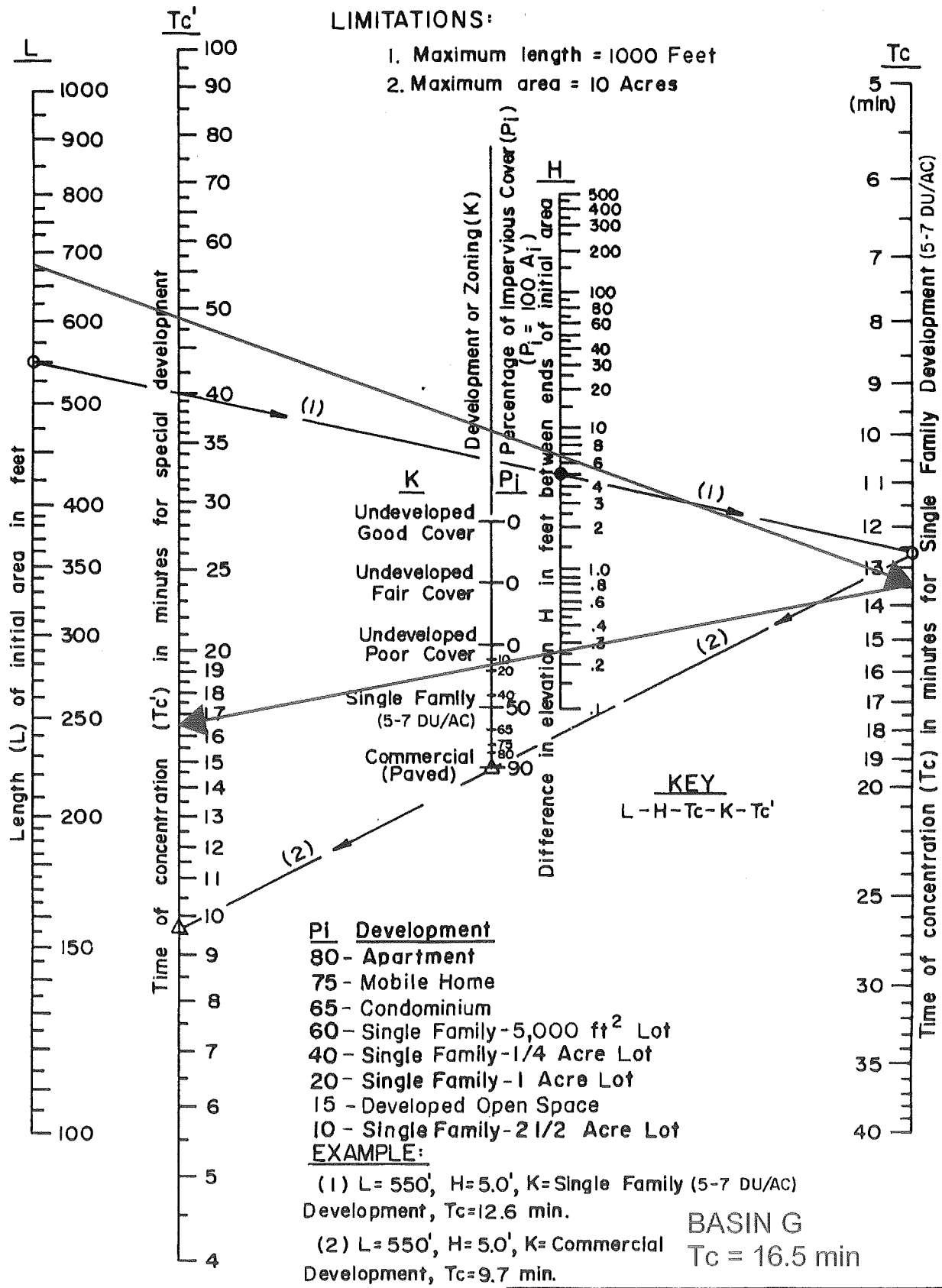

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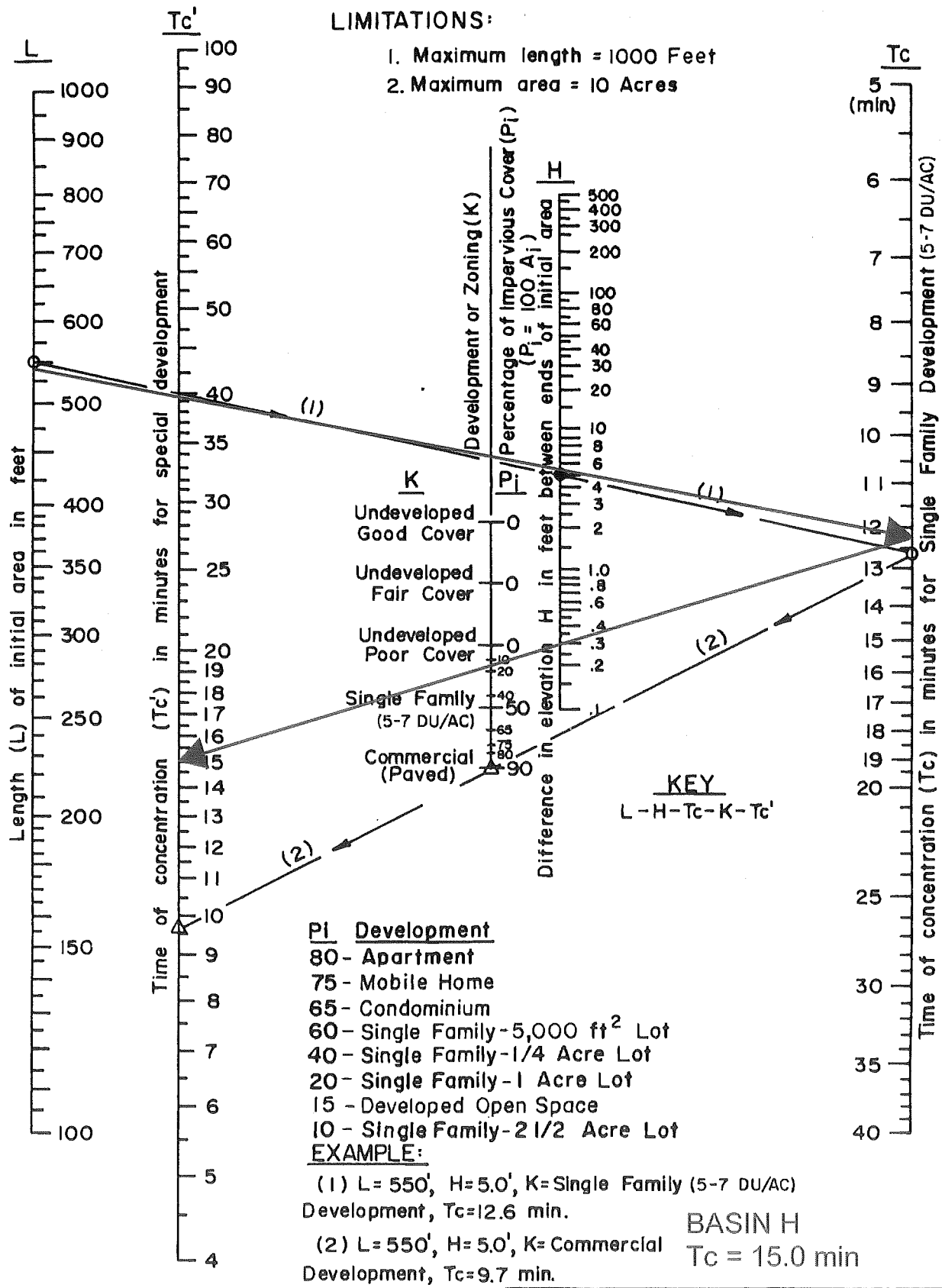

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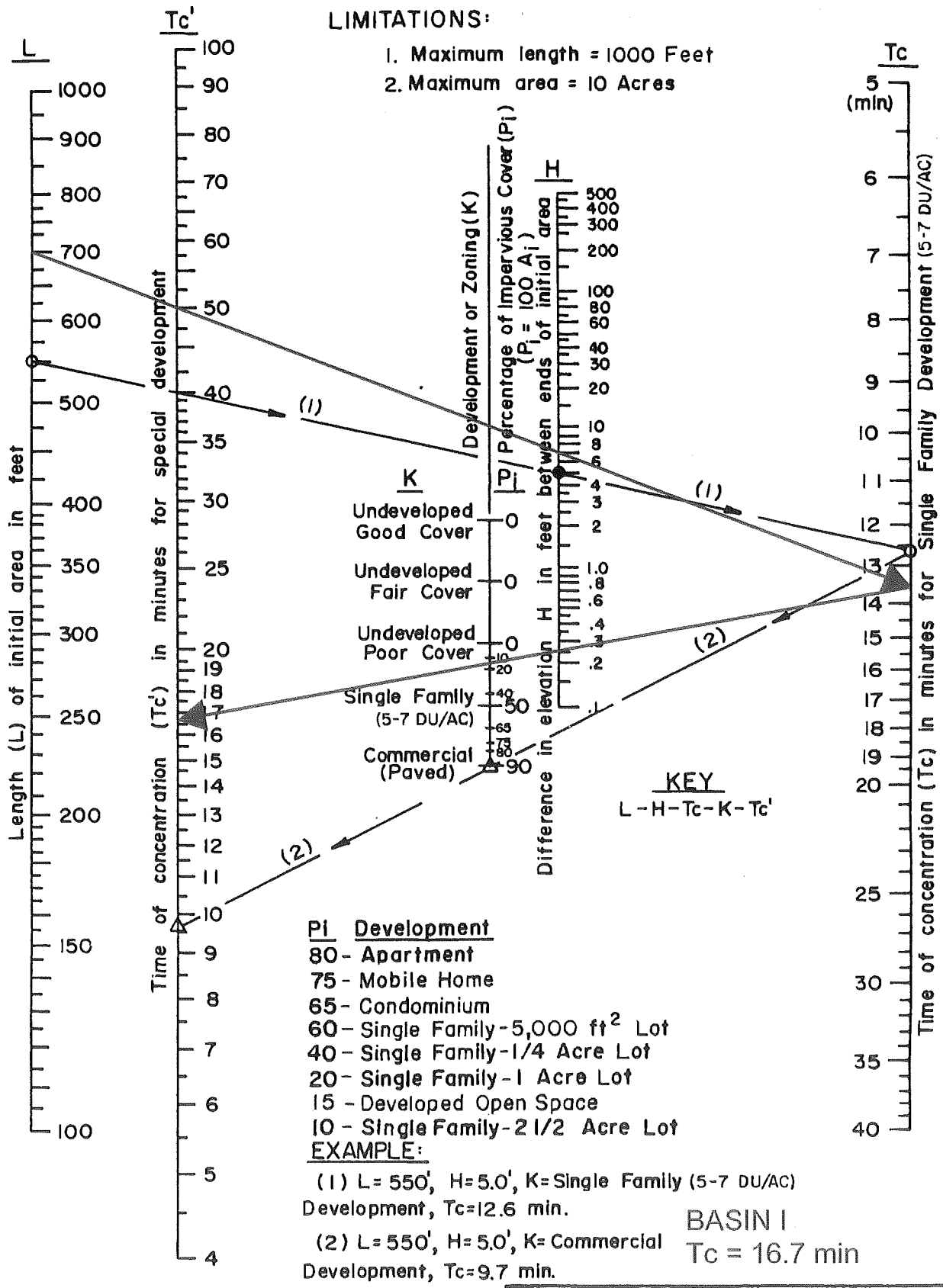

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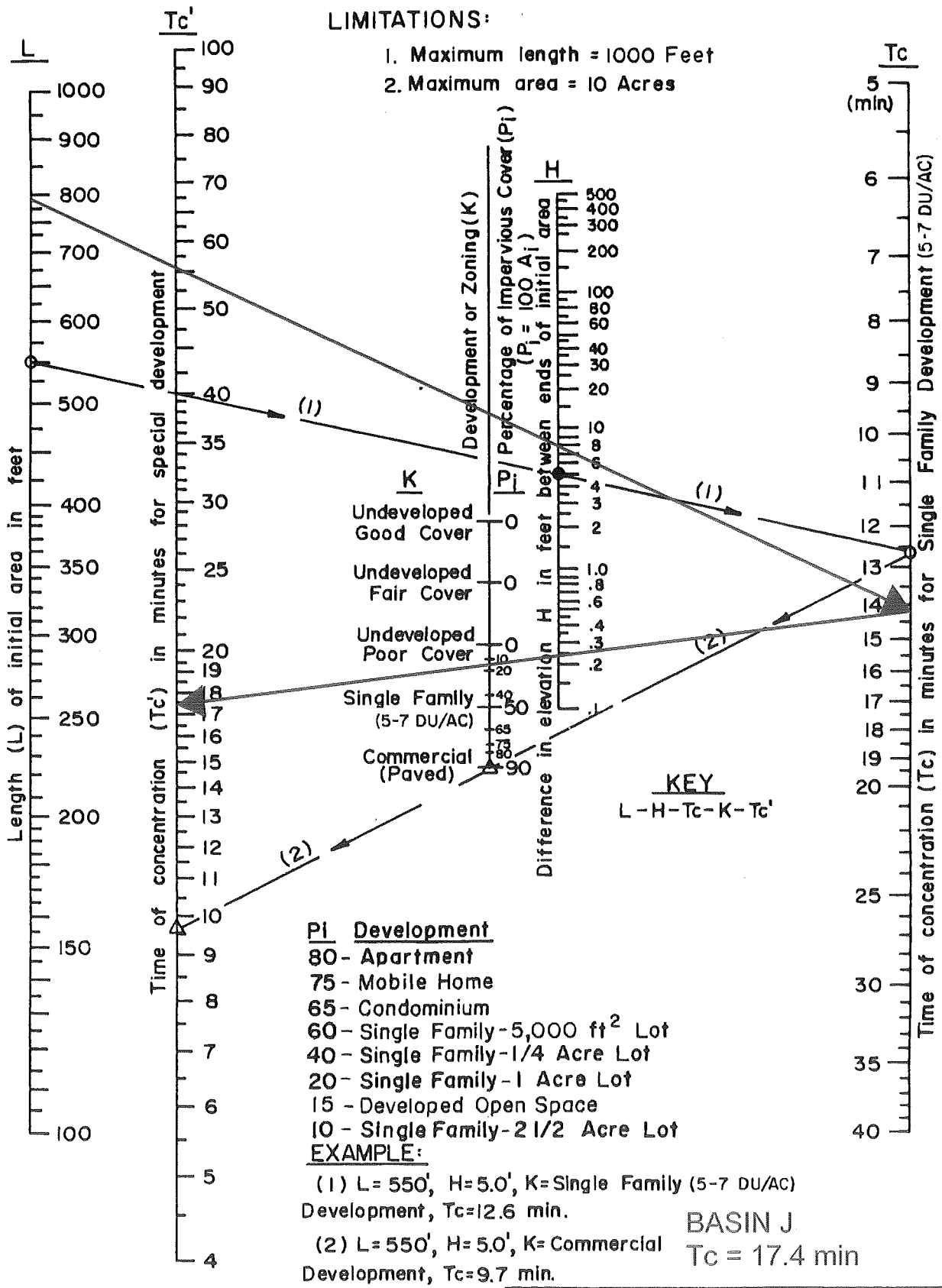

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