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

Project Name:

Terravita

588-161-06, -07, -08, -09, -10, -13

Prepared for:

Kingsbarn Realty Capital
2500 Sand Hill Road, Suite 320
Menlo Park, CA 94025
650.782.3300

Prepared by:

Fuscoe Engineering, Inc.
6390 Greenwich Drive, Suite 170
San Diego, CA 92122
858.795.4057

Prepared On:

March 2025

Revised On:

FEBRUARY 2026

Project Owner's Certification			
Planning Application No. (If Applicable)	USE-0209-2025	Grading Permit No.	TBD
Tract/Parcel Map and Lot(s) No.	Parcel 2, PM 98-191 311/69 Parcel 3, Parcel A Per T.R., PM 98-191 Parcel 4, Parcel A per T.R., PM 98-191 Parcel 4, Parcel B per T.R., PM 98-191 Parcel 5, Parcel A Per T.R., PM 98-191 Parcel 7, Parcel B per T.R., PM 98-191	Building Permit No.	TBD
Address of Project Site and APN (If no address, specify Tract/Parcel Map and Lot Numbers)			588-161-06, -07, -08, -09, -10, -13

This Water Quality Management Plan (WQMP) has been prepared for Kingsbarn Realty Capital by Fuscoe Engineering, 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: John Stack			
Title	VP Development Manager		
Company	Kingsbarn Realty Capital		
Address	2500 Sand Hill Road, Suite 320, Menlo Park, CA 94025		
Email	jstack@kingsbarn.com		
Telephone #	650.782.3302		
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): Jaemin Blackwelder			
Title	Project Manager	PE Registration #	92959
Company	Fuscoe Engineering, Inc.		
Address	6390 Greenwich Drive, Suite 170, San Diego, CA 92122		
Email	jblackwelder@fuscoe.com		
Telephone #	858.795.4057		
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

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

Provide discretionary or grading/building permit information and water quality conditions of approval, or permit issuance, applied to the project. If conditions are unknown, please request applicable conditions from staff. *Refer to Section 2.1 in the Technical Guidance Document (TGD) available on the OC Planning website (ocplanning.net).*

Project Information			
Permit/Application No. (If Applicable)	USE-0209-2025	Grading or Building Permit No. (If Applicable)	
Address of Project Site (or Tract Map and Lot Number if no address) and APN	23282 Mill Creek Dr, Laguna Hills, CA 92653 588-161-06, -07, -08, -09, -10, -13		
Water Quality Conditions of Approval or Issuance			
Water Quality Conditions of Approval or Issuance applied to this project. (Please list verbatim.)	N/A		
Conceptual WQMP			
Was a Conceptual Water Quality Management Plan previously approved for this project?	No, this serves as the Conceptual WQMP.		
Watershed-Based Plan Conditions			
Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS.	Sediment, Nutrients, Toxics, Fecal Coliform		

Section II Project Description

II.1 Project Description

Provide a detailed project description including:

- Project areas;
- Land uses;
- Land cover;
- Design elements;

A general description not broken down by drainage management areas (DMAs).

Include attributes relevant to determining applicable source controls. Refer to Section 2.2 in the Technical Guidance Document (TGD) for information that must be included in the project description.

Description of Proposed Project				
Development Category (From Model WQMP, Table 7.11-2; or -3):	8. All significant redevelopment projects, where significant redevelopment is defined as the addition of 5,000 or more square feet of impervious surface on an already developed site, and the existing development or redevelopment falls under another Priority Project Category.			
Project Area (ft^2): 695,728	Number of Dwelling Units: 480		SIC Code: N/A	
Project Area	Pervious		Impervious	
	Area (acres or sq ft)	Percentage	Area (acres or sq ft)	Percentage
Pre-Project Conditions	6.15 ac	39%	9.82 ac	61%
Post-Project Conditions	4.31 ac	26%	11.66 ac	73%
Drainage Patterns/ Connections	The existing project site is currently a commercial building and parking lot and surface drains through a series of v-gutters down the drive entrance on onto Mill Creek Drive and Ridge Route Drive and into the existing 48" diameter storm drain in Ridge Route Drive, ultimately discharging into Veeh Reservoir. The existing slope along the northern property line drains north to Veeh Reservoir.			

	The project will maintain existing drainage patterns to the maximum extent practical. The onsite drainage identified as series 100 in the drainage study is divided into flow originating from the multistory area and flow originating around the single-family residential area. It is composed of concentrated flow moving towards the south through the proposed storm drain pipeline system. Onsite storm water runoff from both areas is detained in a proprietary underground storage system with the purpose of reaching 100-year peak flow attenuation. This runoff is then conveyed to a proprietary treatment control BMP system that leads to a proposed 24-inch storm drain main joined to an existing 48-inch RCP storm drain main in Ridge Route Dr, ultimately draining north into the Veeh Reservoir. Offsite drainage on Mill Creek Drive will continue to convey into the storm drain inlet at Node 111 of the Existing Hydrology Map where it eventually leads to the Veeh Reservoir. Offset drainage on Ridge Route Drive will continue to move along the northern side of the street into the type II storm drain catch basin. This flow will advance north via the existing 48-inch RCP storm drain main into the Veeh Reservoir. The runoff at the asphalt parking lot on the western section and the residential's gate entrance area will be carried across the northeastern curb and gutter of Mill Creek Dr into the existing storm drain inlet and joins the rest of the offsite flow that reaches Node 111 from the Existing Hydrology Map into the Veeh Reservoir. The 200 Node series area (existing slope along the northern property boundary) is reduced compared to existing conditions due to the construction of duplexes on the northeastern side and is comprised of sheet flow that is led into the Veeh Reservoir. The project will not result in increased 100-yr peak flow rates in the proposed condition after mitigation of the 100-year runoff. See the drainage study for more details.
Narrative Project Description: (Use as much space as necessary.)	The proposed residential development will consist of 480 dwelling units, approximately 700,000 SF of a combination of a multifamily residential building, multiple duplexes and triplexes, and associated amenity spaces such as parks and lounges. Some existing driveways will be removed, and new asphalt driveways will be added to existing access roads on Mill Creek Drive and Ridge Route Drive. New improvements in the area and its frontage include the addition of public storm drain, water, & sewer utilities.

	There are no vehicle maintenance or cleaning areas, no delivery areas, loading docks, or fueling areas. The proposed landscaping is a variety of turf, shrubs, and trees typical of a residential development. There will be no proposed slopes and no new run-on or additional run-off from the site. No environmentally sensitive features are proposed or altered. No off-site drainage is anticipated.

II.2 Potential Stormwater Pollutants

Determine and list expected stormwater pollutants based on land uses and site activities. *Refer to Section 2.2.2 and Table 2.1 in the Technical Guidance Document (TGD) for guidance.*

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 ☒	Not applicable.
Pathogens (Bacteria/Virus)	E ☒	N ☐	
Pesticides	E ☒	N ☐	
Oil and Grease	E ☒	N ☐	
Toxic Organic Compounds	E ☐	N ☒	Not applicable.
Trash and Debris	E ☒	N ☐	

II.3 Hydrologic Conditions of Concern

Determine if streams located downstream from the project area are potentially susceptible to hydromodification impacts. *Refer to Section 2.2.3.1 in the Technical Guidance Document (TGD) for North Orange County or Section 2.2.3.2 for South Orange County.*

☐ No – Show map

☒ Yes – Describe applicable hydrologic conditions of concern below. *Refer to Section 2.2.3 in the Technical Guidance Document (TGD).*

Although the project is susceptible to hydromodification impacts, the proposed conditions increase the time of concentration and increases the peak runoff and volume by the allowable thresholds of 110% and 105%, respectively. Therefore, additional mitigation measures are not required. See the table below and Attachment D for additional information.

2-YEAR, 24-HOUR STORM SUMMARY				
Condition	**Area (ac)**	**Tc (min)**	**Peak Runoff (cfs)**	**Volume (ac-ft)**
Pre-development	15.97	8.49	24.71	1.80
Post-development	15.97	8.71	25.08	1.88
Difference	**---**	**0.22**	**0.37**	**0.08**
% Change		**2.61%**	**1.50%**	**4.44%**

II.4 Post-Development Drainage Characteristics

Describe post development drainage characteristics. *Refer to Section 2.2.4 in the Technical Guidance Document (TGD).*

The project will maintain existing drainage patterns to the maximum extent practical. As in existing conditions, stormwater runoff from the proposed development will ultimately discharge to the Veeh Reservoir located northeast of the property boundary.

The onsite drainage identified as series 100 in the drainage study is divided into flow originating from the multistory area and flow originating around the single-family residential area. It is composed of concentrated flow moving towards the south through the proposed storm drain pipeline system. Onsite storm water runoff from both areas is detained in a proprietary underground storage system with the purpose of reaching 100-year peak flow attenuation. This runoff is then conveyed to a proprietary treatment control BMP system that leads to a proposed 24-inch storm drain main joined to an existing 48-inch RCP storm drain main in Ridge Route Dr, ultimately draining north into the Veeh Reservoir.

Offsite drainage on Mill Creek Drive will continue to convey into the storm drain inlet at Node 111 of the Existing Hydrology Map where it eventually leads to the Veeh Reservoir.

Offset drainage on Ridge Route Drive will continue to move along the northern side of the street into the type II storm drain catch basin. This flow will advance north via the existing 48-inch RCP storm drain main into the Veeh Reservoir.

The runoff at the asphalt parking lot on the western section and the residential's gate entrance area will be carried across the northeastern curb and gutter of Mill Creek Dr into the existing storm drain inlet and joins the rest of the offsite flow that reaches Node 111 from the Existing Hydrology Map into the Veeh Reservoir.

The 200 Node series area (existing slope along the northern property boundary) is reduced compared to existing conditions due to the construction of duplexes on the northeastern side and is comprised of sheet flow that is led into the Veeh Reservoir.

The project will not result in increased 100-yr peak flow rates in the proposed condition after mitigation of the 100-year runoff. See the drainage study for more details.

II.5 Property Ownership/Management

Describe property ownership/management. *Refer to Section 2.2.5 in the Technical Guidance Document (TGD).*

On-site proposed drainage facilities will be privately owned and maintained.

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)	N/A
Location/Address	23282 Mill Creek Dr, Laguna Hills, CA 92653
General Plan Land Use Designation	Mixed Use
Zoning	Mixed Use
Acreage of Project Site	15.97
Predominant Soil Type	D

III.2 Site Characteristics

Fill out table with relevant information and include information regarding BMP sizing, suitability, and feasibility, as applicable. *Refer to Section 2.3.2 in the Technical Guidance Document (TGD).*

Site Characteristics	
Precipitation Zone	0.80 in
Topography	The site is graded generally easterly, with an average slope of 2%. The site has an elevation difference of approximately 50-60 ft.
Drainage Patterns/Connections	See Section II.1 and Section II.4 for a complete description of existing and proposed drainage patterns and connections.
Soil Type, Geology, and Infiltration Properties	Hydrologic Soil Type D underlays the site according to the Caltrans Water Quality Planning Tool.

Hydrogeologic (Groundwater) Conditions	According to the site-specific geotechnical report, groundwater was not encountered within 31 feet below ground surface. The reservoir adjacent to the site has a historical groundwater at 10 feet below the existing ground surface, according to the CGS Seismic Hazard Zone Report, San Juan Capistrano Quadrangle (2001).
Geotechnical Conditions (relevant to infiltration)	Two percolation tests were performed, with infiltration rates of 0.0 in/hr and 0.2 in/hr. Due to low infiltration rates, infiltration is deemed infeasible for the site.
Off-Site Drainage	No off-site drainage is anticipated.
Utility and Infrastructure Information	Dry and wet utilities will be incorporated into the proposed project and will tie into existing facilities associated with the existing development.

III.3 Watershed Description

Fill out table with relevant information and include information regarding BMP sizing, suitability, and feasibility, as applicable. *Refer to Section 2.3.3 in the Technical Guidance Document (TGD).*

Receiving Waters	San Diego Creek Reach 1, Newport Bay, Pacific Ocean
303(d) Listed Impairments	Benthic Community Effects, Chlordane, Copper, DDT, Indicator Bacteria, Malathion, Nutrients, PCBs, Sedimentation/Siltation, Selenium, Toxaphene, Toxicity
Applicable TMDLs	Sediment, Nutrients, Toxics, Fecal Coliform
Pollutants of Concern for the Project	Suspended Solids, Nutrients, Bacteria/Pathogens, Pesticides, Oil and Grease, Trash and Debris
Environmentally Sensitive and Special Biological Significant Areas	N/A

Section IV Best Management Practices (BMPs)

IV.1 Project Performance Criteria

Describe project performance criteria. Several steps must be followed in order to determine what performance criteria will apply to a project. These steps include:

- If the project has an approved WIHMP or equivalent, then any watershed specific criteria must be used and the project can evaluate participation in the approved regional or sub-regional opportunities. (Please ask your assigned planner or plan checker regarding whether your project is part of an approved WIHMP or equivalent.)
- Determine applicable hydromodification control performance criteria. *Refer to Section 7.II-2.4.2.2 of the Model WQMP.*
- Determine applicable LID performance criteria. *Refer to Section 7.II-2.4.3 of the Model WQMP.*
- Determine applicable treatment control BMP performance criteria. *Refer to Section 7.II-3.2.2 of the Model WQMP.*
- Calculate the LID design storm capture volume for the project. *Refer to Section 7.II-2.4.3 of the Model WQMP.*

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.		

Project Performance Criteria	
If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP)	If a hydrologic condition of concern (HCOC) exists, priority projects shall implement onsite or regional hydromodification controls such that: • Post-development runoff volume for the two-year frequency storm does not exceed that of the predevelopment condition by more than five percent, and

	• Time of concentration of post-development runoff for the two-year storm event is not less than that for the predevelopment condition by more than five percent.
List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP)	Infiltrate, harvest and use, evapotranspire, or biotreat/biofilter, the 85th percentile, 24-hour storm event (Design Capture Volume). LID BMPs must be designed to retain, on-site, (infiltrate, harvest and use, or evapotranspire) storm water runoff up to 80 percent average annual capture efficiency.
List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP)	If it is not feasible to meet LID performance criteria through retention and/or biotreatment provided on-site or at a sub-regional/regional scale, then treatment control BMPs shall be provided on-site or offsite prior to discharge to waters of the US. Sizing of treatment control BMP(s) shall be based on either the unmet volume after claiming applicable water quality credits, if appropriate.
Calculate LID design storm capture volume for Project.	***DCV =*** *(0.75 x* 0.73 + *0.15) x* 0.80 *in x* 15.97 *ac x 43560 sf/ac x 1/12 in/ft =* **32,348 cu-ft**

IV.2. Site Design and Drainage

Describe site design and drainage including

- A narrative of site design practices utilized or rationale for not using practices;
- A narrative of how site is designed to allow BMPs to be incorporated to the MEP
- A table of DMA characteristics and list of LID BMPs proposed in each DMA.
- Reference to the WQMP "BMP Exhibit."
- Calculation of Design Capture Volume (DCV) for each drainage area.
- A listing of GIS coordinates for LID and Treatment Control BMPs.

Refer to Section 2.4.2 in the Technical Guidance Document (TGD).

HSCs are used throughout the project for runoff dispersion in the form of impervious area dispersion and disconnected roof downspouts. DMA 2 includes of a portion of the site frontage along Ridge Route Drive which drains directly onto Ridge Route Drive. DMA 3 includes of a portion of the site frontage along Mill Creek Drive which drains directly onto Mill Creek Drive. DMA 4 includes a portion of the site is an existing vegetative slope which drains directly into Veeh Reservoir. DMAs 2 through 4 consist of vegetative slopes and insignificant portions of site access walkways.

DMA 1 is a combination of residential buildings, streets, walkways, and residential landscaping. Due to the site sizing constraint and lack of natural infiltration, a proprietary

BMP biotreatment Modular Wetland System (MWS) planter box is proposed. See worksheets and calculations in Attachment A.

Drainage Management Area (DMA) Summary				
DMA	Drainage Area (ac or ft^2)	% Impervious	DCV (ft^3)	BMP
1	14.99	75	30,914	Proprietary Biotreatment
2	0.42	0	182	HSC-2
3	0.24	58	419	HSC-2
4	0.32	76	659	HSC-2

Refer to Section VI for locations of each DMA and BMP proposed for the project.

IV.3 LID BMP Selection and Project Conformance Analysis

Each sub-section below documents that the proposed design features conform to the applicable project performance criteria via check boxes, tables, calculations, narratives, and/or references to worksheets. *Refer to Section 2.4.2.3 in the Technical Guidance Document (TGD) for selecting LID BMPs and Section 2.4.3 in the Technical Guidance Document (TGD) for conducting conformance analysis with project performance criteria.*

IV.3.1 Hydrologic Source Controls (HSCs)

If required HSCs are included, fill out applicable check box forms. If the retention criteria are otherwise met with other LID BMPs, include a statement indicating HSCs not required.

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:	☐

HSCs are used throughout the project for runoff dispersion in the form of impervious area dispersion and disconnected roof downspouts. DMA 2 includes of a portion of the site frontage along Ridge Route Drive which drains directly onto Ridge Route Drive. DMA 3 includes of a portion of the site frontage along Mill Creek Drive which drains directly onto Mill Creek Drive. DMA 4 includes a portion of the site is an existing vegetative slope which drains directly into Veeh Reservoir. DMAs 2 through 4 consist of vegetative slopes and insignificant portions of site access walkways.

IV.3.2 Infiltration BMPs

Identify infiltration BMPs to be used in project. If design volume cannot be met, state why.

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:	☐

Show calculations below to demonstrate if the LID Design Strom Capture Volume can be met with infiltration BMPs. If not, document how much can be met with infiltration and document why it is not feasible to meet the full volume with infiltration BMPs.

Based on the low infiltration rates, infiltration was deemed infeasible for the site.

IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

If the full Design Storm Capture Volume cannot be met with infiltration BMPs, describe any evapotranspiration and/or rainwater harvesting BMPs included.

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

Show calculations below to demonstrate if the LID Design Storm Capture Volume can be met with evapotranspiration and/or rainwater harvesting BMPs in combination with infiltration BMPs. If not, document below how much can be met with either infiltration BMPs, evapotranspiration, rainwater harvesting BMPs, or a combination, and document why it is not feasible to meet the full volume with these BMP categories

For a system to be considered "feasible", the system must be designed with a storage volume equal to the DCV from the tributary area and achieve more than 40% capture. The system must also be able to drawdown in 30 days to meet the 40% capture value. This is determined by calculating the Estimated Applied Water Use (EAWU) equation from Appendix X of the TGD. The EAWU can then be divided by the water quality volume for the project site or DMA to determine drawdown time. If the drawdown time is less than 30 days, harvest and reuse is considered partially feasible and the Effective Irrigated Area to Tributary Area (EIATA) ratio may be utilized to determine the capture efficiency of the system. If drawdown is greater than 30 days, harvest and reuse may be concluded to be infeasible.

As shown by Worksheet J included in Appendix A, harvest and reuse is considered infeasible due insufficient water demand during the wet season to drawdown the water quality volume.

IV.3.4 Biotreatment BMPs

If the full Design Storm Capture Volume cannot be met with infiltration BMPs, and/or evapotranspiration and rainwater harvesting BMPs, describe biotreatment BMPs included. Include sections for selection, suitability, sizing, and infeasibility, as applicable.

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:	☐

Show calculations below to demonstrate if the LID Design Storm Capture Volume can be met with infiltration, evapotranspiration, rainwater harvesting and/or biotreatment BMPs. If not, document how much can be met with either infiltration BMPs, evapotranspiration, rainwater harvesting BMPs, or a combination, and document why it is not feasible to meet the full volume with these BMP categories.

DMA 1 is a combination of residential buildings, streets, walkways, and residential landscaping. Due to the site sizing constraint and lack of natural infiltration, a proprietary BMP biotreatment Modular Wetland System (MWS) planter box is proposed. See worksheets and calculations in Attachment A.

BIOTREATMENT SUMMARY							
DMA	Area (ft²)	% Imp	Tc (min)	Intensity (in/hr)	Q_{Design} (cfs)	BMP Model	BMP Capacity (cfs)
1	653,119	75	5	0.26	2.77	(5) MWS-L-8-20	2.90

IV.3.5 Hydromodification Control BMPs

Describe hydromodification control BMPs. See Section 5 of the Technical Guidance Document (TGD). Include sections for selection, suitability, sizing, and infeasibility, as applicable. Detail compliance with Prior Conditions of Approval (if applicable).

Hydromodification Control BMPs	
BMP Name	**BMP Description**
N/A	N/A

Although the project is susceptible to hydromodification impacts, the proposed conditions increase the time of concentration and increases the peak runoff and volume by the allowable thresholds of 110% and 105%, respectively. Therefore, additional mitigation measures are not required. See Section II.3 and Attachment D for additional information.

IV.3.6 Regional/Sub-Regional LID BMPs

Describe regional/sub-regional LID BMPs in which the project will participate. *Refer to Section 7.II-2.4.3.2 of the Model WQMP.*

Regional/Sub-Regional LID BMPs
Not Applicable.

IV.3.7 Treatment Control BMPs

Treatment control BMPs can only be considered if the project conformance analysis indicates that it is not feasible to retain the full design capture volume with LID BMPs. Describe treatment control BMPs including sections for selection, sizing, and infeasibility, as applicable.

Treatment Control BMPs	
BMP Name	**BMP Description**
N/A	N/A

IV.3.8 Non-structural Source Control BMPs

Fill out non-structural source control check box forms or provide a brief narrative explaining if non-structural source controls were not used.

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)	☐	☒	No hazardous waste proposed onsite.
N6	Local Industrial Permit Compliance	☐	☒	Residential Development
N7	Spill Contingency Plan	☐	☒	Residential Development
N8	Underground Storage Tank Compliance	☐	☒	Residential Development
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous waste proposed onsite.
N10	Uniform Fire Code Implementation	☐	☒	No hazardous waste proposed onsite.
N11	Common Area Litter Control	☐	☒	Residential Development
N12	Employee Training	☐	☒	Residential Development
N13	Housekeeping of Loading Docks	☐	☒	Residential Development
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	Residential Development

IV.3.9 Structural Source Control BMPs

Fill out structural source control check box forms or provide a brief narrative explaining if structural source controls were not used.

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	☐	☒	Residential Development
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☐	☒	Residential Development
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)	☐	☒	Residential Development
S6	Dock areas	☐	☒	Residential Development
S7	Maintenance bays	☐	☒	Residential Development
S8	Vehicle wash areas	☐	☒	Residential Development
S9	Outdoor processing areas	☐	☒	Residential Development
S10	Equipment wash areas	☐	☒	Residential Development
S11	Fueling areas	☐	☒	Residential Development
S12	Hillside landscaping	☐	☒	Residential Development
S13	Wash water control for food preparation areas	☐	☒	Residential Development
S14	Community car wash racks	☐	☒	Residential Development

IV.4 Alternative Compliance Plan (If Applicable)

Describe an alternative compliance plan (if applicable). Include alternative compliance obligations (i.e., gallons, pounds) and describe proposed alternative compliance measures. *Refer to Section 7.II 3.0 in the WQMP.*

Not Applicable

IV.4.1 Water Quality Credits

Determine if water quality credits are applicable for the project. *Refer to Section 3.1 of the Model WQMP for description of credits and Appendix VI of the Technical Guidance Document (TGD) for calculation methods for applying 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)	Not Applicable			

IV.4.2 Alternative Compliance Plan Information

Describe an alternative compliance plan (if applicable). Include alternative compliance obligations (i.e., gallons, pounds) and describe proposed alternative compliance measures. *Refer to Section 7.II 3.0 in the Model WQMP.*

Not Applicable

Section V Inspection/Maintenance Responsibility for BMPs

Fill out information in table below. Prepare and attach an Operation and Maintenance Plan. Identify the funding mechanism through which BMPs will be maintained. Inspection and maintenance records must be kept for a minimum of five years for inspection by the regulatory agencies. *Refer to Section 7.II 4.0 in the Model WQMP.*

BMP INSPECTION AND MAINTENANCE RESPONSIBILITY MATRIX			
Source Control BMP	**Responsible Party**	**Activity**	**Frequency**
Dry Weather Flow Source Control **Note: this is a South Orange County High Priority Water Quality Condition for All Projects**	Owner	Check for dry weather flows such as street washing, irrigation overspray, air conditioner condensate in areas of the project that do not drain to LID BMPs, the sanitary sewer, or landscaped pervious areas. Notify residents of any dry weather flows and follow up to correct.	Twice per year during dry season
		Inspect project outfall or most-downstream project manhole for presence of dry weather flow. If present, conduct reconnaissance to determine source and implement actions to eliminate source.	Twice per year during dry season
N1. Education for Property Owner's Tenants and Occupants	Owner	Distribute appropriate materials to owners, tenants, and/or occupants via contract language, mailings, website, or meetings.	Information provided to owners and tenants upon sale or lease. Reminders sent or posted as needed.

BMP INSPECTION AND MAINTENANCE RESPONSIBILITY MATRIX			
Source Control BMP	**Responsible Party**	**Activity**	**Frequency**
		Check h2oc.org and/or City website for updated educational materials.	Annually
N2. Activity Restrictions	Owner	Within the CC&R's or lease agreement, restrict the following activities: *car washing outside of car wash areas.*	Information provided to owners and tenants upon sale or lease. Reminders sent or posted as needed.
N3/S4. Common Area Landscape Management, Efficient Landscape Design, and Efficient Irrigation	Owner	Check that fertilizer and pesticide usage is in accordance wiN1th the Integrated Pest Management Program. Adjust, if needed.	Annually
		Check the irrigation system water budget to ensure efficiency targets are being met and the system is in good condition. Adjust/repair irrigation system and controllers, if needed.	Annually prior to irrigation system activation
		Check landscaping for presence of invasive species and remove, if needed.	Annually

BMP INSPECTION AND MAINTENANCE RESPONSIBILITY MATRIX			
Source Control BMP	**Responsible Party**	**Activity**	**Frequency**
N14. Common Area Catch Basin Inspection	Owner	Remove trash and debris from catch basins and grates. Check for damage, clogging, and standing water. Repair or mitigate clogging/standing water, as needed.	Four times per year during wet season, including inspection just before the wet season and within 24 hours after at least two storm events >0.5 inches
N15. Street Sweeping Private Streets and Parking Lots	Owner	Sweep curb and gutter areas using a vacuum street sweeper. Report any significant or illicit debris in curb/gutter to HOA or responsible party, as needed.	Weekly
S1. Provide Storm Drain System Stenciling and Signage	Owner	Check that all catch basins in paved areas marked or stenciled with "No dumping-Drains to Ocean; No Descargue Basura" language. Replace/repaint markings if faded, damaged, removed, or otherwise illegible.	Annually

BMP INSPECTION AND MAINTENANCE RESPONSIBILITY MATRIX			
Source Control BMP	**Responsible Party**	**Activity**	**Frequency**
S2. Design and Construct Outdoor Material Storage Areas	Owner	Check outdoor material storage structure to ensure structural stability is sound and that no contact of the stored materials with rainfall or runoff is occurring. Check secondary containment for leaks. Repair leaks or damage, as needed and mitigate, if coming into contact with stormwater.	Twice per year
S3. Design and Construct Trash and Waste Storage Areas	Owner	Check that outdoor waste storage structure is consistently covered, that structural stability is sound, and that no run-on or contact of the trash with runoff is occurring. Repair leaks or damage and mitigate if trash coming into contact with stormwater, as needed.	Twice per year
		Check that trash is removed by local waste management contractor on at least a weekly basis for proper disposal.	Weekly

BMP INSPECTION AND MAINTENANCE RESPONSIBILITY MATRIX			
Source Control BMP	**Responsible Party**	**Activity**	**Frequency**
S5. Protect Slopes and Channels and Provide Energy Dissipation	Owner	Check slopes, channels, riprap and other conveyance or energy dissipation areas for signs of erosion or scour. Replace material, repair channels, replant vegetation, and/or redesign, as needed for signs of erosion/scour.	Four times per year during wet season, including inspection just before the wet season and within 24 hours after at least two storm events >0.5 inches
BIO-7 Proprietary Biotreatment	Owner	Remove trash and debris. Identify excess erosion or scour, sediment accumulation that requires maintenance, any needed corrective maintenance that will require site-specific planning design. Inspect during storm event, when possible, to estimate treatment capacity and determine if premature bypass is occurring. Evaluate plant health and need for corrective action.	Four times per year during wet season, including inspection just before the wet season and within 24 hours after at least two storm events >0.5 inches

BMP INSPECTION AND MAINTENANCE RESPONSIBILITY MATRIX			
Source Control BMP	**Responsible Party**	**Activity**	**Frequency**
HSC- 2 Impervious Area Dispersion (Downspout Disconnect, Sheet Flow Dispersion)	Owner	Confirm presence of HSC. Remove trash. Check facility for excessive sediment accumulation (>~ 1 inch), major erosion, damage, channelization, loss of vegetation, and standing water. Check downspout and flow spreader for damage or clogging. Remove sediment, restore vegetation, scarify soil, and/or otherwise mitigate, as needed, to restore functionality.	Annually

Section VI BMP Exhibit (Site Plan)

VI.1 BMP Exhibit (Site Plan)

Include a BMP Exhibit (Site Plan), at a size no less than 24" by 36," which includes the following minimum information:

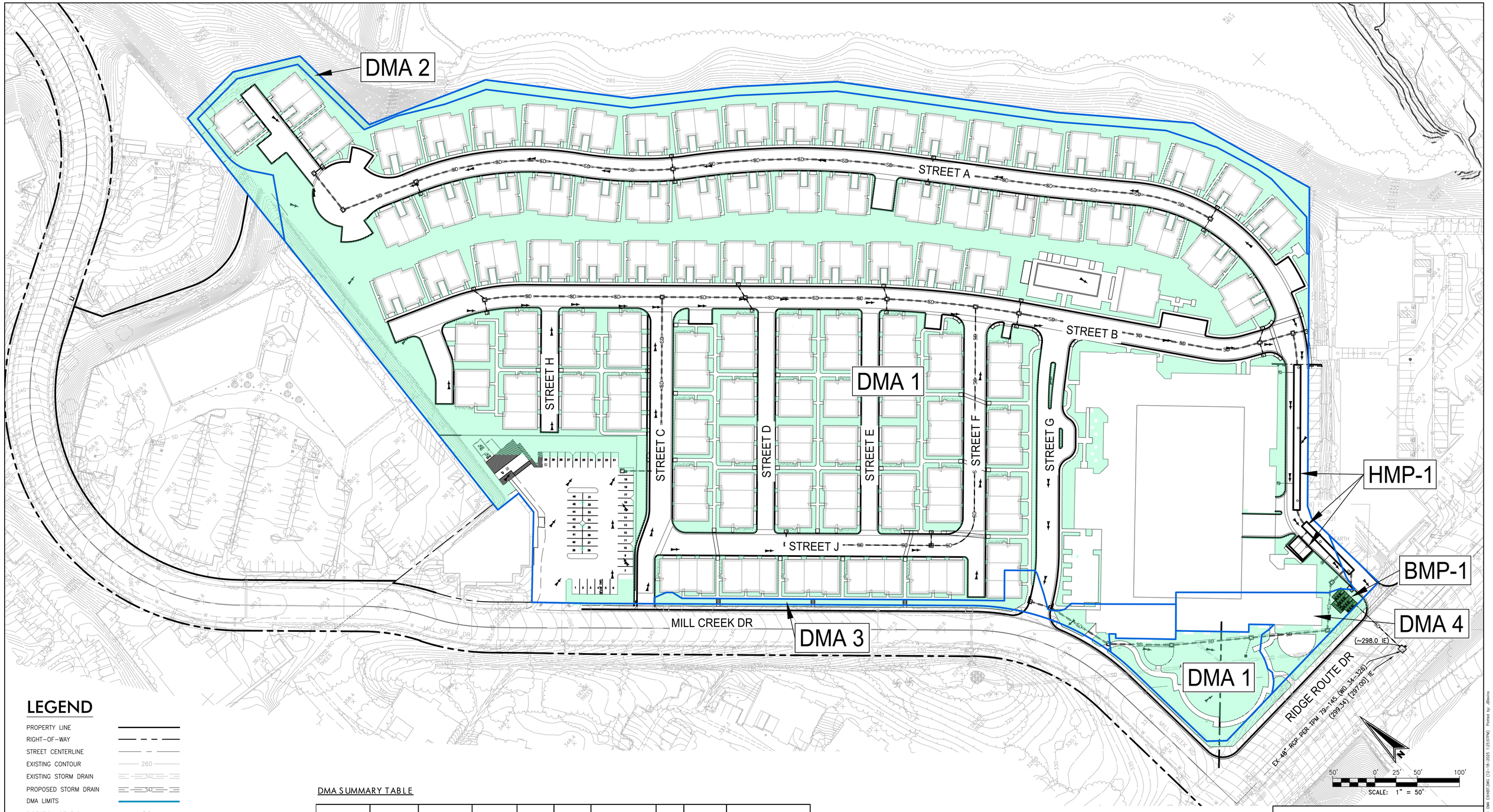
- Insert in the title block (lower right hand corner) of BMP Exhibit: the WQMP Number (assigned by staff) and the grading/building or Planning Application permit numbers
- Project location (address, tract/lot number(s), etc.)
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural BMP locations
- Drainage delineations and flow information
- Delineate the area being treated by each structural BMP
- GIS coordinates for LID and Treatment Control BMPs
- Drainage connections
- BMP details
- Preparer name and stamp

Please do not include any areas outside of the project area or any information not related to drainage or water quality. The approved BMP Exhibit (Site Plan) shall be submitted as a plan sheet on all grading and building plan sets submitted for plan check review and approval. The BMP Exhibit shall be at the same size as the rest of the plan sheets in the submittal and shall have an approval stamp and signature prior to plan check submittal.

VI.2 Submittal and Recordation of Water Quality Management Plan

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

Each approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) shall be recorded in the Orange County Clerk-Recorder's Office, prior to close-out of grading and/or building permit. Educational Materials are not required to be included.



LEGEND

- PROPERTY LINE
- RIGHT–OF–WAY
- STREET CENTERLINE
- EXISTING CONTOUR — 260
- EXISTING STORM DRAIN — SD
- PROPOSED STORM DRAIN — SD
- DMA LIMITS
- DIRECTION OF FLOW
- DMA DESIGNATION — DMA 1
- PERVIOUS AREA
- PROPRIETARY BIOFILTRATION UNIT — BMP 1
- HYDROMODIFICATION CISTERN STORM DRAIN PIPE
- URBAN POND DETENTION VAULT — HMP 1

DMA SUMMARY TABLE

DMA	TOTAL AREA (SF)	TOTAL AREA (AC)	IMPERVIOUS AREA	PERVIOUS AREA	Aimp %	WEIGHTED RUNOFF FACTOR	DCV (CF)	QBMP REQUIRED (CFS)	TREATMENT METHOD
DMA-1	653,119	14.99	491,513	161,606	75%	0.71	30,914	2.77	DRAINS TO BMP-1
DMA-2	18,226	0.42	0	18,226	0%	0.15	182	0.02	HSC-2
DMA-3	10,660	0.24	6,218	4,442	58%	0.59	419	0.04	HSC-2
DMA-4	13,723	0.32	10,406	3,317	76%	0.72	659	0.06	HSC-2
TOTALS	695,728	15.97	508,137	187,591					

TERRAVITA

WQMP EXHIBIT

REVISIONS

NO.	INIT.	DATE	DESCRIPTION	APP'D	DATE

FUSCOE ENGINEERING
6390 Greenwich Dr, Suite 170
San Diego, Ca 92122
858.554.1500
fuscoe.com

JOB NO. 4014-001
DRAWN BY: JGB
SHEET 1 of 1

Section VII Educational Materials

Refer to the Orange County Stormwater Program (h2oc.org) for a library of materials available. Please only attach the educational materials specifically applicable to this project. Other materials specific to the project may be included as well and must be attached.

Educational Materials			
Residential Material (h2oc.org)	**Check If Applicable**	**Business Material (h2oc.org)**	**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	☐	Compliance BMPs for Mobile Businesses	☐
Proper Disposal of Household Hazardous Waste	☒	**Other Material**	**Check If Attached**
Recycle at Your Local Used Oil Collection Center (North County)	☐		
Recycle at Your Local Used Oil Collection Center (Central County)	☐		☐
Recycle at Your Local Used Oil Collection Center (South County)	☒		☐
Tips for Maintaining a Septic Tank System	☐		☐
Responsible Pest Control	☒		☐
Sewer Spill	☒		☐
Tips for the Home Improvement Projects	☒		☐
Tips for Horse Care	☐		☐
Tips for Landscaping and Gardening	☒		☐
Tips for Pet Care	☒		☐
Tips for Projects Using Paint	☒		☐

Attachments

Attachment A

SUPPORTING CALCULATIONS

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.

0.65 0.7 0.75 0.8 0.85 0.9 0.95 1 1.05

SITE

LOS ANGELES COUNTY
ORANGE COUNTY
SAN BERNARDINO COUNTY
RIVERSIDE COUNTY
Riverside County
San Diego County

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

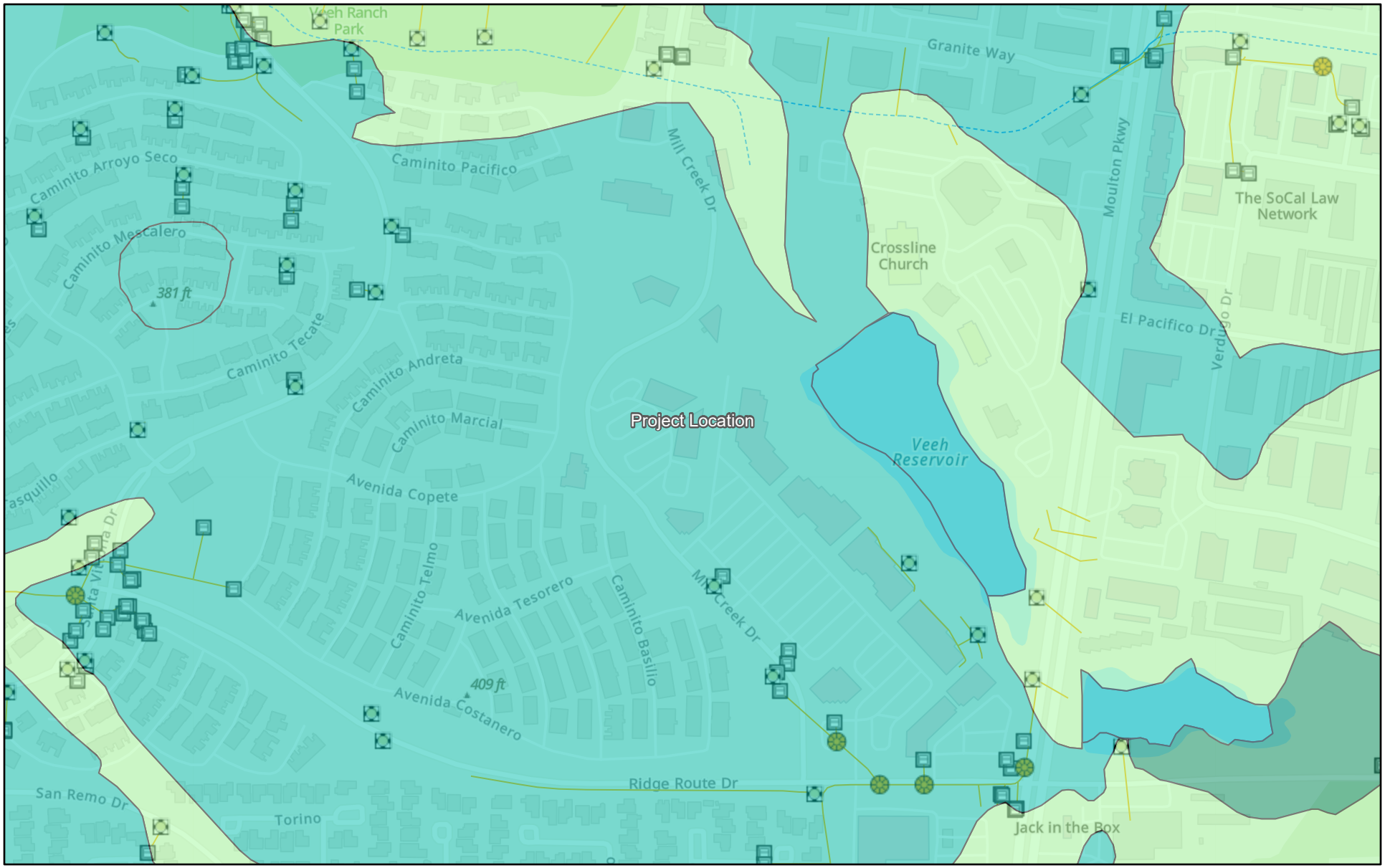
SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/22/10
JOB NO.	9526-E

PACE Advanced Water Engineering

FIGURE XVI-1

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-1_RainfallZones_20110215.mxd

Soil Type



3/10/2025

1:6,485

0 0.04 0.09 0.18 mi

0 0.05 0.1 0.2 km

Soil
- D
- A
- C

Inlets

Manholes

Outlets

Local Drainage
- Closed Conveyance

Regional Channels
- Open Conveyance
- Closed Conveyance

DMA SUMMARY TABLE

DMA	TOTAL AREA (SF)	TOTAL AREA (AC)	IMPERVIOUS AREA	PERVIOUS AREA	Aimp %	WEIGHTED RUNOFF FACTOR	DCV (CF)	QBMP REQUIRED (CFS)	TREATMENT METHOD
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DMA-4	13,723	0.32	10,406	3,317	76%	0.72	659	0.06	HSC-2
TOTALS	**695,728**	**15.97**	**508,137**	**187,591**					

QBMP = (C x I x A) I=0.26 IN/HR FOR Tc=5 MIN OR LESS

DCV=(C x D x A x 43560(1/12)) d=0.8 INCHES (24 HOUR 85TH PERCENTILE RAINFALL)

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		X	
4	Other: _____			
5	What is the design capture storm depth? (Figure III.1)	d	0.80	inches
6	What is the project size?	A	15.97	ac
7	What is the acreage of impervious area?	IA	4.31	ac
For projects with multiple types of demand (toilet flushing, irrigation demand, and/or other				
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 (Section X.2)?		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	
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)		11.19	ac
15	What is the proposed project irrigated area? (multiply conservation landscaping by 1; multiply active turf by 2)		4.31	ac
16	Is partial capture potentially feasible? (Line 15 > Line 14?)		No	

Provide supporting assumptions and citations for controlling demand calculation:

Minimum EIATA for Conservation-Type Landscaping per Table X.8 =	*0.96*	*ac/ac*
Project Impervious Area =	*11.66*	*ac*
Minimum Irrigated Area = Project Impervious Area x EIATA	*11.19*	*ac*

TABLE X.8: MINIMUM IRRIGATED AREA FOR POTENTIAL PARTIAL CAPTURE FEASIBILITY

General Landscape Type	Conservation Design: KL = 0.35			Active Turf Areas: KL = 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	0.9	0.41	0.42	0.45
0.80	0.88	0.9	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	1.1	1.12	1.2	0.55	0.56	0.6

Attachment B

O&M

Operation & Maintenance (O&M) Plan for WQMP XXXX

Project Name:

Terravita

Prepared for:

Kingsbarn Realty Capital

2500 Sand Hill Road, Suite 320

Menlo Park, CA 94025

650.782.3300

Prepared on:

March 10, 2025

Contents

Section 1 Project Description and BMP Overview

General Project Attributes and Stormwater Control Measures		
Site Location	*23282 Mill Creek Dr, Laguna Hills, CA 92653*	
Project Area (ft^2): 695,725	Number of Dwelling Units: 480	SIC Code: N/A
Narrative Project Description:	*The proposed residential development will consist of* 480 *dwelling units, approximately 700,000 SF of a combination of a multifamily residential building, multiple duplexes and triplexes, and associated amenity spaces such as parks and lounges. Some existing driveways will be removed, and new asphalt driveways will be added to existing access roads on Mill Creek Drive and Ridge Route Drive. New improvements in the area and its frontage include the addition of public storm drain, water, & sewer utilities. No off-site drainage is anticipated.*	
Project-specific Source Control BMPs	*N1: Education for Property Owners, Tenants and Occupants* *N2: Activity Restrictions* *N3: Common Area Landscape Management* *N4: BMP Maintenance* *N14: Common Area Catch Basin Inspection* *N15: Street Sweeping Private Streets and Parking Lots* *S1: Provide storm drain system stenciling and signage* *S4: Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control* *S5: Protect slopes and channels and provide energy dissipation*	

General Project Attributes and Stormwater Control Measures	
Summary of Drainage Patterns	*The project will maintain existing drainage patterns to the maximum extent practical. The onsite drainage is divided into flow originating from the multistory area and flow originating around the single-family residential area. It is composed of concentrated flow moving towards the south through the proposed storm drain pipeline system. Onsite storm water runoff from both areas is detained in a proprietary underground storage system with the purpose of reaching 100-year peak flow attenuation. This runoff is then conveyed to a proprietary treatment control BMP system that leads to a proposed 24-inch storm drain main joined to an existing 48-inch RCP storm drain main in Ridge Route Dr.* *Offsite drainage on Mill Creek Drive will continue to convey into the storm drain inlet. Offset drainage on Ridge Route Drive will continue to move along the northern side of the street into the type II storm drain catch basin. This flow will advance north via the existing 48-inch RCP storm drain main. The runoff at the asphalt parking lot on the western section and the residential's gate entrance area will be carried across the northeastern curb and gutter of Mill Creek Dr into the existing storm drain inlet. The existing slope along the northern property boundary is reduced compared to existing conditions due to the construction of duplexes on the northeastern side and is comprised of sheet flow.* *All flows ultimately draining north into the Veeh Reservoir.*
Summary of Hydrologic Source Controls	*N/A*
Structural Treatment and Hydromodification BMPs	*A proprietary biotreatment BMP (Filterra) is proposed.*

BMP ID	BMP Type	Narrative Description	Location	Other Considerations
BMP 1	*Proprietary Biotreatment (BIO-7)*	*A proprietary BMP biotreatment (Filterra) planter box is proposed. Receives flow from DMA 1.*	*North of Ridge Route Dr near southeastern project border.*	*N/A*

Section 2 Personnel, Documentation, and Reporting

2.1 Maintenance Roles and Responsibilities

The roles related to O&M of the BMPs are defined as follows:

- ***Facility Owner*** *– The Facility Owner is the party who is ultimately responsible for the functionality of all BMPs. The maintenance agreement (Attachment 2) identifies the facility owner for each BMP, including the timing of any ownership transitions.*
- ***Responsible Party*** *– The Responsible Party is the party that shall have direct responsibility for the O&M of the BMPs. This party shall be the designated contact with inspectors and lead maintenance personnel. The Responsible Party shall sign self-inspection reports and any correspondence regarding the verification of inspections and required maintenance. The Responsible Party will establish a system to delegate general inquiries to the appropriate maintenance personnel concerning the operation and maintenance of the BMPs. The Responsible Party reports directly to the Facility Owner and operates and manages the BMPs on the Facility Owner's behalf.*
- ***Designated Emergency Respondent*** *– The Designated Emergency Respondent is the party responsible for directing activities and communications during emergencies such as broken irrigation pipes, landslides, hazardous spill responses etc., that would require immediate response should they occur during off-hours. It is the responsibility of the Designated Emergency Respondent to communicate the emergent situation with the Responsible Party as soon as possible.*
- ***Key Maintenance Personnel*** *– Key Maintenance Personnel are the designated lead field manager(s) or supervisor(s) who directly oversee and delegate the maintenance activities, maintain the scheduling, and coordinate activities between all personnel. These tend to change more often than other personnel over time, so their names do not necessarily need to be included in the O&M Plan. However, they must be properly trained as recorded in the training logs (Section 2.2).*

The table below lists the roles for this project. This table must be updated whenever changes occur.

Role	Name (Title and Affiliation)	Phone Number	Address	Email Address
Facility Owner	*John Stack, Kingsbarn Realty Capital*	(650) 782-3300	2500 Sand Hill Road, Suite 320, Menlo Park, CA 94025	jstack@kingsbarn.com
Responsible Party	*John Stack, Kingsbarn Realty Capital*	(650) 782-3300	2500 Sand Hill Road, Suite 320,	jstack@kingsbarn.com

			Menlo Park, CA 94025	
Designated Emergency Respondent	*John Stack, Kingsbarn Realty Capital*	(650) 782-3300	2500 Sand Hill Road, Suite 320, Menlo Park, CA 94025	jstack@kingsbarn.com

2.2 Qualification and Training Requirements for Personnel

Many of the activities presented in this O&M plan can be completed by personnel with basic landscaping and yard maintenance skills and project-specific orientation. However, there are activities that require a more experienced skillset to identify and remediate potential issues that could compromise the functionality of each BMP. The Responsible Party shall exercise discretion in determining the skillset required to complete each task.

Activities that can typically be completed by maintenance personnel with basic training and/or qualifications include:

- General landscaping activities (pruning, weeding, and raking)
- Routine sediment, trash and debris removal;
- Filling in minor scour or erosion areas, or replacing rip rap that has become displaced; and
- Watering or irrigation, as necessary.

Activities that typically require maintenance personnel with specialized qualifications, training, and/or engineering oversight include:

- Inspection and/or repair of inflow and outflow structures;
- Inspection and/or repair of underground elements;
- Large-volume sediment or media removal requiring specialized equipment;
- Inspection, diagnosis, and remediation of significant erosion issues potentially compromising function and/or structural stability; and
- Spill response and remediation.

Maintenance personnel who have identified a potential major issue with any facility should contact the designated key maintenance personnel for the facility immediately.

Training must be provided for all personnel performing maintenance tasks on or providing maintenance oversight of structural BMPs. The table below provides the personnel and relevant training topics.

Training Logs contained in Attachment 3 should be used to document training of maintenance personnel.

Training Topic	Responsible Party	Designated Emergency Respondent	Key Maintenance Personnel
Proper Maintenance of all BMP components	X		X
Identification and clean-up procedures for spills and overflows	X	X	X
Safety concerns when maintaining devices and responding to emergency situations	X	X	X

2.3 Maintenance Agreements and Funding Mechanisms

Kingsbarn Realty Capital will operate the BMPs and provide funding for maintenance.

2.4 Record Keeping Requirements

Documentation of site conditions, maintenance activities performed, and any other remaining maintenance required is necessary during each inspection/maintenance visit. Inspection and maintenance records shall be retained in an accessible, secure location for the life of the facility, and not less than 10 years.

The following documentation mechanisms and procedures have been established for this O&M Plan:

- **Training Logs:** Personnel must document training activities as part of implementing this O&M Plan. Attachment 3 contains a sample training log.
- **Inspection and Routine Maintenance Logs:** Maintenance personnel are required to maintain logs of inspection and maintenance activities. Attachment 4 contain inspection and maintenance logs.
- **Rehabilitative and Corrective Maintenance Log and Reporting:** Rehabilitation and corrective maintenance activities should be documented at a degree of detail that is commensurate to the complexity/significance of the activity. Any significant changes to the BMP designs that arise from rehabilitation/corrective maintenance will be documented via an update to the Project WQMP and as-built drawings. Corrective maintenance that does

not result in design changes will be documented as a special entry in the maintenance logs to provide pertinent details of that rehabilitative or corrective maintenance activity.

No monitoring is required.

2.5 Required Permits Associated with Maintenance Activities

No permits are required.

2.6 Self-Reporting Requirements

No self-reporting is required.

2.7 City Inspections

The *City of Laguna Hills* may conduct a site inspection to evaluate compliance with the Project WQMP, at any time.

2.8 Electronic Data Submittal

This document, along with the attachments, shall be provided to the City or County in PDF format. AutoCAD files and/or GIS coordinates of BMPs shall also be submitted to the City/County.

Section 3 Inspection and Maintenance Activities

This section identifies the inspection and O&M activities for each BMP incorporated into the project. Section 3.1 and 3.2 contain common maintenance activities and frequencies associated with Source Control BMPs and HSCs, respectively. Section 3.3 contains individual tables for each structural LID or hydromodification BMP with an explanation of the various types of maintenance activities associated with these BMPs.

3.1 Inspection and Maintenance of Source Control BMPs

Source Control BMP	Activity	Frequency
Dry Weather Flow Source Control **Note: this is a South Orange County High Priority Water Quality Condition for All Projects**	Check for dry weather flows such as street washing, irrigation overspray, air conditioner condensate in areas of the project that do not drain to LID BMPs, the sanitary sewer, or landscaped pervious areas. Notify residents of any dry weather flows and follow up to correct.	Twice per year during dry season
	Inspect project outfall or most-downstream project manhole for presence of dry weather flow. If present, conduct reconnaissance to determine source and implement actions to eliminate source.	Twice per year during dry season
N1. Education for Property Owner's Tenants and Occupants	Distribute appropriate materials to owners, tenants, and/or occupants via contract language, mailings, website, or meetings.	Information provided to owners and tenants upon sale or lease. Reminders sent or posted as needed.
	Check www.ocwatersheds.com and/or City website for updated educational materials.	Annually
N2. Activity Restrictions	Within the CC&R's or lease agreement, restrict the following activities: *car washing outside of car wash areas.*	Information provided to owners and tenants upon sale or lease. Reminders sent or posted as needed.

Source Control BMP	Activity	Frequency
N3/S4. Common Area Landscape Management, Efficient Landscape Design, and Efficient Irrigation	Check that fertilizer and pesticide usage is in accordance wiN1th the Integrated Pest Management Program. Adjust, if needed.	Annually
	Check the irrigation system water budget to ensure efficiency targets are being met and the system is in good condition. Adjust/repair irrigation system and controllers, if needed.	Annually prior to irrigation system activation
	Check landscaping for presence of invasive species and remove, if needed.	Annually
N14. Common Area Catch Basin Inspection	Remove trash and debris from catch basins and grates. Check for damage, clogging, and standing water. Repair or mitigate clogging/standing water, as needed.	Four times per year during wet season, including inspection just before the wet season and within 24 hours after at least two storm events >0.5 inches
N15. Street Sweeping Private Streets and Parking Lots	Sweep curb and gutter areas using a vacuum street sweeper. Report any significant or illicit debris in curb/gutter to HOA or responsible party, as needed.	Weekly
S1. Provide Storm Drain System Stenciling and Signage	Check that all catch basins in paved areas marked or stenciled with "No dumping-Drains to Ocean; No Descargue Basura" language. Replace/repaint markings if faded, damaged, removed, or otherwise illegible.	Annually
S2. Design and Construct Outdoor Material Storage Areas	Check outdoor material storage structure to ensure structural stability is sound and that no contact of the stored materials with rainfall or runoff is occurring. Check secondary containment for leaks. Repair leaks or damage, as needed and mitigate, if coming into contact with stormwater.	Twice per year

Source Control BMP	Activity	Frequency
S3. Design and Construct Trash and Waste Storage Areas	Check that outdoor waste storage structure is consistently covered, that structural stability is sound, and that no run-on or contact of the trash with runoff is occurring. Repair leaks or damage and mitigate if trash coming into contact with stormwater, as needed.	Twice per year
	Check that trash is removed by local waste management contractor on at least a weekly basis for proper disposal.	Weekly
S5. Protect Slopes and Channels and Provide Energy Dissipation	Check slopes, channels, riprap and other conveyance or energy dissipation areas for signs of erosion or scour. Replace material, repair channels, replant vegetation, and/or redesign, as needed for signs of erosion/scour.	Four times per year during wet season, including inspection just before the wet season and within 24 hours after at least two storm events >0.5 inches

3.2 Inspection and Maintenance of Hydrologic Source Controls

No HSCs are proposed.

3.3 Inspection and Maintenance of Structural LID and Hydromodification BMPs

The section is organized by type of structural LID or hydromodification BMP with separate tables for each BMP type included in the project. The section identifies four categories of activities related to O&M of the BMPs:

General Inspections - Evaluations conducted at regularly scheduled intervals to indicate the need for maintenance of structural BMPs.

Routine Maintenance Activities – Activities conducted at regularly scheduled intervals to sustain long-term performance of each BMP, including inspections and normal upkeep.

Corrective (Major) Maintenance Activities – Includes activities conducted to replace or rehabilitate system components at the end of their usable life as well as activities conducted to resolve major issues that are not anticipated.

Emergency Response Activities – Activities related to emergencies, primarily concerning spills, which may require immediate action and notifications (Section 3.4).

BMP ID	BMP Type	Reference Maintenance Table
BMP 1	Proprietary Biotreatment	*BIO-7 (Page 8)*

BIO-5/7 Proprietary Biotreatment	
Activity	**Frequency**
GENERAL INSPECTIONS	
Remove trash and debris	Four times per year during wet season, including inspection just before the wet season and within 24 hours after at least two storm events ≥ 0.5 inches.
Identify excess erosion or scour	
Identify sediment accumulation that requires maintenance	
Inspect during storm event, when possible, to estimate treatment capacity and determine if premature bypass is occurring	
Evaluate plant health and need for corrective action	
Identify any needed corrective maintenance that will require site-specific planning or design	
OPERATION AND MAINTENANCE	
• O&M of proprietary BMPs must follow established manufacturer guidelines • O&M of accompanying retention BMPs should follow the guidelines established in the associated fact sheet for that BMP.	

3.4 Emergency Response Plan

In some cases, adverse conditions may occur which could be an imminent threat to human or environmental health or severe damage to infrastructure or property. For example, a spill of hazardous substances in the contributing area to a BMP could cause harmful substances to enter the BMP and be released downstream, affecting environmental and public health. Other emergencies could arise related to the stormwater features or water quality protection, such as landsliding, major erosion, or burst pipes in the tributary area.

In the event of an actual or suspected hazardous material release, the following plan shall take effect.

The primary importance of initial response to an actual or suspected spill will be public safety, control of the source of pollution, and containment of spills that have occurred, as applicable. The table below provides the emergency contact information for hazardous materials spills affecting BMPs.

Name	Phone	When to Report
Local Emergency Response (Fire Department)	911	Immediately
Orange County 24-Hour Water Pollution Problem Reporting Hotline	1-877-897-7455	Immediately
CalOES State Warning Center	1-800-852-7550	Immediately

The first number to call is emergency response (9-1-1), followed by the California Governor's Office of Emergency Services (CalOES), formerly the California Emergency Management Agency (CalEMA). (CalOES) maintains guidance and instructions of what to do in the event of a spill of hazardous substances (http://www.caloes.ca.gov/cal-oes-divisions/fire-rescue/hazardous-materials/spill-release-reporting). This plan is based on the guidance provided by CalOES (CalOES, 2014).

1. If an actual or suspected hazardous material incident exists, maintenance personnel will immediately call 911 and the CalOES State Warning Center (**Error! Reference source not found.**).
2. The Designated Emergency Respondent and Responsible Party assigned to the facility (from Section 2.1) must also be notified of any actual or potential spill.
3. Remediation of contamination in the water quality facility should be handled as a corrective maintenance issue per Section 3.2 of this O&M plan.

In the event that a potential spill is identified prior to it reaching the BMPs, the Designated Emergency Respondent will implement an isolation protocol to prevent the spill from entering the BMP. An inflatable plug, Hazmat Plug, or equivalent device as approved by the Designated Emergency Respondent will be installed within the storm drains or catch basins to block upstream flow from reaching and contaminating the BMP. The temporary plug will be an interim measure until the spill is properly maintained and remediated and the Designated Emergency Respondent has determined the risk to the BMP of contamination no longer exists.

Similar measures should be taken in the event of a landslide, mudslide, or major erosion within the tributary area of the BMP to prevent sediment from damaging the BMP to the extent possible.

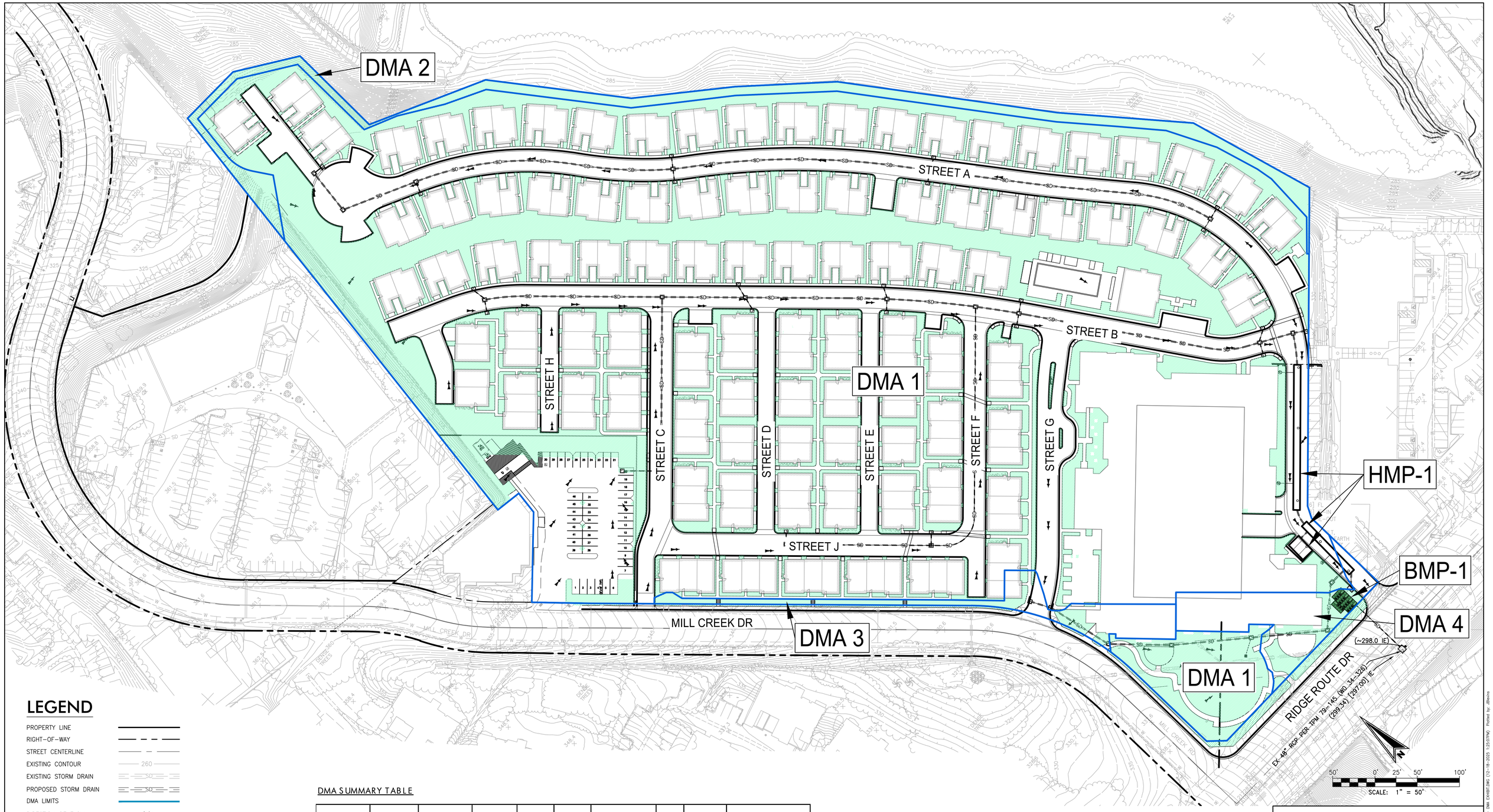
3.5 Vector Control

In addition to the inspection and maintenance activities listed in Section 3, all BMPs shall be inspected for standing water on a regular basis. Standing water which exists for longer than 72 hours may contribute to mosquito breeding areas. Standing water may indicate that the BMP is not functioning properly and proper action to remedy the situation shall be taken in a timely manner.

Elimination of standing water and managing garbage, lawn clippings, and pet droppings can help decrease the present of mosquitoes and flies in the area.

The Orange County Vector Control District may be contacted for more information and support at 714-971-2421 or 949-654-2421 or www.ocvcd.org.

Attachment 1:Photos and Exhibits



LEGEND

- PROPERTY LINE
- RIGHT–OF–WAY
- STREET CENTERLINE
- EXISTING CONTOUR — 260
- EXISTING STORM DRAIN — SD
- PROPOSED STORM DRAIN — SD
- DMA LIMITS
- DIRECTION OF FLOW
- DMA DESIGNATION — DMA 1
- PERVIOUS AREA
- PROPRIETARY BIOFILTRATION UNIT — BMP 1
- HYDROMODIFICATION CISTERN STORM DRAIN PIPE
- URBAN POND DETENTION VAULT — HMP 1

DMA SUMMARY TABLE

DMA	TOTAL AREA (SF)	TOTAL AREA (AC)	IMPERVIOUS AREA	PERVIOUS AREA	Aimp %	WEIGHTED RUNOFF FACTOR	DCV (CF)	QBMP REQUIRED (CFS)	TREATMENT METHOD
DMA-1	653,119	14.99	491,513	161,606	75%	0.71	30,914	2.77	DRAINS TO BMP-1
DMA-2	18,226	0.42	0	18,226	0%	0.15	182	0.02	HSC-2
DMA-3	10,660	0.24	6,218	4,442	58%	0.59	419	0.04	HSC-2
DMA-4	13,723	0.32	10,406	3,317	76%	0.72	659	0.06	HSC-2
TOTALS	695,728	15.97	508,137	187,591					

TERRAVITA

WQMP EXHIBIT

REVISIONS

NO.	INIT.	DATE	DESCRIPTION	APP'D	DATE

FUSCOE ENGINEERING
6390 Greenwich Dr, Suite 170
San Diego, Ca 92122
858.554.1500
fuscoe.com

JOB NO. 4014-001
DRAWN BY: JGB
SHEET 1 of 1

Attachment 2:Maintenance Agreement and Funding Mechanism Documentation

Kingsbarn Realty Capital will operate the BMPs and provide funding for maintenance.

Attachment 3:Training Log Form

TRAINING / EDUCATIONAL LOG

Date of Training/Educational Activity: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

Topic of Training/Educational Activity:

_____

_____

Name of Participant	Signature of Participant

For newsletter or mailer educational activities, please include the following information:

- Date of mailing:
- Number distributed:
- Method of distribution:
- Topics addressed:

If a newsletter article was distributed, please include a copy of it.

Attachment 4: Inspection and Maintenance Log Form

BMP OPERATION & MAINTENANCE LOG

TERRAVITA

Today's Date: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

BMP Name or Type (As Shown in O&M Plan)	Brief Description of Operation, Maintenance, or Inspection Activity Performed	Summary of Notable Observations or Outcomes from Activity

Attachment 5: Inspection and O&M Checklist (Optional)

Weekly Activities	**Check Box**
Selected source control/housekeeping activities (See Section 3.1)	
Monthly Activities	
Selected source control/housekeeping activities (See Section 3.1)	
Quarterly Activities (before wet season, after wet season, plus twice after rain > 0.5 inches)	
Inspections of selected source control BMPs (See Section 3.1)	
Inspections and as-needed minor maintenance of all structural treatment and hydromodification BMPs (See Section 3.3)	
Twice Yearly Activities (during dry weather)	
Dry weather flow inspections (non-structural source control) (See Section 3.1)	
Inspection and as-needed maintenance of other selected source control BMPs(See Section 3.1)	
Annual Activities	
Self-certification (See Section 2.6)	
Various source control BMP and housekeeping activities (See Section 3.1)	
Inspection and maintenance of HSCs (See Section 3.2)	
Various planned maintenance activities of treatment and hydromodification BMPs, such as vegetation maintenance, minor sediment maintenance, etc. (See Section 3.3)	

Attachment 6: Vendor O&M Information

CONTECH®
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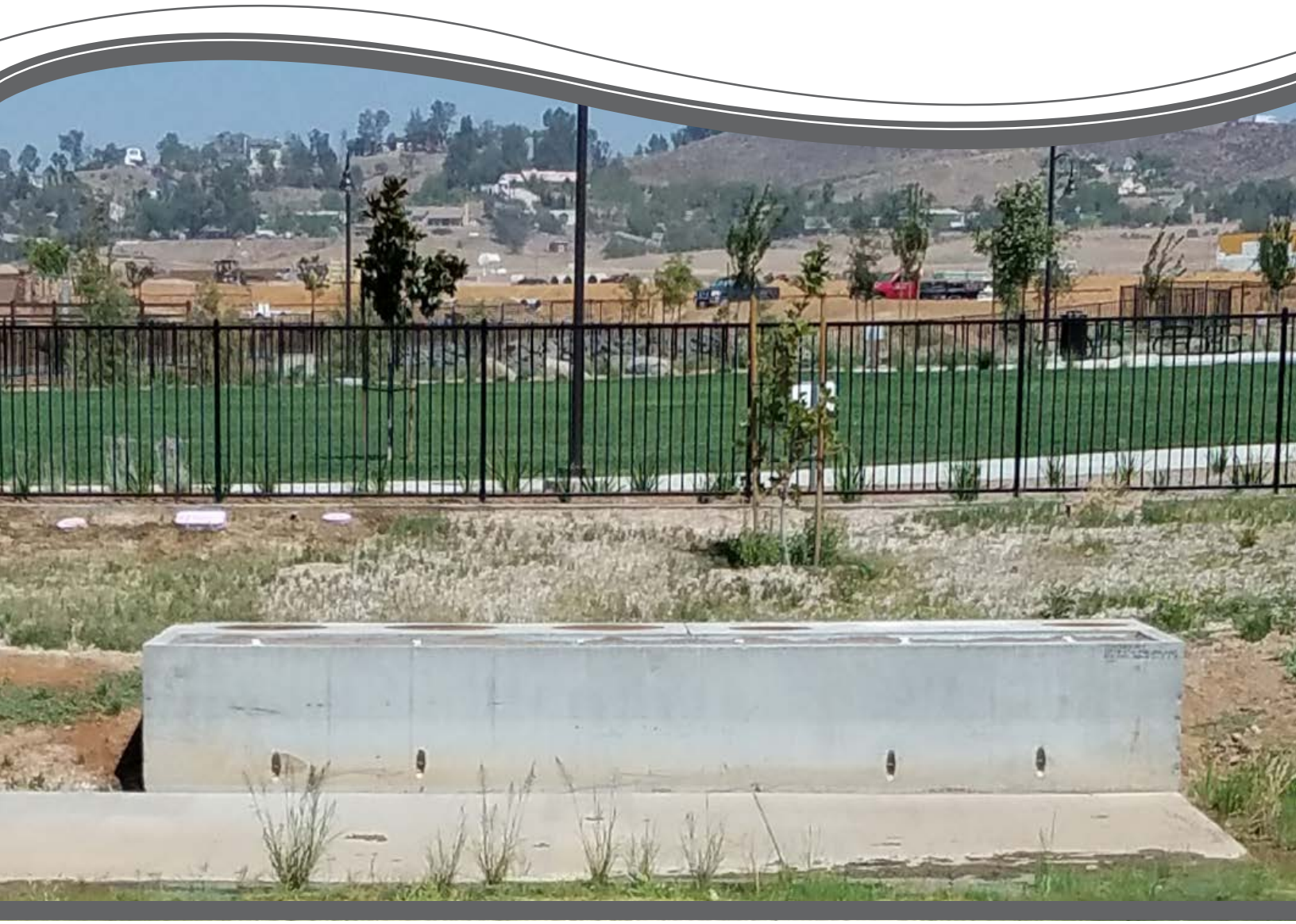
Modular Wetlands® Linear Operations & Maintenance Manual



MODULAR WETLANDS®

MODULAR WETLANDS LINEAR
OPERATION & MAINTENANCE MANUAL

TABLE OF CONTENTS

OVERVIEW

This operation and maintenance (O&M) manual is for the Modular Wetlands Linear Biofilter (MWL). Please read the instructions and equipment lists closely prior to starting. It is important to follow all necessary safety procedures associated with state and local regulations. Please contact Contech for more information on pre-authorized third-party service providers who can provide inspection and maintenance services in your area. For a list of service providers in your area, please visit www.conteches.com/maintenance.

WARNING

Confined space entry may be required. Contractor to obtain all equipment and training to meet applicable local and OSHA regulations regarding confined space entry. It is the Contractor's or entry personnel's responsibility to always proceed safely.

SAFETY NOTICE & PERSONAL SAFETY EQUIPMENT

Job site safety is a topic and a practice addressed comprehensively by others. The inclusions here are merely reminders to whole areas of Safety Practice that are the responsibility of the Owner(s), Manager(s), and Service Provider(s). OSHA and Canadian OSH, Federal, State/Provincial, and Local Jurisdiction Safety Standards apply on any given site or project. The knowledge and applicability of those responsibilities is the Service Provider's responsibility and outside the scope of Contech Engineered Solutions.

Safety Boots

Gloves

Hard Hat

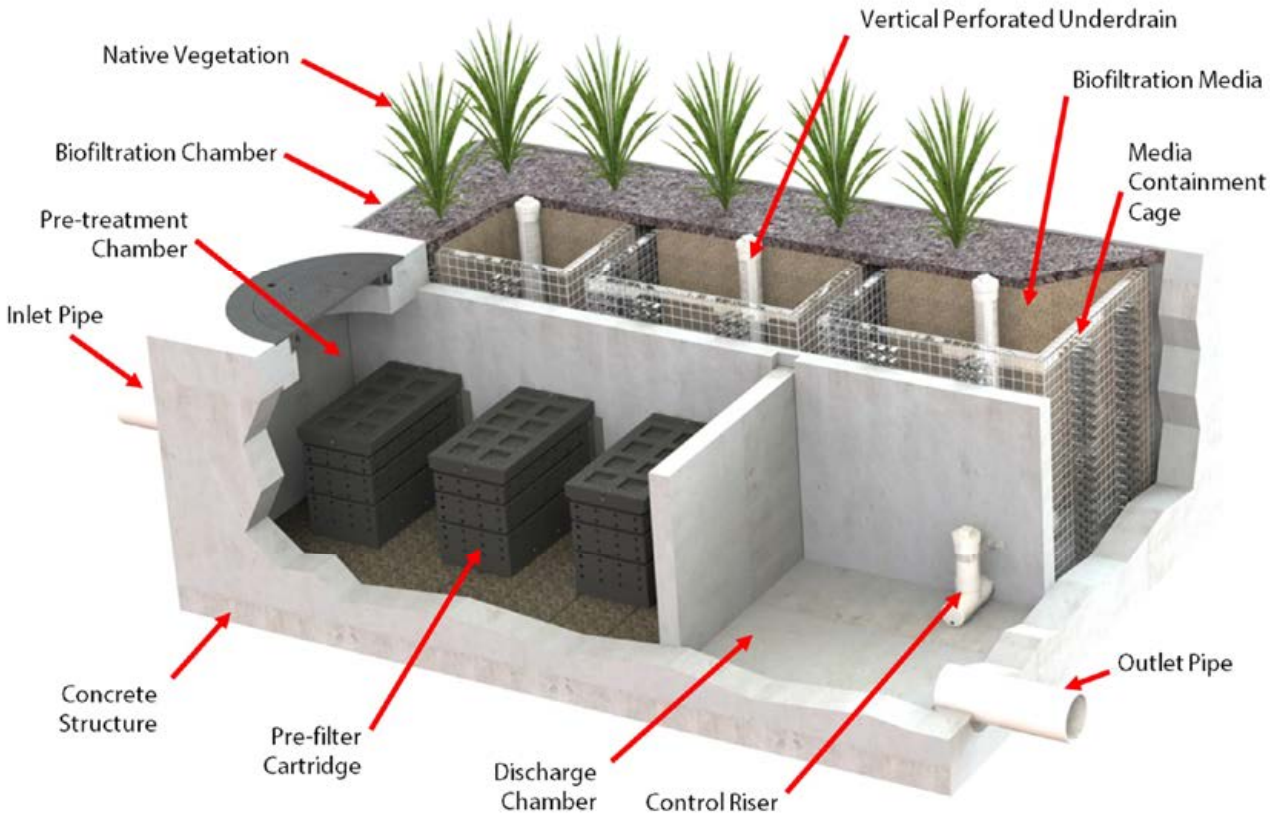
Eye Protection

Maintenance and Protection of Traffic Plan

MODULAR WETLANDS LINEAR COMPONENTS LIST

The MWL system comes in multiple sizes and configurations, including side by side or end to end layouts, both as open planters or underground systems. See shop drawings (plans) for project specific details.

The standard MWL system is comprised of the following components:



INSPECTION SUMMARY & EQUIPMENT LIST

Stormwater regulations require BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess the site-specific loading conditions. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided.

- Inspect pre-treatment, biofiltration, and discharge chambers an average of once every six to twelve months. Varies based on site specific and local conditions.
- Average inspection time is approximately 15 minutes. Always ensure appropriate safety protocol and procedures are followed.

The following is a list of equipment required to allow for simple and effective inspection of the MWL:

Modular Wetlands Linear Inspection Form

Flashlight

Tape Measure

Access Cover Hook

Ratchet
& 7/16" Socket
(if required for older pre-filter cartridges that have two bolts holding the lids on)

INSPECTION & MAINTENANCE NOTES

1. Following maintenance and/or inspection, it is recommended that 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 not require irrigation after initial establishment.

INSPECTION PROCESS

1. Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other information (see inspection form).
2. Observe the inside of the system through the access covers. If minimal light is available and vision into the unit is impaired, utilize a flashlight to see inside the system and all chambers.
3. Look for any out of the ordinary obstructions in the inflow pipe, pre-treatment chamber, biofiltration chamber, discharge chamber or outflow pipe. Write down any observations on the inspection form.
4. Through observation and/or digital photographs, estimate the amount of trash, debris accumulated in the pre-treatment chamber. Utilizing a tape measure or measuring stick, estimate the amount of sediment in this chamber. Record this depth on the inspection form.
5. Through visual observation, inspect the condition of the pre-filter cartridges. Look for excessive build-up of sediment on the cartridges, any build-up on the tops of the cartridges, or clogging of the holes. Record this information on the inspection form. The pre-filter cartridges can be further inspected by removing the cartridge tops and assessing the color of the BioMediaGREEN filter cubes (requires entry into pre-treatment chamber - see notes previous notes regarding confined space entry). Record the color of the material. New material is a light green color. As the media becomes clogged, it will turn darker in color, eventually becoming dark brown or black. The closer to black the media is the higher percentage that the media is exhausted and in need of replacement.

6. The biofiltration chamber is generally maintenance-free due to the system's advanced pre-treatment chamber. For units which have open planters with vegetation, it is recommended that the vegetation be inspected. Look for any plants that are dead or showing signs of disease or other negative stressors. Record the general health of the plants on the inspection form and indicate through visual observation or digital photographs if trimming of the vegetation is required.

7. The discharge chamber houses the control riser (if applicable), drain down filter (only in California - older models), and is connected to the outflow pipe. It is important to check to ensure the orifice is in proper operating condition and free of any obstructions. It is also important to assess the condition of the drain down filter media which utilizes a block form of the BioMediaGREEN. Assess in the same manner as the cubes in the pre-filter cartridge as mentioned above.

8. Finalize the inspection report for analysis by the maintenance manager to determine if maintenance is required.

MAINTENANCE INDICATORS

Based upon the observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components or cartridges.
- Obstructions in the system or its inlet and/or outlet pipes.
- Excessive accumulation of floatables in the pre-treatment chamber in which the length and width of the chamber is fully impacted more than 18".
- Excessive accumulation of sediment in the pre-treatment chamber of more than 6" in depth.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the pretreatment cartridges. When media is more than 85% clogged, replacement is required. The darker the BioMediaGREEN, the more clogged it is and in need of replacement.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the drain down filter (California only - older models).
- Overgrown vegetation.

MAINTENANCE SUMMARY & EQUIPMENT LIST

The time has come to maintain your MWL. All necessary pre-maintenance steps must be carried out before maintenance occurs. Once traffic control has been set up per local and state regulations and access covers have been safely opened, the maintenance process can begin. It should be noted that some maintenance activities require confined space entry. All confined space requirements must be strictly followed before entry into the system. In addition, the following is recommended:

- Prepare the maintenance form by writing in the necessary information including project name, location, date & time, unit number and other info (see maintenance form).
- Set up all appropriate safety and maintenance equipment.
- Ensure traffic control is set up and properly positioned.
- Prepared pre-checks (OSHA, safety, confined space entry) are performed.
    - A gas meter should be used to detect the presence of any hazardous gases prior to entering the system. If hazardous gases are present, do not enter the vault. Following appropriate confined space procedures, take steps such as utilizing a venting system to address the hazard. Once it is determined to be safe, enter the system utilizing appropriate entry equipment such as a ladder and tripod with harness.

The following is a list of equipment required for maintenance of the MWL:

Modular Wetlands Linear Maintenance Form

Flashlight

Access Cover Hook

Ratchet
& 7/16" Socket
(if required for older pre-filter cartridges that have two bolts holding the lids on)

Vacuum Assisted Truck with Pressure Washer

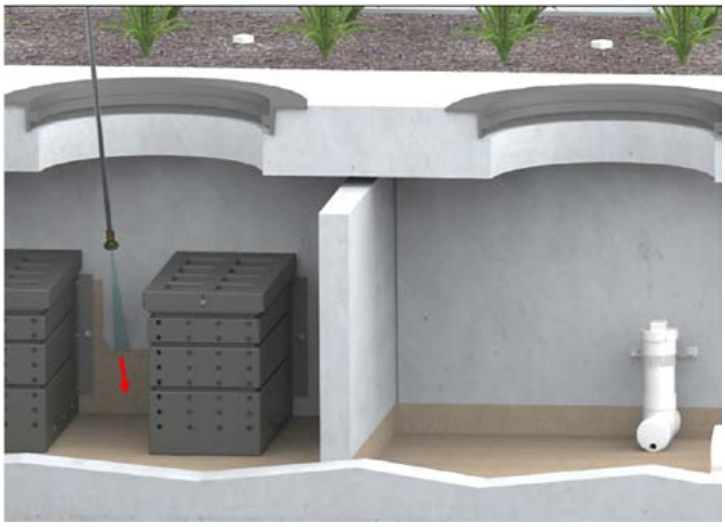
Replacement
BioMediaGREEN
(If Required)

(order BioMediaGREEN from Contech's Maintenance Team members at https://www.conteches.com/maintenance)

MAINTENANCE INSTRUCTIONS

1. ACCESS COVER REMOVAL

Upon determining that the vault is safe for entry, remove all access cover(s) and position the vacuum truck accordingly.



2. PRESSURE WASH SYSTEM CHAMBERS

With the pressure washer, spray down pollutants accumulated on the walls and floors of the pre-treatment and discharge chambers. Then wash any accumulated sediment from the pre-filter cartridge(s).

3. VACUUM SYSTEM CHAMBERS

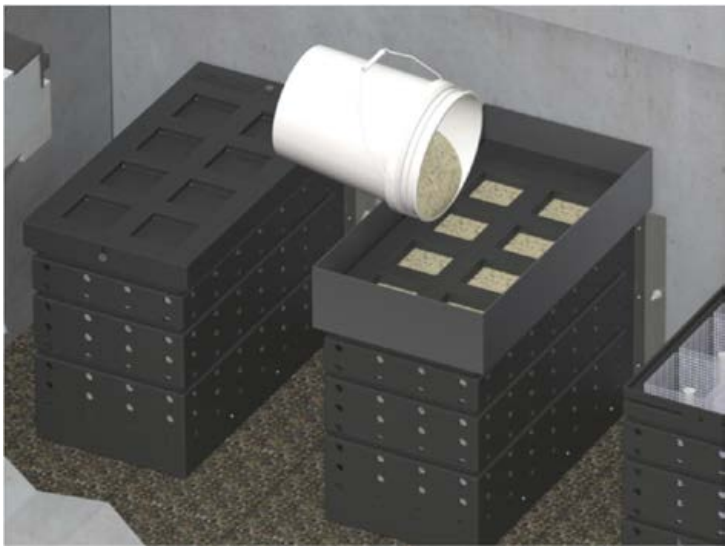
Vacuum out pre-treatment and discharge chambers and remove all accumulated pollutants including trash, debris, and sediments. Be sure to vacuum the pre-treatment floor until the pervious pavers are visible and clean. **(MWL systems outside of California may or may not have pervious pavers on the floor in the pre-treatment chamber)** If pre-filter cartridges require media replacement, proceed to **Step 4**. If not, replace the access cover(s) and proceed to **Step 7**.

4. PRE-FILTER CARTRIDGE LID REMOVAL

After successfully cleaning out the pre-treatment chamber, enter the chamber and remove the lid(s) from the pre-filter cartridge(s) by removing the two thumb screws. (Older pre-filter cartridges have two bolts holding the lids on that require a 7/16" socket to remove)

5. VACUUM EXISTING PRE-FILTER MEDIA

Utilize the vacuum truck hose or hose extension to remove the filter media from each of the individual media cages. Once filter media has been sucked out, use a pressure washer to spray down the inside of the cartridge and its media cages. Remove cleaned media cages and place to the side. Once removed, the vacuum hose can be inserted into the cartridge to vacuum out any remaining material near the bottom of the cartridge.



6. PRE-FILTER MEDIA REPLACEMENT

Reinstall media cages and fill with new media from the manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase. The easiest way to fill the media cages is to utilize a refilling tray that can also be sourced from the manufacturer. Place the refilling tray on top of the cartridge and fill with new bulk media shaking it down into the cages. Using your hands, lightly compact the media into each filter cage. Once the cages are full (each cartridge will hold five heaping 5gal buckets of bulk media), remove the refilling tray and replace the cartridge top, ensuring fasteners are properly tightened.

7. MAINTAINING VEGETATION

In general, the biofiltration chamber is maintenance-free with the exception of maintaining the vegetation. The MWL utilizes vegetation similar to surrounding landscape areas, therefore, trim vegetation to match surrounding vegetation. If any plants have died, replace them with new ones.

8. INSPECT UNDERDRAIN SYSTEM

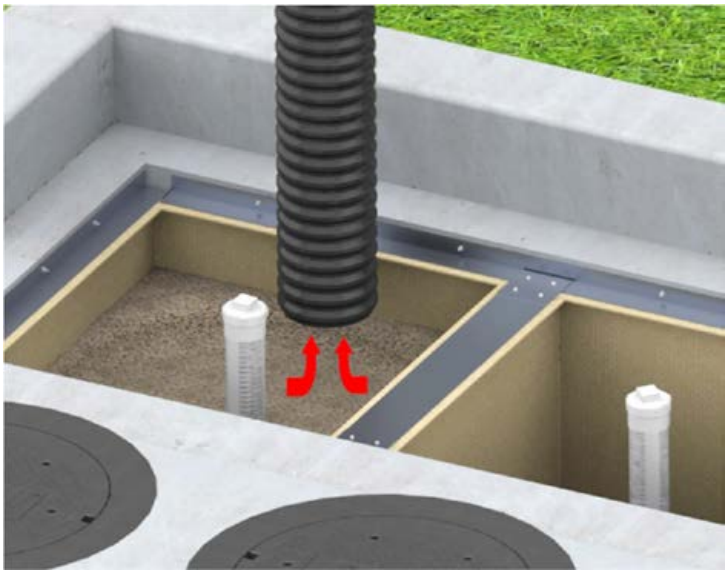
Each vertical under drain on the biofiltration chamber has a removable threaded cap that can be taken off to check for any blockages or root growth. Once removed, a jetting attachment to the pressure washer can be used to clean out the under drain and orifice riser if needed.

9. REPLACE ACCESS COVERS

Once maintenance is complete, replace all access cover(s)

REPLACING BIOFILTRATION MEDIA IF REQUIRED

As with all biofilter systems, at some point the biofiltration media will need to be replaced, either due to physical clogging or sorptive exhaustion (for dissolved pollutants) of the media ion exchange capacity (to remove dissolved metals and phosphorous). The general life of this media is 10 to 20 years based on site specific conditions and pollutant loading, so replacing the biofiltration media should not be a common occurrence. In the event that the biofiltration media requires replacement, contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new biofiltration media. The quantity of media needed can be determined by providing the model number and unit depth. Media will be provided in super sacks for easy installation. Each sack will weigh between 1,000 and 2,000 lbs. Biofiltration media replacement can be done following the steps below:



1. VACUUM EXISTING BIOFILTRATION MEDIA

Remove the mulch and vegetation to access the biofiltration media, and then position the vacuum truck accordingly. Utilize the vacuum truck to vacuum out all the media. Once all media is removed, use the pressure washer to spray down all the netting and underdrain systems on the inside of the media containment cage. Vacuum out any remaining debris after spraying down netting. Inspect the netting for any damage or holes. If the netting is damaged, it can be repaired or replaced with guidance by the manufacturer.

2. INSTALLING NEW BIOFILTRATION MEDIA

Ensure that the chamber is fully cleaned prior to installation of new media into the media containment cage(s). Media will be provided in super sacks for easy installation. A lifting apparatus (forklift, backhoe, boom truck, or other) is recommended to position the super sack over the biofiltration chamber. Add media in lifts to ensure that the riser pipes remain vertical. Be sure to only fill the media cage(s) up to the same level as the old media.

3. REPLANT VEGETATION

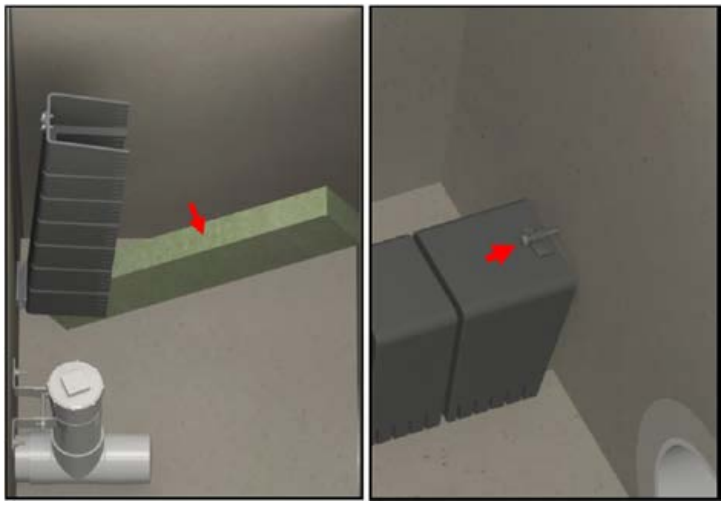
Once the media has been replaced, replant the vegetation and cover biofiltration chamber with approved mulch (if applicable). If the existing vegetation is not being reused, and new vegetation is being planted, you will need to acquire new plant establishment media that will be installed just below the mulch layer at each plant location. (see plan drawings for details). Contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new plant establishment media.

REPLACING DRAIN DOWN FILTER MEDIA (ONLY ON OLDER CALIFORNIA MODELS)

NOTE: The drain down filter is only found on units installed in California prior to 2023
If during inspection it was determined that the drain down filter media requires replacement, contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new media.

1. REMOVE EXISTING DRAIN DOWN MEDIA

Pull knob back to unlock the locking mechanism and lift the drain down filter housing to remove the used BioMediaGREEN filter block.



2. INSTALL NEW DRAIN DOWN MEDIA

Ensure that the chamber and housing are fully cleaned prior to installation of new media, and then insert the new BioMediaGREEN filter block. The media filter block should fit snugly between the chamber walls and be centered under the filter housing. Lower the housing over the filter block and secure the locking mechanism.

NOTES

CONTECH® ENGINEERED SOLUTIONS

Inspection Report
Modular Wetlands Linear

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

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 _____

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: _____

CONTECH®
ENGINEERED SOLUTIONS

Cleaning and Maintenance Report
Modular Wetlands Linear

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

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 _____

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:

CONTECH®
ENGINEERED SOLUTIONS

800-338-1122

WWW.CONTECHES.COM

CONTECH ENGINEERED SOLUTIONS LLC PROVIDES SITE SOLUTIONS FOR THE CIVIL ENGINEERING INDUSTRY. CONTECH'S PORTFOLIO INCLUDES BRIDGES, DRAINAGE, SANITARY SEWER, STORMWATER AND EARTH STABILIZATION PRODUCTS. FOR INFORMATION ON OTHER CONTECH DIVISION OFFERINGS, VISIT CONTECHES.COM OR CALL 800-338-1122.

SUPPORT

DRAWINGS AND SPECIFICATIONS ARE AVAILABLE AT WWW.CONTECHES.COM

ModWetLinear OM Manual 03/24

Attachment C

EDUCATIONAL MATERIALS

The Ocean Begins at Your Front Door

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

Did You Know?

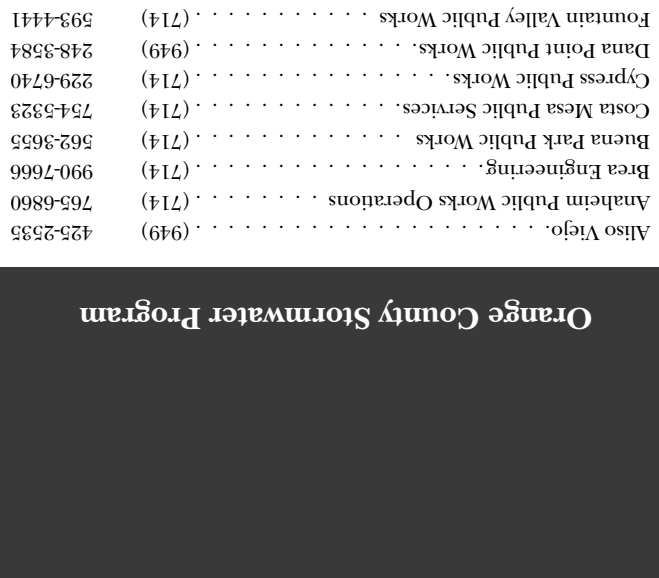
- Most people believe that the largest source of water pollution in urban areas comes from specific sources such as factories and sewage treatment plants. In fact, the largest source of water pollution comes from city streets, neighborhoods, construction sites and parking lots. This type of pollution is sometimes called "non-point source" pollution.
- There are two types of non-point source pollution: stormwater and urban runoff pollution.
- 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?

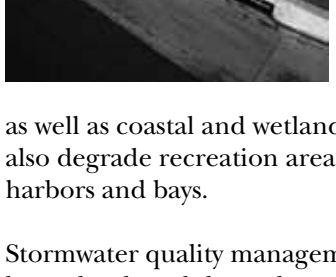
- Anything we use outside homes, vehicles and businesses – like motor oil, paint, pesticides, fertilizers and cleaners – can be blown or washed into storm drains.
- A little water from a garden hose or rain can also send materials into storm drains.
- Storm drains are separate from our sanitary sewer 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.

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

For More Information

Orange County Stormwater Program

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

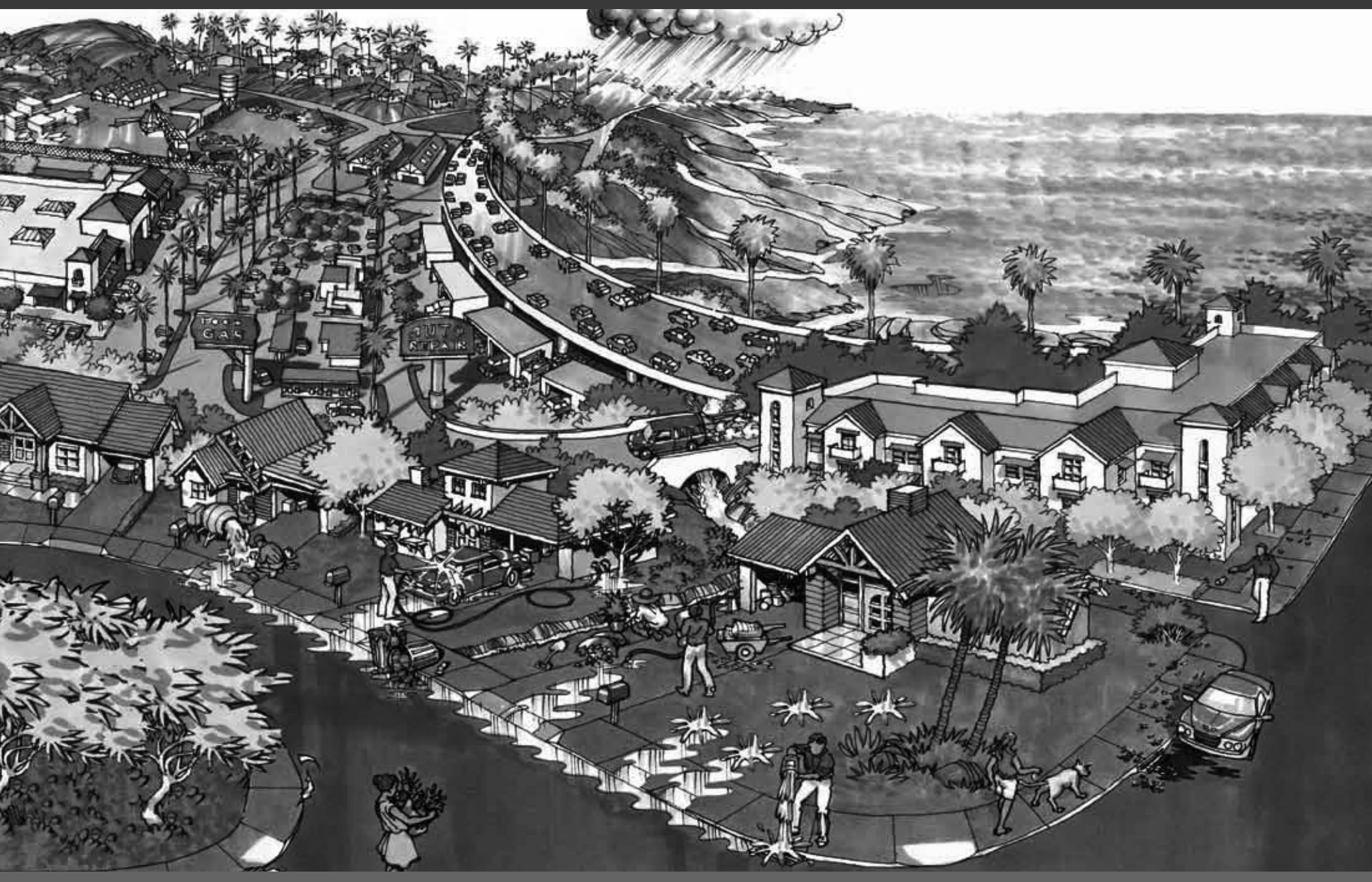
Aliso Viejo	(949)	425-2535
Anaheim Public Works Operations	(714)	765-6860
Brea Engineering	(714)	990-7666
Buena Park Public Works	(714)	562-3655
Costa Mesa Public Services	(714)	754-5323
Cypress Public Works	(714)	229-6740
Dana Point Public Works	(949)	248-3584
Fountain Valley Public Works	(714)	593-4441
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)

On-line Water Pollution Problem Reporting Form
www.ocwatersheds.com

Printed on Recycled Paper

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.oclandfills.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.oclandfills.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

Home Maintenance
- Detergents, cleaners and solvents
- Oil and latex paint
- Swimming pool chemicals
- Outdoor trash and litter

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 Pollution Solution

Several residential activities can result in water pollution. Among these activities are car washing and hosing off driveways and sidewalks. Both activities can waste water and result in excess runoff. Water conservation methods described in this pamphlet can prevent considerable amounts of runoff and conserve water. By taking your car to a commercial car wash and by sweeping driveways and sidewalks, you can further prevent the transport of pollutants to Orange County waterways. Here are some of the common pollutants for which you can be part of the solution:

1 Pesticides and Fertilizer

- **Pollution:** The same pesticides that are designed to be toxic to pests can have an equally lethal impact on our marine life. The same fertilizer that promotes plant growth in lawns and gardens can also create nuisance algae blooms, which remove oxygen from the water and clog waterways when it decomposes.
- **Solution:** Never use pesticides or fertilizer within 48 hours of an anticipated rainstorm. Use only as much as is directed on the label and keep it off driveways and sidewalks.

2 Dirt and Sediment

- **Pollution:** Dirt or sediment can impede the flow of the stormwater and negatively impact stream habitat as it travels through waterways and deposits downstream. Pollutants can attach to sediment, which can then be transported through our waterways.
- **Solution:** Protect dirt stockpiles by covering them with tarps or secure plastic sheets to prevent wind or rain from allowing dirt or sediment to enter the storm drain system.

3 Metals

- **Pollution:** Metals and other toxins present in car wash water can harm important plankton, which forms the base of the aquatic food chain.
- **Solution:** Take your car to a commercial car wash where the wash water is captured and treated at a local wastewater treatment plant.

DID YOU KNOW?

Did you know that most of the pollution found in our waterways is not from a single source, but from a "non-point" source meaning the accumulation of pollution from residents and businesses throughout the community

4 Pet Waste

- **Pollution:** Pet waste carries bacteria through our watersheds and eventually will be washed out to the ocean. This can pose a health risk to swimmers and surfers.
- **Solution:** Pick up after your pets!

5 Trash and Debris

- **Pollution:** Trash and debris can enter waterways by wind, littering and careless maintenance of trash receptacles. Street sweeping collects some of this trash; however, much of what isn't captured ends up in our storm drain system where it flows untreated out to the ocean.
- **Solution:** Don't litter and make sure trash containers are properly covered. It is far more expensive to clean up the litter and trash that ends up in our waterways than it is to prevent it in the first place. Come out to one of Orange County's many locations for Coastal and Inner-Coastal Cleanup Day, which is held in September.

6 Motor Oil / Vehicle Fluids

- **Pollution:** Oil and petroleum products from our vehicles are toxic to people, wildlife and plants.

- **Solution:** Fix any leaks from your vehicle and keep the maintenance up on your car. Use absorbent material such as cat litter on oil spills, then sweep it up and dispose of it in the trash. Recycle used motor oil at a local Household Hazardous Waste Collection Center.

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.

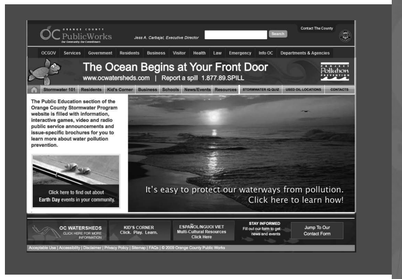
Low Impact Development (LID) and sustainable water use prevents water pollution and conserves water for drinking and reuse. Reducing your water use and the amount of water flowing from your home protects the environment and saves you money.

Thank you for making water protection a priority!

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

www.mwdoc.com

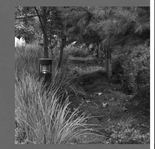
www.uccemg.com



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

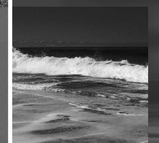
The Metropolitan Water District of Southern California for the use of the California-Friendly Plant and Native Habitat photos



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.

New water quality regulations require implementation of LID in larger new developments and encourage implementation of LID and other sustainable practices in existing residential areas. Implementing modifications to your lawn or garden can reduce pollution in our environment, conserve water and reduce your water bill.

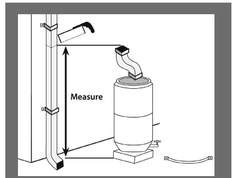
Permeable pavement allows water runoff to infiltrate through the soil and prevents most pollutants from reaching the storm drain system.

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.

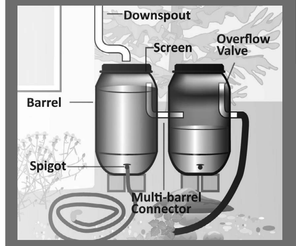
Downspout Disconnection/Redirection

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.

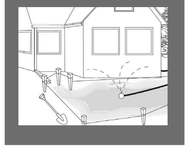


Rain Barrels

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.



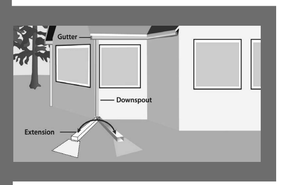
Mosquito growth prevention is very important when installing a rain barrel. The best way to prevent mosquito breeding is to eliminate entry points by ensuring all openings are sealed tightly. If these methods are unsuccessful, products are available to kill mosquito larvae, but that are harmless to animals and humans. Regular application of these products is essential. Please visit the Orange County Vector Control website for more information at www.ocvcd.org/mosquitoes3.php.



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 roof runoff. By utilizing a native plant palate, rain gardens can be maintained all year with minimal additional irrigation. These plants are adapted to the semi-arid 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 departments to ensure your garden plan follows pertinent building codes and ordinances. Besides codes and ordinances, some home owner associations also have guidelines for yard modifications. If your property is in hill areas or includes engineered 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 2009 at www.larainwaterharvesting.org/

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/Gardensoft.

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 booms 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

Water runoff from sprinklers left on too long will carry pollutants into our waterways.

Smart Irrigation Controllers

Smart Irrigation Controllers have internal clocks as well as sensors that will turn off the sprinklers in response to environmental changes. If it is raining, too windy or too cold, the smart irrigation control sprinklers will automatically shut off.

Check with your local water agency for available rebates on irrigation controllers and smart timers.

- Aim your sprinklers at your lawn, not the sidewalk – By simply adjusting the direction of your sprinklers you can save water, prevent water pollution from runoff, keep your lawn healthy and save money.
- **Set a timer for your sprinklers** – lawns absorb the water they need to stay healthy within a few minutes of turning on the sprinklers. Time your sprinklers; when water begins running off your lawn, you can turn them off. Your timer can be set to water your lawn for this duration every time.
- **Water at Sunrise** – Watering early in the morning will reduce water loss due to evaporation. Additionally, winds tend to die down in the early morning so the water will get to the lawn as intended.
- **Water by hand** – Instead of using sprinklers, consider watering your yard by hand. Hand-watering ensures that all plants get the proper amount of water and you will prevent any water runoff, which wastes water and carries pollutants into our waterways.
- **Fix leaks** - Nationwide, households waste one trillion gallons of water a year to leaks – that is enough water to serve the entire state of Texas for a year. If your garden hose is leaking, replace the nylon or rubber hose washer and ensure a tight connection. Fix broken sprinklers immediately.

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

Printed on Recycled Paper

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.

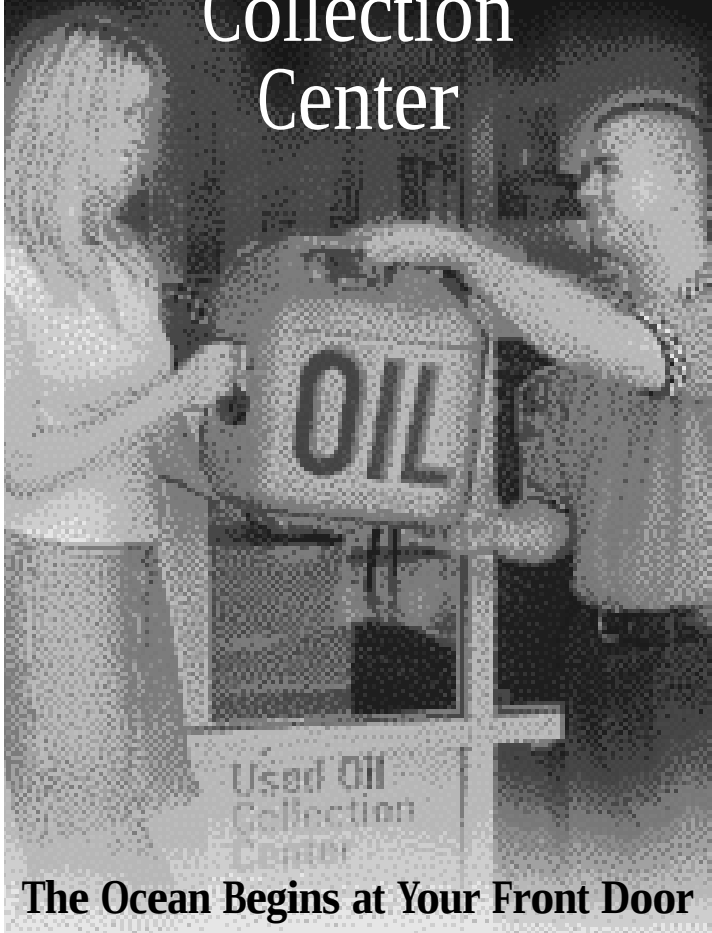
For information about the proper disposal of household hazardous waste, call the Household Waste Hotline at (714) 834-6752 or visit www.oclandfills.com.

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.

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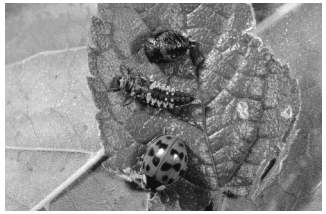
Help Prevent Ocean Pollution:

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 (951) 782-4130
San Diego Region (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.

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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 the 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

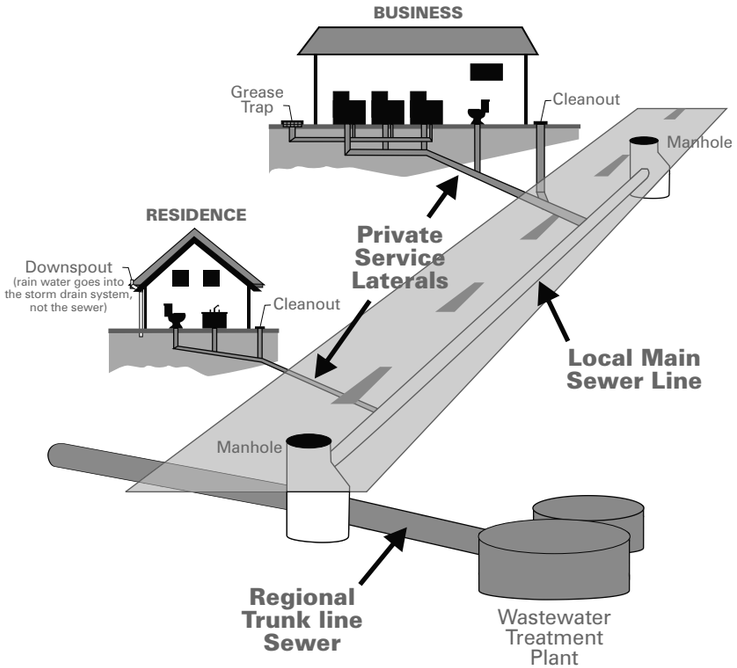
Keep people and pets away from the affected area. Untreated sewage has high levels of disease-causing viruses and bacteria. Call your local health care agency listed on the back for more information.

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.**

Sewage spills can cause damage to the environment. Help prevent them!

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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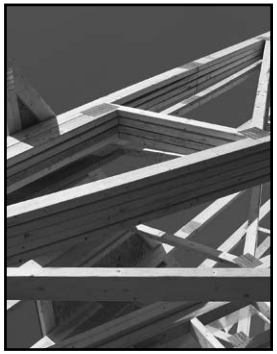
Help Prevent Ocean Pollution:

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



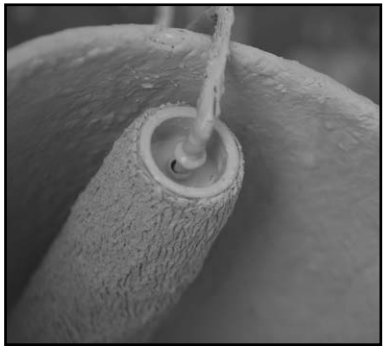
- Schedule projects for dry weather.
- Keep all construction debris away from the street, gutter and storm drain.
- Store materials under cover with temporary roofs or plastic sheets to eliminate or reduce the possibility that rainfall, runoff or wind will carry materials from the project site to the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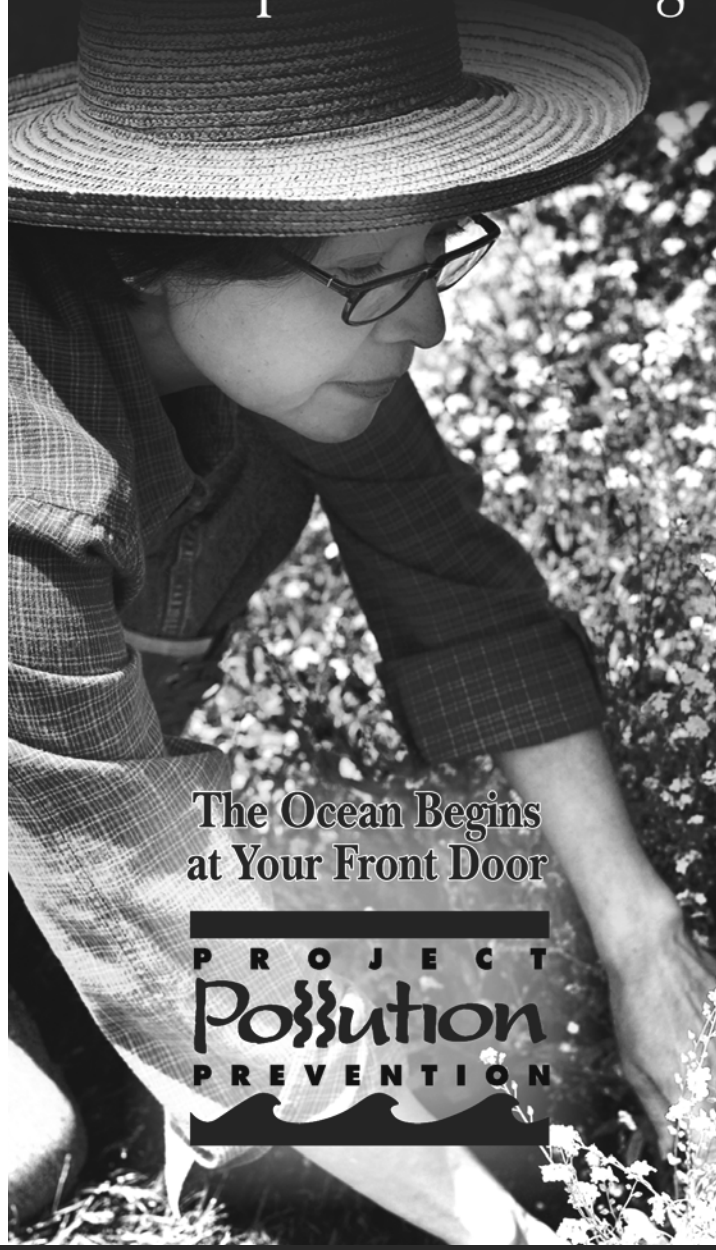
Help Prevent Ocean Pollution:

Tips for Landscape & Gardening



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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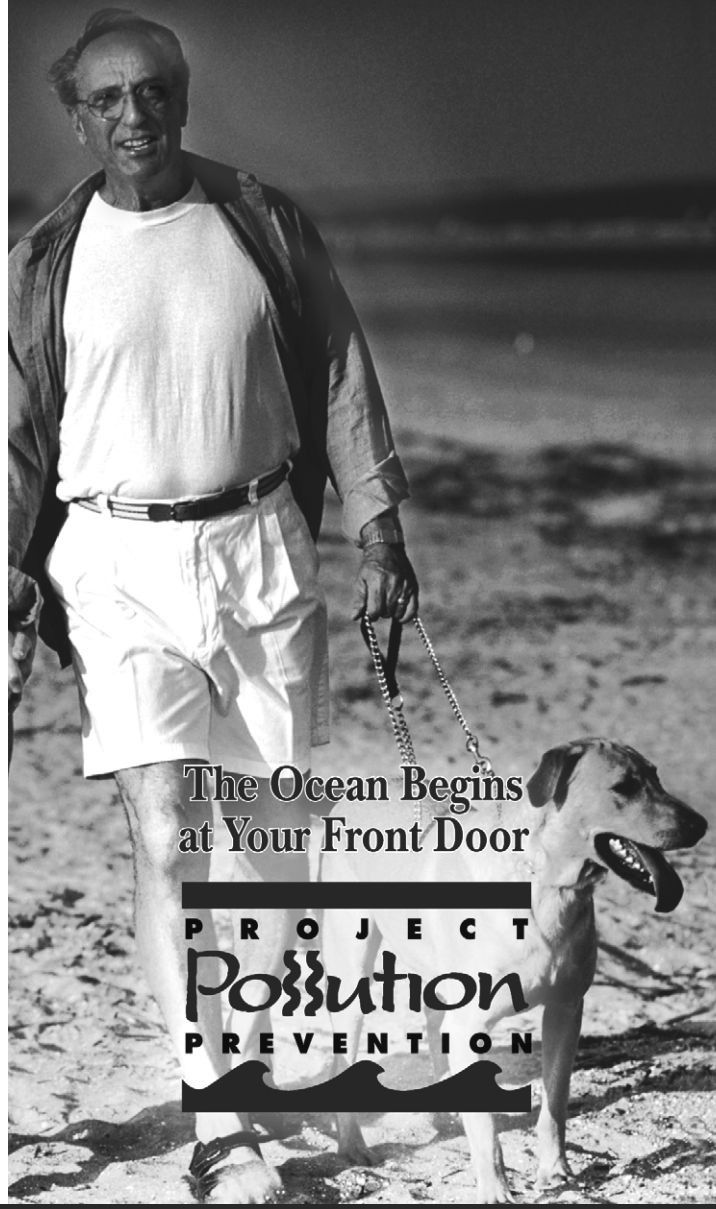
Help Prevent Ocean Pollution:

Tips for Pet Care



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 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.

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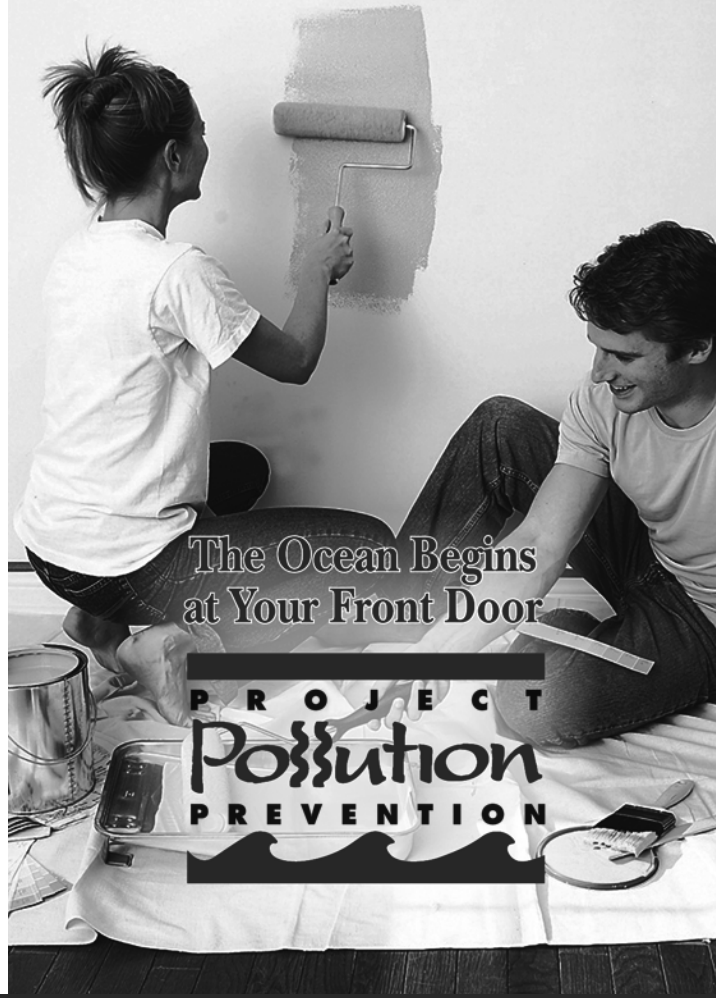
Help Prevent Ocean Pollution:

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

Attachment D

HCOC CALCULATIONS

```
****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
         (c) Copyright 1983-2016 Advanced Engineering Software (aes)
             Ver. 23.0  Release Date: 07/01/2016  License ID 1355

                          Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* TERRAVITA                                                             *
* 2-YR STORM EVENT - EXISITING CONDITIONS                               *
* LAGUNA HILLS, CALIFORNIA                                              *
 ************************************************************************

  FILE NAME: EX2S1.DAT
  TIME/DATE OF STUDY: 15:30 03/04/2025
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   4.00
  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   30.0     20.0    0.020/0.020/0.020   0.67    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

****************************************************************************
  FLOW PROCESS FROM NODE    117.00 TO NODE    116.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   111.00
  ELEVATION DATA: UPSTREAM(FEET) =    345.10  DOWNSTREAM(FEET) =    344.20

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.239
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.204
  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                 D        0.17      0.20     0.100    57    5.24
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      0.33
  TOTAL AREA(ACRES) =      0.17   PEAK FLOW RATE(CFS) =      0.33

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    115.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    344.20
  DOWNSTREAM NODE ELEVATION(FEET) =    332.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   951.00
  "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.100
  PAVEMENT LIP(FEET) =  0.375   MANNING'S N = .0130
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   3.00
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.753
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 D        5.76      0.20     0.100    57
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.83
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   6.17
  AVERAGE FLOW DEPTH(FEET) =   0.47   FLOOD WIDTH(FEET) =    3.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.57   Tc(MIN.) =    7.81
  SUBAREA AREA(ACRES) =    5.76       SUBAREA RUNOFF(CFS) =    8.98
  EFFECTIVE AREA(ACRES) =    5.93     AREA-AVERAGED Fm(INCH/HR) =   0.02
  AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =        5.9         PEAK FLOW RATE(CFS) =       9.25

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.52   FLOOD WIDTH(FEET) =    7.13
  FLOW VELOCITY(FEET/SEC.) =   6.23   DEPTH*VELOCITY(FT*FT/SEC) =   3.22
```

```
 LONGEST FLOWPATH FROM NODE    117.00 TO NODE    115.00 =    1062.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    115.00 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) =   328.50  DOWNSTREAM(FEET) =   325.10
 FLOW LENGTH(FEET) =   100.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  15.0 INCH PIPE IS  10.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  10.27
 ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       9.25
 PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =    7.97
 LONGEST FLOWPATH FROM NODE    117.00 TO NODE    111.00 =    1162.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    111.00 TO NODE    111.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.97
 RAINFALL INTENSITY(INCH/HR) =   1.73
 AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       5.93
 TOTAL STREAM AREA(ACRES) =       5.93
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       9.25

****************************************************************************
 FLOW PROCESS FROM NODE    119.00 TO NODE    118.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    92.00
 ELEVATION DATA: UPSTREAM(FEET) =    353.20  DOWNSTREAM(FEET) =    349.50

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
 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                 D        0.11      0.20     0.100    57    5.00
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      0.22
  TOTAL AREA(ACRES) =      0.11   PEAK FLOW RATE(CFS) =      0.22

****************************************************************************
  FLOW PROCESS FROM NODE    118.00 TO NODE    111.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  349.50  DOWNSTREAM ELEVATION(FEET) =  329.10
  STREET LENGTH(FEET) =   466.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  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) =       0.87
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.20
    HALFSTREET FLOOD WIDTH(FEET) =    3.79
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.33
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.67
  STREET FLOW TRAVEL TIME(MIN.) =   2.34   Tc(MIN.) =    7.34
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.817
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 D        0.80      0.20     0.100    57
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.80      SUBAREA RUNOFF(CFS) =    1.29
  EFFECTIVE AREA(ACRES) =      0.91    AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        0.9        PEAK FLOW RATE(CFS) =       1.47

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.23   HALFSTREET FLOOD WIDTH(FEET) =   5.38
  FLOW VELOCITY(FEET/SEC.) =  3.61   DEPTH*VELOCITY(FT*FT/SEC.) =   0.84
  LONGEST FLOWPATH FROM NODE    119.00 TO NODE    111.00 =     558.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    111.00 IS CODE =   1
----------------------------------------------------------------------------
```

```
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.34
  RAINFALL INTENSITY(INCH/HR) =   1.82
  AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       0.91
  TOTAL STREAM AREA(ACRES) =       0.91
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.47

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    113.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    78.00
  ELEVATION DATA: UPSTREAM(FEET) =    401.60  DOWNSTREAM(FEET) =    400.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
  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                 D        0.29      0.20     0.100    57    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      0.59
  TOTAL AREA(ACRES) =      0.29   PEAK FLOW RATE(CFS) =      0.59

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    112.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
==============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    338.10
  DOWNSTREAM NODE ELEVATION(FEET) =    332.20
  CHANNEL LENGTH THRU SUBAREA(FEET) =   320.00
  "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.500
  PAVEMENT LIP(FEET) =  0.375   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   3.00
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.032
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
```

```
  COMMERCIAL                  D        1.04      0.20     0.100    57
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      1.53
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.15
  AVERAGE FLOW DEPTH(FEET) =   0.50   FLOOD WIDTH(FEET) =    3.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.03   Tc(MIN.) =    6.03
  SUBAREA AREA(ACRES) =    1.04       SUBAREA RUNOFF(CFS) =    1.88
  EFFECTIVE AREA(ACRES) =    1.33     AREA-AVERAGED Fm(INCH/HR) =   0.02
  AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =        1.3         PEAK FLOW RATE(CFS) =       2.41

         NOTE:TRAVEL TIME ESTIMATES BASED ON NORMAL DEPTH
         IN A FLOWING-FULL GUTTER(NORMAL DEPTH = GUTTER HIKE)


  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.50   FLOOD WIDTH(FEET) =    3.00
  FLOW VELOCITY(FEET/SEC.) =   5.15   DEPTH*VELOCITY(FT*FT/SEC) =   2.58
  LONGEST FLOWPATH FROM NODE    114.00 TO NODE    112.00 =     398.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 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) =   328.00  DOWNSTREAM(FEET) =   325.10
  FLOW LENGTH(FEET) =    84.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   6.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.37
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.41
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =    6.22
  LONGEST FLOWPATH FROM NODE    114.00 TO NODE    111.00 =     482.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    111.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.22
  RAINFALL INTENSITY(INCH/HR) =   2.00
  AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       1.33
```

```
 TOTAL STREAM AREA(ACRES) =       1.33
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.41

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1        9.25    7.97    1.732  0.20( 0.02) 0.10       5.9     117.00
     2        1.47    7.34    1.817  0.20( 0.02) 0.10       0.9     119.00
     3        2.41    6.22    1.996  0.20( 0.02) 0.10       1.3     114.00

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  3 STREAMS.

 ** PEAK FLOW RATE TABLE **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1       12.12    6.22    1.996  0.20( 0.02) 0.10       6.7     114.00
     2       12.59    7.34    1.817  0.20( 0.02) 0.10       7.7     119.00
     3       12.74    7.97    1.732  0.20( 0.02) 0.10       8.2     117.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      12.74    Tc(MIN.) =     7.97
 EFFECTIVE AREA(ACRES) =       8.17   AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =        8.2
 LONGEST FLOWPATH FROM NODE    117.00 TO NODE    111.00 =    1162.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    111.00 TO NODE    110.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   325.10  DOWNSTREAM(FEET) =   321.90
 FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  15.0 INCH PIPE IS  11.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  13.05
 ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      12.74
 PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    8.05
 LONGEST FLOWPATH FROM NODE    117.00 TO NODE    110.00 =    1222.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    109.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    321.90  DOWNSTREAM(FEET) =    318.80
 CHANNEL LENGTH THRU SUBAREA(FEET) =    53.00   CHANNEL SLOPE =  0.0585
```

```
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   5.00
  CHANNEL FLOW THRU SUBAREA(CFS) =      12.74
  FLOW VELOCITY(FEET/SEC.) =   4.72   FLOW DEPTH(FEET) =   0.26
  TRAVEL TIME(MIN.) =   0.19   Tc(MIN.) =    8.23
  LONGEST FLOWPATH FROM NODE    117.00 TO NODE    109.00 =    1275.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    100.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   318.80  DOWNSTREAM(FEET) =   276.00
  FLOW LENGTH(FEET) =   970.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  15.0 INCH PIPE IS  12.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.96
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.74
  PIPE TRAVEL TIME(MIN.) =   1.35    Tc(MIN.) =    9.59
  LONGEST FLOWPATH FROM NODE    117.00 TO NODE    100.00 =    2245.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    100.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    106.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    77.00
  ELEVATION DATA: UPSTREAM(FEET) =    401.40  DOWNSTREAM(FEET) =    400.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
  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                 D        0.30      0.20     0.100    57    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      0.61
  TOTAL AREA(ACRES) =      0.30   PEAK FLOW RATE(CFS) =      0.61

****************************************************************************
```

```
 FLOW PROCESS FROM NODE    106.00 TO NODE    102.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =    330.90
 DOWNSTREAM NODE ELEVATION(FEET) =    306.80
 CHANNEL LENGTH THRU SUBAREA(FEET) =   662.00
 "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.300
 PAVEMENT LIP(FEET) =  0.038   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
 MAXIMUM DEPTH(FEET) =   3.00
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.892
 SUBAREA LOSS RATE DATA(AMC  I ):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        2.42      0.20     0.100    57
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      2.60
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   6.01
 AVERAGE FLOW DEPTH(FEET) =   0.34   FLOOD WIDTH(FEET) =    3.00
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.83   Tc(MIN.) =    6.83
 SUBAREA AREA(ACRES) =    2.42       SUBAREA RUNOFF(CFS) =    4.08
 EFFECTIVE AREA(ACRES) =    2.72     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =        2.7         PEAK FLOW RATE(CFS) =       4.58

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.37   FLOOD WIDTH(FEET) =    6.58
 FLOW VELOCITY(FEET/SEC.) =   6.25   DEPTH*VELOCITY(FT*FT/SEC) =   2.33
 LONGEST FLOWPATH FROM NODE    107.00 TO NODE    102.00 =     739.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 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.) =    6.83
 RAINFALL INTENSITY(INCH/HR) =   1.89
 AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       2.72
 TOTAL STREAM AREA(ACRES) =       2.72
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       4.58

****************************************************************************
 FLOW PROCESS FROM NODE    105.00 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) =    81.00
  ELEVATION DATA: UPSTREAM(FEET) =    401.60  DOWNSTREAM(FEET) =    400.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
  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                 D        0.20      0.20     0.100    57    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.20   PEAK FLOW RATE(CFS) =      0.40

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    103.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    331.40
  DOWNSTREAM NODE ELEVATION(FEET) =    318.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   386.00
  "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.300
  PAVEMENT LIP(FEET) =  0.038   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   3.00
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.991
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 D        0.93      0.20     0.100    57
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      1.23
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.14
  AVERAGE FLOW DEPTH(FEET) =   0.30   FLOOD WIDTH(FEET) =    3.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.25   Tc(MIN.) =    6.25
  SUBAREA AREA(ACRES) =    0.93       SUBAREA RUNOFF(CFS) =    1.65
  EFFECTIVE AREA(ACRES) =    1.13     AREA-AVERAGED Fm(INCH/HR) =   0.02
  AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =        1.1         PEAK FLOW RATE(CFS) =       2.00

         NOTE:TRAVEL TIME ESTIMATES BASED ON NORMAL DEPTH
         IN A FLOWING-FULL GUTTER(NORMAL DEPTH = GUTTER HIKE)
```

```
  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.30   FLOOD WIDTH(FEET) =    3.00
  FLOW VELOCITY(FEET/SEC.) =   5.14   DEPTH*VELOCITY(FT*FT/SEC) =   1.54
  LONGEST FLOWPATH FROM NODE    105.00 TO NODE    103.00 =     467.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    102.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   312.90  DOWNSTREAM(FEET) =   306.80
  FLOW LENGTH(FEET) =    36.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   4.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.68
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.00
  PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =    6.30
  LONGEST FLOWPATH FROM NODE    105.00 TO NODE    102.00 =     503.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 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.) =    6.30
  RAINFALL INTENSITY(INCH/HR) =   1.98
  AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       1.13
  TOTAL STREAM AREA(ACRES) =       1.13
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.00

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        4.58    6.83    1.892  0.20( 0.02) 0.10       2.7     107.00
      2        2.00    6.30    1.983  0.20( 0.02) 0.10       1.1     105.00

  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        6.43    6.30    1.983  0.20( 0.02) 0.10       3.6     105.00
      2        6.49    6.83    1.892  0.20( 0.02) 0.10       3.8     107.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       6.49    Tc(MIN.) =     6.83
  EFFECTIVE AREA(ACRES) =       3.85   AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        3.8
  LONGEST FLOWPATH FROM NODE    107.00 TO NODE    102.00 =     739.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    101.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  306.80  DOWNSTREAM ELEVATION(FEET) =  297.70
  STREET LENGTH(FEET) =   357.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  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) =       6.49
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   12.23
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.03
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.49
  STREET FLOW TRAVEL TIME(MIN.) =   1.48   Tc(MIN.) =    8.31
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.691
  SUBAREA AREA(ACRES) =    0.00      SUBAREA RUNOFF(CFS) =    0.00
  EFFECTIVE AREA(ACRES) =      3.85    AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        3.8        PEAK FLOW RATE(CFS) =       6.49
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.23
  FLOW VELOCITY(FEET/SEC.) =  4.03   DEPTH*VELOCITY(FT*FT/SEC.) =   1.49
  LONGEST FLOWPATH FROM NODE    107.00 TO NODE    101.00 =    1096.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    100.00 IS CODE =  31
```

```
------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   293.00  DOWNSTREAM(FEET) =   276.00
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   6.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  20.91
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.49
  PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =    8.36
  LONGEST FLOWPATH FROM NODE    107.00 TO NODE    100.00 =    1156.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    100.00 IS CODE =  11
------------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
==============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        6.43    7.84    1.749  0.20( 0.02) 0.10       3.6     105.00
      2        6.49    8.36    1.685  0.20( 0.02) 0.10       3.8     107.00
  LONGEST FLOWPATH FROM NODE    107.00 TO NODE    100.00 =    1156.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       12.12    7.85    1.748  0.20( 0.02) 0.10       6.7     114.00
      2       12.59    8.95    1.620  0.20( 0.02) 0.10       7.7     119.00
      3       12.74    9.59    1.558  0.20( 0.02) 0.10       8.2     117.00
  LONGEST FLOWPATH FROM NODE    117.00 TO NODE    100.00 =    2245.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       18.54    7.84    1.749  0.20( 0.02) 0.10      10.4     105.00
      2       18.55    7.85    1.748  0.20( 0.02) 0.10      10.4     114.00
      3       18.83    8.36    1.685  0.20( 0.02) 0.10      11.0     107.00
      4       18.83    8.95    1.620  0.20( 0.02) 0.10      11.5     119.00
      5       18.73    9.59    1.558  0.20( 0.02) 0.10      12.0     117.00
    TOTAL AREA(ACRES) =        12.0

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       18.83  Tc(MIN.) =    8.954
  EFFECTIVE AREA(ACRES) =     11.55  AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       12.0
  LONGEST FLOWPATH FROM NODE    117.00 TO NODE    100.00 =    2245.00 FEET.
```

```
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       12.0  TC(MIN.) =      8.95
  EFFECTIVE AREA(ACRES) =     11.55  AREA-AVERAGED Fm(INCH/HR)=  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =      18.83

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       18.54    7.84    1.749  0.20( 0.02) 0.10      10.4     105.00
      2       18.55    7.85    1.748  0.20( 0.02) 0.10      10.4     114.00
      3       18.83    8.36    1.685  0.20( 0.02) 0.10      11.0     107.00
      4       18.83    8.95    1.620  0.20( 0.02) 0.10      11.5     119.00
      5       18.73    9.59    1.558  0.20( 0.02) 0.10      12.0     117.00
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
         (c) Copyright 1983-2016 Advanced Engineering Software (aes)
             Ver. 23.0  Release Date: 07/01/2016  License ID 1355

                          Analysis prepared by:
```

```
 ************************* DESCRIPTION OF STUDY *************************
* TERRAVITA                                                             *
* 2-YR STORM EVENT - EXISTING CONDITIONS                                *
* LAGUNA HILLS, CALIFORNIA                                              *
 ************************************************************************

  FILE NAME: EX2S2.DAT
  TIME/DATE OF STUDY: 15:35 03/04/2025
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   4.00
  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   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 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    202.00 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) =   119.00
  ELEVATION DATA: UPSTREAM(FEET) =    354.80  DOWNSTREAM(FEET) =    307.80

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.751
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.089
  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.)
  NATURAL FAIR COVER
  "WOODLAND"                  D        0.12      0.20     1.000    62    5.75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      0.20
  TOTAL AREA(ACRES) =      0.12   PEAK FLOW RATE(CFS) =      0.20

********************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    200.00 IS CODE =  51
--------------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    307.80  DOWNSTREAM(FEET) =    295.20
  CHANNEL LENGTH THRU SUBAREA(FEET) =    52.00   CHANNEL SLOPE =  0.2423
  CHANNEL BASE(FEET) = 1000.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   5.00
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.853
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL FAIR COVER
  "WOODLAND"                  D        3.83      0.20     1.000    62
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.09
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.65
  AVERAGE FLOW DEPTH(FEET) =   0.00   TRAVEL TIME(MIN.) =   1.34
  Tc(MIN.) =    7.09
  SUBAREA AREA(ACRES) =     3.83       SUBAREA RUNOFF(CFS) =    5.70
  EFFECTIVE AREA(ACRES) =      3.95     AREA-AVERAGED Fm(INCH/HR) =   0.20
  AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =        3.9         PEAK FLOW RATE(CFS) =       5.88

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.00   FLOW VELOCITY(FEET/SEC.) =   1.23
  LONGEST FLOWPATH FROM NODE    202.00 TO NODE    200.00 =     171.00 FEET.
```

```
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =         3.9  TC(MIN.) =      7.09
  EFFECTIVE AREA(ACRES) =      3.95  AREA-AVERAGED Fm(INCH/HR)=  0.20
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)   =       5.88
==============================================================================
==============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
          NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
                    AND LOW LOSS FRACTION ESTIMATIONS
==========================================================================
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              Ver. 23.0  Release Date: 07/01/2016  License ID 1355
                           Analysis prepared by:



 ************************* DESCRIPTION OF STUDY *************************
* TERRAVITA                                                             *
* 2-YR STORM EVENT - EXISITING CONDITION HYDROGRAPH                     *
* LAGUNA HILLS, CALIFORNIA                                              *
 ************************************************************************
==========================================================================
*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
    AND LOW LOSS FRACTION ESTIMATIONS FOR AMC I:

    TOTAL 24-HOUR DURATION RAINFALL DEPTH =     2.05 (inches)

    SOIL-COVER     AREA      PERCENT OF    SCS CURVE    LOSS RATE
       TYPE      (Acres)   PERVIOUS AREA     NUMBER    Fp(in./hr.)    YIELD
         1         12.02       10.00       75.(AMC II)     0.200       0.803
         2          3.95      100.00       79.(AMC II)     0.200       0.048

    TOTAL AREA (Acres) =     15.97

    AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.065

    AREA-AVERAGED LOW LOSS FRACTION, Y = 0.384
==========================================================================

    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.96
    TOTAL CATCHMENT AREA(ACRES) =   15.97
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.065
    LOW LOSS FRACTION = 0.384
    TIME OF CONCENTRATION(MIN.) =  8.49
    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) = 1.80
TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) = 0.93

****

TIME (HOURS)	VOLUME (AF)	Q (CFS)	0.	7.5	15.0	22.5	30.0
0.01	0.0000	0.00	Q	.	.	.	.
0.15	0.0018	0.30	Q	.	.	.	.
0.29	0.0053	0.31	Q	.	.	.	.
0.44	0.0089	0.31	Q	.	.	.	.
0.58	0.0125	0.31	Q	.	.	.	.
0.72	0.0161	0.31	Q	.	.	.	.
0.86	0.0197	0.31	Q	.	.	.	.
1.00	0.0234	0.31	Q	.	.	.	.
1.14	0.0271	0.32	Q	.	.	.	.
1.28	0.0308	0.32	Q	.	.	.	.
1.43	0.0345	0.32	Q	.	.	.	.
1.57	0.0382	0.32	Q	.	.	.	.
1.71	0.0420	0.32	Q	.	.	.	.
1.85	0.0458	0.32	Q	.	.	.	.
1.99	0.0496	0.33	Q	.	.	.	.
2.13	0.0535	0.33	Q	.	.	.	.
2.27	0.0573	0.33	Q	.	.	.	.
2.42	0.0612	0.33	Q	.	.	.	.
2.56	0.0651	0.34	Q	.	.	.	.
2.70	0.0691	0.34	Q	.	.	.	.
2.84	0.0730	0.34	Q	.	.	.	.
2.98	0.0770	0.34	Q	.	.	.	.
3.12	0.0810	0.35	Q	.	.	.	.
3.27	0.0851	0.35	Q	.	.	.	.
3.41	0.0891	0.35	Q	.	.	.	.
3.55	0.0932	0.35	Q	.	.	.	.
3.69	0.0974	0.35	Q	.	.	.	.
3.83	0.1015	0.36	Q	.	.	.	.
3.97	0.1057	0.36	Q	.	.	.	.
4.11	0.1099	0.36	Q	.	.	.	.
4.26	0.1142	0.37	Q	.	.	.	.
4.40	0.1185	0.37	Q	.	.	.	.
4.54	0.1228	0.37	Q	.	.	.	.
4.68	0.1271	0.37	Q	.	.	.	.
4.82	0.1315	0.38	Q	.	.	.	.
4.96	0.1359	0.38	Q	.	.	.	.
5.10	0.1404	0.38	Q	.	.	.	.
5.25	0.1449	0.38	Q	.	.	.	.
5.39	0.1494	0.39	Q	.	.	.	.
5.53	0.1540	0.39	Q	.	.	.	.
5.67	0.1586	0.40	Q	.	.	.	.

5.81	0.1632	0.40	Q	.	.	.	.
5.95	0.1679	0.40	Q	.	.	.	.
6.10	0.1726	0.40	Q	.	.	.	.
6.24	0.1774	0.41	Q	.	.	.	.
6.38	0.1822	0.41	Q	.	.	.	.
6.52	0.1870	0.42	Q	.	.	.	.
6.66	0.1919	0.42	Q	.	.	.	.
6.80	0.1969	0.43	Q	.	.	.	.
6.94	0.2019	0.43	Q	.	.	.	.
7.09	0.2069	0.43	Q	.	.	.	.
7.23	0.2120	0.44	Q	.	.	.	.
7.37	0.2171	0.44	Q	.	.	.	.
7.51	0.2223	0.45	Q	.	.	.	.
7.65	0.2276	0.45	Q	.	.	.	.
7.79	0.2328	0.45	Q	.	.	.	.
7.93	0.2382	0.46	Q	.	.	.	.
8.08	0.2436	0.46	Q	.	.	.	.
8.22	0.2491	0.47	Q	.	.	.	.
8.36	0.2546	0.48	Q	.	.	.	.
8.50	0.2602	0.48	Q	.	.	.	.
8.64	0.2659	0.49	Q	.	.	.	.
8.78	0.2716	0.49	Q	.	.	.	.
8.93	0.2774	0.50	Q	.	.	.	.
9.07	0.2833	0.51	Q	.	.	.	.
9.21	0.2892	0.51	Q	.	.	.	.
9.35	0.2953	0.52	Q	.	.	.	.
9.49	0.3014	0.52	Q	.	.	.	.
9.63	0.3075	0.53	Q	.	.	.	.
9.77	0.3138	0.54	Q	.	.	.	.
9.92	0.3202	0.55	Q	.	.	.	.
10.06	0.3266	0.55	Q	.	.	.	.
10.20	0.3332	0.57	Q	.	.	.	.
10.34	0.3398	0.57	Q	.	.	.	.
10.48	0.3466	0.58	Q	.	.	.	.
10.62	0.3534	0.59	Q	.	.	.	.
10.76	0.3604	0.60	Q	.	.	.	.
10.91	0.3675	0.61	Q	.	.	.	.
11.05	0.3747	0.62	Q	.	.	.	.
11.19	0.3820	0.63	Q	.	.	.	.
11.33	0.3894	0.65	Q	.	.	.	.
11.47	0.3970	0.65	Q	.	.	.	.
11.61	0.4048	0.67	Q	.	.	.	.
11.76	0.4127	0.68	Q	.	.	.	.
11.90	0.4208	0.70	Q	.	.	.	.
12.04	0.4290	0.71	Q	.	.	.	.
12.18	0.4383	0.89	.Q	.	.	.	.
12.32	0.4487	0.90	.Q	.	.	.	.
12.46	0.4594	0.92	.Q	.	.	.	.
12.60	0.4703	0.94	.Q	.	.	.	.
12.75	0.4814	0.96	.Q	.	.	.	.

12.89	0.4927	0.98	.Q	.	.	.	.
13.03	0.5044	1.01	.Q	.	.	.	.
13.17	0.5163	1.03	.Q	.	.	.	.
13.31	0.5286	1.07	.Q	.	.	.	.
13.45	0.5412	1.09	.Q	.	.	.	.
13.59	0.5542	1.13	.Q	.	.	.	.
13.74	0.5675	1.16	.Q	.	.	.	.
13.88	0.5813	1.21	.Q	.	.	.	.
14.02	0.5956	1.24	.Q	.	.	.	.
14.16	0.6107	1.35	.Q	.	.	.	.
14.30	0.6267	1.38	.Q	.	.	.	.
14.44	0.6434	1.47	.Q	.	.	.	.
14.59	0.6608	1.51	. Q	.	.	.	.
14.73	0.6792	1.63	. Q	.	.	.	.
14.87	0.6988	1.73	. Q	.	.	.	.
15.01	0.7205	1.97	. Q	.	.	.	.
15.15	0.7444	2.12	. Q	.	.	.	.
15.29	0.7714	2.49	. Q	.	.	.	.
15.43	0.8016	2.69	. Q	.	.	.	.
15.58	0.8340	2.84	. Q	.	.	.	.
15.72	0.8701	3.33	. Q	.	.	.	.
15.86	0.9205	5.29	. Q	.	.	.	.
16.00	0.9958	7.58	. Q	.	.	.	.
16.14	1.1846	24.71	.	.	.	. Q	.
16.28	1.3530	4.10	. Q	.	.	.	.
16.42	1.3915	2.48	. Q	.	.	.	.
16.57	1.4193	2.29	. Q	.	.	.	.
16.71	1.4435	1.84	. Q	.	.	.	.
16.85	1.4634	1.56	. Q	.	.	.	.
16.99	1.4809	1.42	.Q	.	.	.	.
17.13	1.4967	1.28	.Q	.	.	.	.
17.27	1.5111	1.18	.Q	.	.	.	.
17.42	1.5244	1.11	.Q	.	.	.	.
17.56	1.5371	1.05	.Q	.	.	.	.
17.70	1.5490	1.00	.Q	.	.	.	.
17.84	1.5604	0.95	.Q	.	.	.	.
17.98	1.5713	0.91	.Q	.	.	.	.
18.12	1.5812	0.78	.Q	.	.	.	.
18.26	1.5898	0.69	Q	.	.	.	.
18.41	1.5977	0.66	Q	.	.	.	.
18.55	1.6053	0.64	Q	.	.	.	.
18.69	1.6126	0.62	Q	.	.	.	.
18.83	1.6197	0.60	Q	.	.	.	.
18.97	1.6265	0.58	Q	.	.	.	.
19.11	1.6332	0.56	Q	.	.	.	.
19.25	1.6396	0.54	Q	.	.	.	.
19.40	1.6459	0.53	Q	.	.	.	.
19.54	1.6520	0.52	Q	.	.	.	.
19.68	1.6579	0.50	Q	.	.	.	.
19.82	1.6637	0.49	Q	.	.	.	.

19.96	1.6694	0.48	Q	.	.	.	.
20.10	1.6749	0.47	Q	.	.	.	.
20.24	1.6804	0.46	Q	.	.	.	.
20.39	1.6857	0.45	Q	.	.	.	.
20.53	1.6908	0.44	Q	.	.	.	.
20.67	1.6959	0.43	Q	.	.	.	.
20.81	1.7009	0.42	Q	.	.	.	.
20.95	1.7058	0.41	Q	.	.	.	.
21.09	1.7106	0.41	Q	.	.	.	.
21.24	1.7153	0.40	Q	.	.	.	.
21.38	1.7200	0.39	Q	.	.	.	.
21.52	1.7245	0.39	Q	.	.	.	.
21.66	1.7290	0.38	Q	.	.	.	.
21.80	1.7335	0.37	Q	.	.	.	.
21.94	1.7378	0.37	Q	.	.	.	.
22.08	1.7421	0.36	Q	.	.	.	.
22.23	1.7463	0.36	Q	.	.	.	.
22.37	1.7505	0.35	Q	.	.	.	.
22.51	1.7546	0.35	Q	.	.	.	.
22.65	1.7586	0.34	Q	.	.	.	.
22.79	1.7626	0.34	Q	.	.	.	.
22.93	1.7665	0.33	Q	.	.	.	.
23.08	1.7704	0.33	Q	.	.	.	.
23.22	1.7743	0.33	Q	.	.	.	.
23.36	1.7781	0.32	Q	.	.	.	.
23.50	1.7818	0.32	Q	.	.	.	.
23.64	1.7855	0.31	Q	.	.	.	.
23.78	1.7892	0.31	Q	.	.	.	.
23.92	1.7928	0.31	Q	.	.	.	.
24.07	1.7963	0.30	Q	.	.	.	.
24.21	1.7981	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%	1443.3
10%	76.4
20%	25.5
30%	17.0
40%	8.5
50%	8.5
60%	8.5
70%	8.5
80%	8.5
90%	8.5

```
**************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
          (c) Copyright 1983-2016 Advanced Engineering Software (aes)
              Ver. 23.0  Release Date: 07/01/2016  License ID 1355

                          Analysis prepared by:
```

```
 ************************* DESCRIPTION OF STUDY *************************
* TERRAVITA                                                             *
* 2-YR STORM EVENT - PROPOSED UNMITIGATED                               *
* LAGUNA HILLS, CALIFORNIA                                              *
 ************************************************************************

  FILE NAME: P2S1.DAT
  TIME/DATE OF STUDY: 15:39 03/04/2025
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  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) 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   13.0      5.0    0.020/0.020/0.020   0.33    1.50 0.0312 0.125 0.0150
  2   10.0      5.0    0.020/0.020/0.020   0.33    1.50 0.0312 0.125 0.0150
  3   13.0      5.0    0.020/0.020/0.020   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
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    131.00 TO NODE    130.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   208.60
  ELEVATION DATA: UPSTREAM(FEET) =    361.80  DOWNSTREAM(FEET) =    356.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.676
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.105
  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.)
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       D        0.12      0.20     0.200    57    5.68
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      0.22
  TOTAL AREA(ACRES) =      0.12   PEAK FLOW RATE(CFS) =      0.22

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    129.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  356.30  DOWNSTREAM ELEVATION(FEET) =  339.70
  STREET LENGTH(FEET) =   245.30   CURB HEIGHT(INCHES) =  4.0
  STREET HALFWIDTH(FEET) = 13.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  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) =       0.73
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.17
    HALFSTREET FLOOD WIDTH(FEET) =    2.29
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.29
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.74
  STREET FLOW TRAVEL TIME(MIN.) =   0.95   Tc(MIN.) =    6.63
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.925
  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"        D        0.60      0.20      0.200    57
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.60      SUBAREA RUNOFF(CFS) =    1.02
  EFFECTIVE AREA(ACRES) =      0.72    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        0.7         PEAK FLOW RATE(CFS) =       1.22

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.21   HALFSTREET FLOOD WIDTH(FEET) =   4.17
  FLOW VELOCITY(FEET/SEC.) =  4.19   DEPTH*VELOCITY(FT*FT/SEC.) =   0.88
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE    129.00 =     453.90 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    129.00 TO NODE    172.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   339.70  DOWNSTREAM(FEET) =   334.60
  FLOW LENGTH(FEET) =   159.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   4.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.12
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.22
  PIPE TRAVEL TIME(MIN.) =   0.43    Tc(MIN.) =    7.06
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE    172.00 =     612.90 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    172.00 TO NODE    172.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.06
  RAINFALL INTENSITY(INCH/HR) =   1.86
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.72
  TOTAL STREAM AREA(ACRES) =       0.72
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.22

****************************************************************************
  FLOW PROCESS FROM NODE    119.00 TO NODE    118.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    73.00
  ELEVATION DATA: UPSTREAM(FEET) =    346.20  DOWNSTREAM(FEET) =    345.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
  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
  "11+ DWELLINGS/ACRE"       D        0.17      0.20     0.200    57    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      0.34
  TOTAL AREA(ACRES) =      0.17   PEAK FLOW RATE(CFS) =      0.34

******************************************************************************
  FLOW PROCESS FROM NODE    118.00 TO NODE    117.00 IS CODE =  62
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  345.00  DOWNSTREAM ELEVATION(FEET) =  338.20
  STREET LENGTH(FEET) =   363.00   CURB HEIGHT(INCHES) =  4.0
  STREET HALFWIDTH(FEET) = 13.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  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) =       0.87
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.23
    HALFSTREET FLOOD WIDTH(FEET) =    5.08
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.31
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.53
  STREET FLOW TRAVEL TIME(MIN.) =   2.62   Tc(MIN.) =    7.62
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.777
  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"       D        0.67      0.20     0.200    57
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.67      SUBAREA RUNOFF(CFS) =    1.05
  EFFECTIVE AREA(ACRES) =      0.84    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       1.31

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.25   HALFSTREET FLOOD WIDTH(FEET) =   6.40
  FLOW VELOCITY(FEET/SEC.) =  2.49   DEPTH*VELOCITY(FT*FT/SEC.) =   0.63
  LONGEST FLOWPATH FROM NODE    119.00 TO NODE    117.00 =     436.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    117.00 TO NODE    172.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   334.60  DOWNSTREAM(FEET) =   333.60
  FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   4.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.95
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.31
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    7.66
  LONGEST FLOWPATH FROM NODE    119.00 TO NODE    172.00 =     451.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    172.00 TO NODE    172.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.66
  RAINFALL INTENSITY(INCH/HR) =   1.77
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.84
  TOTAL STREAM AREA(ACRES) =       0.84
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.31

****************************************************************************
  FLOW PROCESS FROM NODE    128.00 TO NODE    127.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
```

```
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    95.00
 ELEVATION DATA: UPSTREAM(FEET) =    344.70  DOWNSTREAM(FEET) =    342.20

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
 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
 "11+ DWELLINGS/ACRE"       D        0.15      0.20     0.200    57    5.00
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA RUNOFF(CFS) =      0.30
 TOTAL AREA(ACRES) =      0.15   PEAK FLOW RATE(CFS) =      0.30

****************************************************************************
 FLOW PROCESS FROM NODE    127.00 TO NODE    126.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  342.20  DOWNSTREAM ELEVATION(FEET) =  338.40
 STREET LENGTH(FEET) =   205.00   CURB HEIGHT(INCHES) =  4.0
 STREET HALFWIDTH(FEET) = 13.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 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) =       0.63
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.21
   HALFSTREET FLOOD WIDTH(FEET) =    4.06
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.21
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.46
 STREET FLOW TRAVEL TIME(MIN.) =   1.55   Tc(MIN.) =    6.55
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.939
 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"       D        0.38      0.20     0.200    57
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
```

```
  SUBAREA AREA(ACRES) =    0.38      SUBAREA RUNOFF(CFS) =    0.65
  EFFECTIVE AREA(ACRES) =      0.53    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        0.5        PEAK FLOW RATE(CFS) =       0.91

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.23   HALFSTREET FLOOD WIDTH(FEET) =   5.23
  FLOW VELOCITY(FEET/SEC.) =  2.31   DEPTH*VELOCITY(FT*FT/SEC.) =   0.53
  LONGEST FLOWPATH FROM NODE    128.00 TO NODE    126.00 =     300.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    172.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   334.90  DOWNSTREAM(FEET) =   333.60
  FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   3.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.26
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.91
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    6.58
  LONGEST FLOWPATH FROM NODE    128.00 TO NODE    172.00 =     315.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    172.00 TO NODE    172.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.58
  RAINFALL INTENSITY(INCH/HR) =   1.93
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.53
  TOTAL STREAM AREA(ACRES) =       0.53
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.91

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        1.22    7.06    1.857  0.20( 0.04) 0.20       0.7     131.00
      2        1.31    7.66    1.773  0.20( 0.04) 0.20       0.8     119.00
      3        0.91    6.58    1.934  0.20( 0.04) 0.20       0.5     128.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
```

```
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        3.33    6.58    1.934  0.20( 0.04) 0.20       1.9     128.00
      2        3.36    7.06    1.857  0.20( 0.04) 0.20       2.0     131.00
      3        3.31    7.66    1.773  0.20( 0.04) 0.20       2.1     119.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       3.36    Tc(MIN.) =     7.06
  EFFECTIVE AREA(ACRES) =       2.02   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        2.1
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE    172.00 =     612.90 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    172.00 TO NODE    171.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   333.60  DOWNSTREAM(FEET) =   329.60
  FLOW LENGTH(FEET) =   289.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   8.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.67
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.36
  PIPE TRAVEL TIME(MIN.) =   0.85    Tc(MIN.) =    7.91
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE    171.00 =     901.90 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    171.00 TO NODE    171.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.91
  RAINFALL INTENSITY(INCH/HR) =   1.74
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       2.02
  TOTAL STREAM AREA(ACRES) =       2.09
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.36

****************************************************************************
  FLOW PROCESS FROM NODE    125.00 TO NODE    124.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    87.00
  ELEVATION DATA: UPSTREAM(FEET) =    342.00  DOWNSTREAM(FEET) =    337.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
  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
  "11+ DWELLINGS/ACRE"       D        0.16      0.20     0.200    57    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      0.32
  TOTAL AREA(ACRES) =      0.16   PEAK FLOW RATE(CFS) =      0.32

******************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    123.00 IS CODE =  62
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  337.40  DOWNSTREAM ELEVATION(FEET) =  334.70
  STREET LENGTH(FEET) =   236.00   CURB HEIGHT(INCHES) =  4.0
  STREET HALFWIDTH(FEET) = 13.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  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) =       0.66
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.23
    HALFSTREET FLOOD WIDTH(FEET) =    4.98
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.81
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.41
  STREET FLOW TRAVEL TIME(MIN.) =   2.18   Tc(MIN.) =    7.18
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.840
  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"       D        0.42      0.20     0.200    57
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.42      SUBAREA RUNOFF(CFS) =    0.68
  EFFECTIVE AREA(ACRES) =      0.58    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        0.6        PEAK FLOW RATE(CFS) =       0.94

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.25   HALFSTREET FLOOD WIDTH(FEET) =   6.10
  FLOW VELOCITY(FEET/SEC.) =  1.92   DEPTH*VELOCITY(FT*FT/SEC.) =   0.48
  LONGEST FLOWPATH FROM NODE    125.00 TO NODE    123.00 =     323.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    171.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   330.70  DOWNSTREAM(FEET) =   329.60
  FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   3.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.80
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.94
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    7.21
  LONGEST FLOWPATH FROM NODE    125.00 TO NODE    171.00 =     338.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    171.00 TO NODE    171.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.21
  RAINFALL INTENSITY(INCH/HR) =   1.83
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.58
  TOTAL STREAM AREA(ACRES) =       0.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.94

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    115.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
```

```
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    81.00
 ELEVATION DATA: UPSTREAM(FEET) =    338.40  DOWNSTREAM(FEET) =    337.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
 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
 "11+ DWELLINGS/ACRE"       D        0.12      0.20     0.200    57    5.00
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA RUNOFF(CFS) =      0.24
 TOTAL AREA(ACRES) =      0.12   PEAK FLOW RATE(CFS) =      0.24

****************************************************************************
 FLOW PROCESS FROM NODE    115.00 TO NODE    114.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  337.00  DOWNSTREAM ELEVATION(FEET) =  334.30
 STREET LENGTH(FEET) =   225.00   CURB HEIGHT(INCHES) =  4.0
 STREET HALFWIDTH(FEET) = 13.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 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) =       0.58
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.22
   HALFSTREET FLOOD WIDTH(FEET) =    4.47
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.81
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.39
 STREET FLOW TRAVEL TIME(MIN.) =   2.07   Tc(MIN.) =    7.07
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.855
 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"       D        0.41      0.20     0.200    57
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
```

```
  SUBAREA AREA(ACRES) =    0.41      SUBAREA RUNOFF(CFS) =    0.67
  EFFECTIVE AREA(ACRES) =      0.53    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        0.5        PEAK FLOW RATE(CFS) =       0.87

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.24   HALFSTREET FLOOD WIDTH(FEET) =   5.74
  FLOW VELOCITY(FEET/SEC.) =  1.93   DEPTH*VELOCITY(FT*FT/SEC.) =   0.47
  LONGEST FLOWPATH FROM NODE    116.00 TO NODE    114.00 =     306.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    171.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   330.30  DOWNSTREAM(FEET) =   329.60
  FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   3.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.41
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.87
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    7.11
  LONGEST FLOWPATH FROM NODE    116.00 TO NODE    171.00 =     321.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    171.00 TO NODE    171.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.11
  RAINFALL INTENSITY(INCH/HR) =   1.85
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.53
  TOTAL STREAM AREA(ACRES) =       0.53
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.87

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        3.33    7.43    1.804  0.20( 0.04) 0.20       1.9     128.00
      1        3.36    7.91    1.740  0.20( 0.04) 0.20       2.0     131.00
      1        3.31    8.51    1.669  0.20( 0.04) 0.20       2.1     119.00
      2        0.94    7.21    1.835  0.20( 0.04) 0.20       0.6     125.00
      3        0.87    7.11    1.849  0.20( 0.04) 0.20       0.5     116.00
```

```
 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  3 STREAMS.

 ** PEAK FLOW RATE TABLE **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1        5.07    7.11    1.849  0.20( 0.04) 0.20       2.9     116.00
     2        5.08    7.21    1.835  0.20( 0.04) 0.20       3.0     125.00
     3        5.09    7.43    1.804  0.20( 0.04) 0.20       3.0     128.00
     4        5.06    7.91    1.740  0.20( 0.04) 0.20       3.1     131.00
     5        4.94    8.51    1.669  0.20( 0.04) 0.20       3.2     119.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       5.09    Tc(MIN.) =     7.43
 EFFECTIVE AREA(ACRES) =       3.03   AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
 TOTAL AREA(ACRES) =        3.2
 LONGEST FLOWPATH FROM NODE    131.00 TO NODE    171.00 =     901.90 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    171.00 TO NODE    170.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   329.60  DOWNSTREAM(FEET) =   325.60
 FLOW LENGTH(FEET) =   352.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  15.0 INCH PIPE IS  10.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.89
 ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       5.09
 PIPE TRAVEL TIME(MIN.) =   1.00    Tc(MIN.) =    8.42
 LONGEST FLOWPATH FROM NODE    131.00 TO NODE    170.00 =    1253.90 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    170.00 TO NODE    170.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    8.42
 RAINFALL INTENSITY(INCH/HR) =   1.68
 AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20
 AREA-AVERAGED Ap =  0.20
 EFFECTIVE STREAM AREA(ACRES) =       3.03
 TOTAL STREAM AREA(ACRES) =       3.20
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       5.09
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    121.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  ELEVATION DATA: UPSTREAM(FEET) =    336.20  DOWNSTREAM(FEET) =    333.60

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
  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
  "11+ DWELLINGS/ACRE"       D        0.16      0.20     0.200    57    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      0.32
  TOTAL AREA(ACRES) =      0.16   PEAK FLOW RATE(CFS) =      0.32

****************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    120.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  333.60  DOWNSTREAM ELEVATION(FEET) =  330.20
  STREET LENGTH(FEET) =   266.00   CURB HEIGHT(INCHES) =  4.0
  STREET HALFWIDTH(FEET) = 13.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  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) =       0.76
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.23
    HALFSTREET FLOOD WIDTH(FEET) =    5.23
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.93
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.44
  STREET FLOW TRAVEL TIME(MIN.) =   2.30   Tc(MIN.) =    7.30
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.822
```

```
 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"       D        0.54      0.20     0.200    57
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA AREA(ACRES) =    0.54      SUBAREA RUNOFF(CFS) =    0.87
 EFFECTIVE AREA(ACRES) =      0.70    AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
 TOTAL AREA(ACRES) =        0.7        PEAK FLOW RATE(CFS) =       1.12

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.26   HALFSTREET FLOOD WIDTH(FEET) =   6.50
 FLOW VELOCITY(FEET/SEC.) =  2.08   DEPTH*VELOCITY(FT*FT/SEC.) =   0.53
 LONGEST FLOWPATH FROM NODE    122.00 TO NODE    120.00 =     351.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    120.00 TO NODE    170.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   326.20  DOWNSTREAM(FEET) =   325.60
 FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN   9.0 INCH PIPE IS   3.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.50
 ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       1.12
 PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    7.34
 LONGEST FLOWPATH FROM NODE    122.00 TO NODE    170.00 =     366.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    170.00 TO NODE    170.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.34
 RAINFALL INTENSITY(INCH/HR) =   1.82
 AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20
 AREA-AVERAGED Ap =  0.20
 EFFECTIVE STREAM AREA(ACRES) =       0.70
 TOTAL STREAM AREA(ACRES) =       0.70
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.12

****************************************************************************
 FLOW PROCESS FROM NODE    113.00 TO NODE    112.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    79.00
  ELEVATION DATA: UPSTREAM(FEET) =    335.20  DOWNSTREAM(FEET) =    333.60

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
  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
  "11+ DWELLINGS/ACRE"       D        0.13      0.20     0.200    57    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      0.26
  TOTAL AREA(ACRES) =      0.13   PEAK FLOW RATE(CFS) =      0.26

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    111.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  333.60  DOWNSTREAM ELEVATION(FEET) =  330.40
  STREET LENGTH(FEET) =   257.00   CURB HEIGHT(INCHES) =  4.0
  STREET HALFWIDTH(FEET) = 13.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  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) =       0.66
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.22
    HALFSTREET FLOOD WIDTH(FEET) =    4.83
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.87
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.42
  STREET FLOW TRAVEL TIME(MIN.) =   2.30   Tc(MIN.) =    7.30
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.822
  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"       D        0.49      0.20     0.200    57
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.49      SUBAREA RUNOFF(CFS) =    0.79
  EFFECTIVE AREA(ACRES) =      0.62    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        0.6        PEAK FLOW RATE(CFS) =       0.99

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.25   HALFSTREET FLOOD WIDTH(FEET) =   6.15
  FLOW VELOCITY(FEET/SEC.) =  2.01   DEPTH*VELOCITY(FT*FT/SEC.) =   0.50
  LONGEST FLOWPATH FROM NODE    113.00 TO NODE    111.00 =     336.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    170.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   326.40  DOWNSTREAM(FEET) =   325.60
  FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   4.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.96
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.99
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    7.33
  LONGEST FLOWPATH FROM NODE    113.00 TO NODE    170.00 =     351.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    170.00 TO NODE    170.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.33
  RAINFALL INTENSITY(INCH/HR) =   1.82
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.62
  TOTAL STREAM AREA(ACRES) =       0.62
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.99

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        5.07    8.11    1.715  0.20( 0.04) 0.20       2.9     116.00
```

```
     1        5.08    8.21    1.703  0.20( 0.04) 0.20       3.0     125.00
     1        5.09    8.42    1.678  0.20( 0.04) 0.20       3.0     128.00
     1        5.06    8.91    1.625  0.20( 0.04) 0.20       3.1     131.00
     1        4.94    9.51    1.565  0.20( 0.04) 0.20       3.2     119.00
     2        1.12    7.34    1.816  0.20( 0.04) 0.20       0.7     122.00
     3        0.99    7.33    1.817  0.20( 0.04) 0.20       0.6     113.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1        6.98    7.33    1.817  0.20( 0.04) 0.20       4.0     113.00
     2        6.98    7.34    1.816  0.20( 0.04) 0.20       4.0     122.00
     3        7.06    8.11    1.715  0.20( 0.04) 0.20       4.3     116.00
     4        7.06    8.21    1.703  0.20( 0.04) 0.20       4.3     125.00
     5        7.04    8.42    1.678  0.20( 0.04) 0.20       4.4     128.00
     6        6.95    8.91    1.625  0.20( 0.04) 0.20       4.5     131.00
     7        6.76    9.51    1.565  0.20( 0.04) 0.20       4.5     119.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       7.06    Tc(MIN.) =     8.21
  EFFECTIVE AREA(ACRES) =       4.30   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        4.5
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE    170.00 =    1253.90 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    170.00 TO NODE    169.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   325.60  DOWNSTREAM(FEET) =   323.20
  FLOW LENGTH(FEET) =   198.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.60
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.06
  PIPE TRAVEL TIME(MIN.) =   0.50    Tc(MIN.) =    8.71
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE    169.00 =    1451.90 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    169.00 TO NODE    169.00 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.) =    8.71
  RAINFALL INTENSITY(INCH/HR) =   1.65
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       4.30
  TOTAL STREAM AREA(ACRES) =       4.52
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       7.06

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    109.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    84.00
  ELEVATION DATA: UPSTREAM(FEET) =    331.20  DOWNSTREAM(FEET) =    329.80

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
  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
  "11+ DWELLINGS/ACRE"       D        0.13      0.20     0.200    57    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      0.26
  TOTAL AREA(ACRES) =      0.13   PEAK FLOW RATE(CFS) =      0.26

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    108.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  329.80  DOWNSTREAM ELEVATION(FEET) =  328.10
  STREET LENGTH(FEET) =   165.00   CURB HEIGHT(INCHES) =  4.0
  STREET HALFWIDTH(FEET) = 13.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  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) =       0.42
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.20
  HALFSTREET FLOOD WIDTH(FEET) =    3.76
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.62
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.33
 STREET FLOW TRAVEL TIME(MIN.) =   1.70   Tc(MIN.) =    6.70
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.914
 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"       D        0.19      0.20     0.200    57
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA AREA(ACRES) =    0.19      SUBAREA RUNOFF(CFS) =    0.32
 EFFECTIVE AREA(ACRES) =      0.32    AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
 TOTAL AREA(ACRES) =        0.3        PEAK FLOW RATE(CFS) =       0.54

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.22   HALFSTREET FLOOD WIDTH(FEET) =   4.52
 FLOW VELOCITY(FEET/SEC.) =  1.67   DEPTH*VELOCITY(FT*FT/SEC.) =   0.36
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    108.00 =     249.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    108.00 TO NODE    169.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   324.10  DOWNSTREAM(FEET) =   323.20
 FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN   6.0 INCH PIPE IS   2.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.32
 ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       0.54
 PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    6.74
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    169.00 =     264.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    169.00 TO NODE    169.00 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.) =    6.74
 RAINFALL INTENSITY(INCH/HR) =   1.91
```

```
 AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20
 AREA-AVERAGED Ap =  0.20
 EFFECTIVE STREAM AREA(ACRES) =       0.32
 TOTAL STREAM AREA(ACRES) =       0.32
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.54

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1        6.98    7.83    1.749  0.20( 0.04) 0.20       4.0     113.00
     1        6.98    7.84    1.748  0.20( 0.04) 0.20       4.0     122.00
     1        7.06    8.61    1.657  0.20( 0.04) 0.20       4.3     116.00
     1        7.06    8.71    1.646  0.20( 0.04) 0.20       4.3     125.00
     1        7.04    8.93    1.623  0.20( 0.04) 0.20       4.4     128.00
     1        6.95    9.41    1.575  0.20( 0.04) 0.20       4.5     131.00
     1        6.76   10.01    1.519  0.20( 0.04) 0.20       4.5     119.00
     2        0.54    6.74    1.908  0.20( 0.04) 0.20       0.3     110.00

 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        7.09    6.74    1.908  0.20( 0.04) 0.20       3.7     110.00
     2        7.47    7.83    1.749  0.20( 0.04) 0.20       4.3     113.00
     3        7.47    7.84    1.748  0.20( 0.04) 0.20       4.3     122.00
     4        7.53    8.61    1.657  0.20( 0.04) 0.20       4.6     116.00
     5        7.53    8.71    1.646  0.20( 0.04) 0.20       4.6     125.00
     6        7.50    8.93    1.623  0.20( 0.04) 0.20       4.7     128.00
     7        7.40    9.41    1.575  0.20( 0.04) 0.20       4.8     131.00
     8        7.18   10.01    1.519  0.20( 0.04) 0.20       4.8     119.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       7.53    Tc(MIN.) =     8.61
 EFFECTIVE AREA(ACRES) =       4.58   AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
 TOTAL AREA(ACRES) =        4.8
 LONGEST FLOWPATH FROM NODE    131.00 TO NODE    169.00 =    1451.90 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    169.00 TO NODE    169.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    146.00 TO NODE    145.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
================================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.10
  ELEVATION DATA: UPSTREAM(FEET) =    346.10  DOWNSTREAM(FEET) =    344.60

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
  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
  "11+ DWELLINGS/ACRE"       D        0.20      0.20     0.200    57    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.20   PEAK FLOW RATE(CFS) =      0.40

********************************************************************************
  FLOW PROCESS FROM NODE    145.00 TO NODE    144.00 IS CODE =  62
--------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
================================================================================
  UPSTREAM ELEVATION(FEET) =  344.60  DOWNSTREAM ELEVATION(FEET) =  341.50
  STREET LENGTH(FEET) =   118.00   CURB HEIGHT(INCHES) =  4.0
  STREET HALFWIDTH(FEET) = 13.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  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) =       0.68
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.20
    HALFSTREET FLOOD WIDTH(FEET) =    3.76
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.61
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.53
  STREET FLOW TRAVEL TIME(MIN.) =   0.75   Tc(MIN.) =    5.75
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.088
  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"       D        0.30      0.20     0.200    57
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.30      SUBAREA RUNOFF(CFS) =    0.55
  EFFECTIVE AREA(ACRES) =      0.50    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        0.5        PEAK FLOW RATE(CFS) =       0.92

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.22   HALFSTREET FLOOD WIDTH(FEET) =   4.72
  FLOW VELOCITY(FEET/SEC.) =  2.70   DEPTH*VELOCITY(FT*FT/SEC.) =   0.60
  LONGEST FLOWPATH FROM NODE    146.00 TO NODE    144.00 =     203.10 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    144.00 TO NODE    177.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   341.50  DOWNSTREAM(FEET) =   340.50
  FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   3.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.52
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.92
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    5.79
  LONGEST FLOWPATH FROM NODE    146.00 TO NODE    177.00 =     218.10 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    177.00 TO NODE    177.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.79
  RAINFALL INTENSITY(INCH/HR) =   2.08
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.50
  TOTAL STREAM AREA(ACRES) =       0.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.92

****************************************************************************
  FLOW PROCESS FROM NODE    147.00 TO NODE    148.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
```

```
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    93.60
 ELEVATION DATA: UPSTREAM(FEET) =    344.70  DOWNSTREAM(FEET) =    343.70

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
 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
 "11+ DWELLINGS/ACRE"       D        0.18      0.20     0.200    57    5.00
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA RUNOFF(CFS) =      0.36
 TOTAL AREA(ACRES) =      0.18   PEAK FLOW RATE(CFS) =      0.36

****************************************************************************
 FLOW PROCESS FROM NODE    148.00 TO NODE    149.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  343.70  DOWNSTREAM ELEVATION(FEET) =  337.90
 STREET LENGTH(FEET) =   174.60   CURB HEIGHT(INCHES) =  4.0
 STREET HALFWIDTH(FEET) = 13.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
 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 =   0.0150

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.34
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.19
   HALFSTREET FLOOD WIDTH(FEET) =    3.35
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.91
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.56
 STREET FLOW TRAVEL TIME(MIN.) =   1.00   Tc(MIN.) =    6.00
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.039
 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"       D        1.09      0.20     0.200    57
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
```

```
  SUBAREA AREA(ACRES) =    1.09      SUBAREA RUNOFF(CFS) =    1.96
  EFFECTIVE AREA(ACRES) =      1.27    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        1.3        PEAK FLOW RATE(CFS) =       2.28

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.23   HALFSTREET FLOOD WIDTH(FEET) =   5.03
  FLOW VELOCITY(FEET/SEC.) =  3.08   DEPTH*VELOCITY(FT*FT/SEC.) =   0.70
  LONGEST FLOWPATH FROM NODE    147.00 TO NODE    149.00 =     268.20 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    149.00 TO NODE    177.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   347.90  DOWNSTREAM(FEET) =   340.50
  FLOW LENGTH(FEET) =    13.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   3.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  21.10
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.28
  PIPE TRAVEL TIME(MIN.) =   0.01    Tc(MIN.) =    6.01
  LONGEST FLOWPATH FROM NODE    147.00 TO NODE    177.00 =     281.20 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    177.00 TO NODE    177.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.01
  RAINFALL INTENSITY(INCH/HR) =   2.04
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       1.27
  TOTAL STREAM AREA(ACRES) =       1.27
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.28

****************************************************************************
  FLOW PROCESS FROM NODE    151.00 TO NODE    150.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    38.00
  ELEVATION DATA: UPSTREAM(FEET) =    350.50  DOWNSTREAM(FEET) =    349.90
```

```
  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
  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
  "11+ DWELLINGS/ACRE"       D        0.13      0.20     0.200    57    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      0.26
  TOTAL AREA(ACRES) =      0.13   PEAK FLOW RATE(CFS) =      0.26

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    178.00 IS CODE =  92
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    349.90
  DOWNSTREAM NODE ELEVATION(FEET) =    344.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   166.00
  "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.150
  PAVEMENT LIP(FEET) =  0.012   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   1.00
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.072
  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"       D        0.43      0.20     0.200    57
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      0.65
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.31
  AVERAGE FLOW DEPTH(FEET) =   0.15   FLOOD WIDTH(FEET) =    3.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   0.84   Tc(MIN.) =    5.84
  SUBAREA AREA(ACRES) =    0.43       SUBAREA RUNOFF(CFS) =    0.79
  EFFECTIVE AREA(ACRES) =    0.56     AREA-AVERAGED Fm(INCH/HR) =   0.04
  AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.20
  TOTAL AREA(ACRES) =        0.6         PEAK FLOW RATE(CFS) =       1.02

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.17   FLOOD WIDTH(FEET) =    3.41
  FLOW VELOCITY(FEET/SEC.) =   3.74   DEPTH*VELOCITY(FT*FT/SEC) =   0.62
  LONGEST FLOWPATH FROM NODE    151.00 TO NODE    178.00 =     204.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    178.00 TO NODE    177.00 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) =   338.30
  FLOW LENGTH(FEET) =   246.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   4.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.19
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.02
  PIPE TRAVEL TIME(MIN.) =   0.79    Tc(MIN.) =    6.63
  LONGEST FLOWPATH FROM NODE    151.00 TO NODE    177.00 =     450.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    177.00 TO NODE    177.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
================================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.63
  RAINFALL INTENSITY(INCH/HR) =   1.93
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.56
  TOTAL STREAM AREA(ACRES) =       0.56
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.02

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        0.92    5.79    2.081  0.20( 0.04) 0.20       0.5     146.00
      2        2.28    6.01    2.037  0.20( 0.04) 0.20       1.3     147.00
      3        1.02    6.63    1.926  0.20( 0.04) 0.20       0.6     151.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        4.14    5.79    2.081  0.20( 0.04) 0.20       2.2     146.00
      2        4.17    6.01    2.037  0.20( 0.04) 0.20       2.3     147.00
      3        4.03    6.63    1.926  0.20( 0.04) 0.20       2.3     151.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       4.17    Tc(MIN.) =     6.01
  EFFECTIVE AREA(ACRES) =       2.28   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
```

```
  TOTAL AREA(ACRES) =        2.3
  LONGEST FLOWPATH FROM NODE    151.00 TO NODE    177.00 =     450.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    177.00 TO NODE    176.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   337.60  DOWNSTREAM(FEET) =   332.90
  FLOW LENGTH(FEET) =   242.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   8.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.77
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.17
  PIPE TRAVEL TIME(MIN.) =   0.60    Tc(MIN.) =    6.61
  LONGEST FLOWPATH FROM NODE    151.00 TO NODE    176.00 =     692.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    176.00 TO NODE    176.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.61
  RAINFALL INTENSITY(INCH/HR) =   1.93
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       2.28
  TOTAL STREAM AREA(ACRES) =       2.33
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       4.17

****************************************************************************
  FLOW PROCESS FROM NODE    157.00 TO NODE    156.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    71.00
  ELEVATION DATA: UPSTREAM(FEET) =    342.10  DOWNSTREAM(FEET) =    340.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
  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
```

```
  "11+ DWELLINGS/ACRE"       D        0.10      0.20     0.200    57    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      0.20
  TOTAL AREA(ACRES) =      0.10   PEAK FLOW RATE(CFS) =      0.20

****************************************************************************
  FLOW PROCESS FROM NODE    156.00 TO NODE    155.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  340.50  DOWNSTREAM ELEVATION(FEET) =  336.80
  STREET LENGTH(FEET) =   195.00   CURB HEIGHT(INCHES) =  4.0
  STREET HALFWIDTH(FEET) = 13.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  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) =       0.49
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.19
    HALFSTREET FLOOD WIDTH(FEET) =    3.25
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.20
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.42
  STREET FLOW TRAVEL TIME(MIN.) =   1.48   Tc(MIN.) =    6.48
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.951
  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"       D        0.34      0.20     0.200    57
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.34      SUBAREA RUNOFF(CFS) =    0.58
  EFFECTIVE AREA(ACRES) =      0.44    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        0.4        PEAK FLOW RATE(CFS) =       0.76

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.22   HALFSTREET FLOOD WIDTH(FEET) =   4.62
  FLOW VELOCITY(FEET/SEC.) =  2.28   DEPTH*VELOCITY(FT*FT/SEC.) =   0.50
  LONGEST FLOWPATH FROM NODE    157.00 TO NODE    155.00 =     266.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    155.00 TO NODE    176.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   336.80  DOWNSTREAM(FEET) =   332.90
  FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   2.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.80
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.76
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =    6.50
  LONGEST FLOWPATH FROM NODE    157.00 TO NODE    176.00 =     281.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    176.00 TO NODE    176.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.50
  RAINFALL INTENSITY(INCH/HR) =   1.95
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.44
  TOTAL STREAM AREA(ACRES) =       0.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.76

****************************************************************************
  FLOW PROCESS FROM NODE    143.00 TO NODE    142.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    93.00
  ELEVATION DATA: UPSTREAM(FEET) =    340.70  DOWNSTREAM(FEET) =    340.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.783
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.900
  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
  "11+ DWELLINGS/ACRE"       D        0.15      0.20     0.200    57    6.78
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
```

```
  SUBAREA RUNOFF(CFS) =      0.25
  TOTAL AREA(ACRES) =      0.15   PEAK FLOW RATE(CFS) =      0.25

****************************************************************************
  FLOW PROCESS FROM NODE    142.00 TO NODE    141.00 IS CODE =  92
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    340.50
  DOWNSTREAM NODE ELEVATION(FEET) =    337.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   182.00
  "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.200
  PAVEMENT LIP(FEET) =  0.125   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   1.00
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.752
  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"       D        0.53      0.20     0.200    57
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      0.66
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.94
  AVERAGE FLOW DEPTH(FEET) =   0.20   FLOOD WIDTH(FEET) =    3.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.03   Tc(MIN.) =    7.81
  SUBAREA AREA(ACRES) =    0.53       SUBAREA RUNOFF(CFS) =    0.82
  EFFECTIVE AREA(ACRES) =    0.68     AREA-AVERAGED Fm(INCH/HR) =   0.04
  AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.20
  TOTAL AREA(ACRES) =        0.7         PEAK FLOW RATE(CFS) =       1.05

         NOTE:TRAVEL TIME ESTIMATES BASED ON NORMAL
         DEPTH EQUAL TO [GUTTER-HIKE + PAVEMENT LIP]

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.32   FLOOD WIDTH(FEET) =    3.00
  FLOW VELOCITY(FEET/SEC.) =   4.79   DEPTH*VELOCITY(FT*FT/SEC) =   1.56
  LONGEST FLOWPATH FROM NODE    143.00 TO NODE    141.00 =     275.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    141.00 TO NODE    176.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   337.00  DOWNSTREAM(FEET) =   332.90
  FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   2.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.19
```

```
 ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       1.05
 PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =    7.83
 LONGEST FLOWPATH FROM NODE    143.00 TO NODE    176.00 =     290.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    176.00 TO NODE    176.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.83
 RAINFALL INTENSITY(INCH/HR) =   1.75
 AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20
 AREA-AVERAGED Ap =  0.20
 EFFECTIVE STREAM AREA(ACRES) =       0.68
 TOTAL STREAM AREA(ACRES) =       0.68
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.05

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1        4.14    6.38    1.967  0.20( 0.04) 0.20       2.2     146.00
     1        4.17    6.61    1.929  0.20( 0.04) 0.20       2.3     147.00
     1        4.03    7.22    1.833  0.20( 0.04) 0.20       2.3     151.00
     2        0.76    6.50    1.948  0.20( 0.04) 0.20       0.4     157.00
     3        1.05    7.83    1.750  0.20( 0.04) 0.20       0.7     143.00

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  3 STREAMS.

 ** PEAK FLOW RATE TABLE **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1        5.85    6.38    1.967  0.20( 0.04) 0.20       3.2     146.00
     2        5.88    6.50    1.948  0.20( 0.04) 0.20       3.2     157.00
     3        5.90    6.61    1.929  0.20( 0.04) 0.20       3.3     147.00
     4        5.76    7.22    1.833  0.20( 0.04) 0.20       3.4     151.00
     5        5.57    7.83    1.750  0.20( 0.04) 0.20       3.4     143.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       5.90    Tc(MIN.) =     6.61
 EFFECTIVE AREA(ACRES) =       3.29   AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
 TOTAL AREA(ACRES) =        3.4
 LONGEST FLOWPATH FROM NODE    151.00 TO NODE    176.00 =     692.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    176.00 TO NODE    175.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   332.90  DOWNSTREAM(FEET) =   330.70
  FLOW LENGTH(FEET) =   112.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  15.0 INCH PIPE IS   9.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.55
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.90
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =    6.85
  LONGEST FLOWPATH FROM NODE    151.00 TO NODE    175.00 =     804.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    175.00 TO NODE    175.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    168.00 TO NODE    167.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    83.00
  ELEVATION DATA: UPSTREAM(FEET) =    345.20  DOWNSTREAM(FEET) =    344.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
  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
  "11+ DWELLINGS/ACRE"       D        0.11      0.20     0.200    57    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      0.22
  TOTAL AREA(ACRES) =      0.11   PEAK FLOW RATE(CFS) =      0.22

****************************************************************************
  FLOW PROCESS FROM NODE    167.00 TO NODE    166.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  344.00  DOWNSTREAM ELEVATION(FEET) =  342.10
```

```
 STREET LENGTH(FEET) =   129.00   CURB HEIGHT(INCHES) =  4.0
 STREET HALFWIDTH(FEET) = 10.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
 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 =   0.0150

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.83
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.19
   HALFSTREET FLOOD WIDTH(FEET) =    3.11
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.92
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.36
 STREET FLOW TRAVEL TIME(MIN.) =   1.12   Tc(MIN.) =    6.12
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.016
 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"       D        0.68      0.20     0.200    57
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA AREA(ACRES) =    0.68      SUBAREA RUNOFF(CFS) =    1.21
 EFFECTIVE AREA(ACRES) =      0.79    AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
 TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       1.40

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.22   HALFSTREET FLOOD WIDTH(FEET) =   4.81
 FLOW VELOCITY(FEET/SEC.) =  2.01   DEPTH*VELOCITY(FT*FT/SEC.) =   0.45
 LONGEST FLOWPATH FROM NODE    168.00 TO NODE    166.00 =     212.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    166.00 TO NODE    179.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   338.10  DOWNSTREAM(FEET) =   335.90
 FLOW LENGTH(FEET) =   192.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN   9.0 INCH PIPE IS   6.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.26
 ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       1.40
 PIPE TRAVEL TIME(MIN.) =   0.75    Tc(MIN.) =    6.87
```

```
 LONGEST FLOWPATH FROM NODE    168.00 TO NODE    179.00 =     404.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    179.00 TO NODE    179.00 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.) =    6.87
 RAINFALL INTENSITY(INCH/HR) =   1.89
 AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20
 AREA-AVERAGED Ap =  0.20
 EFFECTIVE STREAM AREA(ACRES) =       0.79
 TOTAL STREAM AREA(ACRES) =       0.79
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.40

****************************************************************************
 FLOW PROCESS FROM NODE    182.00 TO NODE    181.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    73.70
 ELEVATION DATA: UPSTREAM(FEET) =    340.20  DOWNSTREAM(FEET) =    339.70

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
 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
 "11+ DWELLINGS/ACRE"       D        0.10      0.20     0.200    57    5.00
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA RUNOFF(CFS) =      0.20
 TOTAL AREA(ACRES) =      0.10   PEAK FLOW RATE(CFS) =      0.20

****************************************************************************
 FLOW PROCESS FROM NODE    181.00 TO NODE    165.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  339.40  DOWNSTREAM ELEVATION(FEET) =  337.80
 STREET LENGTH(FEET) =   106.00   CURB HEIGHT(INCHES) =  4.0
 STREET HALFWIDTH(FEET) = 10.00
```

```
 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
 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 =   0.0150

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.85
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.19
   HALFSTREET FLOOD WIDTH(FEET) =    3.17
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.95
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.37
 STREET FLOW TRAVEL TIME(MIN.) =   0.90   Tc(MIN.) =    5.90
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.058
 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"       D        0.72      0.20     0.200    57
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA AREA(ACRES) =    0.72      SUBAREA RUNOFF(CFS) =    1.31
 EFFECTIVE AREA(ACRES) =      0.82    AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
 TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       1.49

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.22   HALFSTREET FLOOD WIDTH(FEET) =   4.92
 FLOW VELOCITY(FEET/SEC.) =  2.07   DEPTH*VELOCITY(FT*FT/SEC.) =   0.46
 LONGEST FLOWPATH FROM NODE    182.00 TO NODE    165.00 =     179.70 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    165.00 TO NODE    179.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   336.50  DOWNSTREAM(FEET) =   335.90
 FLOW LENGTH(FEET) =    13.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN   9.0 INCH PIPE IS   4.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.39
 ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       1.49
 PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    5.93
 LONGEST FLOWPATH FROM NODE    182.00 TO NODE    179.00 =     192.70 FEET.

****************************************************************************
```

```
 FLOW PROCESS FROM NODE    179.00 TO NODE    179.00 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.) =    5.93
 RAINFALL INTENSITY(INCH/HR) =   2.05
 AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20
 AREA-AVERAGED Ap =  0.20
 EFFECTIVE STREAM AREA(ACRES) =       0.82
 TOTAL STREAM AREA(ACRES) =       0.82
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.49

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1        1.40    6.87    1.886  0.20( 0.04) 0.20       0.8     168.00
     2        1.49    5.93    2.052  0.20( 0.04) 0.20       0.8     182.00

 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        2.81    5.93    2.052  0.20( 0.04) 0.20       1.5     182.00
     2        2.77    6.87    1.886  0.20( 0.04) 0.20       1.6     168.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       2.81    Tc(MIN.) =     5.93
 EFFECTIVE AREA(ACRES) =       1.50   AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
 TOTAL AREA(ACRES) =        1.6
 LONGEST FLOWPATH FROM NODE    168.00 TO NODE    179.00 =     404.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    179.00 TO NODE    175.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   335.90  DOWNSTREAM(FEET) =   330.70
 FLOW LENGTH(FEET) =   306.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.95
 ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.81
```

```
  PIPE TRAVEL TIME(MIN.) =   0.86    Tc(MIN.) =    6.79
  LONGEST FLOWPATH FROM NODE    168.00 TO NODE    175.00 =     710.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    175.00 TO NODE    175.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        2.81    6.79    1.899  0.20( 0.04) 0.20       1.5     182.00
      2        2.77    7.73    1.763  0.20( 0.04) 0.20       1.6     168.00
  LONGEST FLOWPATH FROM NODE    168.00 TO NODE    175.00 =     710.00 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        5.85    6.63    1.925  0.20( 0.04) 0.20       3.2     146.00
      2        5.88    6.75    1.906  0.20( 0.04) 0.20       3.2     157.00
      3        5.90    6.85    1.889  0.20( 0.04) 0.20       3.3     147.00
      4        5.76    7.47    1.798  0.20( 0.04) 0.20       3.4     151.00
      5        5.57    8.08    1.718  0.20( 0.04) 0.20       3.4     143.00
  LONGEST FLOWPATH FROM NODE    151.00 TO NODE    175.00 =     804.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        8.64    6.63    1.925  0.20( 0.04) 0.20       4.7     146.00
      2        8.68    6.75    1.906  0.20( 0.04) 0.20       4.7     157.00
      3        8.70    6.79    1.899  0.20( 0.04) 0.20       4.8     182.00
      4        8.70    6.85    1.889  0.20( 0.04) 0.20       4.8     147.00
      5        8.54    7.47    1.798  0.20( 0.04) 0.20       5.0     151.00
      6        8.45    7.73    1.763  0.20( 0.04) 0.20       5.0     168.00
      7        8.27    8.08    1.718  0.20( 0.04) 0.20       5.1     143.00
    TOTAL AREA(ACRES) =         5.1

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =        8.70  Tc(MIN.) =    6.854
  EFFECTIVE AREA(ACRES) =      4.80  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        5.1
  LONGEST FLOWPATH FROM NODE    151.00 TO NODE    175.00 =     804.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    175.00 TO NODE    175.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    175.00 TO NODE    174.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   330.70  DOWNSTREAM(FEET) =   329.90
  FLOW LENGTH(FEET) =    43.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.16
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.70
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    6.94
  LONGEST FLOWPATH FROM NODE    151.00 TO NODE    174.00 =     847.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    174.00 TO NODE    174.00 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.) =    6.94
  RAINFALL INTENSITY(INCH/HR) =   1.88
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       4.80
  TOTAL STREAM AREA(ACRES) =       5.06
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       8.70

****************************************************************************
  FLOW PROCESS FROM NODE    164.00 TO NODE    163.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    92.00
  ELEVATION DATA: UPSTREAM(FEET) =    340.70  DOWNSTREAM(FEET) =    339.10

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
  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
  "11+ DWELLINGS/ACRE"       D        0.11      0.20     0.200    57    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      0.22
  TOTAL AREA(ACRES) =      0.11   PEAK FLOW RATE(CFS) =      0.22

****************************************************************************
  FLOW PROCESS FROM NODE    163.00 TO NODE    162.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  339.10  DOWNSTREAM ELEVATION(FEET) =  333.50
  STREET LENGTH(FEET) =   224.00   CURB HEIGHT(INCHES) =  4.0
  STREET HALFWIDTH(FEET) = 13.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  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 =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.05
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.19
    HALFSTREET FLOOD WIDTH(FEET) =    3.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.53
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.47
  STREET FLOW TRAVEL TIME(MIN.) =   1.47   Tc(MIN.) =    6.47
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.952
  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"       D        0.97      0.20     0.200    57
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.97      SUBAREA RUNOFF(CFS) =    1.67
  EFFECTIVE AREA(ACRES) =      1.08    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       1.86

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.22   HALFSTREET FLOOD WIDTH(FEET) =   4.83
  FLOW VELOCITY(FEET/SEC.) =  2.65   DEPTH*VELOCITY(FT*FT/SEC.) =   0.59
  LONGEST FLOWPATH FROM NODE    164.00 TO NODE    162.00 =     316.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    162.00 TO NODE    174.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   330.20  DOWNSTREAM(FEET) =   329.90
  FLOW LENGTH(FEET) =    13.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   6.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.96
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.86
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    6.51
  LONGEST FLOWPATH FROM NODE    164.00 TO NODE    174.00 =     329.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    174.00 TO NODE    174.00 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.) =    6.51
  RAINFALL INTENSITY(INCH/HR) =   1.95
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       1.08
  TOTAL STREAM AREA(ACRES) =       1.08
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.86

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        8.64    6.72    1.910  0.20( 0.04) 0.20       4.7     146.00
      1        8.68    6.83    1.892  0.20( 0.04) 0.20       4.7     157.00
      1        8.70    6.88    1.885  0.20( 0.04) 0.20       4.8     182.00
      1        8.70    6.94    1.875  0.20( 0.04) 0.20       4.8     147.00
      1        8.54    7.56    1.786  0.20( 0.04) 0.20       5.0     151.00
      1        8.45    7.82    1.751  0.20( 0.04) 0.20       5.0     168.00
      1        8.27    8.18    1.707  0.20( 0.04) 0.20       5.1     143.00
      2        1.86    6.51    1.945  0.20( 0.04) 0.20       1.1     164.00

  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       10.38    6.51    1.945  0.20( 0.04) 0.20       5.6     164.00
      2       10.46    6.72    1.910  0.20( 0.04) 0.20       5.7     146.00
```

```
      3       10.49    6.83    1.892  0.20( 0.04) 0.20       5.8     157.00
      4       10.50    6.88    1.885  0.20( 0.04) 0.20       5.8     182.00
      5       10.49    6.94    1.875  0.20( 0.04) 0.20       5.9     147.00
      6       10.24    7.56    1.786  0.20( 0.04) 0.20       6.1     151.00
      7       10.12    7.82    1.751  0.20( 0.04) 0.20       6.1     168.00
      8        9.90    8.18    1.707  0.20( 0.04) 0.20       6.1     143.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      10.50    Tc(MIN.) =     6.88
  EFFECTIVE AREA(ACRES) =       5.85   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        6.1
  LONGEST FLOWPATH FROM NODE    151.00 TO NODE    174.00 =     847.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    174.00 TO NODE    173.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   329.90  DOWNSTREAM(FEET) =   324.80
  FLOW LENGTH(FEET) =   292.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.27
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.50
  PIPE TRAVEL TIME(MIN.) =   0.59    Tc(MIN.) =    7.47
  LONGEST FLOWPATH FROM NODE    151.00 TO NODE    173.00 =    1139.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    173.00 TO NODE    173.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.47
  RAINFALL INTENSITY(INCH/HR) =   1.80
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       5.85
  TOTAL STREAM AREA(ACRES) =       6.14
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      10.50

****************************************************************************
  FLOW PROCESS FROM NODE    137.00 TO NODE    136.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
```

```
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    67.00
  ELEVATION DATA: UPSTREAM(FEET) =    400.00  DOWNSTREAM(FEET) =    398.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
  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
  "11+ DWELLINGS/ACRE"       D        0.28      0.20     0.200    57    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      0.56
  TOTAL AREA(ACRES) =      0.28   PEAK FLOW RATE(CFS) =      0.56

**************************************************************************
  FLOW PROCESS FROM NODE    136.00 TO NODE    135.00 IS CODE =  62
--------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
==========================================================================
  UPSTREAM ELEVATION(FEET) =  334.50  DOWNSTREAM ELEVATION(FEET) =  328.90
  STREET LENGTH(FEET) =   381.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 13.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  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 =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.83
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.19
    HALFSTREET FLOOD WIDTH(FEET) =    3.10
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.93
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.36
  STREET FLOW TRAVEL TIME(MIN.) =   3.28   Tc(MIN.) =    8.28
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.694
  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"       D        0.36      0.20     0.200    57
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.36      SUBAREA RUNOFF(CFS) =    0.54
  EFFECTIVE AREA(ACRES) =      0.64    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        0.6        PEAK FLOW RATE(CFS) =       0.95

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.20   HALFSTREET FLOOD WIDTH(FEET) =   3.61
  FLOW VELOCITY(FEET/SEC.) =  1.92   DEPTH*VELOCITY(FT*FT/SEC.) =   0.38
  LONGEST FLOWPATH FROM NODE    137.00 TO NODE    135.00 =     448.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    135.00 TO NODE    173.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   325.20  DOWNSTREAM(FEET) =   324.80
  FLOW LENGTH(FEET) =    13.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   3.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.68
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.95
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    8.32
  LONGEST FLOWPATH FROM NODE    137.00 TO NODE    173.00 =     461.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    173.00 TO NODE    173.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.32
  RAINFALL INTENSITY(INCH/HR) =   1.69
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.64
  TOTAL STREAM AREA(ACRES) =       0.64
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.95

****************************************************************************
  FLOW PROCESS FROM NODE    154.00 TO NODE    153.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   106.40
  ELEVATION DATA: UPSTREAM(FEET) =    337.40  DOWNSTREAM(FEET) =    334.50
```

```
 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
 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
 "11+ DWELLINGS/ACRE"       D        0.15      0.20     0.200    57    5.00
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA RUNOFF(CFS) =      0.30
 TOTAL AREA(ACRES) =      0.15   PEAK FLOW RATE(CFS) =      0.30

****************************************************************************
 FLOW PROCESS FROM NODE    153.00 TO NODE    152.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  334.50  DOWNSTREAM ELEVATION(FEET) =  328.80
 STREET LENGTH(FEET) =   336.30   CURB HEIGHT(INCHES) =  4.0
 STREET HALFWIDTH(FEET) = 13.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 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) =       0.95
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.24
   HALFSTREET FLOOD WIDTH(FEET) =    5.54
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.24
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.53
 STREET FLOW TRAVEL TIME(MIN.) =   2.50   Tc(MIN.) =    7.50
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.793
 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"       D        0.82      0.20     0.200    57
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA AREA(ACRES) =    0.82      SUBAREA RUNOFF(CFS) =    1.29
 EFFECTIVE AREA(ACRES) =      0.97    AREA-AVERAGED Fm(INCH/HR) =  0.04
```

```
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
 TOTAL AREA(ACRES) =        1.0        PEAK FLOW RATE(CFS) =       1.53

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =   7.06
 FLOW VELOCITY(FEET/SEC.) =  2.48   DEPTH*VELOCITY(FT*FT/SEC.) =   0.66
 LONGEST FLOWPATH FROM NODE    154.00 TO NODE    152.00 =     442.70 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    152.00 TO NODE    173.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   325.20  DOWNSTREAM(FEET) =   324.80
 FLOW LENGTH(FEET) =    13.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN   9.0 INCH PIPE IS   4.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.40
 ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       1.53
 PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    7.54
 LONGEST FLOWPATH FROM NODE    154.00 TO NODE    173.00 =     455.70 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    173.00 TO NODE    173.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.54
 RAINFALL INTENSITY(INCH/HR) =   1.79
 AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20
 AREA-AVERAGED Ap =  0.20
 EFFECTIVE STREAM AREA(ACRES) =       0.97
 TOTAL STREAM AREA(ACRES) =       0.97
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.53

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1       10.38    7.10    1.851  0.20( 0.04) 0.20       5.6     164.00
     1       10.46    7.31    1.821  0.20( 0.04) 0.20       5.7     146.00
     1       10.49    7.42    1.804  0.20( 0.04) 0.20       5.8     157.00
     1       10.50    7.47    1.798  0.20( 0.04) 0.20       5.8     182.00
     1       10.49    7.53    1.790  0.20( 0.04) 0.20       5.9     147.00
     1       10.24    8.15    1.710  0.20( 0.04) 0.20       6.1     151.00
     1       10.12    8.41    1.679  0.20( 0.04) 0.20       6.1     168.00
```

```
     1        9.90    8.77    1.640  0.20( 0.04) 0.20       6.1     143.00
     2        0.95    8.32    1.690  0.20( 0.04) 0.20       0.6     137.00
     3        1.53    7.54    1.789  0.20( 0.04) 0.20       1.0     154.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1       12.77    7.10    1.851  0.20( 0.04) 0.20       7.1     164.00
     2       12.87    7.31    1.821  0.20( 0.04) 0.20       7.2     146.00
     3       12.92    7.42    1.804  0.20( 0.04) 0.20       7.3     157.00
     4       12.93    7.47    1.798  0.20( 0.04) 0.20       7.4     182.00
     5       12.94    7.53    1.790  0.20( 0.04) 0.20       7.4     147.00
     6       12.94    7.54    1.789  0.20( 0.04) 0.20       7.4     154.00
     7       12.65    8.15    1.710  0.20( 0.04) 0.20       7.7     151.00
     8       12.56    8.32    1.690  0.20( 0.04) 0.20       7.7     137.00
     9       12.50    8.41    1.679  0.20( 0.04) 0.20       7.7     168.00
    10       12.22    8.77    1.640  0.20( 0.04) 0.20       7.8     143.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      12.94    Tc(MIN.) =     7.53
  EFFECTIVE AREA(ACRES) =       7.43   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        7.8
  LONGEST FLOWPATH FROM NODE    151.00 TO NODE    173.00 =    1139.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    173.00 TO NODE    169.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   324.80  DOWNSTREAM(FEET) =   324.30
  FLOW LENGTH(FEET) =    45.40   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.32
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.94
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    7.63
  LONGEST FLOWPATH FROM NODE    151.00 TO NODE    169.00 =    1184.40 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    169.00 TO NODE    169.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
```

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	12.77	7.20	1.836	0.20(0.04)	0.20	7.1	164.00
2	12.87	7.41	1.806	0.20(0.04)	0.20	7.2	146.00
3	12.92	7.53	1.790	0.20(0.04)	0.20	7.3	157.00
4	12.93	7.57	1.784	0.20(0.04)	0.20	7.4	182.00
5	12.94	7.63	1.776	0.20(0.04)	0.20	7.4	147.00
6	12.94	7.64	1.775	0.20(0.04)	0.20	7.4	154.00
7	12.65	8.25	1.698	0.20(0.04)	0.20	7.7	151.00
8	12.56	8.43	1.678	0.20(0.04)	0.20	7.7	137.00
9	12.50	8.52	1.667	0.20(0.04)	0.20	7.7	168.00
10	12.22	8.88	1.628	0.20(0.04)	0.20	7.8	143.00

LONGEST FLOWPATH FROM NODE 151.00 TO NODE 169.00 = 1184.40 FEET.

** MEMORY BANK # 1 CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	7.09	6.74	1.908	0.20(0.04)	0.20	3.7	110.00
2	7.47	7.83	1.749	0.20(0.04)	0.20	4.3	113.00
3	7.47	7.84	1.748	0.20(0.04)	0.20	4.3	122.00
4	7.53	8.61	1.657	0.20(0.04)	0.20	4.6	116.00
5	7.53	8.71	1.646	0.20(0.04)	0.20	4.6	125.00
6	7.50	8.93	1.623	0.20(0.04)	0.20	4.7	128.00
7	7.40	9.41	1.575	0.20(0.04)	0.20	4.8	131.00
8	7.18	10.01	1.519	0.20(0.04)	0.20	4.8	119.00

LONGEST FLOWPATH FROM NODE 131.00 TO NODE 169.00 = 1451.90 FEET.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	19.51	6.74	1.908	0.20(0.04)	0.20	10.3	110.00
2	20.02	7.20	1.836	0.20(0.04)	0.20	11.0	164.00
3	20.20	7.41	1.806	0.20(0.04)	0.20	11.3	146.00
4	20.29	7.53	1.790	0.20(0.04)	0.20	11.5	157.00
5	20.31	7.57	1.784	0.20(0.04)	0.20	11.6	182.00
6	20.34	7.63	1.776	0.20(0.04)	0.20	11.6	147.00
7	20.34	7.64	1.775	0.20(0.04)	0.20	11.6	154.00
8	20.32	7.83	1.749	0.20(0.04)	0.20	11.8	113.00
9	20.31	7.84	1.748	0.20(0.04)	0.20	11.8	122.00
10	20.15	8.25	1.698	0.20(0.04)	0.20	12.1	151.00
11	20.07	8.43	1.678	0.20(0.04)	0.20	12.2	137.00
12	20.02	8.52	1.667	0.20(0.04)	0.20	12.3	168.00
13	19.96	8.61	1.657	0.20(0.04)	0.20	12.3	116.00
14	19.88	8.71	1.646	0.20(0.04)	0.20	12.4	125.00
15	19.73	8.88	1.628	0.20(0.04)	0.20	12.4	143.00
16	19.68	8.93	1.623	0.20(0.04)	0.20	12.4	128.00
17	19.20	9.41	1.575	0.20(0.04)	0.20	12.5	131.00
18	18.56	10.01	1.519	0.20(0.04)	0.20	12.6	119.00

TOTAL AREA(ACRES) = 12.6

```
  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       20.34  Tc(MIN.) =    7.639
  EFFECTIVE AREA(ACRES) =     11.63  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =       12.6
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE    169.00 =    1451.90 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    169.00 TO NODE    169.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    169.00 TO NODE    102.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   324.30  DOWNSTREAM(FEET) =   312.20
  FLOW LENGTH(FEET) =   311.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.28
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      20.34
  PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =    8.03
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE    102.00 =    1762.90 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.03
  RAINFALL INTENSITY(INCH/HR) =   1.72
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =      11.63
  TOTAL STREAM AREA(ACRES) =      12.59
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      20.34

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    103.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
```

```
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   132.10
 ELEVATION DATA: UPSTREAM(FEET) =    327.90  DOWNSTREAM(FEET) =    323.70

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
 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
 "11+ DWELLINGS/ACRE"       D        0.13      0.20     0.200    57    5.00
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA RUNOFF(CFS) =      0.26
 TOTAL AREA(ACRES) =      0.13   PEAK FLOW RATE(CFS) =      0.26

****************************************************************************
 FLOW PROCESS FROM NODE    103.00 TO NODE    102.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  323.70  DOWNSTREAM ELEVATION(FEET) =  316.20
 STREET LENGTH(FEET) =   192.30   CURB HEIGHT(INCHES) =  4.0
 STREET HALFWIDTH(FEET) = 13.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
 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 =   0.0150

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.52
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.16
   HALFSTREET FLOOD WIDTH(FEET) =    1.50
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.72
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.58
 STREET FLOW TRAVEL TIME(MIN.) =   0.86   Tc(MIN.) =    5.86
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.066
 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"       D        0.28      0.20     0.200    57
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
```

```
  SUBAREA AREA(ACRES) =    0.28      SUBAREA RUNOFF(CFS) =    0.51
  EFFECTIVE AREA(ACRES) =      0.41    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        0.4        PEAK FLOW RATE(CFS) =       0.75

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.16   HALFSTREET FLOOD WIDTH(FEET) =   1.50
  FLOW VELOCITY(FEET/SEC.) =  3.72   DEPTH*VELOCITY(FT*FT/SEC.) =   0.58
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    102.00 =     324.40 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.86
  RAINFALL INTENSITY(INCH/HR) =   2.07
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.41
  TOTAL STREAM AREA(ACRES) =       0.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.75

****************************************************************************
  FLOW PROCESS FROM NODE    147.00 TO NODE    146.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   141.00
  ELEVATION DATA: UPSTREAM(FEET) =    400.00  DOWNSTREAM(FEET) =    397.20

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.136
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.229
  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
  "11+ DWELLINGS/ACRE"       D        0.46      0.20     0.200    57    5.14
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      0.91
  TOTAL AREA(ACRES) =      0.46   PEAK FLOW RATE(CFS) =      0.91

****************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    102.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   318.50  DOWNSTREAM(FEET) =   312.20
  FLOW LENGTH(FEET) =   143.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   4.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.34
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.91
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =    5.51
  LONGEST FLOWPATH FROM NODE    147.00 TO NODE    102.00 =     284.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.51
  RAINFALL INTENSITY(INCH/HR) =   2.14
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.46
  TOTAL STREAM AREA(ACRES) =       0.46
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.91

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       19.51    7.14    1.844  0.20( 0.04) 0.20      10.3     110.00
      1       20.02    7.60    1.781  0.20( 0.04) 0.20      11.0     164.00
      1       20.20    7.80    1.753  0.20( 0.04) 0.20      11.3     146.00
      1       20.29    7.92    1.739  0.20( 0.04) 0.20      11.5     157.00
      1       20.31    7.96    1.733  0.20( 0.04) 0.20      11.6     182.00
      1       20.34    8.02    1.726  0.20( 0.04) 0.20      11.6     147.00
      1       20.34    8.03    1.725  0.20( 0.04) 0.20      11.6     154.00
      1       20.32    8.22    1.701  0.20( 0.04) 0.20      11.8     113.00
      1       20.31    8.23    1.700  0.20( 0.04) 0.20      11.8     122.00
      1       20.15    8.65    1.653  0.20( 0.04) 0.20      12.1     151.00
      1       20.07    8.82    1.635  0.20( 0.04) 0.20      12.2     137.00
      1       20.02    8.91    1.625  0.20( 0.04) 0.20      12.3     168.00
      1       19.96    9.00    1.615  0.20( 0.04) 0.20      12.3     116.00
      1       19.88    9.10    1.605  0.20( 0.04) 0.20      12.4     125.00
      1       19.73    9.27    1.588  0.20( 0.04) 0.20      12.4     143.00
      1       19.68    9.32    1.584  0.20( 0.04) 0.20      12.4     128.00
      1       19.20    9.82    1.537  0.20( 0.04) 0.20      12.5     131.00
```

1	18.56	10.42	1.485	0.20(0.04) 0.20	12.6	119.00
2	0.75	5.86	2.066	0.20(0.04) 0.20	0.4	104.00
3	0.91	5.51	2.140	0.20(0.04) 0.20	0.5	147.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 3 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	19.16	5.51	2.140	0.20(0.04) 0.20		8.8	147.00
2	19.60	5.86	2.066	0.20(0.04) 0.20		9.4	104.00
3	20.96	7.14	1.844	0.20(0.04) 0.20		11.2	110.00
4	21.42	7.60	1.781	0.20(0.04) 0.20		11.9	164.00
5	21.57	7.80	1.753	0.20(0.04) 0.20		12.2	146.00
6	21.64	7.92	1.739	0.20(0.04) 0.20		12.4	157.00
7	21.67	7.96	1.733	0.20(0.04) 0.20		12.4	182.00
8	21.69	8.02	1.726	0.20(0.04) 0.20		12.5	147.00
9	21.69	8.03	1.725	0.20(0.04) 0.20		12.5	154.00
10	21.65	8.22	1.701	0.20(0.04) 0.20		12.7	113.00
11	21.64	8.23	1.700	0.20(0.04) 0.20		12.7	122.00
12	21.44	8.65	1.653	0.20(0.04) 0.20		13.0	151.00
13	21.35	8.82	1.635	0.20(0.04) 0.20		13.1	137.00
14	21.29	8.91	1.625	0.20(0.04) 0.20		13.1	168.00
15	21.22	9.00	1.615	0.20(0.04) 0.20		13.2	116.00
16	21.13	9.10	1.605	0.20(0.04) 0.20		13.2	125.00
17	20.97	9.27	1.588	0.20(0.04) 0.20		13.3	143.00
18	20.92	9.32	1.584	0.20(0.04) 0.20		13.3	128.00
19	20.40	9.82	1.537	0.20(0.04) 0.20		13.4	131.00
20	19.72	10.42	1.485	0.20(0.04) 0.20		13.5	119.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 21.69 Tc(MIN.) = 8.02
EFFECTIVE AREA(ACRES) = 12.50 AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.20
TOTAL AREA(ACRES) = 13.5
LONGEST FLOWPATH FROM NODE 131.00 TO NODE 102.00 = 1762.90 FEET.

****
FLOW PROCESS FROM NODE 102.00 TO NODE 102.00 IS CODE = 10

>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
==

****
FLOW PROCESS FROM NODE 145.00 TO NODE 144.00 IS CODE = 21

>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==

```
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   167.00
 ELEVATION DATA: UPSTREAM(FEET) =    400.00  DOWNSTREAM(FEET) =    396.70

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.501
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.143
 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
 "11+ DWELLINGS/ACRE"       D        0.41      0.20     0.200    57    5.50
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA RUNOFF(CFS) =      0.78
 TOTAL AREA(ACRES) =      0.41   PEAK FLOW RATE(CFS) =      0.78

****************************************************************************
 FLOW PROCESS FROM NODE    144.00 TO NODE    102.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   317.00  DOWNSTREAM(FEET) =   312.20
 FLOW LENGTH(FEET) =    43.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN   6.0 INCH PIPE IS   2.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.75
 ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       0.78
 PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    5.58
 LONGEST FLOWPATH FROM NODE    145.00 TO NODE    102.00 =     210.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1        0.78    5.58    2.125  0.20( 0.04) 0.20       0.4     145.00
 LONGEST FLOWPATH FROM NODE    145.00 TO NODE    102.00 =     210.00 FEET.

 ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1       19.16    5.51    2.140  0.20( 0.04) 0.20       8.8     147.00
     2       19.60    5.86    2.066  0.20( 0.04) 0.20       9.4     104.00
     3       20.96    7.14    1.844  0.20( 0.04) 0.20      11.2     110.00
     4       21.42    7.60    1.781  0.20( 0.04) 0.20      11.9     164.00
```

5	21.57	7.80	1.753	0.20(0.04)	0.20	12.2	146.00
6	21.64	7.92	1.739	0.20(0.04)	0.20	12.4	157.00
7	21.67	7.96	1.733	0.20(0.04)	0.20	12.4	182.00
8	21.69	8.02	1.726	0.20(0.04)	0.20	12.5	147.00
9	21.69	8.03	1.725	0.20(0.04)	0.20	12.5	154.00
10	21.65	8.22	1.701	0.20(0.04)	0.20	12.7	113.00
11	21.64	8.23	1.700	0.20(0.04)	0.20	12.7	122.00
12	21.44	8.65	1.653	0.20(0.04)	0.20	13.0	151.00
13	21.35	8.82	1.635	0.20(0.04)	0.20	13.1	137.00
14	21.29	8.91	1.625	0.20(0.04)	0.20	13.1	168.00
15	21.22	9.00	1.615	0.20(0.04)	0.20	13.2	116.00
16	21.13	9.10	1.605	0.20(0.04)	0.20	13.2	125.00
17	20.97	9.27	1.588	0.20(0.04)	0.20	13.3	143.00
18	20.92	9.32	1.584	0.20(0.04)	0.20	13.3	128.00
19	20.40	9.82	1.537	0.20(0.04)	0.20	13.4	131.00
20	19.72	10.42	1.485	0.20(0.04)	0.20	13.5	119.00

LONGEST FLOWPATH FROM NODE 131.00 TO NODE 102.00 = 1762.90 FEET.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	19.93	5.51	2.140	0.20(0.04)	0.20	9.2	147.00
2	20.03	5.58	2.125	0.20(0.04)	0.20	9.3	145.00
3	20.35	5.86	2.066	0.20(0.04)	0.20	9.8	104.00
4	21.63	7.14	1.844	0.20(0.04)	0.20	11.6	110.00
5	22.06	7.60	1.781	0.20(0.04)	0.20	12.3	164.00
6	22.21	7.80	1.753	0.20(0.04)	0.20	12.6	146.00
7	22.28	7.92	1.739	0.20(0.04)	0.20	12.8	157.00
8	22.30	7.96	1.733	0.20(0.04)	0.20	12.8	182.00
9	22.32	8.02	1.726	0.20(0.04)	0.20	12.9	147.00
10	22.32	8.03	1.725	0.20(0.04)	0.20	12.9	154.00
11	22.26	8.22	1.701	0.20(0.04)	0.20	13.1	113.00
12	22.26	8.23	1.700	0.20(0.04)	0.20	13.1	122.00
13	22.04	8.65	1.653	0.20(0.04)	0.20	13.4	151.00
14	21.94	8.82	1.635	0.20(0.04)	0.20	13.5	137.00
15	21.88	8.91	1.625	0.20(0.04)	0.20	13.5	168.00
16	21.80	9.00	1.615	0.20(0.04)	0.20	13.6	116.00
17	21.72	9.10	1.605	0.20(0.04)	0.20	13.6	125.00
18	21.54	9.27	1.588	0.20(0.04)	0.20	13.7	143.00
19	21.49	9.32	1.584	0.20(0.04)	0.20	13.7	128.00
20	20.96	9.82	1.537	0.20(0.04)	0.20	13.8	131.00
21	20.26	10.42	1.485	0.20(0.04)	0.20	13.9	119.00

TOTAL AREA(ACRES) = 13.9

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 22.32 Tc(MIN.) = 8.023
EFFECTIVE AREA(ACRES) = 12.91 AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.20
TOTAL AREA(ACRES) = 13.9
LONGEST FLOWPATH FROM NODE 131.00 TO NODE 102.00 = 1762.90 FEET.

```
****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    143.00 TO NODE    142.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   180.00
  ELEVATION DATA: UPSTREAM(FEET) =    400.00  DOWNSTREAM(FEET) =    396.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.655
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.109
  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
  "11+ DWELLINGS/ACRE"       D        0.53      0.20     0.200    57    5.66
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      0.99
  TOTAL AREA(ACRES) =      0.53   PEAK FLOW RATE(CFS) =      0.99

****************************************************************************
  FLOW PROCESS FROM NODE    142.00 TO NODE    141.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  334.40  DOWNSTREAM ELEVATION(FEET) =  331.00
  STREET LENGTH(FEET) =   141.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 13.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  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 =   0.0150

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.28
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.20
   HALFSTREET FLOOD WIDTH(FEET) =    3.76
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.48
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.50
 STREET FLOW TRAVEL TIME(MIN.) =   0.95   Tc(MIN.) =    6.60
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.929
 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"       D        0.35      0.20     0.200    57
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA AREA(ACRES) =    0.35      SUBAREA RUNOFF(CFS) =    0.60
 EFFECTIVE AREA(ACRES) =      0.88    AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
 TOTAL AREA(ACRES) =        0.9        PEAK FLOW RATE(CFS) =       1.50

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.21   HALFSTREET FLOOD WIDTH(FEET) =   4.22
 FLOW VELOCITY(FEET/SEC.) =  2.53   DEPTH*VELOCITY(FT*FT/SEC.) =   0.53
 LONGEST FLOWPATH FROM NODE    143.00 TO NODE    141.00 =     321.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    141.00 TO NODE    138.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   327.00  DOWNSTREAM(FEET) =   318.80
 FLOW LENGTH(FEET) =   238.50   MANNING'S N =  0.013
 DEPTH OF FLOW IN   9.0 INCH PIPE IS   4.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.63
 ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       1.50
 PIPE TRAVEL TIME(MIN.) =   0.60    Tc(MIN.) =    7.20
 LONGEST FLOWPATH FROM NODE    143.00 TO NODE    138.00 =     559.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    138.00 TO NODE    138.00 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.) =    7.20
  RAINFALL INTENSITY(INCH/HR) =   1.84
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.88
  TOTAL STREAM AREA(ACRES) =       0.88
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.50

****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    139.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    97.40
  ELEVATION DATA: UPSTREAM(FEET) =    327.00  DOWNSTREAM(FEET) =    324.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
  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
  "11+ DWELLINGS/ACRE"       D        0.19      0.20     0.200    57    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      0.38
  TOTAL AREA(ACRES) =      0.19   PEAK FLOW RATE(CFS) =      0.38

****************************************************************************
  FLOW PROCESS FROM NODE    139.00 TO NODE    138.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   320.30  DOWNSTREAM(FEET) =   318.80
  FLOW LENGTH(FEET) =    23.20   MANNING'S N =  0.013
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   2.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.93
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.38
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =    5.07
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    138.00 =     120.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    138.00 TO NODE    138.00 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.) =    5.07
  RAINFALL INTENSITY(INCH/HR) =   2.25
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.19
  TOTAL STREAM AREA(ACRES) =       0.19
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.38

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        1.50    7.20    1.836  0.20( 0.04) 0.20       0.9     143.00
      2        0.38    5.07    2.247  0.20( 0.04) 0.20       0.2     140.00

  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        1.67    5.07    2.247  0.20( 0.04) 0.20       0.8     140.00
      2        1.81    7.20    1.836  0.20( 0.04) 0.20       1.1     143.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       1.81    Tc(MIN.) =     7.20
  EFFECTIVE AREA(ACRES) =       1.07   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        1.1
  LONGEST FLOWPATH FROM NODE    143.00 TO NODE    138.00 =     559.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    138.00 TO NODE    102.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   318.80  DOWNSTREAM(FEET) =   312.20
  FLOW LENGTH(FEET) =   191.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   5.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.94
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.81
  PIPE TRAVEL TIME(MIN.) =   0.46    Tc(MIN.) =    7.66
  LONGEST FLOWPATH FROM NODE    143.00 TO NODE    102.00 =     750.50 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        1.67    5.53    2.136  0.20( 0.04) 0.20       0.8     140.00
      2        1.81    7.66    1.772  0.20( 0.04) 0.20       1.1     143.00
  LONGEST FLOWPATH FROM NODE    143.00 TO NODE    102.00 =     750.50 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       19.93    5.51    2.140  0.20( 0.04) 0.20       9.2     147.00
      2       20.03    5.58    2.125  0.20( 0.04) 0.20       9.3     145.00
      3       20.35    5.86    2.066  0.20( 0.04) 0.20       9.8     104.00
      4       21.63    7.14    1.844  0.20( 0.04) 0.20      11.6     110.00
      5       22.06    7.60    1.781  0.20( 0.04) 0.20      12.3     164.00
      6       22.21    7.80    1.753  0.20( 0.04) 0.20      12.6     146.00
      7       22.28    7.92    1.739  0.20( 0.04) 0.20      12.8     157.00
      8       22.30    7.96    1.733  0.20( 0.04) 0.20      12.8     182.00
      9       22.32    8.02    1.726  0.20( 0.04) 0.20      12.9     147.00
     10       22.32    8.03    1.725  0.20( 0.04) 0.20      12.9     154.00
     11       22.26    8.22    1.701  0.20( 0.04) 0.20      13.1     113.00
     12       22.26    8.23    1.700  0.20( 0.04) 0.20      13.1     122.00
     13       22.04    8.65    1.653  0.20( 0.04) 0.20      13.4     151.00
     14       21.94    8.82    1.635  0.20( 0.04) 0.20      13.5     137.00
     15       21.88    8.91    1.625  0.20( 0.04) 0.20      13.5     168.00
     16       21.80    9.00    1.615  0.20( 0.04) 0.20      13.6     116.00
     17       21.72    9.10    1.605  0.20( 0.04) 0.20      13.6     125.00
     18       21.54    9.27    1.588  0.20( 0.04) 0.20      13.7     143.00
     19       21.49    9.32    1.584  0.20( 0.04) 0.20      13.7     128.00
     20       20.96    9.82    1.537  0.20( 0.04) 0.20      13.8     131.00
     21       20.26   10.42    1.485  0.20( 0.04) 0.20      13.9     119.00
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE    102.00 =    1762.90 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       21.60    5.51    2.140  0.20( 0.04) 0.20      10.0     147.00
      2       21.63    5.53    2.136  0.20( 0.04) 0.20      10.1     140.00
      3       21.70    5.58    2.125  0.20( 0.04) 0.20      10.2     145.00
      4       22.05    5.86    2.066  0.20( 0.04) 0.20      10.6     104.00
      5       23.40    7.14    1.844  0.20( 0.04) 0.20      12.6     110.00
      6       23.87    7.60    1.781  0.20( 0.04) 0.20      13.4     164.00
      7       23.92    7.66    1.772  0.20( 0.04) 0.20      13.5     143.00
```

```
      8       24.00    7.80    1.753  0.20( 0.04) 0.20      13.7     146.00
      9       24.05    7.92    1.739  0.20( 0.04) 0.20      13.8     157.00
     10       24.06    7.96    1.733  0.20( 0.04) 0.20      13.9     182.00
     11       24.07    8.02    1.726  0.20( 0.04) 0.20      14.0     147.00
     12       24.07    8.03    1.725  0.20( 0.04) 0.20      14.0     154.00
     13       24.00    8.22    1.701  0.20( 0.04) 0.20      14.2     113.00
     14       23.99    8.23    1.700  0.20( 0.04) 0.20      14.2     122.00
     15       23.73    8.65    1.653  0.20( 0.04) 0.20      14.5     151.00
     16       23.61    8.82    1.635  0.20( 0.04) 0.20      14.6     137.00
     17       23.53    8.91    1.625  0.20( 0.04) 0.20      14.6     168.00
     18       23.45    9.00    1.615  0.20( 0.04) 0.20      14.7     116.00
     19       23.35    9.10    1.605  0.20( 0.04) 0.20      14.7     125.00
     20       23.16    9.27    1.588  0.20( 0.04) 0.20      14.8     143.00
     21       23.10    9.32    1.584  0.20( 0.04) 0.20      14.8     128.00
     22       22.52    9.82    1.537  0.20( 0.04) 0.20      14.9     131.00
     23       21.77   10.42    1.485  0.20( 0.04) 0.20      14.9     119.00
   TOTAL AREA(ACRES) =        14.9

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       24.07  Tc(MIN.) =    8.023
  EFFECTIVE AREA(ACRES) =     13.98  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =       14.9
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE    102.00 =    1762.90 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    101.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   312.20  DOWNSTREAM(FEET) =   298.00
  FLOW LENGTH(FEET) =    81.30   MANNING'S N =  0.013
  DEPTH OF FLOW IN  15.0 INCH PIPE IS  11.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  23.73
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      24.07
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =    8.08
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE    101.00 =    1844.20 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    100.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   298.00  DOWNSTREAM(FEET) =   276.00
  FLOW LENGTH(FEET) =   479.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS   9.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.04
  GIVEN PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      24.07
  PIPE TRAVEL TIME(MIN.) =   0.57    Tc(MIN.) =    8.65
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE    100.00 =    2323.20 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       14.9  TC(MIN.) =      8.65
  EFFECTIVE AREA(ACRES) =     13.98  AREA-AVERAGED Fm(INCH/HR)=  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap = 0.200
  PEAK FLOW RATE(CFS)   =      24.07

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       21.60    6.16    2.009  0.20( 0.04) 0.20      10.0     147.00
      2       21.63    6.18    2.005  0.20( 0.04) 0.20      10.1     140.00
      3       21.70    6.23    1.996  0.20( 0.04) 0.20      10.2     145.00
      4       22.05    6.50    1.947  0.20( 0.04) 0.20      10.6     104.00
      5       23.40    7.78    1.757  0.20( 0.04) 0.20      12.6     110.00
      6       23.87    8.22    1.701  0.20( 0.04) 0.20      13.4     164.00
      7       23.92    8.29    1.694  0.20( 0.04) 0.20      13.5     143.00
      8       24.00    8.43    1.677  0.20( 0.04) 0.20      13.7     146.00
      9       24.05    8.54    1.665  0.20( 0.04) 0.20      13.8     157.00
     10       24.06    8.59    1.660  0.20( 0.04) 0.20      13.9     182.00
     11       24.07    8.65    1.653  0.20( 0.04) 0.20      14.0     147.00
     12       24.07    8.66    1.652  0.20( 0.04) 0.20      14.0     154.00
     13       24.00    8.85    1.631  0.20( 0.04) 0.20      14.2     113.00
     14       23.99    8.86    1.630  0.20( 0.04) 0.20      14.2     122.00
     15       23.73    9.27    1.588  0.20( 0.04) 0.20      14.5     151.00
     16       23.61    9.45    1.571  0.20( 0.04) 0.20      14.6     137.00
     17       23.53    9.54    1.563  0.20( 0.04) 0.20      14.6     168.00
     18       23.45    9.63    1.554  0.20( 0.04) 0.20      14.7     116.00
     19       23.35    9.73    1.545  0.20( 0.04) 0.20      14.7     125.00
     20       23.16    9.90    1.529  0.20( 0.04) 0.20      14.8     143.00
     21       23.10    9.95    1.525  0.20( 0.04) 0.20      14.8     128.00
     22       22.52   10.46    1.482  0.20( 0.04) 0.20      14.9     131.00
     23       21.77   11.07    1.435  0.20( 0.04) 0.20      14.9     119.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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             Ver. 23.0  Release Date: 07/01/2016  License ID 1355

                          Analysis prepared by:



 ************************* DESCRIPTION OF STUDY *************************
* TERRAVITA                                                              *
* 2-YR STORM EVENT - PROPOSED UNMITIGATED                                *
* LAGUNA HILLS, CALIFORNIA                                               *
 ************************************************************************

  FILE NAME: P2S2.DAT
  TIME/DATE OF STUDY: 15:43 03/04/2025
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   4.00
  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   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 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    202.00 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) =   124.00
  ELEVATION DATA: UPSTREAM(FEET) =    362.60  DOWNSTREAM(FEET) =    319.90

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.009
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.037
  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.)
  NATURAL FAIR COVER
  "WOODLAND"                  D        0.12      0.20     1.000    62    6.01
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      0.20
  TOTAL AREA(ACRES) =      0.12   PEAK FLOW RATE(CFS) =      0.20

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    200.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    319.90  DOWNSTREAM(FEET) =    295.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =    52.00   CHANNEL SLOPE =  0.4788
  CHANNEL BASE(FEET) = 1000.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   5.00
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.538
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL FAIR COVER
  "WOODLAND"                  D        0.72      0.20     1.000    62
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.65
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.23
  AVERAGE FLOW DEPTH(FEET) =   0.00   TRAVEL TIME(MIN.) =   3.80
  Tc(MIN.) =    9.81
  SUBAREA AREA(ACRES) =     0.72       SUBAREA RUNOFF(CFS) =    0.87
  EFFECTIVE AREA(ACRES) =      0.84     AREA-AVERAGED Fm(INCH/HR) =   0.20
  AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =        0.8         PEAK FLOW RATE(CFS) =       1.01

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.00   FLOW VELOCITY(FEET/SEC.) =   0.35
  LONGEST FLOWPATH FROM NODE    202.00 TO NODE    200.00 =     176.00 FEET.
```

```
==========================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        0.8  TC(MIN.) =      9.81
  EFFECTIVE AREA(ACRES) =      0.84  AREA-AVERAGED Fm(INCH/HR)=  0.20
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)   =       1.01
==========================================================================
==========================================================================
  END OF RATIONAL METHOD ANALYSIS
```

****
NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
AND LOW LOSS FRACTION ESTIMATIONS
==========

Ver. 23.0 Release Date: 07/01/2016 License ID 1355
Analysis prepared by:

********** DESCRIPTION OF STUDY **********
* TERRAVITA *
* 2-YR STORM EVENT - PROPOSED CONDITION HYDROGRAPH *
* LAGUNA HILLS, CALIFORNIA *
****
==========

*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
AND LOW LOSS FRACTION ESTIMATIONS FOR AMC I:

TOTAL 24-HOUR DURATION RAINFALL DEPTH = 1.05 (inches)

SOIL-COVER TYPE	AREA (Acres)	PERCENT OF PERVIOUS AREA	SCS CURVE NUMBER	LOSS RATE Fp(in./hr.)	YIELD
1	14.94	20.00	75.(AMC II)	0.200	0.640
2	0.84	100.00	79.(AMC II)	0.200	0.000

TOTAL AREA (Acres) = 15.78

AREA-AVERAGED LOSS RATE, $\bar{F}m$ (in./hr.) = 0.049

AREA-AVERAGED LOW LOSS FRACTION, $\bar{Y}$ = 0.394
==========

RATIONAL METHOD CALIBRATION COEFFICIENT = 0.99
TOTAL CATCHMENT AREA(ACRES) = 15.78
SOIL-LOSS RATE, Fm,(INCH/HR) = 0.049
LOW LOSS FRACTION = 0.394
TIME OF CONCENTRATION(MIN.) = 8.71
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) = 1.88
TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) = 0.82

****

TIME (HOURS)	VOLUME (AF)	Q (CFS)	0.	7.5	15.0	22.5	30.0
0.03	0.0000	0.00	Q	.	.	.	.
0.18	0.0018	0.31	Q	.	.	.	.
0.32	0.0055	0.31	Q	.	.	.	.
0.47	0.0092	0.31	Q	.	.	.	.
0.61	0.0129	0.31	Q	.	.	.	.
0.76	0.0166	0.31	Q	.	.	.	.
0.90	0.0204	0.31	Q	.	.	.	.
1.05	0.0242	0.32	Q	.	.	.	.
1.19	0.0280	0.32	Q	.	.	.	.
1.34	0.0318	0.32	Q	.	.	.	.
1.48	0.0356	0.32	Q	.	.	.	.
1.63	0.0395	0.32	Q	.	.	.	.
1.77	0.0434	0.33	Q	.	.	.	.
1.92	0.0473	0.33	Q	.	.	.	.
2.06	0.0513	0.33	Q	.	.	.	.
2.21	0.0552	0.33	Q	.	.	.	.
2.35	0.0592	0.33	Q	.	.	.	.
2.50	0.0633	0.34	Q	.	.	.	.
2.64	0.0673	0.34	Q	.	.	.	.
2.79	0.0714	0.34	Q	.	.	.	.
2.93	0.0755	0.34	Q	.	.	.	.
3.08	0.0796	0.35	Q	.	.	.	.
3.23	0.0838	0.35	Q	.	.	.	.
3.37	0.0880	0.35	Q	.	.	.	.
3.52	0.0922	0.35	Q	.	.	.	.
3.66	0.0964	0.36	Q	.	.	.	.
3.81	0.1007	0.36	Q	.	.	.	.
3.95	0.1050	0.36	Q	.	.	.	.
4.10	0.1094	0.36	Q	.	.	.	.
4.24	0.1138	0.37	Q	.	.	.	.
4.39	0.1182	0.37	Q	.	.	.	.
4.53	0.1226	0.37	Q	.	.	.	.
4.68	0.1271	0.37	Q	.	.	.	.
4.82	0.1316	0.38	Q	.	.	.	.
4.97	0.1362	0.38	Q	.	.	.	.
5.11	0.1408	0.38	Q	.	.	.	.
5.26	0.1454	0.39	Q	.	.	.	.
5.40	0.1501	0.39	Q	.	.	.	.
5.55	0.1548	0.39	Q	.	.	.	.
5.69	0.1595	0.40	Q	.	.	.	.
5.84	0.1643	0.40	Q	.	.	.	.

5.98	0.1692	0.41	Q	.	.	.	.
6.13	0.1740	0.41	Q	.	.	.	.
6.27	0.1790	0.41	Q	.	.	.	.
6.42	0.1839	0.42	Q	.	.	.	.
6.56	0.1890	0.42	Q	.	.	.	.
6.71	0.1940	0.42	Q	.	.	.	.
6.85	0.1991	0.43	Q	.	.	.	.
7.00	0.2043	0.43	Q	.	.	.	.
7.14	0.2095	0.44	Q	.	.	.	.
7.29	0.2148	0.44	Q	.	.	.	.
7.44	0.2201	0.45	Q	.	.	.	.
7.58	0.2255	0.45	Q	.	.	.	.
7.73	0.2309	0.46	Q	.	.	.	.
7.87	0.2364	0.46	Q	.	.	.	.
8.02	0.2419	0.47	Q	.	.	.	.
8.16	0.2476	0.47	Q	.	.	.	.
8.31	0.2532	0.48	Q	.	.	.	.
8.45	0.2590	0.48	Q	.	.	.	.
8.60	0.2648	0.49	Q	.	.	.	.
8.74	0.2707	0.49	Q	.	.	.	.
8.89	0.2767	0.50	Q	.	.	.	.
9.03	0.2827	0.51	Q	.	.	.	.
9.18	0.2888	0.51	Q	.	.	.	.
9.32	0.2950	0.52	Q	.	.	.	.
9.47	0.3013	0.53	Q	.	.	.	.
9.61	0.3076	0.53	Q	.	.	.	.
9.76	0.3141	0.54	Q	.	.	.	.
9.90	0.3206	0.55	Q	.	.	.	.
10.05	0.3273	0.56	Q	.	.	.	.
10.19	0.3340	0.56	Q	.	.	.	.
10.34	0.3409	0.58	Q	.	.	.	.
10.48	0.3478	0.58	Q	.	.	.	.
10.63	0.3549	0.60	Q	.	.	.	.
10.77	0.3621	0.60	Q	.	.	.	.
10.92	0.3694	0.62	Q	.	.	.	.
11.06	0.3768	0.62	Q	.	.	.	.
11.21	0.3844	0.64	Q	.	.	.	.
11.35	0.3921	0.65	Q	.	.	.	.
11.50	0.4000	0.66	Q	.	.	.	.
11.65	0.4080	0.67	Q	.	.	.	.
11.79	0.4162	0.69	Q	.	.	.	.
11.94	0.4245	0.70	Q	.	.	.	.
12.08	0.4334	0.77	.Q	.	.	.	.
12.23	0.4434	0.89	.Q	.	.	.	.
12.37	0.4542	0.91	.Q	.	.	.	.
12.52	0.4652	0.93	.Q	.	.	.	.
12.66	0.4765	0.96	.Q	.	.	.	.
12.81	0.4881	0.97	.Q	.	.	.	.
12.95	0.4999	1.00	.Q	.	.	.	.
13.10	0.5121	1.02	.Q	.	.	.	.

13.24	0.5245	1.06	.Q	.	.	.	.
13.39	0.5374	1.08	.Q	.	.	.	.
13.53	0.5506	1.12	.Q	.	.	.	.
13.68	0.5641	1.15	.Q	.	.	.	.
13.82	0.5783	1.21	.Q	.	.	.	.
13.97	0.5930	1.25	.Q	.	.	.	.
14.11	0.6090	1.41	.Q	.	.	.	.
14.26	0.6264	1.50	.Q	.	.	.	.
14.40	0.6452	1.63	. Q	.	.	.	.
14.55	0.6652	1.71	. Q	.	.	.	.
14.69	0.6867	1.88	. Q	.	.	.	.
14.84	0.7099	1.98	. Q	.	.	.	.
14.98	0.7352	2.23	. Q	.	.	.	.
15.13	0.7627	2.37	. Q	.	.	.	.
15.27	0.7935	2.75	. Q	.	.	.	.
15.42	0.8278	2.99	. Q	.	.	.	.
15.56	0.8643	3.10	. Q	.	.	.	.
15.71	0.9044	3.59	. Q	.	.	.	.
15.85	0.9593	5.56	. Q	.	.	.	.
16.00	1.0399	7.87	. Q	.	.	.	.
16.15	1.2377	25.11	.	.	.	Q	.
16.29	1.4144	4.35	. Q	.	.	.	.
16.44	1.4572	2.79	. Q	.	.	.	.
16.58	1.4892	2.54	. Q	.	.	.	.
16.73	1.5171	2.10	. Q	.	.	.	.
16.87	1.5404	1.79	. Q	.	.	.	.
17.02	1.5605	1.56	. Q	.	.	.	.
17.16	1.5777	1.30	.Q	.	.	.	.
17.31	1.5925	1.17	.Q	.	.	.	.
17.45	1.6061	1.10	.Q	.	.	.	.
17.60	1.6190	1.04	.Q	.	.	.	.
17.74	1.6311	0.99	.Q	.	.	.	.
17.89	1.6427	0.94	.Q	.	.	.	.
18.03	1.6537	0.90	.Q	.	.	.	.
18.18	1.6634	0.71	Q	.	.	.	.
18.32	1.6718	0.68	Q	.	.	.	.
18.47	1.6798	0.66	Q	.	.	.	.
18.61	1.6875	0.63	Q	.	.	.	.
18.76	1.6950	0.61	Q	.	.	.	.
18.90	1.7021	0.59	Q	.	.	.	.
19.05	1.7091	0.57	Q	.	.	.	.
19.19	1.7158	0.55	Q	.	.	.	.
19.34	1.7224	0.54	Q	.	.	.	.
19.48	1.7287	0.52	Q	.	.	.	.
19.63	1.7349	0.51	Q	.	.	.	.
19.77	1.7410	0.50	Q	.	.	.	.
19.92	1.7469	0.48	Q	.	.	.	.
20.06	1.7526	0.47	Q	.	.	.	.
20.21	1.7582	0.46	Q	.	.	.	.
20.36	1.7637	0.45	Q	.	.	.	.

20.50	1.7691	0.44	Q	.	.	.	.
20.65	1.7744	0.43	Q	.	.	.	.
20.79	1.7795	0.43	Q	.	.	.	.
20.94	1.7846	0.42	Q	.	.	.	.
21.08	1.7896	0.41	Q	.	.	.	.
21.23	1.7944	0.40	Q	.	.	.	.
21.37	1.7992	0.40	Q	.	.	.	.
21.52	1.8039	0.39	Q	.	.	.	.
21.66	1.8086	0.38	Q	.	.	.	.
21.81	1.8131	0.38	Q	.	.	.	.
21.95	1.8176	0.37	Q	.	.	.	.
22.10	1.8220	0.37	Q	.	.	.	.
22.24	1.8264	0.36	Q	.	.	.	.
22.39	1.8307	0.35	Q	.	.	.	.
22.53	1.8349	0.35	Q	.	.	.	.
22.68	1.8390	0.34	Q	.	.	.	.
22.82	1.8431	0.34	Q	.	.	.	.
22.97	1.8472	0.34	Q	.	.	.	.
23.11	1.8512	0.33	Q	.	.	.	.
23.26	1.8551	0.33	Q	.	.	.	.
23.40	1.8590	0.32	Q	.	.	.	.
23.55	1.8629	0.32	Q	.	.	.	.
23.69	1.8667	0.31	Q	.	.	.	.
23.84	1.8704	0.31	Q	.	.	.	.
23.98	1.8741	0.31	Q	.	.	.	.
24.13	1.8778	0.30	Q	.	.	.	.
24.27	1.8796	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%	1445.9
10%	87.1
20%	26.1
30%	17.4
40%	8.7
50%	8.7
60%	8.7
70%	8.7
80%	8.7
90%	8.7

Attachment E

GEOTECHNICAL REPORT

PRELIMINARY GEOTECHNICAL EVALUATION

for

Mill Creek Drive and Ridge Route Drive
Laguna Hills, California

Prepared For:

Kingsbarn Realty Capital
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Las Vegas, Nevada 89134

Prepared By:

Langan Engineering, Environmental Services, Inc.
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2 June 2023
700128701

LANGAN

PRELIMINARY GEOTECHNICAL EVALUATION

for

Mill Creek Drive and Ridge Route Drive
Laguna Hills, California

Prepared For:

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2 June 2023
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PRELIMINARY GEOTECHNICAL EVALAUTION
Mill Creek Drive and Ridge Route Drive
Laguna Hills, California

EXECUTIVE SUMMARY

Langan Engineering and Environmental Services has performed a preliminary geotechnical evaluation for the proposed residential development located in Laguna Hills, California. The approximately 16 acre site is bound by Mill Creek Drive to the west, Ridge Route Drive to the south, the lower portion of the downhill slope to the Veeh Reservoir to the east, and office buildings to the northwest. The proposed development consists of four 6-story apartment buildings, with each apartment building wrapped around a 6- to 7-level parking structure. The project will also include a park, surface parking, and other improvements. All proposed structures are planned to be at-grade.

A portion of the proposed development is within the FEMA Zone A, defined as a having a "1% Annual Chance Flood Hazard without base flood elevation" Therefore, we recommend that the project civil engineer confirm the base flood elevation during design and that the site grades meet the requirement to accommodate the base flood elevation including any required freeboard.

The subsurface conditions beneath the northern portion of the project site generally consist of shallow bedrock of the Sespe formation (Ts). In general, the existing Sespe formation (Ts) is considered suitable for support of the proposed structures and other improvements.

The subsurface conditions encountered during our exploration in southern portion of the site include a variable thickness of fill or residual soil over Sespe formation bedrock. Considering the nature of the proposed construction and the subsurface conditions within the site, we recommend shallow foundations for the proposed apartment buildings and parking structures. However, the use of shallow foundations in areas of fill and residual soil could require the overexcavations and recompaction of the fill and residual soil or other ground improvement. The quality and lateral extents of the fill should be characterized further as part of a design-level geotechnical investigation.

On the basis of the soluble sulfate percent, concrete can be designed as exposure class S0 for sulfate exposure. Per ACI 318-A, a minimum specified compressive strength (f'c) of 2,500 pounds per square inch (psi) may be used for foundation element and slabs (ASTM C150). A corrosion expert should be consulted during the design phase for the most economical and effective corrosion protection if ferrous site utilities are required.

The Site is in a seismically active region. The closest fault is approximately 3.5 miles away. The site is not located within a currently established Alquist-Priolo Earthquake Study Zone. The California Building Code should be followed with respect to seismic design.

Table 1 summarizes our preliminary recommendations.

TABLE 1

SUMMARY OF PRELIMINARY RECOMMENDATIONS FOR PROPOSED DEVELOPMENT

Design Item	Recommended Design Parameter
Shallow Foundations	
Allowable Bearing Pressure (for dead plus live loads)	2,500 to 4,500 psf (see Section 6.5.1 for recommendation where footings will span cut-fill transitions)
Minimum Footing Width	12 inches
Minimum Footing Embedment	24 inches or, where closer than 15 to 20 feet from the top of the slope, deepened so that distance to daylight meets the setback requirement (see Section 6.5.1)
Minimum Reinforcement	Structural engineer to design for medium expansion potential
Seismic Design Class	Site Class D (additional future testing could support Site Class C for some buildings)
PROJECT SITE CONDITIONS:	
Expansive Nature of Site Soils	Medium potential
Liquefaction Potential	Low potential
Corrosion Consideration	Sulfate exposure S0
Groundwater Depth Design Groundwater Elevation	Groundwater was not encountered to the maximum depth explored of approximately 31 feet below existing ground surface (corresponding to approximate elevation 297 feet) Design Groundwater Elevation 286 feet (NAVD88[1] vertical datum)

[1] North American Vertical Datum of 1988

PRELIMINARY GEOTECHNICAL EVALAUTION
Mill Creek Drive and Ridge Route Drive
Laguna Hills, California

1.0 INTRODUCTION

As requested, and in accordance with our 2 February 2023 proposal and subsequent authorization by Kingsbarn Realty Capital, LLC, we have completed a preliminary geotechnical investigation for the proposed Mill Creek Drive Apartments located at Mill Creek Drive and Ridge Route Drive in Laguna Hills, Orange County, California (the Site). The purposes of this report are (1) to summarize our understanding of the geological and geotechnical aspects of the Site, (2) to document existing site conditions; (3) to summarize our subsurface investigation and findings; and (4) to provide preliminary geotechnical recommendations for the proposed future development. Recommendations provided herein are in accordance with the 2022 California Building Code (2022 CBC) and the City of Laguna Hills Municipal Code.

2.0 PROJECT DESCRIPTION

2.1 Existing Conditions

The proposed development is located at the northeast corner of Mill Creek Drive and Ridge Route Drive in Laguna Hills, CA. The approximately 16-acre site is on Orange County Assessor Tax Number (APNs) 588-161-06 to 588-161-10, 588-161-12, 588-161-13. The site is bound by Mill Creek Drive to the west, Ridge Route Drive to the south, the lower portion of the downhill slope to the Veeh Reservoir to the east, and existing development to the north as shown on Figure 1, Site Location Map.

Ground surface elevations at the site range from approximate elevation 345 feet[2] to elevation 318 feet, sloping downward toward the south. The northeast portion of the property slopes downward towards the water line of the Veeh Reservoir to the northeast with a maximum height of approximately 60 feet (as measured from the top of slope to the water line of the reservoir shown in the topographic plan provided by Fuscoe Engineering, the project civil engineer) and a slope of approximately 1:1 to 3½:1 (horizontal to vertical).

[2] Elevations referenced to NAVD88 vertical datum based on topographic plan titled "Basemap of 23272 & 23282 Mill Creek Drive, Laguna Hills, California" by Fuscoe Engineering dated 19 April 2023.

2.2 Proposed Development

Our understanding of the proposed project is based on a concept site plan dated 12 January 2023[3]. According to the conceptual site plan, we understand Kingsbarn Realty Capital plans to redevelop the site in multiple phases with four 6-story apartment buildings (total of 1,200 apartments), designated as Building 1 to Building 4. Each apartment building will be wrapped around a 6 to 7-level parking structure, which will provide a total of 2,100 parking spaces. All of the structures are planned to be at-grade. The project will also include a park, surface parking, a paseo/fire access lane, and other improvements.

According to correspondence with Fuscoe Engineering received 27 March 2023, the project civil engineer, we understand that, on a preliminary basis, proposed grades will be matched to existing grades and that cuts and fills to the existing building pads will likely be minimal. However, a portion of proposed Building 4 as well as a section of the paseo/fire access lane appears to extend north of the limits of the current building and parking lot pad and, assuming a pad and finished pavement subgrade elevation of approximate el. 345 feet, will require up to 45 feet of new fill to be placed.

3.0 AVAILABLE INFORMATION REVIEW

Information that Langan reviewed included reports, maps, and other publicly available information from the United States Geological Survey (USGS), California Geological Survey (CGS), Orange County, Federal Emergency Management Agency (FEMA), California Geologic Energy Management Division (CalGEM), Groundwater Ambient Monitoring and Assessment Program (GAMA), the City of Laguna Hills, and data from our files.

A summary of the available information reviewed is provided in the sections below.

3.1 Regional and Local Geology

The site is located in Southern California in the Peninsular Ranges geomorphic province. The Peninsular Ranges province is generally characterized by a series of northwest trending mountain

[3] Conceptual plan titled "Mill Creek Dr. Apartments, Laguna Hills, CA" by Architects Orange dated 12 January 2023.

ranges and valleys. These topographic features are roughly parallel to the regional faults branching off of the San Andreas (e.g. Elsinore fault). Basement rook of the Peninsular Ranges is comprised of metamorphic rock with younger granitic intrusions.

Within the Peninsular Ranges, the site is located in the Santa Ana Mountains structural block. The Santa Ana block is bounded to the north and northeast by the Whittier and Elsinore fault zones and to the south and southwest by the Pacific Ocean. The site lies just northeast of the San Joaquin Hills and south of a broad alluvial fan complex associated with the Santa Ana River. The area is characterized by a series of relatively low, rolling hills primarily underlain by Tertiary-aged sedimentary bedrock.

Regional geologic mapping indicates that the subject site is mostly underlain by the Sespe formation, an Eocene to early Miocene (56 to 23 million years ago) continental conglomeratic unit (Morton and Miller, 2006) (Figure 2). The Sespe formation is generally comprised of massive to thickly bedded conglomerate, sandstone, and silty sandstone. The northeastern limits of the site are within a mapped Quaternary alluvial fan deposit. Regional mapping describes this unit as Holocene and late Pleistocene (present to about 130,000 years) alluvial fan deposits comprised of unconsolidated to moderately consolidated silt and sand with varying pebbles and cobbles.

3.2 Geologic Hazards Review

Our geologic hazard review was performed in general accordance with CGS Special Publication 117A, "Guidelines for Evaluating and Mitigating Seismic Hazards in California," dated 2008. The following subsections present the results of our hazard review.

3.2.1 Regional Faulting

Recognized and mapped faults that are the highest percentage contributor to the ground motion parameter values for the site are obtained from the USGS Unified Hazard tool. From our review, the fault that contributes the highest percentage to the probabilistic ground motion is the San Joaquin Hills Fault, located approximately 3.5 miles (5.6 kilometers (km)) northeast of the site.

The Site is located in an active seismic area that has historically been affected by generally high to occasionally very high levels of ground motion. Therefore, the proposed development will probably experience high to occasionally very high levels of ground motion from nearby faults as well as ground motions from other active seismic areas of the southern California region. See Figures 3A and 3B for a map of regional faults and the map legend, respectively.

3.2.2 Regional Seismicity

A search of the web-based USGS Advanced National Seismic System (ANSS) Comprehensive Earthquake Catalog (ComCat), accessed on 5 April 2023, found that 30 earthquakes with magnitudes of 5.0 or greater have occurred within a 100-km radius of the site since 1900. See Figures 3A and 3B for a map of earthquakes and the map legend, respectively

3.2.3 Surface Rupture

Earthquake Fault Zones are regulatory zones delineated by the CGS around known, active faults with the potential to cause surface rupture. The zones average approximately ¼-mile in width. According to the CGS Earthquake Zones of Required Investigation Map, the site is not within a mapped Alquist-Priolo Special Study Zone or a Fault Rupture Study Area. See Figure 4 for a map showing the earthquake fault zones.

3.2.4 Historic High Groundwater

According to CGS Seismic Hazard Zone Report, San Juan Capistrano Quadrangle (2001), the reservoir adjacent to the site has a historical high groundwater at 10 feet below the existing ground surface (bgs). From the basemap that was provided See Figure 5.

3.2.5 Liquefaction

Liquefaction is a transformation of soil from a solid to a liquefied state during which saturated soil temporarily loses shear strength resulting from the buildup of excess pore water pressure, especially during earthquake-induced cyclic loading. Flow failure, lateral spreading, differential settlement, loss of bearing, ground fissures, and sand boils are evidence of excess pore pressure generation and liquefaction. Soil susceptible to liquefaction includes loose to medium-dense sands and gravels, low-plasticity silts, and some low-plasticity clay deposits below the groundwater table. According to CGS Earthquake Zones of Required Investigation, San Juan Capistrano Quadrangle (2001), the northeast section of the site borders a liquefaction hazard zone (Figure 4).

In our investigation, groundwater was not encountered within the maximum explored depth of approximately 31 feet. As discussed in Section 3.2.4, the recorded historic high groundwater data in the reservoir adjacent to the site is about 10 feet bgs. From the depth to historic high groundwater as well as the results of our investigation and engineering judgment, we preliminarily judge that a design groundwater elevation of el. 286 feet is appropriate. Subsurface

conditions below the design groundwater elevation are anticipated to consist of Sespe formation bedrock that is not susceptible to liquefaction. Therefore, we preliminarily conclude that the liquefaction potential at the site is low.

3.2.6 Landslides

The CGS Landslide Inventory Map and the CGS Earthquake Zones of Required Investigation, San Juan Capistrano Quadrangle (2001) map, indicates that a portion of the slope along the northern part the site is mapped within a potential earthquake-induced landslide zone (Figure 4). Please see Section 6.4.1 for conclusions from our preliminary landslide analyses.

3.2.7 Seismically-Induced Ground Deformations

Seismically-induced ground deformations include ground-surface settlement and differential settlement resulting from liquefaction-induced ground deformation and seismic densification of unsaturated sands and gravels from earthquakes. As discussed above, the site borders a liquefaction hazard zone and a portion of the site is mapped within an earthquake-induced landslide zone.

With the exception of the approximately 5½ feet of silty sand fill encountered in LB-3, the soil encountered above the groundwater table at the site generally consists of clayey or silty sandstone or stiff sandy clay to very dense clayey sand that are either cohesive and not subject to seismic densification or sufficiently dense to resist seismic densification. Therefore, we preliminarily conclude that the seismic densification potential at the site is low.

3.2.8 Lateral Spreading

Lateral spreading is a phenomenon in which surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. The surficial blocks are transported downslope or in the direction of a free face, such as a slope, by earthquake and gravitational forces. On the basis of the subsurface conditions encountered, we anticipate that the potential for liquefaction is low. Therefore, we also preliminarily judge that the potential for lateral spreading is low.

3.2.9 Flood Mapping

A review of the FEMA National Flood Hazard Layer, FIRM Panel 060590426J (2009) indicates that the northeast portion of the Site along the slope to the reservoir is located within Zone A, defined as a having a "1% Annual Chance Flood Hazard" without base flood elevation, and the

southwest portion of the Site is located within Zone X, defined as having a "0.2% Annual Chance Flood Hazard." See Figure 6 for the FEMA Flood Hazard Map. The Project Civil engineer and architect should address the potential flood hazard as part of the site design.

3.2.10 Tsunami, Seiche, and Dam Inundation

A tsunami is a long, high sea wave caused by an earthquake, submarine landslide, or other disturbances. According to CGS Information Warehouse: Tsunami Hazard Area Map, the site is not within a mapped tsunami inundation hazard zone and we therefore judge the potential for tsunami to be low.

A seiche is an oscillation of surface water in an enclosed or semi-enclosed basin such as a lake, bay, or harbor. As noted previously, the property is in close proximity to a large body of water (The Veeh Reservoir, which borders the site to the east). However, due to the height of the property above the reservoir, which is at least 45 feet, we anticipate that the risk for seiche to inundate the site is low.

A review of the California Department of Water Resources Division of Safety of Dams California Dam Breach Inundation Maps web-viewer indicates that the site is not located within an inundation zone from a dam breach.

3.2.11 Subsidence

Land subsidence may be induced from withdrawal of oil, gas, or water from wells or from organic decomposition such as in a landfill or marsh area. According to a search on the CalGEM Well Finder online tool, no oil, gas, or geothermal wells are located within approximately 2½ miles of the site. Therefore, the site is not considered to be subject to land subsidence from oil, gas, or water withdrawal from oil wells. From our review of the site geology, the site is not on a former landfill or marsh area.

3.2.12 Expansive Soils

Expansive soils occur when the moisture content in the soil causes swelling or shrinking as a result of cyclic wet/dry weather cycles, installation of irrigation systems, change in landscape plantings, or changes in grading. Swelling and shrinking soils can result in differential movement of structures including floor slabs and foundations, and site work including hardscape, utilities, and sidewalks. The 2022 CBC defines potentially expansive soils as soils with expansion indices (EI) greater than 20. EI testing was performed as part of our investigation, the results of which are discussed in a later section of this report.

3.3 Previous Geotechnical Investigations

As part of our preliminary geotechnical investigation, we requested and reviewed available files for the site from the City of Laguna Hills archives. A geotechnical report for the prior development by EJN & Associates (EJN, 1986) as well as boring logs by Irvine Soils Engineering (ISE, 1994) were included with the data transmittal. Boring logs prepared by EJN and ISE are included in Appendix A.

From our review of cross sections prepared by EJN, we understand that the following grading was proposed as part of the development in the late 1980's

- the northern portion of the site was primarily cut, with cut depths of approximately 16 feet with shoulder fills up to approximately 12-feet-thick along the downhill slopes to Veeh Reservoir and Mill Creek Drive
- the central portion of the site was a combination of cuts up to 7 feet and fills up to approximately 6 feet
- the southern portion of the site was raised, with fills up to approximately 10 feet that were thickest along the top of the downhill slope to Veeh Reservoir.

According to the compaction reports prepared by EJN, the new fill for the office development was placed as engineered fills at a minimum of 90 percent of ASTM Test Method D1557. Ten-foot-wide keyways were excavated two feet into competent material (as determined by EJN's geotechnical engineer and engineering geologist) and benches were cut and prepared prior to the placement of fill.

3.4 Site History

As part of our preliminary geotechnical investigation, we reviewed historic aerial photos for the site area dated 1938, 1946, 1952, 1963, 1967, 1972, 1980, 1981, 1985, 1987, 1988, 1992 to 2000, 2002 to 2005, 2009, 2010, 2012, 2014, 2016, 2018, and 2020. Pertinent information from these photos are summarized as follows:

1938: The site is undeveloped and occupied by a northwest – southeast trending ridge. The slope down to the reservoir appears generally devoid of vegetation. The area is otherwise undeveloped. Orchards are visible north and east of the reservoir.

1946-1967: The photo depicts similar conditions to the 1938 map. Some trees are visible on the slope to the reservoir. Orchards surround the site

1972: The southeastern tip of the ridge has been removed.

1980: The ridge has been removed. The orchards surrounding the site have been largely replaced by development.

1981-1985: These photos depict similar conditions to the 1980 map. The 1985 photo shows the 23282 and 23272 Mill Creek Drive buildings to the north of the Project HERE site have been constructed.

1987: Some grading of the pads for the 24411 and 23422 Mill Creek Drive buildings appears to have been completed. The slope down to the reservoir is still largely devoid of vegetation

1988: The 24411 and 23422 Mill Creek Drive buildings as well as the appurtenant site improvements along the southern half of the project site have been constructed. Building pads and foundations for the 23382 and 23332 Mill Creek Drive buildings are in progress.

1992: The current office buildings and site improvements have been completed. Vegetation is visible on the slope down to the reservoir.

1993-current: The photo shows conditions generally similar to the 1992 photo.

We also reviewed topographic maps for the site dated 1948 for 2022. The topographic map from 1948 indicates that the boundary of the Veeh Reservoir wraps around the southeastern tip of the ridge along what is now Ridge Route Drive.

4.0 SURFACE AND SUBSURFACE INVESTIGATION

4.1 Langan's Subsurface Investigation

Langan's subsurface investigation consisted drilling of six (6) borings, identified as LB-1 to LB-4, PT-1, and PT-2, to depths ranging from approximately 11½ to 31 feet bgs at the approximate locations shown on Figure 7, Site Plan. Percolation tests were performed in PT-1 and PT-2. Prior to performing our subsurface investigation, the borings were located in the field and DigAlert

was contacted to locate and mark public underground utilities at the Site. The borings were drilled on 16 March 2023 by Martini Drilling under the full-time engineering observation of a Langan field engineer.

In LB-1 through LB-4, samples were collected at 2½-foot-intervals within the upper 10 feet using a 3-inch-outer-diameter split barrel California sampler lined with 2.42-inch-inner-diameter brass rings. Below a depth of 10 feet, samples were collected with the California sampler or a 2-inch-outer-diameter standard penetration test (SPT) sampler. Soil samples were visually examined and classified in the field in accordance with the Unified Soil Classification System (USCS). Classifications were confirmed by re-examination at the laboratory. Representative samples were selected for testing. Details regarding the subsurface materials encountered are presented in the boring logs included in Appendix B.

In addition to our subsurface investigation, we also conducted a separate site visit to observe surficial slope conditions. Due to heavy vegetation covering the northerly descending slope toward Veeh Reservoir, site observations for geologic contacts or surficial sliding could not be readily obtained. However, we observed no apparent indicators of existing landslides based on aerial imagery, or field proxies, such as zones of dead vegetation - which can be an indicator of slope movement. Slope stability considerations are discussed further in Section 6.4.1.

4.2 Percolation Testing

Two (2) percolation tests were performed at depths of approximately 10 feet bgs; one in boring PT-1 and another boring PT-2. The percolation tests were performed in general accordance with the methods presented in the Orange County Technical Guidance Document for the Preparation of Conceptual/Preliminary and/or Water Quality Management Plans (2013). Percolation test results are included in Appendix C.

4.3 Laboratory Testing

The geotechnical laboratory testing was performed by GeoLogic Associates and included the following tests:

- Moisture Content – ASTM D2216
- Atterberg Limits – ASTM D4318
- Sieve Analysis – ASTM C136
- Direct Shear – ASTM D3080

- Expansion Index – ASTM D4829
- R-Value – ASTM D2844/CTM 301
- Electrical Resistivity – CTM 643
- Sulfate Content – CTM 417
- Chloride Content – CTM 422
- Soil pH – CTM 643

The laboratory test results are included in Appendix D.

5.0 SUBSURFACE CONDITIONS

In general, subsurface conditions below the Site generally consist of shallow bedrock of the Sespe formation (Ts) overlain by up to 17 feet of soil consisting of either fill or native, residual soil. Our interpretation of the subsurface conditions based in the available boring logs (EJN & Associates, Irvine Soils Engineering, and Langan) is summarized below.

- **Fill** – As noted above, between 5½ and 13 feet of fill is currently present below portions of the site and was encountered in borings LB-3, LB-4, PT-1, and PT-2. ISE noted the presence of between 8 and 17 feet of fill during their exploration, which occurred after the grading for the existing development. The fill is generally comprised of silty to clayey sand or silt or stiff to very stiff sandy clay. Direct shear laboratory test results on a sample of the fill collected during the current investigation indicates the sandy clay fill has a friction angle of about 30.5 degrees and a cohesion of 150 pounds per square foot (psf).

- **Native soil** – EJN borings 1, 2, 4, 5, and 7 to 9 encountered between 1½ and more than 10 feet of native soil comprised of clay with varying amounts of sand and silt or sand with varying amounts of clay. The native soil encountered in EJN borings 1 and 2 was likely removed as part of the grading for the existing development. The native soil encountered in EJN borings 4, 5, and 7 to 9 likely remained in place as part of grading for the existing development. Langan boring LB-4 encountered approximately three feet of native (residual) soil comprised of stiff sandy clay.

- **Sespe formation (Ts)** – Sespe formation bedrock is present throughout the site. The bedrock consists of red to tannish brown, non-marine clayey to silty sandstone that extends to the maximum explored depth of approximately 31 feet bgs. A corrosion test was performed on bag sample of the Sespe formation collected from boring LB-2.

An expansion index test (EI) performed on bag sample of the Sespe formation collected from boring PT-1 indicates that the material has medium expansion potential, with an expansion index of 57. Direct shear laboratory test results on ring samples of the bedrock indicate the material has ultimate friction angles of about 28.5 to 31 degrees with cohesion of 100 to 200 psf. Laboratory test results are included in Appendix B.

- **Groundwater** – Groundwater was not encountered within the maximum explored depth of about 31 feet.

6.0 SEISMIC EVALUATION AND GEOTECHNICAL RECOMMENDATIONS

6.1 Seismic Design Parameters

On the basis of our evaluation of the subsurface conditions at the site, we preliminarily conclude that the site may be characterized as Seismic Site Class D, in accordance with Chapter 20 of ASCE 7-16. As such, the following preliminary seismic design criteria may be used.

Type	Value	Description
S_S	1.222	MCE_R mapped spectral response acceleration at short period
S_1	0.439	MCE_R mapped spectral response acceleration at one-second period
F_a	1.011	Site Amplification Factor at 0.2 second
F_v	2.79	Site Amplification Factor at 1.0 second
S_{MS}	1.236	Site-modified spectral acceleration at short period
S_{M1}	1.225	Site-modified spectral acceleration at one-second period
S_{DS}	0.824	Design earthquake spectral response acceleration at short period
S_{D1}	0.817	Design earthquake spectral response acceleration at one-second period
PGA_M	0.565	MCE geometric mean peak ground acceleration adjusted for site class effects

Notes:

1. Values based on Site Class D
2. Values of F_v, S_{M1}, and S_{D1} assume the exceptions of ASCE 7-16 Section 11.4.8 are met and have been increased by 50 percent per Supplement 3 of ASCE 7-16.
3. MCE = Maximum Considered Earthquake
4. MCE_R = Risked-Targeted Maximum Considered Earthquake

The recommended mapped values of F_v, S_{M1}, and S_{D1} for Site Class D have been increased by 50 percent in accordance with the exception of Section 11.4.8.1 of Supplement No. 3 to ASCE 7-16. If the structural engineer elects not to use this exception in the seismic design approach, we should be notified so that we may develop site-specific response spectra and seismic design criteria in accordance with Chapter 21 of ASCE 7-16.

The design-level geotechnical investigation should include additional subsurface exploration of the site to better understand the subsurface conditions to establish it is appropriate to classify a portion of the site as Site Class C.

6.2 Flood Design

As discussed in Section 3.2.9, a portion of the proposed development is within the FEMA Zone A, defined as a having a "1% Annual Chance Flood Hazard" with base flood elevation or depth not determined. The civil engineer should confirm that the site grades consider the base flood elevation and any required freeboard.

6.3 Groundwater Considerations

As discussed in Section 5.0, groundwater was not encountered within the maximum explored depth of approximately 31 feet during our subsurface investigation. The recorded historic high groundwater noted during our records research data from the site vicinity is about 10 feet bgs. However, we judge that the mapped depth to historic high groundwater likely applies to the reservoir and not to the Project HERE site. Our preliminary geotechnical evaluation did not encounter groundwater above approximately el. 297 feet and the topographic plan provided by Fuscoe indicates that the water level in Veeh Reservoir is approximately el. 283 feet. On the basis of the data from the preliminary geotechnical evaluation and the water level in the reservoir, we judge that a design groundwater elevation of el. 286 feet is appropriate for design.

Some seepage through the Sespe formation bedrock or between the top of bedrock and soil should be anticipated.

6.4 Seismic and Geologic Hazards

During a major earthquake, high to very high ground shaking is expected to occur at the project site. Ground shaking during an earthquake can result in ground failure such as that associated

with soil liquefaction[4] and cyclic softening[5], lateral spreading,[6] seismic densification[7], and fault rupture. Each of these conditions has been evaluated based on our literature review, field investigation and analysis, and are discussed in Section 3.2 or in this section.

On the basis of the deaggregation of the probabilistic seismic hazard spectrum from the USGS Unified Hazard Tool, the mean and mode earthquakes for the 2 percent probability of exceedance in 50 years (2,475-year return period) event are 6.71 and 6.89 moment magnitudes, respectively.

6.4.1 Slope Stability

Based on review of historic aerials from 1938 through 2020, there is no apparent history of landsliding onsite. Based on limited site observations above existing slopes, there is no apparent evidence of slope instability.

Records provided by the City of Laguna Hills indicate slope stability analysis for portions of the northerly descending slope was performed by EJN and Associates in March and May of 1986 in support of the existing development and they concluded that the slope is generally stable.

Since the time of their investigation, updated regulations and standard of practice regarding slope stability and analysis have become more conservative, including analysis for earthquake induced landsliding, often referred to as a pseudostatic analysis. A quantitative analysis of the slope stability under static and pseudostatic conditions for the downhill slope into Veeh Reservoir should be performed as part of a design-level geotechnical investigation.

6.5 Preliminary Foundation Evaluation and Recommendations

From a geotechnical standpoint, the proposed site development is considered feasible provided the site conditions and geotechnical issues in this report are properly addressed during the design

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[4] Liquefaction is a transformation of soil from a solid to a liquefied state during which saturated soil temporarily loses strength resulting from the buildup of excess pore water pressure, especially during earthquake-induced cyclic loading. Soil susceptible to liquefaction includes loose to medium dense sand and gravel, low-plasticity silt, and some low-plasticity clay deposits.

[5] Cyclic softening is a phenomenon in which soil loses strength resulting from the buildup of excess pore water pressure, especially during earthquake-induced loading, but has sufficient internal cohesion to resist complete liquefaction.

[6] Lateral spreading is a phenomenon in which surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. Upon reaching mobilization, the surficial blocks are transported downslope or in the direction of a free face by earthquake and gravitational forces.

[7] Seismic densification is a phenomenon in which non-saturated, cohesionless soil is densified by earthquake vibrations, causing ground-surface settlement.

and construction of the proposed improvements. However, additional subsurface information should be gathered during a design-level geotechnical investigation to better characterize the quality, depth, and lateral extents of the fill.

From our preliminary discussions with Fuscoe Engineering, we understand that the grades for the proposed development will be at, or near, existing grades, with the exception of the north portion of Block 4 and the paseo/fire access lane, where up to 45 feet fill could be required. If confirmed, we will need to provide supplemental recommendations during final once grading plans are available.

On the basis of our evaluation of the subsurface data and our understanding of the proposed development, foundations are expected to be underlain by Sespe formation, fill, or native soil, which is generally suitable for support of the structure. From our review of the subsurface information as well as our geotechnical exploration, we anticipate the proposed structures can supported on shallow foundations such as spread footings or a mat foundation. Additional foundation information is provided below.

6.5.1 Shallow Foundations

- **Spread Footings or Continuous Footings:** A preliminary bearing value of 2,500 to 4,500 psf may be used for continuous and isolated footings bearing a minimum depth of 24 inches below the lowest adjacent grade and having a minimum width of 12 inches. Transition cut/fill building areas with shallow fill (less than 5 feet thick) should be overexcavated to a minimum depth of 5 feet in order to provide a uniform fill blanket for foundation support. In addition, building footprints underlain by rock should be overexcavated a minimum depth of 5 feet.

  Footings nearest the top of the downhill slope to the Veeh Reservoir can be deepened based on the recommendation provided in Section 6.13. Recommended allowable bearing values include both dead and live loads and may be increased by one-third for wind and seismic forces. The parking structures could require partial mat foundations under shear walls to reduce the bearing pressures to the recommended allowable values. Recommendations for mat foundations are provided in Section 6.5.2.

  Footing static settlement of approximately one inch and differential settlements of up to ½-inch over 50 feet are anticipated with foundations bearing on appropriately prepared engineered fills. Seismically-induced settlements are not anticipated based on the available subsurface data.

Footing excavations should be performed using a backhoe bucket fitted with a smooth steel plate welded across the bucket teeth to minimize disturbance during excavation and to provide a smooth bearing surface.

The footing subgrades should be firm and unyielding, inspected and approved by a qualified geotechnical engineer prior to steel or concrete placement.

Foundations should be constructed as soon as possible following subgrade approval. The contractor shall be responsible for maintaining the subgrade in its as approved condition (i.e. free of water, debris, etc.) until the footing is constructed.

- **Lateral Resistance:** Lateral loads on footings bearing on appropriately prepared engineered fills or bedrock can be resisted by a combination of passive resistance acting against the vertical faces of the footings and friction along the bases of the footings. We recommend a passive resistance be calculated using a lateral pressure corresponding to an equivalent fluid pressure of 250 pounds per cubic foot (pcf); the upper foot of soil should be ignored unless confined by a concrete slab or pavement. Frictional resistance should be computed using a base friction coefficient of 0.25. The passive resistance and base friction values include a factor of safety of about 1.5 and can be used to resist total loads (including wind and/or seismic loads). They may be used in combination without reduction.

6.6 Slabs-on-Grade

The building pads could span transitions between fill and bedrock at the exposed subgrade (pad) level. Even if the fill is compacted based on the recommendations provided in Section 7.2, we anticipate that the compressibility of the fill will differ from the compressibility of bedrock. Therefore, we recommend that the slab on grade be cast over a minimum of 5 feet of new material, which could consist of 56 inches of engineered fill and a four-inch-thick capillary moisture break layer below the floor slab. If the pad subgrade is disturbed during excavation for footings and utilities, it should be re-rolled. Loose, disturbed materials should be excavated, removed, and replaced with engineered fill during final subgrade preparation.

Steel reinforcing and concrete thickness should be designed by the project Structural Engineer for soils with a medium expansion potential ($50 < EI < 90$). We recommend, at a minimum, using the following recommendations:

- subgrade modulus, K, equal to 120 pounds per cubic inch (pci); and
- 4-inch minimum thickness.

For moisture-sensitive floor areas, a moisture barrier, consisting of a 15-mil polyethylene water vapor retarder over a minimum of four inches of capillary break as required by 2022 CBC Section 1805.4.1, shall be placed between the base course and concrete floor slab. The water vapor retarder should meet the requirements for Class C vapor retarders stated in ASTM E1745 and should be placed in accordance with the requirements of ASTM E1643. The capillary break should consist of open-graded, free draining, virgin material with a gradation that meets the requirements of the 2022 CBC.

6.7 Lateral Earth Pressure

Although grading plans were not available at the time of preparation of this preliminary evaluation, we recommend that any proposed retaining walls be designed to resist soil and surcharge pressures using the parameters below. The project should include the replacement of the crib wall along a portion of the northwest perimeter of the site.

- Ultimate Coefficient of Friction = 0.35
- Soil Unit Weight = 130 pounds per cubic foot (pcf)
- Friction Angle = 28.5 degrees
- Equivalent Fluid Pressure (At-Rest Condition / Restrained Wall): Drained and Above Design Groundwater Level = 70 psf/foot
- Equivalent Fluid Pressure (Active Condition / Unrestrained Wall): Drained and Above Design Groundwater Level = 45 psf/foot
- Hydrostatic Equivalent Fluid Pressure = 62.4 psf/foot
- The design of any retaining walls greater than six feet in height should consider the additional earth pressures caused by seismic ground shaking. The seismic force increment is estimated based on the design earthquake and may be considered to act as a triangular distribution pressure equal to 30 psf/foot. The seismic increment should be added to the active (unrestrained) lateral earth pressures when considered for below grade walls.
- At-rest, active, passive, and seismic thrust increment should be considered to follow a triangular distribution.
- Lateral loads from surcharges on retaining walls may be considered to impart surcharges to the restrained walls using an earth pressure coefficient of ½ for restrained walls presuming a uniform distribution. Surcharge loading from adjacent structures should be considered where the adjacent foundations are supported on the soil above a 1H:1V theoretical influence line projected upwards from the base of the retaining wall.

- Surcharge loading should consider adjacent streets, vehicular traffic, and sidewalks. Where vehicular traffic will pass within 10 feet of retaining walls, temporary traffic loads should be considered in the design of walls. Traffic loads such as fire trucks or cars parked on the street beyond the sidewalk may be modeled by a minimum uniform pressure of 100 psf/foot applied on the upper 10 feet of the walls.

- A wall drainage system, such as uniformly spaced prefabricated drainage panels connected to a toe drain, should be installed behind retaining grade walls to reduce the potential for hydrostatic pressure build up. The toe drain should be sloped to drain into an appropriate outlet. The design of the retaining walls should include the hydrostatic equivalent fluid pressure if they will not be drained.

6.8 Preliminary Pavement Sections

On the basis of the soil conditions present at the Site and estimated traffic volume, preliminary pavement sections are provided in the following table. We selected an R-value of 7 for preliminary design based on the lab test results.

The sections provided herein are for planning purposes only and should be re-evaluated subsequent to site grading. Final pavement sections should be based on actual R-value testing of in-place soils and analysis of anticipated traffic. Preliminary flexible pavement sections for parking areas have been developed with the parameters summarized on the following table.

Pavement Area	Traffic Index	Section Thickness	
		Asphalt Concrete	Class 2 Aggregate Base
Parking Areas with Occasional Trucks	4.0	4 inches	6 inches
Driveways and Truck-Use Areas	6.0	4 inches	12 inches

Aggregate base materials should be Crushed Aggregate Base or Crushed Miscellaneous Base conforming to Section 200-2 of the Standard Specification for Public Works Construction (Greenbook) or Class 2 Aggregate Base conforming to the Caltrans' Standard Specifications. The materials should be moisture conditioned to slightly over the optimum moisture content then compacted to at least 95 percent of ASTM Test Method D1557, latest edition.

Prior to placement of pavement elements, the upper two feet of subgrade soils should be moisture-conditioned to within 2 percent of the optimum moisture content then compacted to at

least 95 percent of the laboratory determined maximum dry density. Areas observed to pump or yield under vehicle traffic should be removed and replaced with firm and unyielding compacted soil or aggregate base materials.

Non-vehicular concrete pavements (including exterior slabs and hardscape) should have a nominal thickness of at least 4 inches and be supported on compacted subgrade and at least 6 inches of Class 2 Aggregate Base compacted to at least 90 percent relative compaction. Cold joints or saw cuts in the concrete should be provided at least every 15 feet in each direction.

6.9 Corrosion Considerations

Chemical analyses performed on the near-surface soil are summarized in the following table. A copy of the corrosion test results is provided in Appendix D.

Soil Type	Boring ID	Resistivity (ohm-cm)	pH	Sulfate (ppm)	Chloride (ppm)
Clayey Sandstone (0 to 5 feet)	LB-2	6,200	7.5	106	9

A corrosion expert should be consulted during the design phase for the most economical and effective corrosion protection if ferrous site utilities are required. On the basis of the soluble sulfate percent, concrete can be designed as exposure class S0 for sulfate exposure. Per ACI 318-A, no special recommendation for cement, but a minimum specified compressive strength (f'c) of 2,500 pounds per square inch (psi) may be used for foundation element and slabs (ASTM C150).

6.10 Site Infiltration

The infiltration rate of the soils at the locations tested is summarized in the table below. The percolation tests suggest the soil at tested locations were not permeable. When final drywell or infiltration structure locations are confirmed, supplemental testing may be required to meet North Orange County Percolation Test Requirements. Percolation Test results are included in Appendix C.

Boring ID	Test Depth (feet)	Soil Type	Infiltration Rate (inches/hour)
PT-1	10	CL	0.0
PT-2	10	SM	0.2

All proposed storm water infiltration systems should be located at least 50 feet away from any settlement sensitive structures and the downhill slope to Veeh Reservoir. If the storm water infiltration systems need to be located less than five feet from the edge of the new foundations, we recommend footings adjacent to storm water infiltration systems bear below an imaginary 1.5:1 (horizontal to vertical) plane projected upward from the bottom edge of the storm water infiltration system areas. In addition, the passive resistance against the vertical face of the footing should be ignored. The structural engineer will need to confirm that this is acceptable to their foundation design.

6.11 California Building Code Required Slope Setbacks

For buildings on top of a slope, the Orange County Grading Manual requires building foundations be set back a minimum horizontal distance of H/3, where H is the height of the slope, but no more than 40 feet. For this Site, the adjacent slopes (estimated from top of slope to the waterline of the reservoir) vary between approximately 45 and 60 feet tall, so we anticipate that a minimum setback of 15 to 20 feet will be required. Alternatively, the foundations can be deepened such that the horizontal distance between the foundation and the face of the slope (distance to daylight) meets the setback requirement. We note that the estimated setback does not account for the height of the slope below the water line of Veeh Reservoir as shown in the topographic plan provided by Fuscoe.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Site Preparation and Grading

Prior to the commencement of mass excavation and grading, a meeting should be held at the Site with the owner, city inspector, excavation/grading contractor, civil engineer, and geotechnical consultant to discuss the work schedule and geotechnical aspects of the grading.

All vegetation and deleterious materials should be disposed of off-site prior to initiation of grading operations.

All surficial units consisting of any soil with roots or loose surficial soil are considered unsuitable for support of the proposed improvements. These materials should be over-excavated to expose competent soils. These over-excavated soils, free of deleterious materials and approved by the geotechnical engineer, may be reused as compacted fill. These surficial soil materials are anticipated to be relatively easy to excavate with conventional heavy earthmoving equipment.

Zones of harder bedrock should be anticipated during site preparation. Most of these materials are below optimum moisture content and will require the addition of water to achieve proper compaction.

The geotechnical consultant should be provided with appropriate survey staking during grading to verify that depths and locations of recommended over-excavations have been achieved. Observations of over-excavations should be performed by the geotechnical engineer to verify the anticipated conditions. All excavations should conform to the requirements of CAL/OSHA.

All over-excavation bottoms should be observed by the geotechnical engineer prior to fill placement. Prior to placement of fill material, the over-excavation bottom should be scarified to a depth of at least six inches, moisture conditioned to above optimum moisture content, and proof-rolled.

Any foundation remnants or construction debris encountered within excavations should be fully removed, and any void spaces that may be created should be backfilled with approved compacted structural fill. Private sewage systems, if encountered during grading should be properly removed or abandoned in place in accordance with local codes. If septic systems or seepage pits are encountered, and they are abandoned in-place, they should be pumped clean, backfilled with gravel or clean sand and capped with a minimum of two feet of 2-sack slurry. The top of the slurry cap should be at 5 feet below proposed grade.

Any environmentally unsuitable soils encountered during the excavation process should be properly disposed of off-site in accordance with all state and local regulations.

If removals are limited by existing improvements or property lines, special grading techniques, such as slot cuttings or other acceptable construction methods may be required. Under such conditions, specific recommendations should be provided by the geotechnical consultant during review of final grading plan.

7.2 Fill Material and Compaction Criteria

Fill material (imported or re-used) should be free of organic, and other deleterious materials and have a maximum particle size no greater than 3 inches. Imported fill should contain no more than 12 percent passing the no. 200 sieve by dry weight and have a plasticity index less than 7. Grain-size distributions, Atterberg Limits, maximum dry density, and optimum water content determinations should be made on representative samples of the proposed fill material.

Engineered fill below building foundations and behind retaining walls should be placed in uniform lifts (maximum 8-inches thick) and compacted to at least 95 percent of its maximum dry density at a moisture content above optimum moisture content, as determined by ASTM D1557.

All fill placed below non-vehicular flatwork should be compacted to a minimum of 90 percent of its maximum dry density at a moisture content above optimum moisture content, as determined by ASTM D1557. All fill placed below vehicular pavement or fill thicker than five feet should be compacted to a minimum of 95 percent of its maximum dry density at a moisture content above optimum moisture content, as determined by ASTM D1557. Fill placement should be subject to controlled full-time engineering observation and testing by the geotechnical engineer. Fill material should not be placed in areas where free water is standing or on surfaces which have not been approved by the geotechnical engineer.

Preliminarily, keyways and benches should be anticipated below the fill slopes that will support the north end of Building 4 and the paseo/fire access lane.

7.3 Site Drainage

Proper drainage should be maintained at all times. Ponding or trapping of water in localized areas can cause differing moisture levels in the subsurface soil. Drainage should be directed away from the tops of slopes and excavations. Erosion protection and drainage control measures should be implemented during periods of inclement weather. During rainfall events, backfill operations may need to be restricted to allow for proper moisture control during fill placement.

Although groundwater was not encountered during explorations performed for this study, shallow perched water may be encountered at the Site depending on seasonal rainfall. The Site should be graded to ensure positive drainage away from the locations of the proposed development.

8.0 FUTURE STUDIES AND DESIGN AND CONSTRUCTION PHASE SERVICES

The conclusions and preliminary recommendation provide herein are based on project information provided to date and a limited number of borings. As part of schematic design, a design-level geotechnical investigation and evaluation should be provided when structural loads are available. The design-level geotechnical investigation should include additional exploratory borings that extend below the proposed foundation level to confirm the subsurface conditions.

During final design we should be retained to consult with the design team as geotechnical questions arise. Technical specifications and design drawings should incorporate Langan's recommendations. When authorized, Langan will assist the design team in preparing specification sections related to geotechnical issues such as earthwork, shallow foundations, backfill and excavation support. Langan should also, when authorized, review the project plans, as well as Contractor submittals relating to materials and construction procedures for geotechnical work, to confirm the designs incorporate the intent of our recommendations.

Langan has investigated and interpreted the site subsurface conditions and developed the foundation design recommendations contained herein, and is therefore best suited to perform quality assurance observation and testing of geotechnical-related work during construction. The work requiring quality assurance confirmation and/or special inspections per the Building Code includes, but is not limited to, earthwork, backfill, shallow foundations, and excavation support.

Recognizing that construction observation is the final stage of geotechnical design, quality assurance observation during construction by Langan is necessary to confirm the design assumptions and design elements, to maintain our continuity of responsibility on this project, and allow us to make changes to our recommendations, as necessary. The foundation system and general geotechnical construction methods recommended herein are predicated upon Langan assisting with the final design and providing construction observation services for the Owner. Should Langan not be retained for these services, we cannot assume the role of geotechnical engineer of record, and the entity providing the final design and construction observation services must serve as the engineer of record.

9.0 OWNER AND CONTRACTOR RESPONSIBILITIES

The Contractor is responsible for construction quality control, which includes satisfactorily constructing the foundation system and any associated temporary works to achieve the design intent while not adversely impacting or causing loss of support to neighboring structures. Construction activities that can alter the existing ground conditions such as excavation, fill placement, foundation construction, ground improvement, etc. can also potentially induce stresses, vibrations, and movements in nearby structures and utilities, and disturb occupants of nearby structures. Contractors working at the Site must ensure that their activities will not adversely affect the performance of the structures and utilities, and will not disturb occupants of nearby structures. Contractors must also take all necessary measures to protect the existing structures during construction. By using this report, contractors agree that Langan will not be held responsible for any damage to adjacent structures.

10.0 LIMITATIONS

The conclusions and recommendations provided in this report result from our interpretation of the geotechnical conditions existing at the Site inferred from a limited number of borings. Recommendations provided are contingent upon one another and no recommendation should be followed independent of the others.

Any proposed changes in structures or their locations should be brought to Langan's attention as soon as possible so that we can determine whether such changes affect our recommendations. Information on subsurface strata shown on the logs represents conditions encountered only at the locations indicated and at the time of investigation. If different conditions are encountered during construction, they should immediately be brought to Langan's attention for evaluation, as they may affect our recommendations.

This report has been prepared to assist the owner in their site selection process and is only applicable to the design of the specific project identified. The information in this report cannot be utilized or depended on by engineers or contractors who are involved in evaluations or designs of facilities (including underpinning, grouting, stabilization, etc.) on adjacent properties which are beyond the limits of that which is the specific subject of this report.

Environmental issues (such as permitting or potentially contaminated soil and groundwater) are outside the scope of this study and should be addressed in a separate evaluation.

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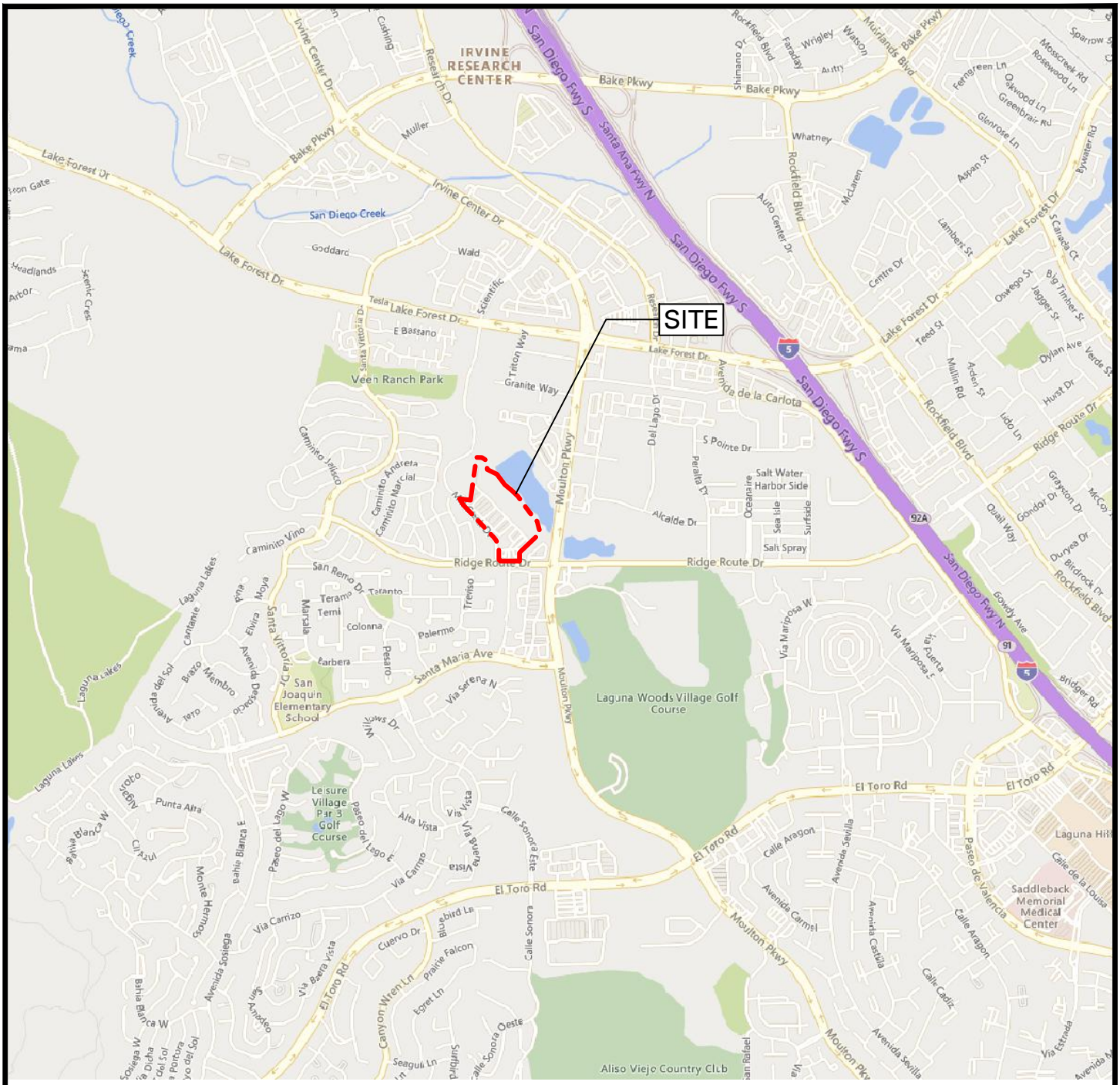
FIGURES



LEGEND:

SITE LIMITS

2,000 1,000 0 2,000

SCALE IN FEET

REFERENCE: BING MAP ACCESSED ON 30 MARCH 2023.

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MILL CREEK DRIVE AND RIDGE ROUTE DRIVE

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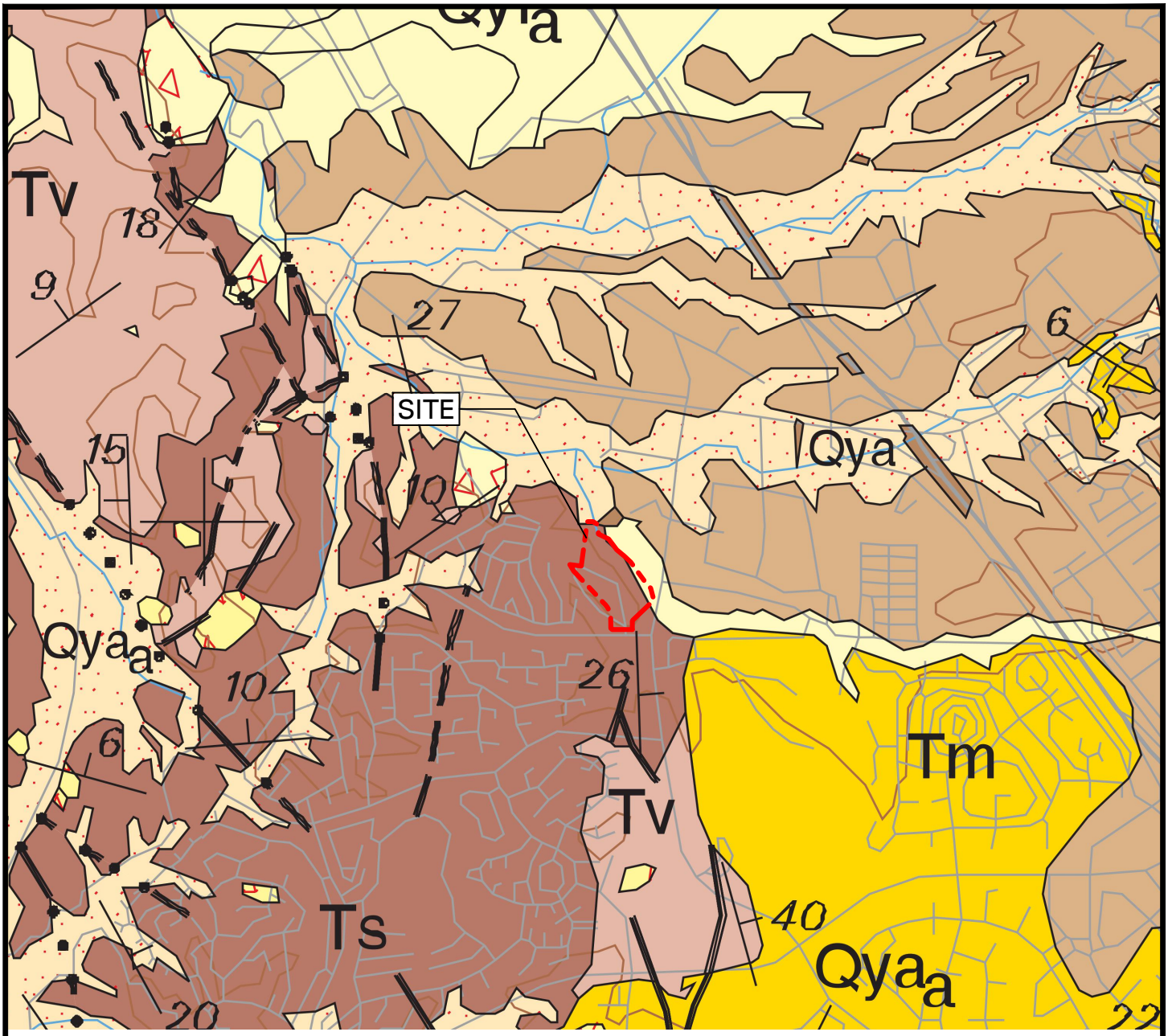
ORANGE COUNTY CALIFORNIA

Figure Title

SITE LOCATION MAP

Project No.	Figure No.
700128701	1
Date: APRIL 2023	
Scale: AS SHOWN	
Drawn By: JX	

Filename: \\langan.com\data\IRV\data7\700128701\Project Data_Discipline\Geotechnical\CAD\phase 1\GEOTECHNICAL FIGURES_R1.dwg Date: 5/3/2023 Time: 18:13 User: agekas Style Table: Langan.stb Layout: SLM



LEGEND:

Qy	YOUNG QUATERNARY DEPOSITS
Qo	OLD QUATERNARY DEPOSITS
Tm	MONTEREY FORMATION
Ts	SESPE FORMATION
Tv	VAQUEROS FORMATION

FAULT - SOLID WHERE ACCURATELY LOCATED, DASHED WHERE APPROXIMATELY LOCATED OR INFERRED; DOTTED WHERE CONCEALED

10 STRIKE AND DIP OF BEDS - INCLINED

2,000 1,000 0 2,000

SCALE IN FEET

REFERENCE: GEOLOGIC MAP OF THE SAN BERNARDINO AND SANTA ANA 30' X 60' QUADRANGLES, CALIFORNIA, D.M. MORTON AND F.K. MILLER (2006).

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Figure Title

REGIONAL GEOLOGIC MAP

Project No.	700128701
Date	APRIL 2023
Scale	AS SHOWN
Drawn By	JX

Figure No. 2

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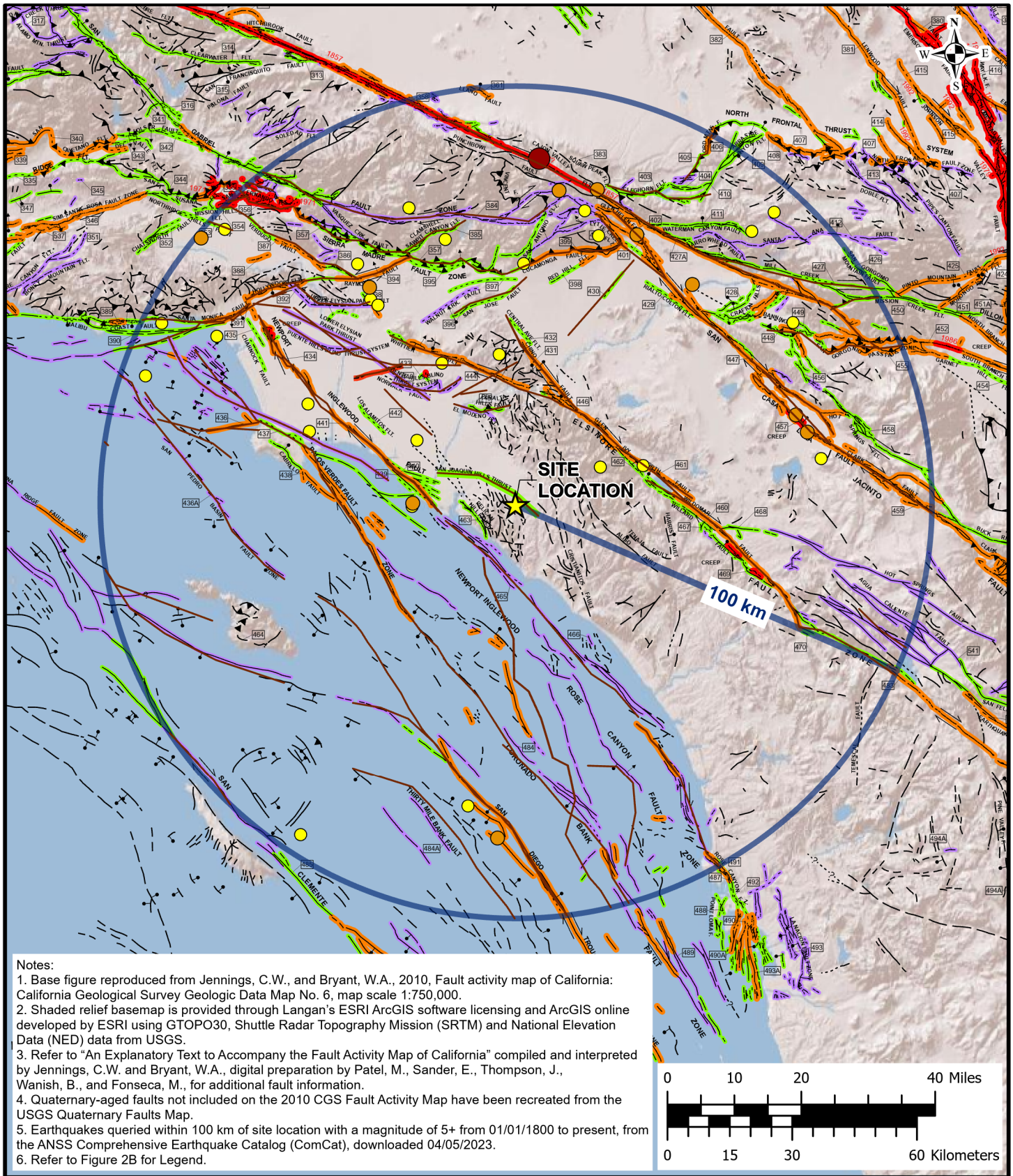

Notes:
1. Base figure reproduced from Jennings, C.W., and Bryant, W.A., 2010, Fault activity map of California: California Geological Survey Geologic Data Map No. 6, map scale 1:750,000.
2. Shaded relief basemap is provided through Langan's ESRI ArcGIS software licensing and ArcGIS online developed by ESRI using GTOPO30, Shuttle Radar Topography Mission (SRTM) and National Elevation Data (NED) data from USGS.
3. Refer to "An Explanatory Text to Accompany the Fault Activity Map of California" compiled and interpreted by Jennings, C.W. and Bryant, W.A., digital preparation by Patel, M., Sander, E., Thompson, J., Wanish, B., and Fonseca, M., for additional fault information.
4. Quaternary-aged faults not included on the 2010 CGS Fault Activity Map have been recreated from the USGS Quaternary Faults Map.
5. Earthquakes queried within 100 km of site location with a magnitude of 5+ from 01/01/1800 to present, from the ANSS Comprehensive Earthquake Catalog (ComCat), downloaded 04/05/2023.
6. Refer to Figure 2B for Legend.

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Figure Title
MAP OF MAJOR FAULTS AND EARTHQUAKE EPICENTERS

Project No.	700128701
Date	MAY 2023
Scale	1 inch = 20 miles
Drawn By	AC

Figure
3A

LEGEND:

Site Location

Fault Age

- Historic
- Holocene
- Late Quaternary
- Early Quaternary
- Pre-Quaternary Fault
- 100 km Search Radius

Earthquake Epicenter

- Magnitude 5.0 to 5.9
- Magnitude 6.0 to 6.9
- Magnitude 7.0 to 7.4
- Magnitude 7.5 to 8.0

Fault Symbols

- Bar and ball on downthrown side (relative or apparent).
- Relative or apparent direction of lateral movement.
- Direction of dip.
- Low angle fault (barbs on upper plate). Fault surface generally dips less than 45° but locally may have been subsequently steepened.
- 491 — Numbers refer to annotations listed in the appendices of the accompanying report.
- Structural discontinuity (offshore) separating differing Neogene structural domains.
- Brawley Seismic Zone.

Fault Classification

Fault along which historic (last 200 years) displacement has occurred and is associated with one or more of the following:
(a) a recorded earthquake with surface rupture. (Also included are some well-defined surface breaks caused by ground shaking during earthquakes, e.g. extensive ground breakage, not on the White Wolf fault, caused by the Arvin-Tehachapi earthquake of 1952). The date of the associated earthquake is indicated. Where repeated surface ruptures on the same fault have occurred, only the date of the latest movement may be indicated, especially if earlier reports are not well documented as to location of ground breaks.
(b) fault creep slippage - slow ground displacement usually without accompanying earthquakes.
(c) displaced survey lines.

1906 — A triangle to the right or left of the date indicates termination point of observed surface displacement. Solid red triangle indicates known location of rupture termination point. Open black triangle indicates uncertain or estimated location of rupture termination point.

1906 — Date bracketed by triangles indicates local fault break.

1906 — No triangle by date indicates an intermediate point along fault break.

CREEP — Fault that exhibits fault creep slippage. Hachures indicate linear extent of fault creep. Annotation (creep with leader) indicates representative locations where fault creep has been observed and recorded.

1906 / 1906 — Square on fault indicates where fault creep slippage has occurred that has been triggered by an earthquake on some other fault. Date of causative earthquake indicated. Squares to right and left of date indicate terminal points between which triggered creep slippage has occurred (creep either continuous or intermittent between these end points).

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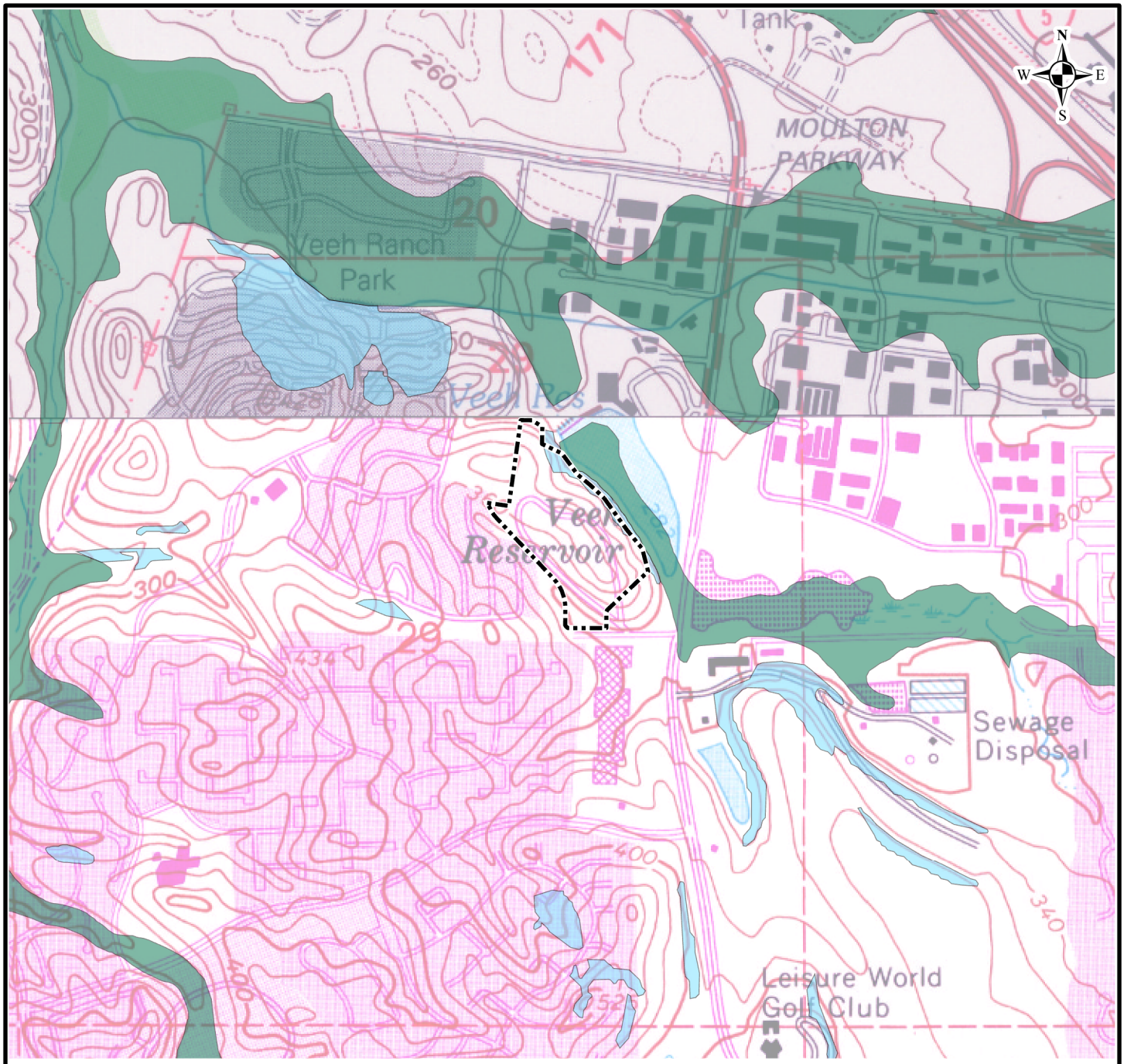
Figure Title
MAJOR FAULTS AND EARTHQUAKE EPICENTERS MAP LEGEND

Project No.	Figure
700128701	3B
Date: MAY 2023	
Scale: NOT TO SCALE	
Drawn By: AC	



Legend

- Approximate Site Location
- **Liquefaction Zone** — Areas where historical occurrence of liquefaction, or local geological, geotechnical and ground water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required
- **Landslide Zone** — Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Notes:
1. USGS Historical Topographic basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online, National Geographic Society, i-cubed.
2. Landslide and liquefaction data provided by the CGS.
3. All features shown are approximate.

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Figure Title
SEISMIC HAZARD ZONES MAP

Project No.	700084801
Date	5/3/2023
Scale	1" = 1,000'
Drawn By	OG
Figure	4

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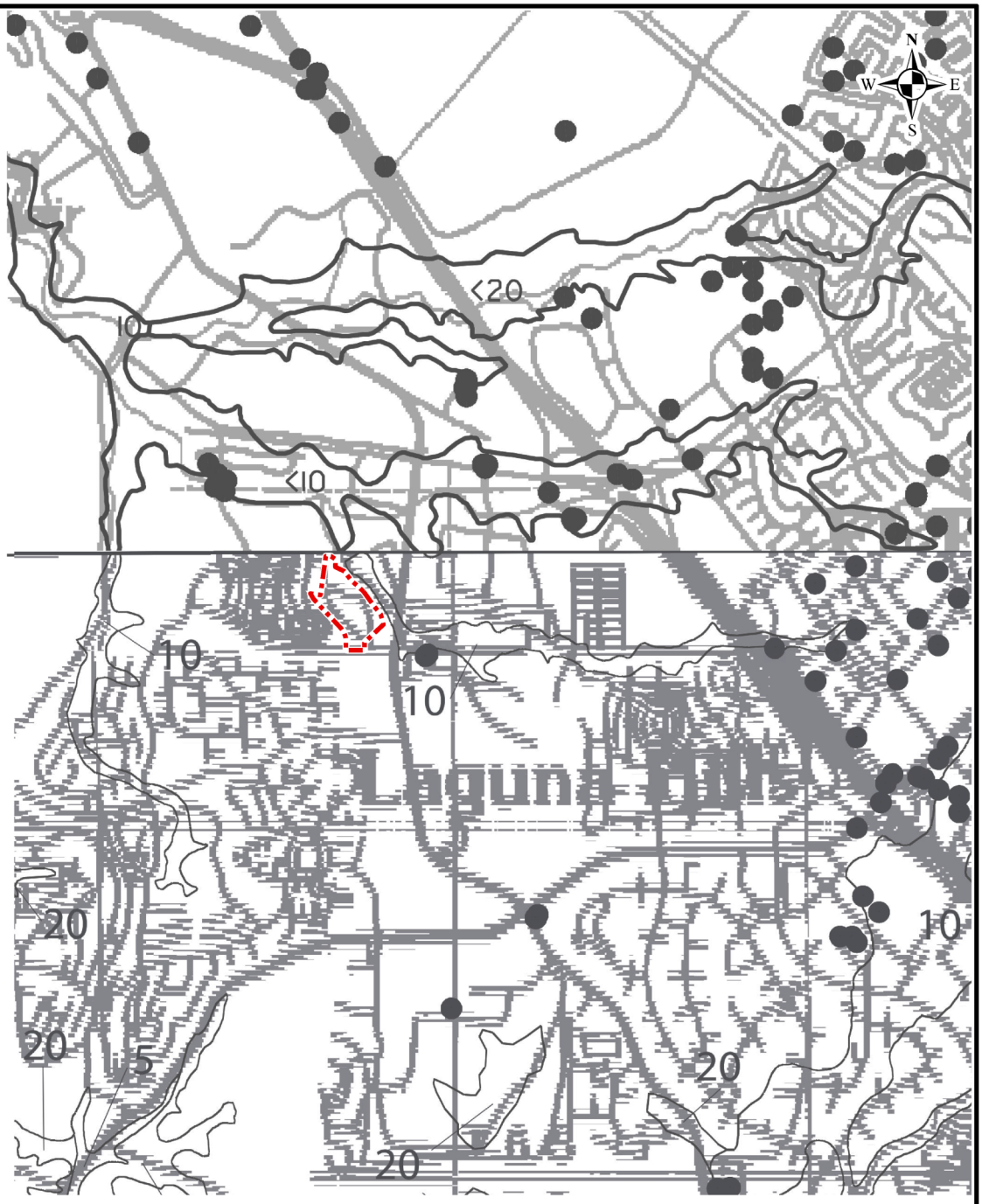

Legend

- Approximate Site Location
- Geotechnical bore holes used in liquefaction evaluation
- 20 — Depth to groundwater (in feet)

Notes:
1. Seismic Hazard Zone Reports for San Juan Capistrano Plate and Lake Forest (El Toro) Plate provided by California Department of Conservation Division of Mines and Geology.
2 All features shown are approximate.

2,500 0 2,500
SCALE IN FEET

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Figure Title
HISTORICAL HIGH GROUNDWATER MAP

Project No. 700084801	Figure 5
Date 5/30/2023	
Scale 1" = 2,500'	
Drawn By OG	

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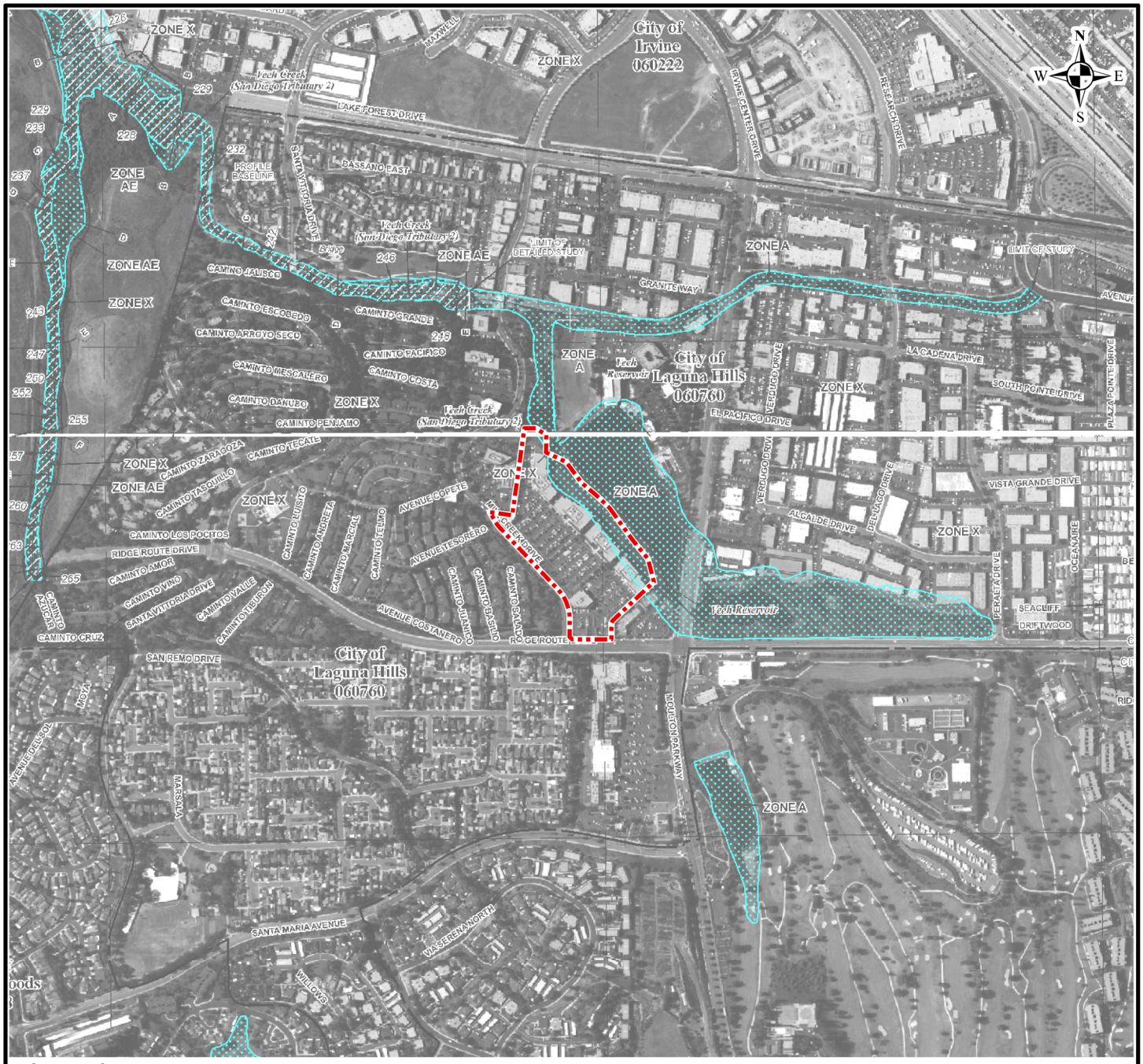

Legend

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

Notes:
1. Flood Firm Panels for San Juan Capistrano Plate and Lake Forest (El Toro) Plate provided by Federal Emergency Management Agency (FEMA).
2 All features shown are approximate.

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SCALE IN FEET

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Figure Title
FEMA FLOOD MAP

Project No.	700084801
Date	5/4/2023
Scale	1" = 1,000'
Drawn By	OG
Figure	6

Path: \\langan.com\data\IRV\data7\700128701\Project Data\ArcGIS\APRX\LagunaHill_FaultFigs.aprx

LEGEND:

- SITE LIMITS
- APPROXIMATE OUTLINE OF PROPOSED BUILDINGS
- WATER LINE OF VEEH RESERVOIR AT THE TIME OF THE SURVEY
- LB-1 / 21' — APPROXIMATE BORING LOCATION AND DEPTH IN FEET. (LANGAN 2023)
- PT-1 / 11.5' — APPROXIMATE PERCOLATION TEST LOCATION AND DEPTH IN FEET. (LANGAN 2023)
- B-1 — APPROXIMATE BORING LOCATION (EJN & ASSOCIATES 1986)

Geologic Units:

- fill — ARTIFICIAL FILL
- rs — RESIDUAL SOIL
- Ts — BEDROCK - SESPE FORMATION, CIRCLED WHERE BURIED

NOTES:

SITE PLAN BASED ON:

1. TOPOGRAPHIC AND BOUNDARY PLANS TITLED "BASEMAP OF 23272, 32382 MILL CREEK DRIVE, LAGUNA HILLS, CALIFORNIA" DATED 19 APRIL 2023 FROM FUSCOE ENGINEERING.
2. CONCEPTUAL DEVELOPMENT PLAN TITLED "SITE DIAGRAM" DATED 26 JANUARY 2023 FROM ARCHITECTS ORANGE.
3. GEOTECHNICAL REPORT TITLED "PRELIMINARY SOILS INVESTIGATION, TENTATIVE PARCEL MAP. NO. 85-367, ORANGE COUNTY, CALIFORNIA" DATED 18 MARCH 1986 BY EJN & ASSOCIATES

200 100 0 200
SCALE IN FEET

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Project
PROJECT HERE
MILL CREEK DRIVE AND RIDGE ROUTE DRIVE
LAGUNA HILLS
ORANGE COUNTY CALIFORNIA

Figure Title
SITE PLAN

Project No. 700128701
Date APRIL 2023
Scale AS SHOWN
Drawn By CDC
Figure No. **7**

Filename: C:\Users\agekas\Desktop\700128701-B-SP0101.dwg Date: 5/31/2023 Time: 14:15 User: agekas Style Table: Langan.stb Layout: 11x17

APPENDIX A

BORING LOGS FROM PREVIOUS INVESTIGATIONS

Major Divisions			Group Symbols		Soil Description
COARSE GRAINED SOIL (More than 50% material larger than the #200 sieve)	GRAVEL (More than 50% material larger than #4 sieve)	Clean GRAVEL (Less than 5% fines)	GW		Well graded gravels, gravel-sand mixtures, little or no fines.
			GP		Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVEL With Fines (More than 12% fines)	GM		Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC		Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	SAND (More than 50% material smaller than #4 sieve)	Clean SAND (Less than 5% fines)	SW		Well graded sands, gravelly sands, little or no fines.
			SP		Poorly graded sands or gravelly sands, little or no fines.
		SAND With Fines (More than 12% fines)	SM		Silty sands, sand-silt mixtures, non-plastic fines.
			SC		Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOIL (More than 50% material smaller than the #200 sieve)	SILT & CLAY (Liquid limit less than 50)		ML		Inorganic silts, sandy or clayey silts Low to no plasticity.
			CL		Inorganic clay, sandy or silty clay. Low to medium plasticity.
			OL		Organic silt or organic silty clay. Low to medium plasticity.
	SILT & CLAY (Liquid limit more than 50)		MH		Inorganic silts, diatomaceous or micaceous fine sandy or silty soils.
			CH		Inorganic clays of high plasticity, Fat clays.
			OH		Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOIL			PT		Peat and other highly organic soils.

PARTICLE SIZE LIMITS

(Sieve Openings in mm.)	.074	.425	2.00	4.17	19.0	75.0	300.0
SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		
(U.S. Standard Sieve Sizes)	#200	#40	#10	#4	.75 in.	3in.	12 in.

Relative Density

SANDS, GRAVELS AND NON-PLASTIC SILTS	BLOWS/FOOT*
VERY LOOSE	0 - 4
LOOSE	4 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	OVER 50

Consistency

CLAYS AND PLASTIC SILTS	STRENGTH+	BLOWS/FOOT*
VERY SOFT	0 - 1/4	0 - 2
SOFT	1/4 - 1/2	2 - 4
FIRM	1/2 - 1	4 - 8
STIFF	1 - 2	8 - 16
VERY STIFF	2 - 4	16 - 32
HARD	OVER 4	OVER 32

*Number of blows of 140 pound hammer falling 30 inches to drive a 2 inch O.D. (1 - 3/8 inch I.D.) split spoon (ASTM D-1586).

+Unconfined compressive strength in tons/sq. ft. as determined by laboratory testing or approximated by the standard penetration test (ASTM D-1586), pocket penetrometer, torvane, or visual observation.

Surface Elevation: ≈ 360.0'

RELATIVE COMPACTION %	MAX. DENSITY (pcf)	DRY DENSITY (pcf)	MOISTURE (%)	PENETRATION (N)	DEPTH (ft)	MATERIAL SYMBOL	UNIFIED SOIL CLASSIFICATION	Comments:
	127.6				1 Bulk			**Sandy Silty CLAY** - Brownish Red Moist, Firm
87.9	127.6	112.2	17.3		2 Ring			
					3		CL	
					4			
					5			
		107.1	19.4		Ring 6			**CLAY** - Red/Brown Very Moist, Stiff Some Silt
					7			
					8			Material gets very stiff Density decreases @ 9 Feet
					9			
		109.5	19.7		10 Ring			
					11		CL	Firm Color changes @ ≈ 11 Feet Some Sand, probable Native Sespe Formation
					12			
					13			
					14			Gets Very Stiff
		111.4	16.5		15 Ring			
					16			End of Boring @ 16 Feet No Groundwater No Caving
					17			
					18			
					19			
					20			

Fill

Native

Logged By: RW

Depth of Boring: 1

Groundwater: None

Exploratory Boring Number: 1

EJN & Associates | Date: 3/24/86 | Job No.: 86-155-1 | Appendix D1

Surface Elevation: ≈362.0'								Comments:
		107.2	16.5		1 2 Ring 3 4 5		CL	**Silty CLAY**- Red/Brown Moist, Firm
		109.7	16.3		Ring 6 7 8		CL	**Silty CLAY**- Dark Red/Brown Moist, Soft to Firm Fill
		123.8	11.0		9 10 Ring 11 12 13		SM	**Clayey Silty SAND**- Light Red Moist, Soft to Firm (probable Sespe Formation) Native Gets Stiff
					14 15 16 17 18 19 20			End of Boring @ 13 feet No Groundwater No Caving

RELATIVE COMPACTION %	MAX. DENSITY (pcf)	DRY DENSITY (pcf)	MOISTURE (%)	PENETRATION (N)	DEPTH (ft)	MATERIAL SYMBOL	UNIFIED SOIL CLASSIFICATION	
								Logged By: RW
								Depth of Boring: 13 Feet
								Groundwater: None
								Exploratory Boring Number: 2

EJN & Associates	Date: 3/24/86	Job No.: 86-155-1	Appendix D2

Surface Elevation: ≈ 343.0'

RELATIVE COMPACTION %	
MAX. DENSITY (pcf)	
DRY DENSITY (pcf)	110.9 / 113.4
MOISTURE (%)	18.2 / 17.0
PENETRATION (N)	
DEPTH (ft)	20 19 18 17 16 15 14 13 12 11 (Ring) 10 9 8 7 6 (Ring) 5 4 3 2 1
MATERIAL SYMBOL	
UNIFIED SOIL CLASSIFICATION	SM / CL
Comments:	Silty SAND- Light Red Moist, Very Stiff to Hard (Sespe Formation) / Silty CLAY- Light Red/Brown Moist, Soft; Gets Firm; Gets Stiff

Native *Fill* →

Logged By: RW

Depth of Boring: 13 1/2 Feet

Groundwater: None

Exploratory Boring Number: 3

EJN & Associates | Date: 3/24/86

Job No.: 86-156-1 | Appendix D3

RELATIVE COMPACTION %	MAX. DENSITY (pcf)	DRY DENSITY (pcf)	MOISTURE (%)	PENETRATION (N)	DEPTH (ft)	MATERIAL SYMBOL	UNIFIED SOIL CLASSIFICATION	Surface Elevation: ≈ 332' — Comments:
	120.3				1 Bulk 2 Bulk			**Sandy CLAY** - Red Moist, Soft
85.4	120.3	102.7	18.3		3 Rings 4		CL	Very Soft
					5			Fill
					6			
					7		SM	**Silty SAND** - Grau Moist, Firm
					8			**Silty CLAY** - Red Moist, Stiff
					9			Native
		109.2	16.5		10 Rings			
					11			
					12		CL	
					13			
					14			
					15			Gets Sandier
					16			
					17		SM	**Silty SAND** - Pinkush Gray Moist, Very Stiff (Sespe Formation)
					18			
					19			End of Boring @ 18 Feet No Groundwater No Caving
					20			

Logged By: RW

Depth of Boring: 18 Feet

Groundwater: None

Exploratory Boring Number: 4

EJN & Associates	Date: 3/24/86	Job No.: 86-155-1	Appendix D4

Surface Elevation: ≈ 330.0'	RELATIVE COMPACTION %	MAX. DENSITY (pcf)	DRY DENSITY (pcf)	MOISTURE (%)	PENETRATION (N)	DEPTH (ft)	MATERIAL SYMBOL	UNIFIED SOIL CLASSIFICATION	Comments:
			114.3	17.2	Ring	1–5		CL	**Silty CLAY**- Red/Brown *Native* Moist, Firm Gets Stiff
			121.3	8.4	Ring	6–8		SM	**Silty SAND**- Gray Moist, Stiff
						8–10		CL	**Silty CLAY**- Pink Moist, Very Stiff
						10–20			End of Boring @ 10 Feet No Groundwater No Caving

Logged By: RW

Depth of Boring: 10 Feet

Groundwater: None

Exploratory Boring Number: 5

EJN & Associates | Date: 3/25/86 | Job No.: 86-155-1 | Appendix D5

Surface Elevation: 310

RELATIVE COMPACTION %	MAX. DENSITY (pcf)	DRY DENSITY (pcf)	MOISTURE (%)	PENETRATION (N)	DEPTH (ft)	MATERIAL SYMBOL	UNIFIED SOIL CLASSIFICATION	Comments:
		117.6	7.3	Ring	1–4		SM	**Silty SAND**– Redish Brown Firm to Stiff Modreatly Dry
		105.1	19.7	Ring	5–11		CL	**Sandy Clay**– Brown/Red Very Moist, Stiff **GETS Stiff** Some mechanical debris found from 5 to 10 feet ??
					12–15		CL	**Silty Clayey Sand**– Pinkish Gray Probably silty sand from Sespe Formation Fill / Native End of Boring @15 feet No Groundwater No Caving
					16–20			

Logged By: RW

Depth of Boring: 15

Groundwater: None

Exploratory Boring Number: 6

EJN & Associates | Date: 3/24/86 | Job No.: 86-155-1 | Appendix D 6

Surface Elevation: 300

RELATIVE COMPACTION %	MAX. DENSITY (pcf)	DRY DENSITY (pcf)	MOISTURE (%)	PENETRATION (N)	DEPTH (ft)	MATERIAL SYMBOL	UNIFIED SOIL CLASSIFICATION	Comments:
	122.8				1 Bulk 2 Bulk 3		SM	**Silty Sand**- Red/Brown Moist, Firm
94.0	122.8	115.4	9.3		Ring 4			Fill
					5			
					6 7 8 9			**Clayey Silt**- Brown/Red Moist, Stiff Native Some Sand
		104.5	15.7		10 Ring 11		ML	Gets Very Stiff
					12 13 14			Cobbles
					15 16 17		SM	**Silty Sand**- Pink/Brown Moist, Very Stiff Sespe Formation
					18 19 20			Refusal @ 18feet due toCobble No Groundwater No Cavitation

Logged By: RW

Depth of Boring: 18 Feet

Groundwater: None

Exploratory Boring Number: 7

EJN & Associates	Date: 3/25/86	Job No.: 86-155-1	Appendix D 7

EJN & Associates | Date: 3/25/86

RELATIVE COMPACTION %	
MAX. DENSITY (pcf)	
DRY DENSITY (pcf)	
MOISTURE (%)	
PENETRATION (N)	
DEPTH (ft)	20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
MATERIAL SYMBOL	
UNIFIED SOIL CLASSIFICATION	SC / SM
Comments:	Silty Sand-Red/Brown Moderate Dry Firm to Stiff Some Clay Native / Fill Calyey Sand-Pink/White Moist,Very Stiff Sespe Formation Refusal @ 7 feet No Groundwater No Caving

Surface Elevation: 306

Logged By: RW

Depth of Boring: 7 Feet

Groundwater: None

Exploratory Boring Number: 8

RELATIVE COMPACTION %	MAX. DENSITY (pcf)	DRY DENSITY (pcf)	MOISTURE (%)	PENETRATION (N)	DEPTH (ft)	MATERIAL SYMBOL	UNIFIED SOIL CLASSIFICATION	Surface Elevation: 330 / Comments:
					1			**Silty Sand**- Red/Brown
	124.3				Bulk 2			Moist, Dense
					Bulk 3		CL	Sand Gets Whitish Grey
					4			
93.2	124.3	115.8	9.0		Ring 5			Fill
					6			**Clayey Silty Sand**
					7		CL	Moist, Very Dense
		109.5	8.8		6			Native
					9			
					Ring 10			End of Boring @ 10 feet
					11			No Groundwater
					12			No Caving
					13			
					4			
					15			
					16			
					17			
					18			
					19			
					20			

Logged By: RW

Depth of Boring: 10 Feet

Groundwater: None

Exploratory Boring Number: 9

EJN & Associates	Date: 3/25/86	Job No.: 86-155-1	Appendix D 9

Surface Elevation: 329								Comments:
					1			**Cayey Silty Sand** Fill Red/Brown Moist,Stiff Gets Very Stiff ? Where Native
					2		SM	
					3			
					4			
					5			Refusal @ 5 feet due to Tight Materil No Groundwater No Caving ???
					6			
					7			
					8			
					9			
					10			
					11			
					12			
					13			
					14			
					15			
					16			
					17			
					18			
					19			
					20			
RELATIVE COMPACTION %	MAX. DENSITY (pcf)	DRY DENSITY (pcf)	MOISTURE (%)	PENETRATION (N)	DEPTH (ft)	MATERIAL SYMBOL	UNIFIED SOIL CLASSIFICATION	Logged By: RW Depth of Boring: 5 Feet Groundwater: None Exploratory Boring Number: 10

EJN & Associates	Date:3/25/86	Job No.:86-155-1	Appendix D 10

Surface Elevation: 341								Comments:
					1			Clayey SAND- Red/Brown
					Bulk			Very Moist, Stiff
	121.3				2			
					Bulk			
					3		SC	
					4			
50.8	121.3	110.1	9.8		Ring			
					5			
							CL	Sandy Loam- Top Soil, Roots & Grass
					6			
								CLAY- Very Dark Gray
					7			Very Moist,
							CL	Firm to Stiff
					8			
					9			
		123.7	7.1		Ring		SM	Clayey Silt Sand- Red/Brown
					10			Moist, Very Stiff
								Sespe Formation
					11			
								End OF Boring @ 10 Feet
					12			No Groundwater
								No Caving
					13			
					14			
					15			
					16			
					17			
					18			
					19			
					20			

Fill

Native

RELATIVE COMPACTION %	MAX. DENSITY (pcf)	DRY DENSITY (pcf)	MOISTURE (%)	PENETRATION (N)	DEPTH (ft)	MATERIAL SYMBOL	UNIFIED SOIL CLASSIFICATION	
								Logged By: RW
								Depth of Boring: 10
								Groundwater: None
								Exploratory Boring Number: 11

EJN & Associates	Date: 3/25/86	Job No.: 86-155-1	Appendix D 11

Surface Elevation: 365

RELATIVE COMPACTION %	MAX. DENSITY (pcf)	DRY DENSITY (pcf)	MOISTURE (%)	PENETRATION (N)	DEPTH (ft)	MATERIAL SYMBOL	UNIFIED SOIL CLASSIFICATION	Comments:
		109.3	8.2		1 2 3 Ring 4 5		SC	**Clayey Sand**–Reddish Brown Moist,Stiff
		100.3	21.5		6 7 8 Ring 9		CL	**Clay**–Very Dark Gray Very Moist,Very Stiff
		115.3	7.9		10 11 12 13 Ring 14		SM	**Silty Sand**–Red/Brown Stiff Moist Gets Very Stiff
					15 16 17 18 19 20			REfusal @ 14 Feet due to Dense Material No Groundwater No Caving

Native Fill

Logged By: RW

Depth of Boring: 14 Feet

Groundwater: None

Exploratory Boring Number: 12

EJN & Associates	Date: 3/25/86	Job No.: 86-155-1	Appendix D 12

DATE OBSERVED: 9/10/94 METHOD OF DRILLING: 24" Bucket 2150 lbs @ 12"

LOGGED BY: RG GROUND ELEVATION: 303± LOCATION: See Plot Plan

BORING NO. 1

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT (%)	IN PLACE DRY DENSITY (PCF)	DESCRIPTION	SOIL TEST
0	SM	6	X		5.9	123	FILL: Red brown silty SAND, dry, medium dense, slightly porous	EXPANSION
5	ML	4	X	X	19.0	105	@4' Red brown clayey SILT, moist, stiff	MAXIMUM DENSITY SIEVE
10		3	NR				@7' Mottled SAND and CLAY	
15		2	X		19.8	104	@16' Cobble layer, mottled topsoil and red brown CLAY	CONSOLIDATION
	SM						BEDROCK Sespe Formation @17' Light brown SANDSTONE with cobbles, moist @19' Refusal on cobbles	
20							Total Depth 19' No Groundwater No Caving	
25								
30								
35								
40								

JOB NO.: 2610-00 | LOG OF BORING | FIGURE: B-15

IRVINE SOILS ENGINEERING, INC.

DATE OBSERVED: 9/10/84 METHOD OF DRILLING: 24" Bucket Auger 2150 lbs @ 12"

LOGGED BY: RG GROUND ELEVATION: 309± LOCATION: See Plot Plan

BORING NO. 2

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT (%)	IN PLACE DRY DENSITY (PCF)	DESCRIPTION	SOIL TEST
0							FILL Red brown silty SAND, dry, medium dense	
5	CL	3	X		17.0	106	@4' Topsoil mottled with reddish brown CLAY, very moist @5' Red brown sandy CLAY, moist	
10		4	X		13.0	117	@9' Equipment oil filter and oil	
15	SM						BEDROCK Sespe Formation White SANDSTONE with cobbles, moist, dense @17' Red silty SANDSTONE with cobbles, fine grain @18' Refusal at 18' on cobbles	
20							Total Depth 18' No Groundwater No Caving	
25								
30								
35								
40								

JOB NO.: 2610-00 LOG OF BORING FIGURE: B-16

IRVINE SOILS ENGINEERING, INC.

DATE OBSERVED: 9/10/84 METHOD OF DRILLING: 24" Bucket Auger
2150 lbs @ 12"
LOGGED BY: RG GROUND ELEVATION: 327± LOCATION: See Plot Plan

BORING NO. 3

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT (%)	IN PLACE DRY DENSITY (PCF)	DESCRIPTION	SOIL TEST
0							BEDROCK: Sespe Formation Upper 6", white-gray SANDSTONE, massive, dry, dense	
				X				ATTERBERG EXPANSION R-VALUE
5	ML	15	X		17.0	114	Red brown SILTSTONE, hard @6' Shear slicks: N16W 16NE	
10	ML/SM	15	X		7.3	128	@9' Gray to white sandstone layer, 1' thick, contact is irregular, near horizontal @10' Red sandy SILTSTONE, hard	
15							@13' White-gray SANDSTONE, massive, dense @15' Cobble layer, continuous around hole, near horizontal	MAXIMUM DENSITY SHEAR (REMOLDED) SIEVE
20	SM	15/10	X		7.0	133	@20' Grades to silty SANDSTONE	
25							Total Depth 21' No Groundwater No Caving	
30								
35								
40								

JOB NO.: 2610-00 LOG OF BORING FIGURE: B-17

IRVINE SOILS ENGINEERING, INC.

DATE OBSERVED: 9/10/84 METHOD OF DRILLING: 24" Bucket Auger
2150 lbs. @ 12"

LOGGED BY: RG GROUND ELEVATION: 333± LOCATION: See Plot Plan

BORING NO. 4

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT (%)	IN PLACE DRY DENSITY (PCF)	DESCRIPTION	SOIL TEST
0							FILL: Red brown silty SAND to sandy CLAY, moist, medium dense @4' 1" thick layer of topsoil, not continuous, occasional pockets of white sand	
10	SM	10/10"	X		8.0	126	BEDROCK: Sespe Formation White SANDSTONE, massive and dense, one foot thick @10' Red CLAYSTONE, contact is horizontal, very hard, massive @14' 1" shear zone, slicks, near horizontal, soft @15' Grades into a clayey SAND, massive	
20		20/10"	X		6.0	120	@22' SANDSTONE, red brown to white @24' Concretion	
30							@29' Concretion - refusal	
40							Total Depth 29' No Groundwater No Caving	

JOB NO.: 2610-00 LOG OF BORING FIGURE: B-18

IRVINE SOILS ENGINEERING, INC.

DATE OBSERVED: 9/10/84 METHOD OF DRILLING: 24" Bucket Auger
2150 lbs @ 12"

LOGGED BY: RG GROUND ELEVATION: 329± LOCATION: See Plot Plan

BORING NO. 5

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT (%)	IN PLACE DRY DENSITY (PCF)	DESCRIPTION	SOIL TEST
0							BEDROCK: Sespe Formation Red CLAYSTONE, fractured, hard, moist, massive	
5	CL	4	X		20.2	101		SULFATE
10	SM	6/6	X		5.9	121	@7' Red to gray silty SANDSTONE, cobbles dense, moist @10' Red brown SANDSTONE, dense, cobbles, moist	
15			X				@15' Cemented sandstone layer	
20	SM	12/10"	X		9.8	114	@18' Red claystone layer @19' Gray-white SANDSTONE, dense, moist	
25							Total Depth 21' No Groundwater No Caving	
30								
35								
40								

JOB NO.: 2610-00 LOG OF BORING FIGURE: B-19

IRVINE SOILS ENGINEERING, INC.

DATE OBSERVED: 9/10/84 METHOD OF DRILLING: 24" Bucket Auger 2150 lbs @ 12"

LOGGED BY: RG GROUND ELEVATION: 335± LOCATION: See Plot Plan

BORING NO. 6

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT (%)	IN PLACE DRY DENSITY (PCF)	DESCRIPTION	SOIL TEST
0	SM / ML	P/1	X		10.0	88	FILL Dark brown sandy SILT and silty SAND, moist, loose to medium dense @4' Red brown CLAY	
5	CL	3	X		12.4	107	@8' Gray sandstone layer, fine grain	
10	SM	6/6"	X		6.3	128	BEDROCK Sespe Formation Red brown silty SANDSTONE, moist, dense	
15		10/10"	X		17.5	115	Red CLAYSTONE, hard, moist, massive @19' Very difficult drilling	
20							Total Depth 20' No Groundwater No Caving	
25								
30								
35								
40								

JOB NO.: 2610-00 LOG OF BORING FIGURE: B-20

IRVINE SOILS ENGINEERING, INC.

DATE OBSERVED: 9/10/84 METHOD OF DRILLING: 24" Bucket Auger
2150 lbs @ 12"

LOGGED BY: RG GROUND ELEVATION: 343± LOCATION: See Plot Plan

BORING NO. 7

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT (%)	IN PLACE DRY DENSITY (PCF)	DESCRIPTION	SOIL TEST
0							BEDROCK: Sespe Formation Red brown silty SANDSTONE massive, caliche deposits	
5							@4' Grades into a CLAYSTONE, fractured caliche deposits in fractures @5' Grades into a silty SANDSTONE, massive, dense	
10	SM	10/9"	X		6.7	126	@10' Gray SANDSTONE, contact is irregular, dense, massive	
15							@12' Grades into a red brown SANDSTONE, massive, some concretions, pebble size	
20	SP	12/10"	X				@19' Red CLAYSTONE, massive, hard, contact is irregular, near horizontal, micaceous	
25							@24' Gray SANDSTONE, contact is irregular, near horizontal, massive	
30		17	X				@26' Grades to a red brown silty SANDSTONE, contact is irregular. N10E 20NW	
35							@32' Red CLAYSTONE, massive, hard	
40		50/11"	X				@35' Shear N15E 54NW	
							@40' Cemented layer, Refusal	
							Total Depth 40' No Groundwater No Caving	

JOB NO.: 2610-00 LOG OF BORING FIGURE: B-21

IRVINE SOILS ENGINEERING, INC.

DATE OBSERVED: 9/10/84 METHOD OF DRILLING: 24" Bucket Auger
2150 lbs @ 12"

LOGGED BY: RG GROUND ELEVATION: 3631 LOCATION: See Plot Plan

BORING NO. 8

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT (%)	IN PLACE DRY DENSITY (PCF)	DESCRIPTION	SOIL TEST
0	CL						FILL Red brown sandy CLAY, moist, stiff	
10	SM	4	NR				BEDROCK: Sespe Formation Silty SANDSTONE, massive	
15							@14' Shear zone fractured CLAYSTONE & SANDSTONE, mottled, caliche deposits in fractures, some voids ¼" @15' Shear N45E 56SE Joint on CLAY-STONE, N12W , vertical, north side is CLAYSTONE and south side is SANDSTONE,	
20	SM	10/6"	X		6.7	111	@18' Red brown CLAYSTONE	
25							@22' Gray silty SANDSTONE	
30	SL	30/10"	X		8.8	120	@27' Grades into red brown SANDSTONE, some cobbles @31' 2" thick concretion, not continuous around boring, grades to a clayey SANDSTONE	
35							@38' Refusal on concretion layer	
40							Total Depth 38' No Groundwater No Caving	

JOB NO.: 2610-00 | LOG OF BORING | FIGURE: B-22

IRVINE SOILS ENGINEERING, INC.

DATE OBSERVED: 9/10/84 METHOD OF DRILLING: 24" Bucket Auger
2150 lbs @ 12"

LOGGED BY: RG GROUND ELEVATION: 360± LOCATION: See Plot Plan

BORING NO. 9

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT (%)	IN PLACE DRY DENSITY (PCF)	DESCRIPTION	SOIL TEST
0	SC	3	X		15.7	110	FILL Red-brown mottled clayey SAND, moist, medium dense	SULFATE
5		2	X		17.9	105		
	CL						Black CLAY, very moist, firm to stiff, grass	EXPANSION
10	SP	12/10"	X		12.4	124	BEDROCK Sespe Formation Reddish brown SANDSTONE, dense, massive	
15		15/10"	X		17.2	106		
							Dark red CLAYSTONE, very hard, massive Refusal @ 18'	
20							Total Depth 18' No Groundwater No Caving	
25								
30								
35								
40								

JOB NO.: 2610-00 LOG OF BORING FIGURE: B-23

IRVINE SOILS ENGINEERING, INC.

APPENDIX B

BORING LOGS FROM CURRENT INVESTIGATION

LANGAN

Log of Boring **LB-1** Sheet 1 of 2

Project: Project HERE	Project No.: 700128701
Location: Mill Creek Drive and Ridge Route Drive	Elevation and Datum: 344.5 feet (NAVD 88)
Drilling Company: Martini Drilling	Date Started: 03/16/2023 / Date Finished: 03/16/2023
Drilling Equipment: CME75 Truck-Mounted Drill Rig #1	Completion Depth: 21 ft / Rock Depth: <1 ft
Size and Type of Bit: 8-inch O.D. Hollow Stem Auger	Number of Samples: Disturbed 7 / Undisturbed - / Core -
Casing Diameter (in): - / Casing Depth (ft): -	Water Level (ft.): First - / Completion - / 24 HR. -
Casing Hammer: - / Weight (lbs): - / Drop (in): -	Drilling Foreman: Jeff Razer
Sampler: 2-inch O.D. Split Spoon; 3-inch O.D. Cal Mod.	Field Engineer: Julia Xu
Sampler Hammer: Automatic / Weight (lbs): 140 / Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks
	+344.9		0						
	+344.5	5 inches of asphalt.							Bulk sample collected from 0 to 5 feet.
	+344.0	6 inches of aggregate base.							
		Bedrock - Sespe Formation (Ts)	2						
		Red, clayey SANDSTONE, moist.		S-1	CR	18	25 36 34	70	Cohesion = 100 psf, friction angle = 31 deg
		Red, clayey SANDSTONE, moist.	4	S-2	CR	6	50/6	50/6	
		Red, clayey SANDSTONE, moist.	6	S-3	CR	5	50/5	50/5	
		Red, clayey SANDSTONE, moist.	8	S-4	CR	5	50/5	50/5	
			10						
		Tannish red, SANDSTONE, moist.	12	S-5	SS	15	25 42 50/3	92/8	
			14						
		Tannish red SANDSTONE, moist.	16	S-6	CR	4	50/4	50/4	Drill rig encountered refusal at 21 feet.
	+323.9	End of boring at 21 feet.	18						
		No groundwater encountered.							
		Boring backfilled with bentonite grout mixture	20						
		Elevations referenced to NAVD88 vertical datum based on topographic plan titled "Basemap of 23272 & 23282 Mill Creek Drive, Laguna Hills, California" by Fuscoe Engineering dated 19 April 2023.	22						
		Notes:	24						
		LL - Liquid limit							
		PL - Plastic limit	26						
		PI - Plasticity index (the difference between the liquid limit and the plastic limit)	28						
		MC - Moisture content							
		DD - Dry density	30						

LANGAN

Log of Boring **LB-1** Sheet 2 of 2

Project	Project No.
Project HERE	700128701
Location	**Elevation and Datum**
Mill Creek Drive and Ridge Route Drive	344.5 feet (NAVD 88)

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+314.9	AC - Asphalt concrete AB - Aggregate base NP - Non-plastic qu - Unconfined compressive strength	30						
			32						
			34						
			36						
			38						
			40						
			42						
			44						
			46						
			48						
			50						
			52						
			54						
			56						
			58						
			60						
			62						
			64						
			66						
			67.5						

LANGAN

Log of Boring **LB-2** Sheet 1 of 2

Project: Project HERE	Project No.: 700128701
Location: Mill Creek Drive and Ridge Route Drive	Elevation and Datum: 342.7 feet (NAVD 88)
Drilling Company: Martini Drilling	Date Started: 03/16/2023 / Date Finished: 03/16/2023
Drilling Equipment: CME75 Truck-Mounted Drill Rig #1	Completion Depth: 30.7 ft / Rock Depth: <1 ft
Size and Type of Bit: 8-inch O.D. Hollow Stem Auger	Number of Samples: Disturbed 9 / Undisturbed - / Core -
Casing Diameter (in): - / Casing Depth (ft): -	Water Level (ft.): First - / Completion - / 24 HR. -
Casing Hammer: - / Weight (lbs): - / Drop (in): -	Drilling Foreman: Jeff Razer
Sampler: 2-inch O.D. Split Spoon; 3-inch O.D. Cal Mod.	Field Engineer: Julia Xu
Sampler Hammer: Automatic / Weight (lbs): 140 / Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+343.8		0	B-1	BAG				Bulk sample collected from 0 to 5 feet.
	+343.4	5 inches of asphalt.							
	+342.9	6 inches of aggregate base.							Soil corrosivity tests
		Bedrock - Sespe Formation (Ts)	2						
		Reddish tan, silty SANDSTONE, moist.		S-1	CR	4	50/4	50/4	
		Red SANDSTONE, trace clay, trace silt, moist.	4	S-2	CR	5	50/5	50/5	
		Red SANDSTONE, trace clay, trace silt, moist.	6	S-3	CR	5	50/5	50/5	
		Red SANDSTONE, trace clay, trace silt, moist.	8	S-4	CR	5	50/5	50/5	
			10						
			12						
		Red SANDSTONE, trace clay, trace silt, moist.	14	S-5	SS	10	30 50/4	50/4	
			16						
			18						
		Red SANDSTONE, trace clay, trace silt, moist.	20	S-6	CR	5	50/5	50/5	
			22						
			24						
		Red silty SANDSTONE, moist.	26	S-7	SS	17	24 34 50/5	84/11	
			28						
			30						

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Log of Boring **LB-2** Sheet 2 of 2

Project	Project No.
Project HERE	700128701
Location	**Elevation and Datum**
Mill Creek Drive and Ridge Route Drive	342.7 feet (NAVD 88)

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+313.8		30					10 20 30 40	
	+313.1	Red silty SANDSTONE, moist.		S-8	CR	8	36 50/2	50/2	
		End of boring at 30.7 feet. No groundwater encountered. Boring backfilled with bentonite grout mixture	32						
		Elevations referenced to NAVD88 vertical datum based on topographic plan titled "Basemap of 23272 & 23282 Mill Creek Drive, Laguna Hills, California" by Fuscoe Engineering dated 19 April 2023.	34						
		Notes: LL - Liquid limit PL - Plastic limit PI - Plasticity index (the difference between the liquid limit and the plastic limit) MC - Moisture content DD - Dry density AC - Asphalt concrete AB - Aggregate base NP - Non-plastic qu - Unconfined compressive strength	36						
			38						
			40						
			42						
			44						
			46						
			48						
			50						
			52						
			54						
			56						
			58						
			60						
			62						
			64						
			66						
			67.5						

LANGAN

Log of Boring **LB-3** Sheet 1 of 2

Project: Project HERE	Project No.: 700128701
Location: Mill Creek Drive and Ridge Route Drive	Elevation and Datum: 333.5 feet (NAVD 88)
Drilling Company: Martini Drilling	Date Started: 03/16/2023 / Date Finished: 03/16/2023
Drilling Equipment: CME75 Truck-Mounted Drill Rig #1	Completion Depth: 30.3 ft / Rock Depth: 5.5 ft
Size and Type of Bit: 8-inch O.D. Hollow Stem Auger	Number of Samples: Disturbed 8 / Undisturbed - / Core -
Casing Diameter (in): - / Casing Depth (ft): -	Water Level (ft.): First - / Completion - / 24 HR. -
Casing Hammer: - / Weight (lbs): - / Drop (in): -	Drilling Foreman: Jeff Razer
Sampler: 2-inch O.D. Split Spoon; 3-inch O.D. Cal Mod.	Field Engineer: Julia Xu
Sampler Hammer: Automatic / Weight (lbs): 140 / Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+333.7		0						Hand Augered top 5 feet. Bulk sample collected from 0 to 5 feet.
	+333.3	5 inches of asphalt.							
	+332.8	6 inches of aggregate base.							
		FILL	2						
			4						
	+328.2	Tannish red, silty fine SAND, trace clay, (SM), moist.							
		Bedrock - Sespe Formation (Ts)	6	S-1	CR	18	29 35 38	73	MC = 9.4% DD = 120 pcf
		Reddish brown, silty SANDSTONE, moist							
		Reddish brown, clayey SANDSTONE, trace silt, moist.	8	S-2	CR	17	19 36 50/5	86/11	Cohesion = 200 psf, friction angle = 28.5 deg
		Reddish brown, clayey SANDSTONE, trace silt, moist.	10	S-3	CR	6	50/6	50/6	
			12						
			14						
		Reddish brown, clayey SANDSTONE, trace silt, moist.	16	S-4	SS	10	35 50/4	50/4	
			18						
		Tannish brown, SANDSTONE, trace clay, trace silt, moist.	20	S-5	CR	5	50/5	50/5	
			22						
			24						
		Tannish brown, SANDSTONE, trace clay, trace silt, moist.	26	S-6	SS	10	26 50/4	50/4	
			28						
			30						

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Log of Boring **LB-3** Sheet 2 of 2

Project	Project No.
Project HERE	700128701
Location	**Elevation and Datum**
Mill Creek Drive and Ridge Route Drive	333.5 feet (NAVD 88)

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+303.7		30						
	+303.5	Tannish brown, SANDSTONE, trace clay, trace silt, moist.		S-7	CRIII	3	50/3	50/3	
		End of boring at 30.3 feet.							
		No groundwater encountered.							
		Boring backfilled with bentonite grout mixture							
			32						
		Elevations referenced to NAVD88 vertical datum based on topographic plan titled "Basemap of 23272 & 23282 Mill Creek Drive, Laguna Hills, California" by Fuscoe Engineering dated 19 April 2023.	34						
			36						
		Notes: LL - Liquid limit PL - Plastic limit PI - Plasticity index (the difference between the liquid limit and the plastic limit) MC - Moisture content DD - Dry density AC - Asphalt concrete AB - Aggregate base NP - Non-plastic qu - Unconfined compressive strength	38						
			40						
			42						
			44						
			46						
			48						
			50						
			52						
			54						
			56						
			58						
			60						
			62						
			64						
			66						
			67.5						

LANGAN

Log of Boring **LB-4** Sheet 1 of 2

Project: Project HERE	Project No.: 700128701
Location: Mill Creek Drive and Ridge Route Drive	Elevation and Datum: 327.5 feet (NAVD 88)
Drilling Company: Martini Drilling	Date Started: 03/16/2023 / Date Finished: 03/16/2023
Drilling Equipment: CME75 Truck-Mounted Drill Rig #1	Completion Depth: 30.8 ft / Rock Depth: 18 ft
Size and Type of Bit: 8-inch O.D. Hollow Stem Auger	Number of Samples: Disturbed 8 / Undisturbed - / Core -
Casing Diameter (in): - / Casing Depth (ft): -	Water Level (ft.): First - / Completion - / 24 HR. -
Casing Hammer: - / Weight (lbs): - / Drop (in): -	Drilling Foreman: Jeff Razer
Sampler: 2-inch O.D. Split Spoon; 3-inch O.D. Cal Mod.	Field Engineer: Julia Xu
Sampler Hammer: Automatic / Weight (lbs): 140 / Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+327.4		0						
	+327.0	5 inches of asphalt.							
	+326.2	10 inches of aggregate base.							
		FILL	2						
		Very stiff, reddish brown, sandy CLAY, fine to medium sand, trace silt, (CL), moist.	4	S-1	CR	18	4 10 14	24	Cohesion = 150 psf, friction angle = 30.5 deg
		Very stiff, reddish brown, sandy CLAY, fine to medium sand, trace silt, (CL), moist.	6	S-2	CR	18	4 10 16	26	
		Stiff, reddish brown, sandy CLAY, fine to medium sand, trace silt, (CL), moist.	8	S-3	CR	18	6 9 12	21	q_u=1.5 tsf (PP)
		Very stiff, reddish brown and dark grayish brown mottled, sandy CLAY, fine to medium sand, trace silt, (CL), moist.	10	S-4	CR	18	6 11 15	26	q_u=2.25 tsf (PP) MC = 14.8% DD = 116 pcf
	+312.4		12						
		Residual Soil Stiff, reddish brown, sandy CLAY, fine to medium sand, trace silt, (CL), moist, homogenous, in-situ weathering.	14						
	+309.4		16	S-5	SS	18	3 4 8	12	q_u=1.25 tsf (PP) LL = 37, PL = 20, PI = 17
		Bedrock - Sespe Formation (Ts)	18						
		Red, clayey SANDSTONE, trace silt, moist.	20	S-6	CR	9	27 50/3	50/3	
		Red, clayey SANDSTONE, trace silt, moist.	22						
			24						
			26	S-7	SS	12	17 50/6	50/6	
			28						
			30						

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Log of Boring **LB-4** Sheet 2 of 2

Project	Project No.
Project HERE	700128701
Location	**Elevation and Datum**
Mill Creek Drive and Ridge Route Drive	327.5 feet (NAVD 88)

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+297.4		30					10 20 30 40	
	+296.7	Red, clayey SANDSTONE, trace silt, moist.		S-8	CR	9	40 50/3	50/3	
		End of boring at 30.8 feet. No groundwater encountered. Boring backfilled with bentonite grout mixture	32						
		Elevations referenced to NAVD88 vertical datum based on topographic plan titled "Basemap of 23272 & 23282 Mill Creek Drive, Laguna Hills, California" by Fuscoe Engineering dated 19 April 2023.	34						
		Notes: LL - Liquid limit PL - Plastic limit PI - Plasticity index (the difference between the liquid limit and the plastic limit) MC - Moisture content DD - Dry density AC - Asphalt concrete AB - Aggregate base NP - Non-plastic qu - Unconfined compressive strength	36						
			38						
			40						
			42						
			44						
			46						
			48						
			50						
			52						
			54						
			56						
			58						
			60						
			62						
			64						
			66						
			67.5						

LANGAN

Log of Boring **PT-1** Sheet 1 of 1

Project: Project HERE	Project No.: 700128701
Location: Mill Creek Drive and Ridge Route Drive	Elevation and Datum: 320 feet (NAVD 88)
Drilling Company: Martini Drilling	Date Started: 03/16/2023 / Date Finished: 03/16/2023
Drilling Equipment: CME75 Truck-Mounted Drill Rig #1	Completion Depth: 11.5 ft / Rock Depth: -
Size and Type of Bit: 8-inch O.D. Hollow Stem Auger	Number of Samples: Disturbed 4 / Undisturbed - / Core -
Casing Diameter (in): - / Casing Depth (ft): -	Water Level (ft.): First - / Completion - / 24 HR. -
Casing Hammer: - / Weight (lbs): - / Drop (in): -	Drilling Foreman: Jeff Razer
Sampler: 2-inch O.D. Split Spoon; 3-inch O.D. Cal Mod.	Field Engineer: Julia Xu
Sampler Hammer: Automatic / Weight (lbs): 140 / Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+320.7		0						Bulk sample collected from 0 to 5 feet.
	+320.2	6 inches of asphalt.							
	+319.5	9 inches of aggregate base.							
		FILL	2	B-1	BAG				
		Stiff, red, fine to medium sandy CLAY, trace silt, trace fine gravel, (CL), moist.	4						R-value = 12 EI = 57
			6	S-1	SS	18	2 4 5	9	LL = 35, PL = 18, PI = 17
		Stiff, red, fine to medium sandy CLAY, trace fine gravel, (CL), moist.	8	S-2	SS	18	3 4 5	9	
		Stiff, tannish red, fine to medium sandy CLAY, (CL), moist.	10	S-3	SS	18	3 5 8	13	
	+309.2	End of boring at 11.5 feet. No groundwater encountered. Boring backfilled with bentonite grout mixture	12						
		Elevations referenced to NAVD88 vertical datum based on topographic plan titled "Basemap of 23272 & 23282 Mill Creek Drive, Laguna Hills, California" by Fuscoe Engineering dated 19 April 2023.	14						
		Notes: LL - Liquid limit PL - Plastic limit PI - Plasticity index (the difference between the liquid limit and the plastic limit) MC - Moisture content DD - Dry density AC - Asphalt concrete AB - Aggregate base NP - Non-plastic qu - Unconfined compressive strength	16						
			18						
			20						
			22						
			24						
			26						
			28						
			30						

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Log of Boring **PT-2** Sheet 1 of 1

Project: Project HERE	Project No.: 700128701
Location: Mill Creek Drive and Ridge Route Drive	Elevation and Datum: 343 feet (NAVD 88)
Drilling Company: Martini Drilling	Date Started: 03/16/2023 / Date Finished: 03/16/2023
Drilling Equipment: CME75 Truck-Mounted Drill Rig #1	Completion Depth: 11.5 ft / Rock Depth: 8 ft
Size and Type of Bit: 8-inch O.D. Hollow Stem Auger	Number of Samples: Disturbed 4 / Undisturbed - / Core -
Casing Diameter (in): - / Casing Depth (ft): -	Water Level (ft.): First - / Completion - / 24 HR. -
Casing Hammer: - / Weight (lbs): - / Drop (in): -	Drilling Foreman: Jeff Razer
Sampler: 2-inch O.D. Split Spoon; 3-inch O.D. Cal Mod.	Field Engineer: Julia Xu
Sampler Hammer: Automatic / Weight (lbs): 140 / Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks
	+344.0		0						
	+343.6	5 inches of asphalt.							
	+343.1	6 inches of aggregate base.							
		FILL		B-1	BAG				Bulk sample collected from 0 to 5 feet.
		Very dense, tannish red, clayey fine to medium SAND, (SC), moist.	6	S-1	SS	18	21 30 35	65	
	+336.0	Very dense, reddish tan, clayey fine to medium SAND, (SC), moist.	8	S-2	SS	18	10 29 50	79	
		Bedrock - Sespe Formation (Ts)							
		Tannish red, clayey SANDSTONE, moist.	10	S-3	SS	18	16 30 40	70	MC = 9.6%
	+332.5	Tannish red, clayey SANDSTONE, moist.							
		End of boring at 11.5 feet. No groundwater encountered. Boring backfilled with bentonite grout mixture	12						
		Elevations referenced to NAVD88 vertical datum based on topographic plan titled "Basemap of 23272 & 23282 Mill Creek Drive, Laguna Hills, California" by Fuscoe Engineering dated 19 April 2023.	14						
		Notes: LL - Liquid limit PL - Plastic limit PI - Plasticity index (the difference between the liquid limit and the plastic limit) MC - Moisture content DD - Dry density AC - Asphalt concrete AB - Aggregate base NP - Non-plastic qu - Unconfined compressive strength	16						
			18						
			20						
			22						
			24						
			26						
			28						
			30						

N-Value (Blows/ft) scale: 10 20 30 40

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APPENDIX C

PERCOLATION TEST RESULTS

PERCOLATION TEST DATA SHEET

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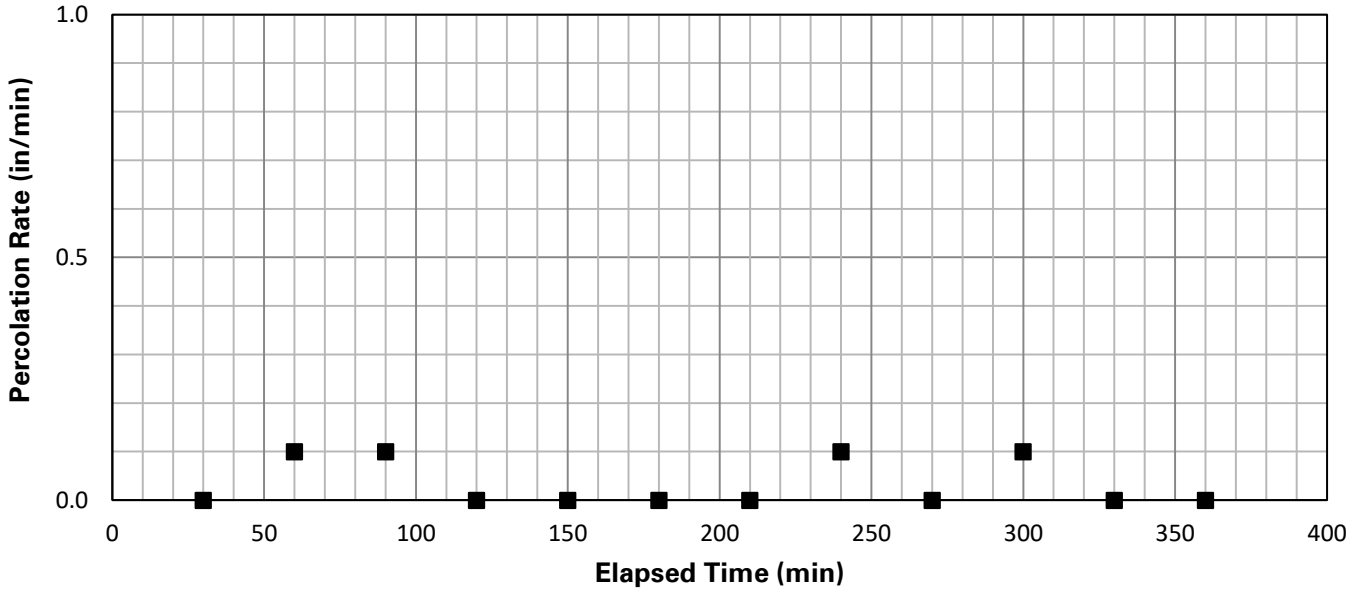
Project:	Project HERE - Laguna Hills				Project No.:	700128701	Date of Test:	3/16/2023	
Test Hole No.:	PT-1				Tested By:	RF			
Depth of Test Hole (ft):	10				USCS Soil Classification:		Sandy CLAY (CL)		
Casing Depth (ft):	10.0' PVC Pipe; with 5 ft screen				Test Hole Diameter (in):		8		
Trial No.	Date	Time of Measurement	Initial Depth to Water (Feet)	Time of Measurement	Final Depth to Water (Feet)	Time Interval (min)	Change in Water Level (Feet)	Percolation Rate (in/min)	Infiltration Rate (in/hr)
Pre-Soak #1	3/16/2023	8:00 AM	4.30	8:30 AM	4.40	30	0.10	0.04	
Pre-Soak #2	3/16/2023	8:30 AM	4.30	9:00 AM	4.40	30	0.10	0.04	
1	3/16/2023	9:30 AM	4.30	10:00 AM	4.30	30	0.00	0.00	
2	3/16/2023	10:00 AM	4.30	10:30 AM	4.40	30	0.10	0.04	
3	3/16/2023	10:30 AM	4.30	11:00 AM	4.40	30	0.10	0.04	
4	3/16/2023	11:00 AM	4.30	11:30 AM	4.30	30	0.00	0.00	
5	3/16/2023	11:30 AM	4.30	12:00 PM	4.30	30	0.00	0.00	
6	3/16/2023	12:00 PM	4.30	12:30 PM	4.30	30	0.00	0.00	
7	3/16/2023	12:30 PM	4.30	1:00 PM	4.30	30	0.00	0.00	
8	3/16/2023	1:00 PM	4.30	1:30 PM	4.40	30	0.10	0.04	
9	3/16/2023	1:30 PM	4.30	2:00 PM	4.30	30	0.00	0.00	
10	3/16/2023	2:00 PM	4.30	2:30 PM	4.40	30	0.10	0.04	
11	3/16/2023	2:30 PM	4.30	3:00 PM	4.30	30	0.00	0.00	
12	3/16/2023	3:00 PM	4.30	3:30 PM	4.30	30	0.00	0.00	0.0

Comments:

1. Percolation test was performed in accordance with the Orange County - Technical Guidance Document dated 28 September 2017.
2. Infiltration Rate was calculated using Porchet Method.
3. Per the procedures for shallow percolation tests in non-sandy soils, a minimum of twelve measurements were taken in 30-minute intervals for six hours after sandy soil criteria was not met.
4. Weather: Cloudy, 62°F
5. Measurements were collected from the Top of PVC Pipe

PT-1



1. Percolation test PT-1 was performed approximately 10 feet below existing grade.
2. Refer to Figure 1 for percolation test location.

LANGAN Langan Engineering & Environmental Services, Inc. 18575 Jamboree, Suite 150 Irvine, CA 92612 P: 949.255.8640 F: 949.255.8641 www.langan.com	Project **Project HERE** **Mill Creek Drive and Ridge Route Drive** LAGUNA HILLS ORANGE COUNTY CALIFORNIA	Title **PERCOLATION TEST RESULTS** **PT-1**	Project No. 700128701 Date March 2023 Scale N/A Prepared By: RF

PERCOLATION TEST DATA SHEET

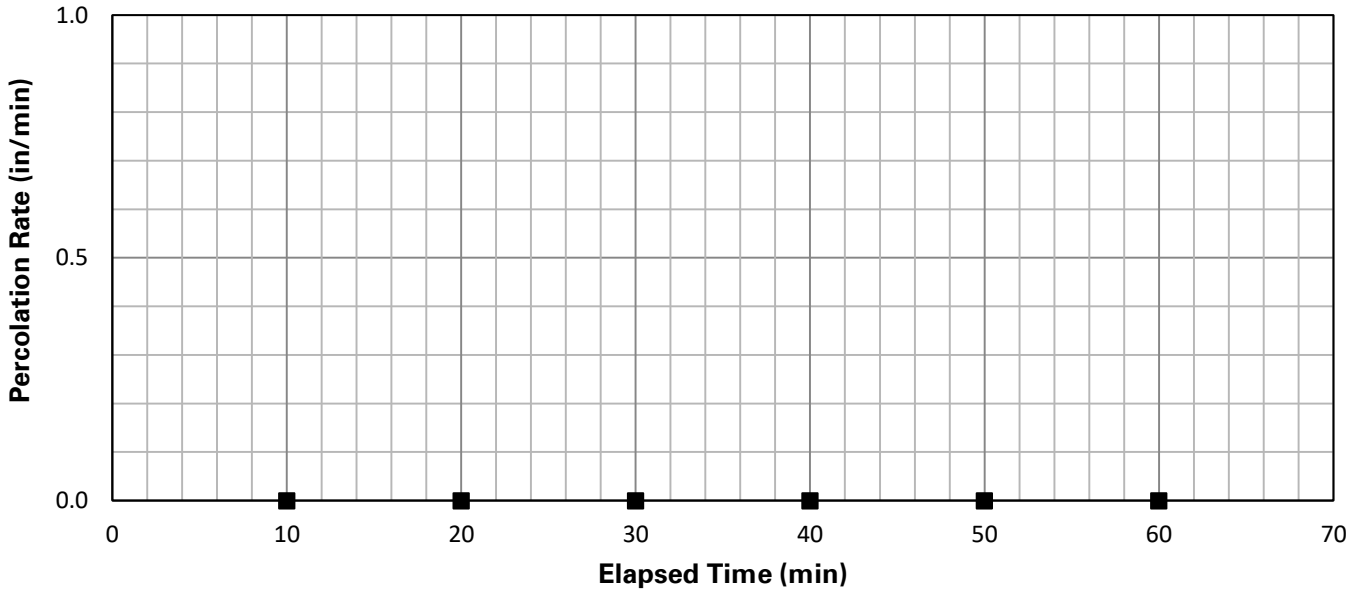
LANGAN

Project:	Project HERE - Laguna Hills				Project No.:	700128701	Date of Test:	3/16/2023	
Test Hole No.:	PT-2				Tested By:	DJJ			
Depth of Test Hole (ft):	10				USCS Soil Classification:		Clayey SAND (SC)		
Casing Depth (ft):	10.0' PVC Pipe; Perforated entire length of pipe				Test Hole Diameter (in):		8		
Trial No.	Date	Time of Measurement	Initial Depth to Water (Feet)	Time of Measurement	Final Depth to Water (Feet)	Time Interval (min)	Change in Water Level (Feet)	Percolation Rate (in/min)	Infiltration Rate (in/hr)
Pre-Soak #1	3/16/2023	8:00 AM	3.70	8:30 AM	3.70	30	0.00	0.00	
Pre-Soak #2	3/16/2023	8:30 AM	3.70	9:00 AM	3.70	30	0.00	0.00	
1	3/16/2023	9:30 AM	3.70	10:00 AM	3.70	30	0.00	0.00	
2	3/16/2023	10:00 AM	3.70	10:30 AM	3.70	30	0.00	0.00	
3	3/16/2023	10:30 AM	3.70	11:00 AM	3.70	30	0.00	0.00	
4	3/16/2023	11:00 AM	3.70	11:30 AM	3.70	30	0.00	0.00	
5	3/16/2023	11:30 AM	3.70	12:00 PM	3.70	30	0.00	0.00	
6	3/16/2023	12:00 PM	3.70	12:30 PM	3.70	30	0.00	0.00	
7	3/16/2023	12:30 PM	3.70	1:00 PM	3.70	30	0.00	0.00	
8	3/16/2023	1:00 PM	3.70	1:30 PM	3.70	30	0.00	0.00	
9	3/16/2023	1:30 PM	3.70	2:00 PM	3.70	30	0.00	0.00	
10	3/16/2023	2:00 PM	3.70	2:30 PM	3.70	30	0.00	0.00	
11	3/16/2023	2:30 PM	3.70	3:00 PM	3.70	30	0.00	0.00	
12	3/16/2023	3:00 PM	3.70	3:30 PM	3.70	30	0.00	0.00	0.0

Comments:

1. Percolation test was performed in accordance with the Orange County - Technical Guidance Document dated 20 December 2013.
2. Infiltration Rate was calculated using Porchet Method.
3. Per the procedures for shallow percolation tests in non-sandy soils, a minimum of twelve measurements were taken in 30-minute intervals for six hours after sandy soil criteria was not met.
4. Weather: Cloudy, 62°F
5. Measurements were collected from the Top of PVC Pipe

PT-2



1. Percolation test PT-2 was performed approximately 10 feet below existing grade.
2. Refer to Figure 1 for percolation test location.

LANGAN
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Project	Title	Project No.
Project HERE **Mill Creek Drive and Ridge Route Drive** LAGUNA HILLS ORANGE COUNTY CALIFORNIA	**PERCOLATION TEST RESULTS** **PT-2**	700128701
		Date: March 2023
		Scale: N/A
		Prepared By: RF

APPENDIX D

LABORATORY TEST RESULTS

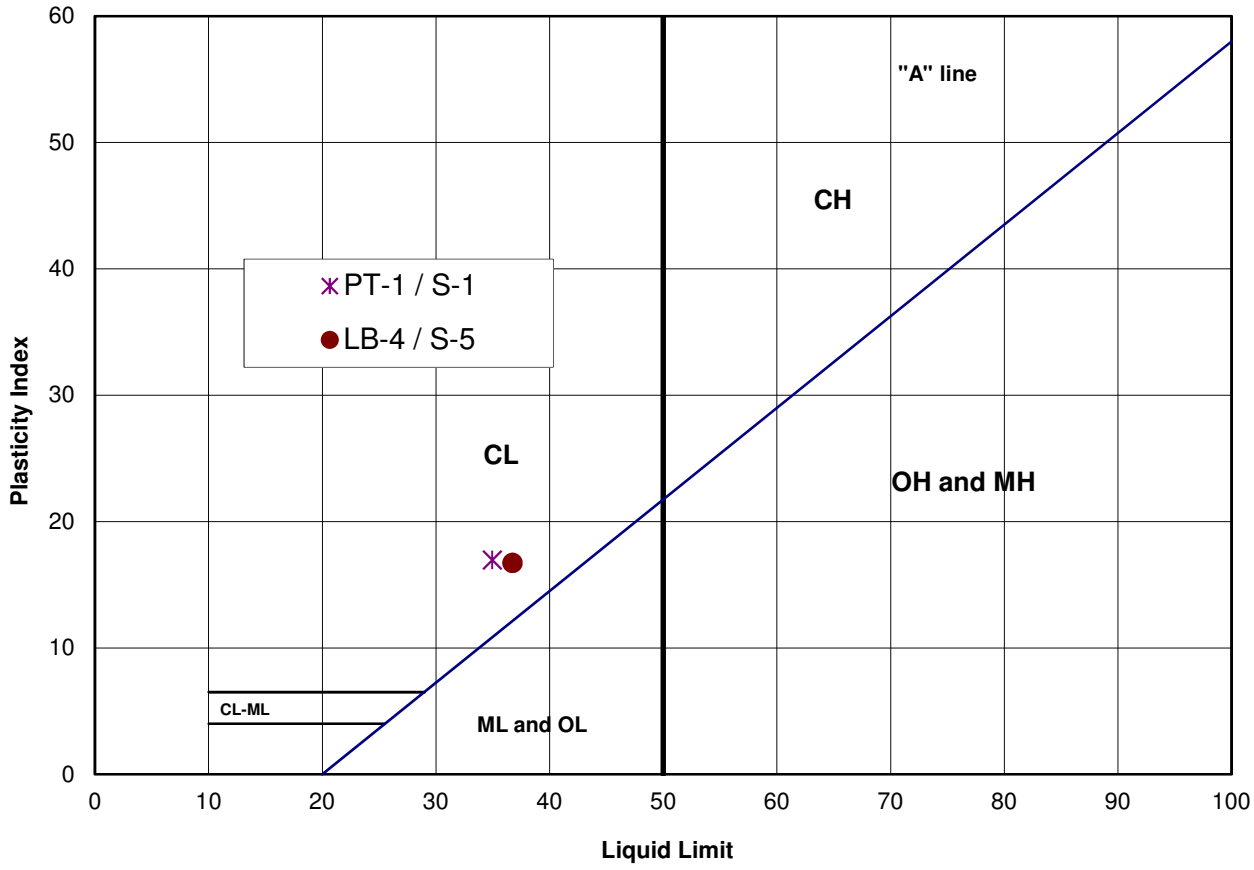
MOISTURE DENSITY TESTS

PROJECT Langan # 700128701 **JOB NO.** 2012-0057 **BY** LD **DATE** 03/28/23

Sample No.	PT-2 / S-3	LB-3 / S-1	LB-4 / S-3					
Depth (ft)	10.0	5.0	7.5					
Testing								
Soil Type	Brown, Clayey Sand	L. Gray, Silty Sand	Brown, Sandy Clay					
Wet+Tare		809.7	1023.4					
Tare		4	5					
Wet Weight	126.4	162.7	163.2					
Dry Weight	115.3	148.7	142.2					
Wet density		131.1	133.0					
% Water	9.6	9.4	14.8					
Dry Density	0.0	119.8	115.9					
O.B.Press(psf)								
Sample No.								
Depth (ft)								
Testing								
Soil Type								
Wet+Tare								
No. Ring								
Wet Weight								
Dry Weight								
Wet density								
% Water								
Dry Density								
O.B.Press(psf)								

Geo-Logic ASSOCIATES

PLASTICITY INDEX _ ASTM D4318



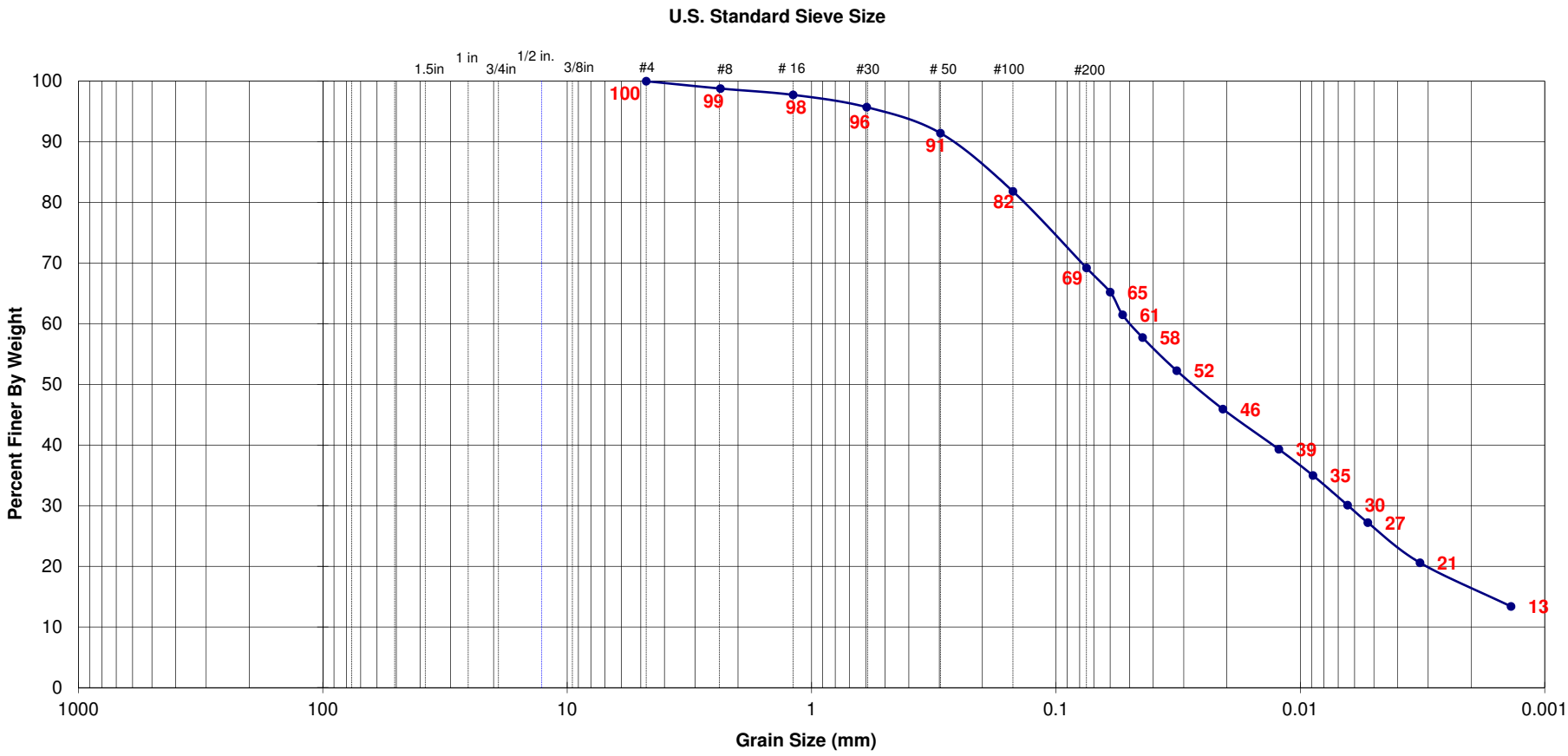
Sample	Depth	LL	PL	PI	USCS	Material Description
PT-1 / S-1	5'	35	18	17	CL	
LB-4 / S-5	15'	37	20	17	CL	

Job Name: Langan # 700128701 Date: 3-28-23

Job No.: 2012-0057

Geo-Logic ASSOCIATES

Date: 3/28/23



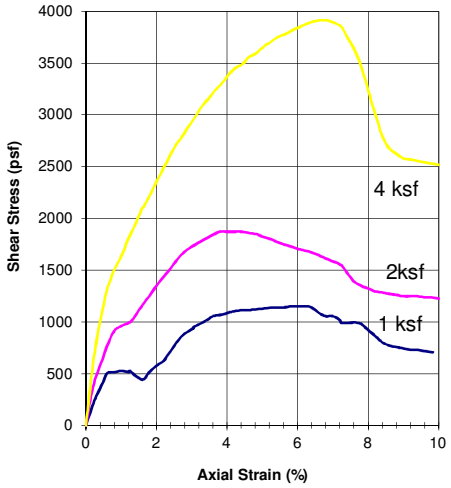
Boring / Sample No.	Initial Dry Density (pcf)	Initial Moist. (%)	Test Dry Density (pcf)	% Passing No. 200 Sieve	Sand Equivalent (ASTM D2419)	LL	PL	PI	Unified Soil Class.	Description
PT-1 / S-2									**CL**	

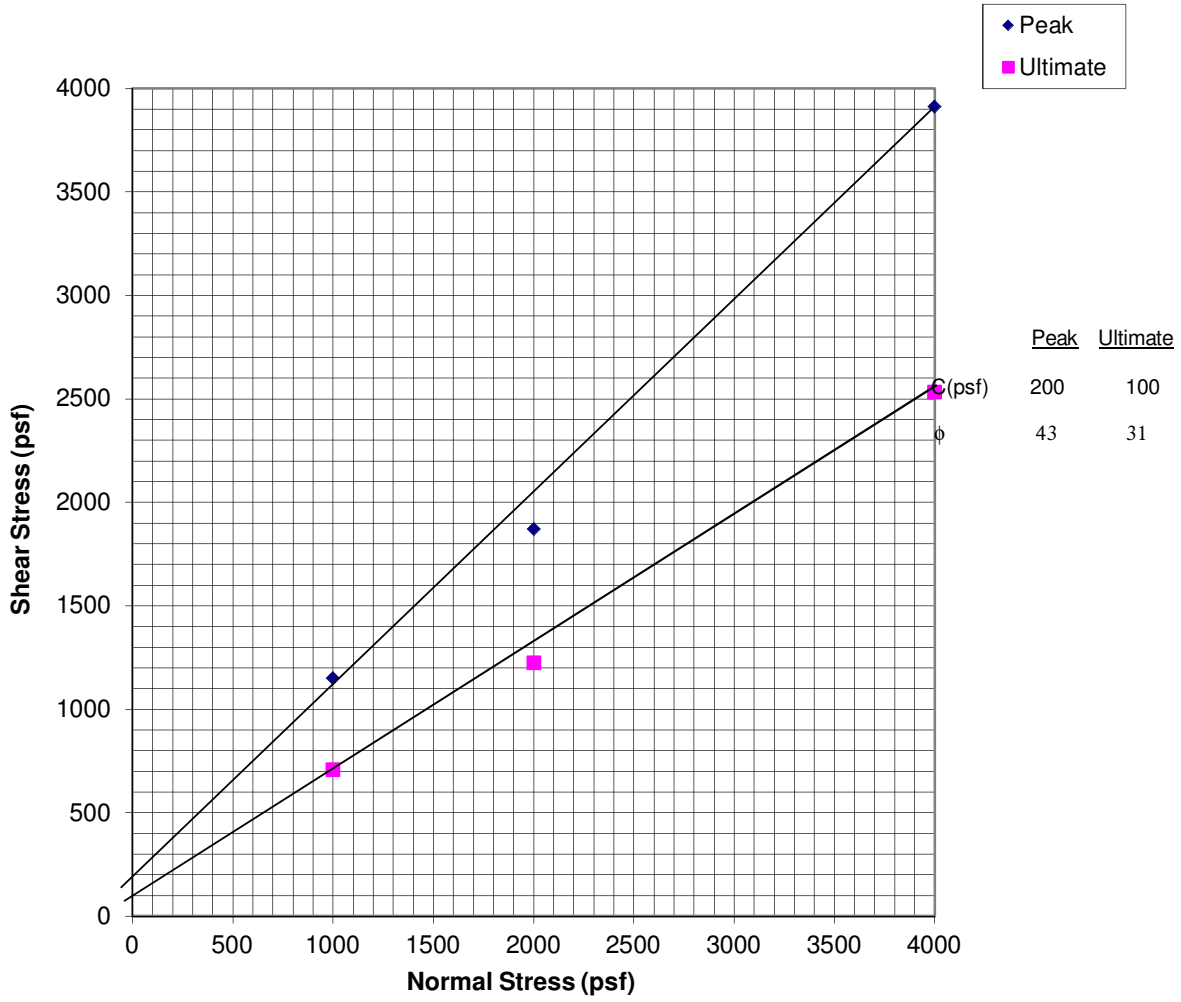
Geo-Logic ASSOCIATES

DIRECT SHEAR
ASTM D3080

PROJECT:	Langan # 700128701	Date:	3/27/2023
GLA JOB NO.:	2012-0057		
SAMPLE :	LB-1 / S-1		
SAMPLE TYPE:	Undisturbed		
DESCRIPTION:	Clayey Sand		

Specimen No.	1	2	3
Normal Stress, psf	1000	2000	4000
Peak Stress, psf	1152	1872	3912
Displacement, % strain	5.84	3.8	6.64
Ultimate Stress, psf	708	1224	2532
Displacement, % strain	10	10	10
Initial Dry Density, pcf	127.2	127.2	127.2
Initial Water Content,%	9.9	9.9	9.9
Final Water Content,%	18.0	18.0	18.0
Strain Rate, in/min.	0.0084	0.0084	0.0084





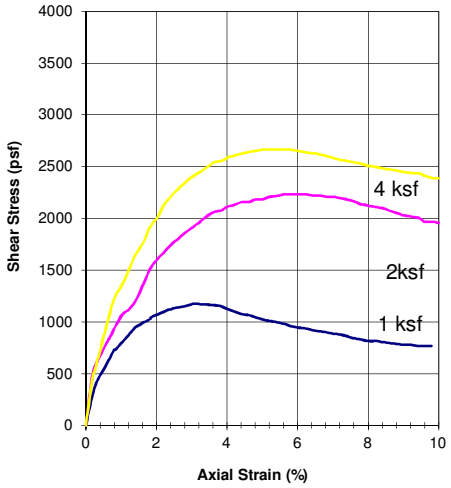
	Peak	Ultimate
C(psf)	200	100
ϕ	43	31

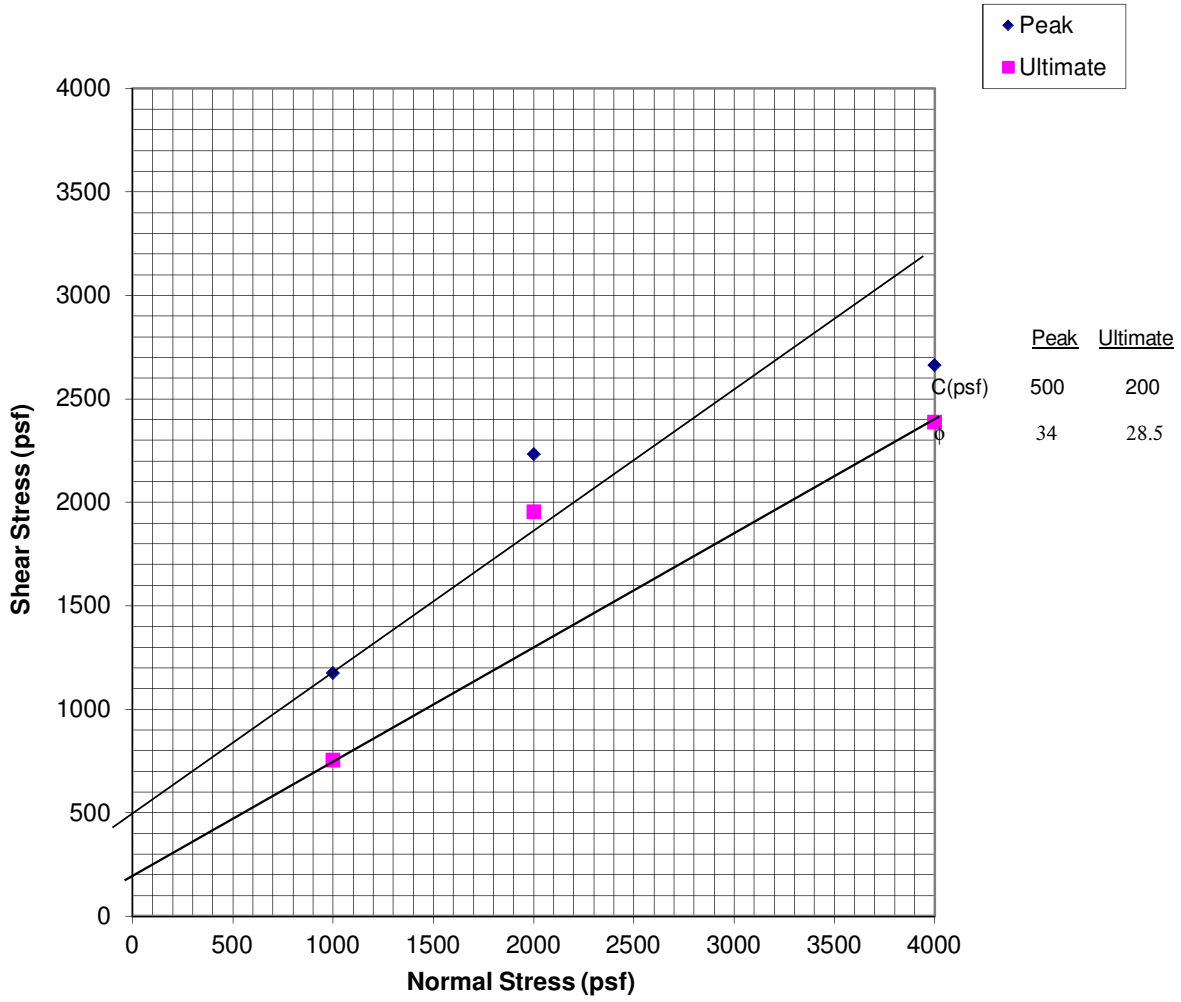
GeoLogic Associates

DIRECT SHEAR
ASTM D3080

PROJECT:	Langan # 700128701	Date:	3/27/2023
GLA JOB NO.:	2012-0057		
SAMPLE :	LB-3 / S-2		
SAMPLE TYPE:	Undisturbed		
DESCRIPTION:	Silty Clay		

Specimen No.	1	2	3
Normal Stress, psf	1000	2000	4000
Peak Stress, psf	1176	2232	2664
Displacement, % strain	3.04	5.6	5
Ultimate Stress, psf	756	1956	2388
Displacement, % strain	10	10	10
Initial Dry Density, pcf	116.2	116.2	116.2
Initial Water Content,%	15.2	15.2	15.2
Final Water Content,%	18.5	18.5	18.5
Strain Rate, in/min.	0.0084	0.0084	0.0084





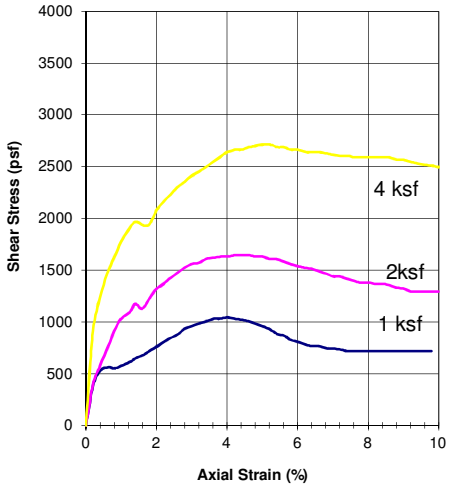
	Peak	Ultimate
C(psf)	500	200
ϕ	34	28.5

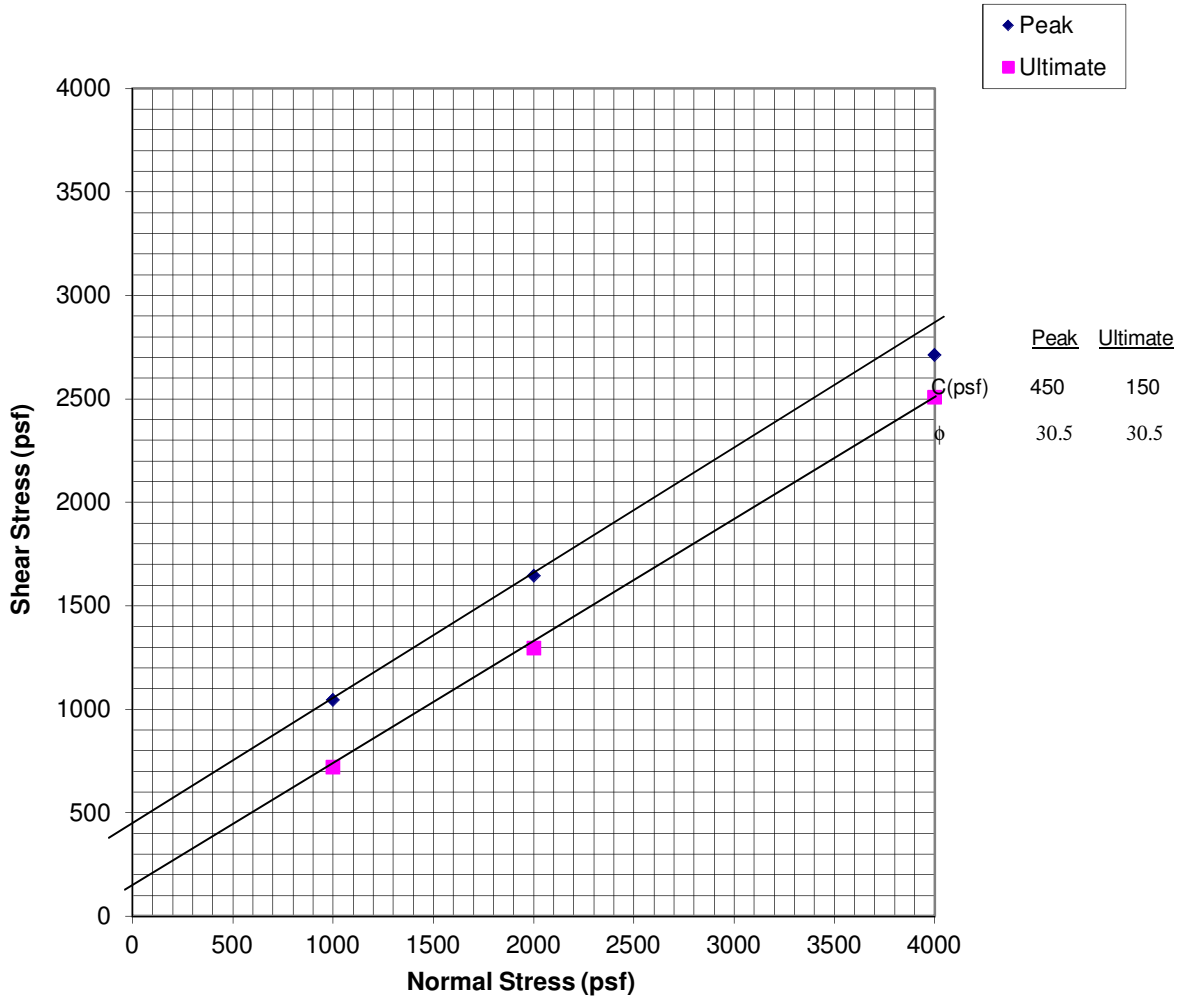
GeoLogic Associates

DIRECT SHEAR
ASTM D3080

PROJECT:	Langan # 700128701		Date: 3/27/2023
GLA JOB NO.:	2012-0057		
SAMPLE :	LB-4 / S-1		
SAMPLE TYPE:	Undisturbed		
DESCRIPTION:	Silty Clay		

Specimen No.	1	2	3
Normal Stress, psf	1000	2000	4000
Peak Stress, psf	1044	1644	2712
Displacement, % strain	4	4.2	5
Ultimate Stress, psf	720	1296	2508
Displacement, % strain	10	10	10
Initial Dry Density, pcf	114.3	114.3	114.3
Initial Water Content,%	15.2	15.2	15.2
Final Water Content,%	17.6	17.6	17.6
Strain Rate, in/min.	0.0084	0.0084	0.0084





GeoLogic Associates

'R' VALUE CA 301

Client: Langan Engineering Date: 3/28/23 By: LD

Client's Job No.: **700128701** Sample No.: PT-1 / B-1

GLA Reference: 2001-064 Soil Type: Brown, Silty Clay

TEST SPECIMEN		A	B	C	D
Compactor Air Pressure	psi	**140**	**70**	**100**	
Initial Moisture Content	%	**14.2**	**14.2**	**14.2**	
Water Added	ml	**40**	**70**	**55**	
Moisture at Compaction	%	18.0	20.9	19.4	
Sample & Mold Weight	gms	**3200**	**3158**	**3167**	
Mold Weight	gms	**2106**	**2092**	**2098**	
Net Sample Weight	gms	1094	1066	1069	
Sample Height	in.	**2.501**	**2.529**	**2.482**	
Dry Density	pcf	112.3	105.7	109.3	
Pressure	lbs	**6360**	**2135**	**3700**	
Exudation Pressure	psi	506	170	295	
Expansion Dial	x 0.0001	**100**	**25**	**54**	
Expansion Pressure	psf	433	108	234	
Ph at 1000lbs	psi	**54**	**70**	**62**	
Ph at 2000lbs	psi	**118**	**140**	**129**	
Displacement	turns	**4.04**	**5.85**	**4.62**	
R' Value		18	6	12	
Corrected 'R' Value		**18**	**6**	**12**	

FINAL 'R' VALUE	
By Exudation Pressure (@ 300 psi):	**12**
By Epansion Pressure :	**7**
TI = 5	

Geo-Logic ASSOCIATES

EXPANSION INDEX - UBC 18-2 & ASTM D 4829-88

PROJECT Langan # 700128701 JOB NO. 2012-0057

Sample	PT-1 / B-1		By LD		Sample			By	
Sta. No.					Sta. No.				
Soil Type	Brown, Silty Clay				Soil Type				
Date	Time	Dial Reading	Wet+Tare	602.4	Date	Time	Dial Reading	Wet+Tare	
3/25/2023	16:20	0.2392	Tare	219.4				Tare	
		H2O	Net Weight	383				Net Weight	
3/26/2023	10:00	0.1825	% Water	11.5				% Water	
			Dry Dens.	104.1				Dry Dens.	
			% Max					% Max	
			Wet+Tare	653.3				Wet+Tare	
			Tare	219.4				Tare	
			Net Weight	433.9				Net Weight	
INDEX	57	5.7%	% Water	26.3	**INDEX**			% Water	

Sample			By		Sample			By	
Sta. No.					Sta. No.				
Soil Type					Soil Type				
Date	Time	Dial Reading	Wet+Tare		Date	Time	Dial Reading	Wet+Tare	
			Tare					Tare	
			Net Weight					Net Weight	
			% Water					% Water	
			Dry Dens.					Dry Dens.	
			% Max					% Max	
			Wet+Tare					Wet+Tare	
			Tare					Tare	
			Net Weight					Net Weight	
INDEX			% Water		**INDEX**			% Water	

SAMPLE NO.:	LB-2 / B-1																	
DESCRIPTION	Silty Sand																	
DIRECT SHEAR TEST (type)																		
Initial Moisture Content %																		
Dry Density (pcf)																		
Normal Stress (psf)																		
Peak Shear Stress (psf)																		
Ultimate Shear Stress (psf)																		
Cohesion (psf)																		
Internal Friction Angle (degrees)																		
EXPANSION TEST UBC STD 18-2																		
Initial Dry Density (pcf)																		
Initial Moisture Content %																		
Final Moisture Content %																		
Pressure (psf)																		
Expansion Index / Swell %																		
CORROSIVITY TEST																		
Resistivity (CTM643) (ohm-cm)	6200																	
pH (CTM643)	7.5																	
CHEMICAL TESTS																		
Soluble Sulfate (CTM 417) (ppm)	106																	
Chloride Content (CTM 422) (ppm)	9																	
Wash #200 Sieve (ASTM-1140) %																		
Sand Equivalent (ASTM D2419)																		