APPENDIX E
Hydrology Study and WQMP

WQ XX-XXXX

City of Yorba Linda/Santa Ana Region Priority Project Preliminary Water Quality Management Plan (PWQMP)

Project Name:

Hilltop 3 Development, LLC

APN 350-331-06, 326-021-50

YORBA LINDA, CA 92886

Prepared for:

Hilltop 3 Development, LLC

3875 CREST DRIVE

YORBA LINDA, CA 92886

714-742-7965

Prepared by:

Gilbert Engineering & Associates
Engineer R. William Gilbert, P.E.   Registration No. 53251
2 Merriweather Place
Ladera Ranch, CA 92694
949-218-8075

November 17, 2020

Project Owner's Certification

Planning Application No. (If applicable)	Not issued	Grading Permit No.	Not issued
Tract/Parcel Map and Lot(s) No.	TENT. PARCEL MAP NO. 2020-125 G.P.A. 2020-02 Z.C. 2020-01	Building Permit No.	Not issued
Address of Project Site and APN (If no address, specify Tract/Parcel Map and Lot Numbers)			350-331-06 326-021-50

This Water Quality Management Plan (WQMP) has been prepared for Hilltop 3 Development by Gilbert Engineering & Associates, Inc.. The WQMP is intended to comply with the requirements of the County of Orange NPDES Stormwater Program requiring the preparation of the plan.

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

Owner:

Title	Owner
Company	Hilltop 3 Development, LLC
Address	3875 Crest Drive, Yorba Linda, CA 92886
Email	rhoff73776@aol.com
Telephone #	714-742-7965

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):			
Title	President	PE Registration #	CA53251
Company	Gilbert Engineering & Associates, Inc.		
Address	2 Merriweather Place, Ladera Ranch, CA 92694		
Email	bill@gilbert-engineering.com		
Telephone #	949-218-8075		
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	11-17-20
Place Stamp Here	REGISTERED PROFESSIONAL ENGINEER R. WILLIAM GILBERT NO. C-053251 Exp. 06/30/21 CIVIL STATE OF CALIFORNIA		

Notice of Transfer of Responsibility
Water Quality Management Plan (WQMP)

WQMP Number – As assigned by the City:__________________________

Submission of this Notice of Transfer of Responsibility constitutes notice to the City that responsibility for the Water Quality Management Plan (WQMP) for the subject property identified below, and implementation of that plan, is being transferred from the Previous Owner (and his/her agent) of the site (or portion thereof) to the New Owner, as further described below.

I. Owner/ Responsible Party Information

Company/ Individual: Hilltop 3 Development, LLC Contact Person: Robert Hoff

Street Address: 3875 Crest Drive Title: Owner

City: Yorba Linda State: CA Zip: 92886 Phone: 714-742-7965

II. Information about Site Relevant to WQMP

Name of Project: Hilltop 3 Development, LLC

Title of WQMP applicable to site: Hilltop 3 Development, LLC

Street Address of the site: APN 350-331-06, 326-021-50

Date of Transfer of Responsibility: ____

III. New Owner (Upon Transfer)/ Responsible Party Information

Company/ Individual:_______________________ Contact Person:_____________________

Street Address:____________________________ Title:______________________________

City _________________State____ Zip________ Phone:____________________________

REVISIONS

No.	*Date*	*By*	*Description*	*Accepted*	*Date*

Contents

Page No.

Attachments

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

Project Infomation			
Permit/Application No. (If applicable)	T.P.M. 2020-125 G.P.A. 2020-02 Z.C. 2020-01	Grading or Building Permit No. (If applicable)	Not Issued
Address of Project Site (or Tract Map and Lot Number if no address) and APN	Parcel 1: THAT PORTION OF THE SOUTH HALF OF SECTION 13, TOWNSHIP 3 SOUTH, RANGE 9 WEST, SAN BERNARDINO MERIDIAN, ACCORDING TO THE OFFICIAL PLAT OF SAID LAND FILED IN THE DISTRICT LAND OFFICE ON JANUARY 07, 1868, AND LYING SOUTHERLY OF THE SOUTHERLY LINE OF THAT CERTAIN LAND CONVEYED TO THE STATE OF CALIFORNIA BY DEED RECORDED JUNE 30, 1983, IN THE CITY OF YORBA LINDA, COUNTY OF ORANGE, STATE OF CALIFORNIA Parcel 2: LOT A OF TRACT NO. 11485, IN THE CITY OF YORBA LINDA, COUNTY OF ORANGE, STATE OF CALIFORNIA, AS SHOWN ON A MAP FILED IN BOOK 575, PAGES 26 TO 33 INCLUSIVE OF MISCELLANEOUS MAPS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY APN 350-331-06, 326-021-50		

Water Quality Conditions of Approval or Issuance	
Water Quality Conditions of Approval or Issuance applied to this project. (Please list verbatim.)	Pending conditions of approval from City of Yorba Linda

Conceptual WQMP

Was a Conceptual Water Quality Management Plan previously approved for this project?	This is the conceptual WQMP

Watershed-Based Plan Conditions

Provide applicable conditions from watershed - based plans including WHIMPs and TMDLS.	There are currently no applicable conditions

Section II Project Description

II.1 Project Description

Description of Proposed Project				
Development Category (From Model WQMP, Table 7.11-2; or -3):	1. New development projects that create 10,000 square feet or more of impervious surface. This category includes commercial, industrial, residential housing subdivisions, mixed-use, and public projects on private or public property that falls under the planning and building authority or the Permittees			
Project Area (ft^2): 1,857,398	Number of Dwelling Units: 1		SIC Code: 1522	
Project Area	Pervious		Impervious	
	Area (acres or sq ft)	Percentage	Area (acres or sq ft)	Percentage
Pre-Project Conditions	42.64	100	0	0
Post-Project Conditions	DMA 1- 0.13 ac DMA 2- 40.72 ac	96 100	DMA 1 - 1.79 ac DMA 2 - 0 ac	4 0
Drainage Patterns/Connections	In the existing condition, the proposed graded area of the project site drainage flows to several areas. The western edge of the undeveloped area flows to Ravenswood Drive to an existing 27" R.C.P. storm drain. The southerly edge of the property has two outlets into an existing 24" R.C.P. storm drain that flows to Ravenswood Drive. The eastern edge of the property has three outlets into Fairmont Blvd. The open space area drains through natural ravines to the south and will not be altered. The proposed condition will continue the same flow patterns. The western edge will continue to go to Ravenswood to a storm drain inlet into an existing 27" R.C.P. storm drain. The southerly edge will continue to flow into a proposed v-ditch and will send it to the existing 24" R.C.P. storm drain headed to Ravenswood Drive. There will be three outlets into Fairmont Blvd which is where the treated water will travel to and enter the existing City storm drain in Fairmont Blvd.			

	Do to the nature of the hillside grading some runoff area will be diverted into Fairmont Blvd. During a 100 year storm event there will be an 8% increase in flows to Fairmont and an 8% decrease to the areas going to Ravenswood Drive or about 3.4 c.f.s of runoff added to the Fairmont Blvd. storm drain.

Narrative Project Description: (Use as much space as necessary.)	The project proposes to develop a 1.92 acres residential site on 42.64 acres of existing hillside located at APN 350-331-06, 326-021-50, Yorba Linda, CA. The property is bound to the north and west by existing natural hillside, to the south by existing residential developments and to the east by Fairmont Blvd. . Site soils are classified Soil Type D per the Orange County Hydrology Manual and are not suitable for infiltration per the steep hillside condition per the Geotechnical Engineer's recommendations. The project proposes to develop the project site for residential use. Improvements include a 14,165 s.f. residence and garage. The site will have landscaping, concrete paving walkways with planter areas and irrigated slopes. The remaining 40.72 acres of the project site will be undisturbed natural or re-graded and landscaped hillside. The proposed development will add 77,972 s.f. of impervious surface to the project site. Potential Storm Water Pollutants: Suspended Solids/Sediments, nutrients, pesticides, oil and grease, trash and debris

II.2 Potential Stormwater Pollutants

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

II.3 Hydrologic Conditions of Concern

☒ No – Show map

☐ Yes – Describe applicable hydrologic conditions of concern below.

Down Stream Channels are stabilized earth or stabilized engineered channels

II.4 Post Development Drainage Characteristics

The proposed condition will take the runoff that is flowing into the southerly residential area and capture by v-ditch and carry it to Fairmont where it will outlet and flow into the City Storm Drain System. The proposed hillside grading and project pad will drain to the proposed driveway and flow out to Fairmont Blvd.

The storm runoff will be collected via roof drains and area drains and it will flow down the hill and outlet into the proposed driveway which will flow into a BioClean Modular Wetland System (Model No. MWS-L-8-12-C) for biofiltration treatment before flowing into the existing v-ditch on the south side of the property and will outlet into Fairmont Blvd.

The BioClean Modular Wetland System will treat the entire design capture volume.

DMA # 1

Design Capture Volume = V= C x d x A x (1/12) in/ft

Where V = runoff volume during the design storm event, cu-ft

C = runoff coefficient = (0.75 x % imp) + 0.15

Imp = impervious fraction of drainage area (0 for existing condition, 0.93 for developed site)

d = storm depth (inches) = 0.75"

A= tributary area (ac) = 1.92 acres

After Development:

V = (0.75 x .93 imp + 0.15) x 0.75" x 1.92 ac x 43560 sf/ac x (1/12) in/ft = 4,430 cf

DMA#2

Project area will be left natural or replanted and irrigated with drought tolerant material, but is not part of the drainage runoff of the proposed project.

II.5 Property Ownership/Management

The property will be maintained by the owner, Hillside 3 Development, LLC

Section III Site Description

III.1 Physical Setting

Name of Planned Community/Planning Area (if applicable)	PD11 Yorba Linda Hills
Location/Address	APN 350-331-06, 326-021-50
General Plan Land Use Designation	Residential and Open Space
Zoning	PD-11 Sub Area A, PD-11 Sub Area D,
Acreage of Project Site	42.64 acres
Predominant Soil Type	Soil Type D

III.2 Site Characteristics

Site Characteristics	
Precipitation Zone	Coastal - 0.75" per Orange County Rainfall Zones Map, Figure XVI-1 of Technical Guidance Document
Topography	The project resides on a hillside lot. It has a flat pad surrounded by steep slopes to the North, South, East and West.
Drainage Patterns/Connections	Do to the nature of the hillside grading some runoff area will be diverted into Fairmont Blvd. During a 100 year storm event there will be an increase of about 1.81 c.f.s of runoff added to the Fairmont Blvd. storm drain.

	The proposed condition will take the runoff that is flowing into the southerly residential area and capture by v-ditch and carry it to Fairmont where it will outlet and flow into the City Storm Drain System. The proposed hillside grading and project pad will drain to the proposed driveway and flow out to Fairmont Blvd. The storm runoff will be collected via roof drains and area drains and it will flow down the hill and outlet into the proposed driveway which will flow into a BioClean Modular Wetland System (Model No. MWS-L-8-12-C) for biofiltration treatment before flowing into the existing v-ditch on the south side of the property and exiting into Fairmont Blvd. The BioClean Modular Wetland System will treat the entire design capture volume.
Soil Type, Geology, and Infiltration Properties	Sandy Silt, Sand Stone Per the Geotechnical Report: Based on the referenced report (TGR, 2020b), infiltration rates were very low and ranged from 0.44 to 0.56 inch per hour without factor of safety. Infiltration near the toe of the proposed slope may also adversely impacted the stability of the slope. Therefore, infiltration is not recommended from a geotechnical viewpoint. Although we were unable to achieve the proposed drilling depth of 40 feet below existing grade in P-2 due to refusal in very dense bedrock, it is our opinion that the infiltration rates to a depth of 40 feet below existing grade would be equal to or less than the values obtained.
Hydrogeologic (Groundwater) Conditions	No groundwater encountered at boring depths up to 75' deep
Geotechnical Conditions (relevant to infiltration)	Depending on the distance of the infiltration area to the toe of the proposed slope, the stability of the slope may be adversely impacted due to water mounding from infiltration.

Off-Site Drainage	There is no off-site drainage entering the property.
Utility and Infrastructure Information	There are no existing utilities on the project site.

III.3 Watershed Description

Receiving Waters	Santa Ana River, Reach 2
303(d) Listed Impairments	None
Applicable TMDLs	None
Pollutants of Concern for the Project	Heavy Metals, Pathogens (Bacteria/Virus), Oil and Grease, Toxic Organic Compounds, Trash and Debris
Environmentally Sensitive and Special Biological Significant Areas	None

Section IV Best Management Practices (BMPs)

IV. 1 Project Performance Criteria

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

Project Performance Criteria	
If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP)	There are no Hydrologic Conditions of Concern

List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP)	Priority Development projects must infiltrate, harvest & re-use, evapotranspire, or biofiltrate, the 85th percentile, 24-hour storm event (design capture volume)
List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP)	Capture and infiltrate, filter or treat the runoff from the 24-hour, 85th percentile storm event as determined from the County of Orange 85th percentile Precipitation Isopluvial Map and draw down the stored volume in no more than 48 hours following the end of precipitation.
Calculate LID design storm capture volume for Project.	DMA # 1 Design Capture Volume = V= C x d x A x (1/12) in/ft Where V = runoff volume during the design storm event, cu-ft C = runoff coefficient = (0.75 x % imp) + 0.15 Imp = impervious fraction of drainage area (0 for existing condition, 0.93 for developed site) d = storm depth (inches) = 0.75” A= tributary area (ac) = 1.92 acres After Development: V = (0.75 x .93 imp + 0.15) x 0.75” x 1.92 ac x 43560 sf/ac x (1/12) in/ft = 4,430 cf DMA#2 Project area will be left natural or replanted and irrigated with drought tolerant material, but is not part of the drainage runoff of the proposed project.

IV.2. Site Design and Drainage

The proposed condition will take the runoff that is flowing into the southerly residential area and capture by v-ditch and carry it to Fairmont where it will outlet and flow into the City Storm Drain System. The proposed hillside grading and project pad will drain to the proposed driveway and flow out to Fairmont Blvd.

The storm runoff will be collected via roof drains and area drains and it will flow down the hill and outlet into the proposed driveway which will flow into a BioClean Modular Wetland System (Model No. MWS-L-8-12-C) for biofiltration treatment before flowing into the existing v-ditch on the south side of the property and out-letting into Fairmont Blvd.

The BioClean Modular Wetland System will treat the entire design capture volume.

See BMP Exhibit for storm drain and BioClean Modular Wetland System,

(Model No. MWS-L-8-12-C)

GIS Coordinates for BioClean Modular Wetland System: Latitude: N 33° 54′ 21"
Longitude: W 117° 46' 05"

IV.3 LID BMP Selection and Project Conformance Analysis

IV.3.1 Hydrologic Source Controls (HSCs)

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

Hydrologic Source Controls are not required with this project type.

IV.3.2 Infiltration BMPs

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:	☐

Per the Geotechnical Engineer's Report Recommendations, infiltration will have a risk of affecting building foundations, slabs, slope stability, hardscape, pavements and other site improvements due to the physical characteristics of the site earth materials.

IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

.

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

Per Worksheet J in Appendix, there is not enough irrigated landscape area to meet the volume required to drawdown the design capture volume through a drip irrigation system with drought tolerant landscaping proposed.

IV.3.4 Biotreatment BMPs

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:	☐

The proposed BioClean Modular Wetlands Systems (Model No. MWS-L-8-12-C) will treat the design capture volume (85th percentile storm) of 4,430 c.f. and will filter the water to remove pollutants.

The removal efficiencies include:

Total Phosphorus - 64% removal rate

Metals (Cu, Zn, Pb) - 69% removal rate

Total Suspended Solids - 85% removal rate

Organics - 90% removal rate

Bacteria - 90% removal rate

Not applicable to project type

IV.3.5 Hydromodification Control BMPs

Hydromodification Control BMPs	
BMP Name	**BMP Description**

Not Applicable to Project Type

IV.3.6 Regional/Sub-Regional LID BMPs

Regional/Sub-Regional LID BMPs
Not applicable to project type

IV.3.7 Treatment Control BMPs

Treatment Control BMPs	
BMP Name	**BMP Description**

Not Applicable to Project Type

IV.3.8 Non-structural Source Control BMPs

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	☐	☒	Not applicable to project type
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	Not applicable to project type
N6	Local Industrial Permit Compliance	☐	☒	Not applicable to project type
N7	Spill Contingency Plan	☐	☒	Not applicable to project type
N8	Underground Storage Tank Compliance	☐	☒	Not applicable to project type
N9	Hazardous Materials Disclosure Compliance	☐	☒	Not applicable to project type
N10	Uniform Fire Code Implementation	☐	☒	Not applicable to project type
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☐	☒	Not applicable to project type
N13	Housekeeping of Loading Docks	☐	☒	Not applicable to project type
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☐	☒	Not applicable to project type
N16	Retail Gasoline Outlets	☐	☒	Not applicable to project type

IV.3.9 Structural Source Control BMPs

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	☐	☒	Not applicable to project type
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☐	☒	Not applicable to project type
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)	☐	☐	
S6	Dock areas	☐	☒	Not applicable to project type
S7	Maintenance bays	☐	☒	Not applicable to project type
S8	Vehicle wash areas	☐	☒	Not applicable to project type
S9	Outdoor processing areas	☐	☒	Not applicable to project type
S10	Equipment wash areas	☐	☒	Not applicable to project type
S11	Fueling areas	☐	☒	Not applicable to project type
S12	Hillside landscaping	☐	☒	Not applicable to project type
S13	Wash water control for food preparation areas	☐	☒	Not applicable to project type
S14	Community car wash racks	☐	☒	Not applicable to project type

IV.4 Alternative Compliance Plan (If Applicable)

Not applicable to project type

IV.4.1 Water Quality Credits

Not applicable to project type

<table>
<tr><th colspan="6">Description of Proposed Project</th></tr>
<tr><td colspan="6">Project Types that Qualify for Water Quality Credits (Select all that apply):</td></tr>
<tr>
<td>☐Redevelopment projects that reduce the overall impervious footprint of the project site.</td>
<td colspan="3">☐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.</td>
<td colspan="2">☐ 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).</td>
</tr>
<tr>
<td colspan="2">☐ 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).</td>
<td colspan="3">☐ 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</td>
<td>☐ 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).</td>
</tr>
<tr>
<td>☐Developments with dedication of undeveloped portions to parks, preservation areas and other pervious uses.</td>
<td>☐ Developments in a city center area.</td>
<td>☐ Developments in historic districts or historic preservation areas.</td>
<td colspan="2">☐ 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.</td>
<td>☐In-fill projects, the conversion of empty lots and other underused spaces into more beneficially used spaces, such as residential or commercial areas.</td>
</tr>
</table>

Calculation of Water Quality Credits (if applicable)	

IV.4.2 Alternative Compliance Plan Information

Not applicable to project type

Section V Inspection/Maintenance Responsibility for BMPs

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
N1 -Education for Property Owners, Tenants and Occupants	Hilltop 3 Development, LLC	Train employees on storm water protection activities. (Education materials in appendix B or other resources will be used.)	Upon hire and annually thereafter
N3 - Common Area Landscape Management	Hilltop 3 Development, LLC	Maintain landscaping, with low drought tolerant plant life. Test irrigation controls.	Maintain weekly. Monthly testing.
N4 - BMP Maintenance	Hilltop 3 Development, LLC	Inspect BMPs, catchbasin and storm drain to insure no build up or pollutants.	Before the rainy season and before and after rain events.
N11 - Common Area Litter Control	Hilltop 3 Development, LLC	Clean up litter when seen onsite and keep trash enclosure clean. Keep lids secure.	Daily

BMP Inspection/Maintenance

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
N14 - Common Area Catch Basin Inspection	Hilltop 3 Development, LLC	Inspect and clean for debris and sediment.	Before and after rainy season and before and after rain events.
S1 - Provide Storm Drain System Stencilling and Signage	Hilltop 3 Development, LLC	Paint, or use permanent placard with statement "NO DUMPING - DRAINS TO OCEAN".	Inspect annually to maintain legibility
S4 - Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	Hilltop 3 Development, LLC	Visual Maintenance and Repair	Inspect weekly to ensure irrigation is working properly
S5 - Protect slopes and channels and provide energy dissipation	Hilltop 3 Development, LLC	Visual Maintenance and Repair	Before and after rainy season and before and after rain events.

BioClean Modular Wetland System (Model No. MWS-L-4-8-V)	Hilltop 3 Development, LLC	Follow Manufacturer's Maintenance Guidelines in Appendix D	
		Remove Trash from Screening Device	Every 6 to 12 months
		Trim Vegetation	Every 6 to 12 months
		Remove Sediment from Separation Chamber	Every 12 to 24 months
		Replace Cartridge Filter Media	Every 12 to 24 months
		Replace Down Drain Filter Media	Every 12 to 24 months

Section VI BMP Exhibit (Site Plan)

VI.1 BMP Exhibit (Site Plan)

See WQMP Exhibit in Appendix

VI.2 Submittal and Recordation of Water Quality Management Plan

See WQMP Exhibit in Appendix

Section VII Educational Materials

Education Materials

Residential Material (http://www.ocwatersheds.com)	**Check If Applicable**	**Business Material (http://www.ocwatersheds.com)**	**Check If Applicable**
The Ocean Begins at Your Front Door	☒	Tips for the Automotive Industry	☐
Tips for Car Wash Fund-raisers	☐	Tips for Using Concrete and Mortar	☐
Tips for the Home Mechanic	☒	Tips for the Food Service Industry	☐
Homeowners Guide for Sustainable Water Use	☒	Proper Maintenance Practices for Your Business	☐
Household Tips	☒	**Other Material**	**Check If Attached**
Proper Disposal of Household Hazardous Waste	☒		
Recycle at Your Local Used Oil Collection Center (North County)	☐		☐
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 Pool Maintenance	☒		☐
Tips for Residential Pool, Landscape and Hardscape Drains	☒		☐
Tips for Projects Using Paint	☐		☐

Appendix A

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

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

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 Ocean Begins at Your Front Door

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

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.

For More Information

California Environmental Protection Agency
www.calepa.ca.gov

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

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

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

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

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

Stormwater Best Management Practice Handbook
Visit www.cabmphandbooks.com

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

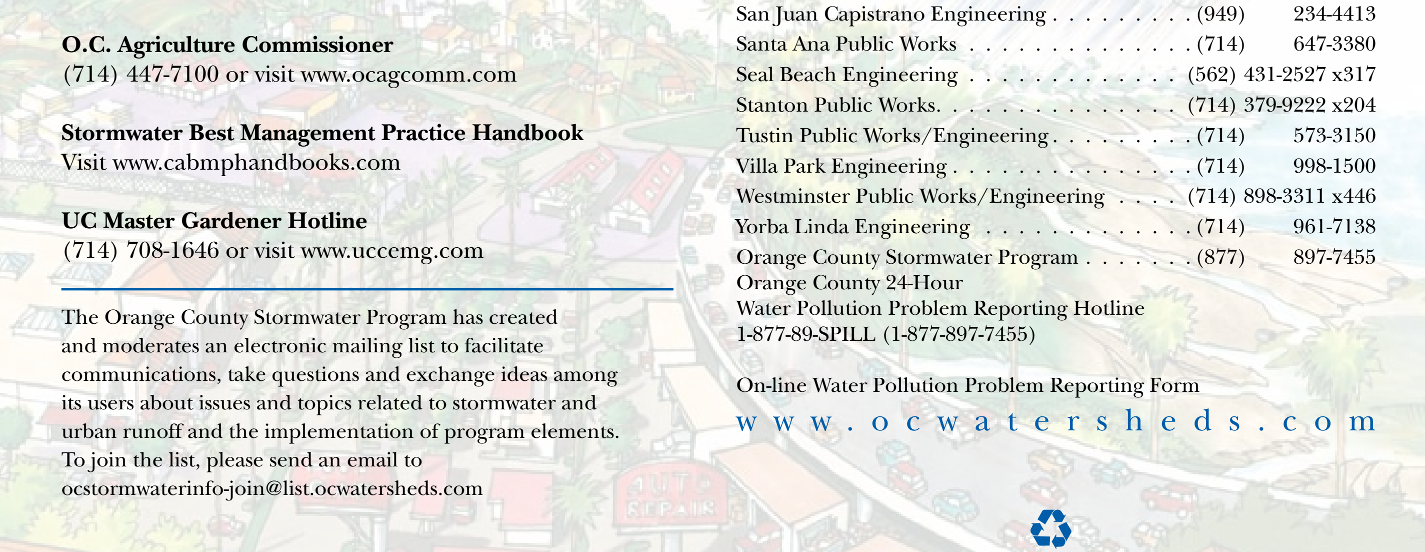
The Orange County Stormwater Program has created and moderates an electronic mailing list to facilitate communications, take questions and exchange ideas among its users about issues and topics related to stormwater and urban runoff and the implementation of program elements. To join the list, please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

Orange County Stormwater Program

Aliso Viejo	(949)	425-2535
Anaheim Public Works Operations	(714)	765-6860
Brea Engineering	(714)	990-7666
Buena Park Public Works	(714)	562-3655
Costa Mesa Public Services	(714)	754-5323
Cypress Public Works	(714)	229-6740
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

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

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

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

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

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

RECYCLE
USED OIL

emc/rev9/08

Help Prevent Ocean Pollution:

Tips for the Home Mechanic

PROJECT
Pollution
PREVENTION

The Ocean Begins at Your Front Door

Tips for the Home Mechanic

WORK SITE

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

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

PREVENT LEAKS AND SPILLS

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

CLEANING SPILLS

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

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

VEHICLE FLUID MANAGEMENT

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

PROJECT Pollution PREVENTION

The Pollution Solution

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

ORANGE COUNTY OC PublicWorks
Our Community. Our Commitment.
Jess A. Carbajal, Executive Director
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The Ocean Begins at Your Front Door
www.ocwatersheds.com | Report a spill 1.877.89.SPILL

Stormwater 101 | Residents | Kid's Corner | Business | Schools | News/Events | Resources | STORMWATER IQ QUIZ | USED OIL LOCATIONS | CONTACTS

The Public Education section of the Orange County Stormwater Program website is filled with information, interactive games, video and radio public service announcements and issue-specific brochures for you to learn more about water pollution prevention.

Click here to find out about Earth Day events in your community.

It's easy to protect our waterways from pollution. Click here to learn how!

OC WATERSHEDS CLICK HERE FOR MORE INFORMATION
KID'S CORNER Click. Play. Learn.
ESPAÑOL/NGUOI VIET Multi-Cultural Resources Click Here
STAY INFORMED Fill out our form to get news and events
Jump To Our Contact Form

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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

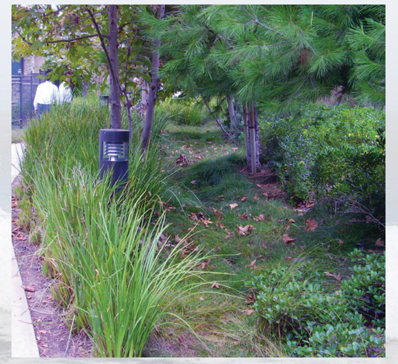
Where Does Water Runoff Go?

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.

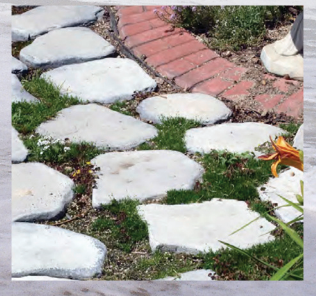
In Orange County, 60-70% of water used by residents and businesses goes to irrigation and other outdoor uses. Reusing rainwater to irrigate our lawn not only reduces the impact of water pollution from runoff, but it also is a great way to conserve our precious water resources and replenish our groundwater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

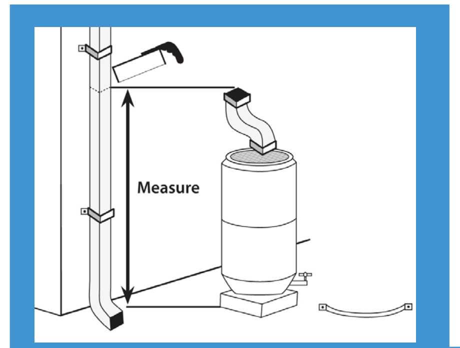
Downspout Disconnection/Redirection

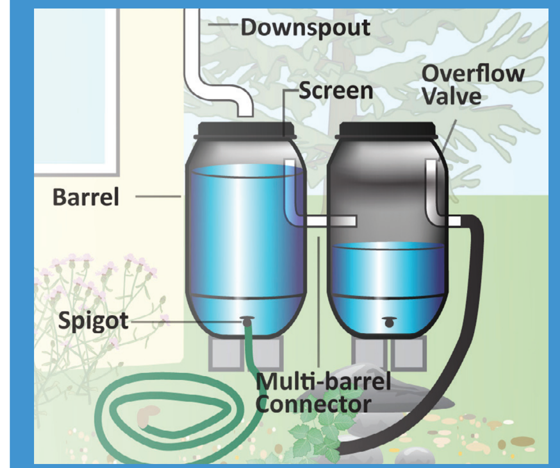
Disconnecting downspouts from pipes running to the gutter prevents runoff from transporting pollutants to the storm drain. Once disconnected, downspouts can be redirected to rain gardens or other vegetated areas, or be connected to a rain barrel.

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.

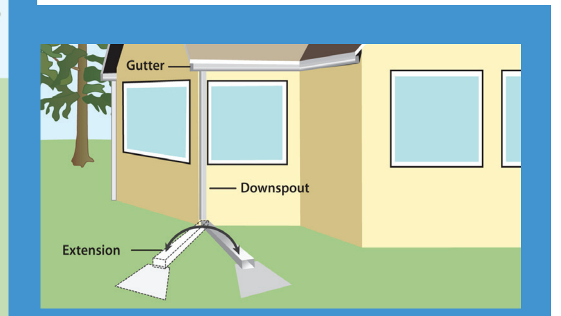




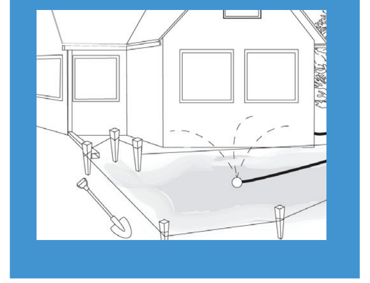
Rain Gardens

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

Smart Irrigation Controllers

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

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, many common household activities can lead to water pollution if you're not careful.

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

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

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

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

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

For emergencies, dial 911.

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

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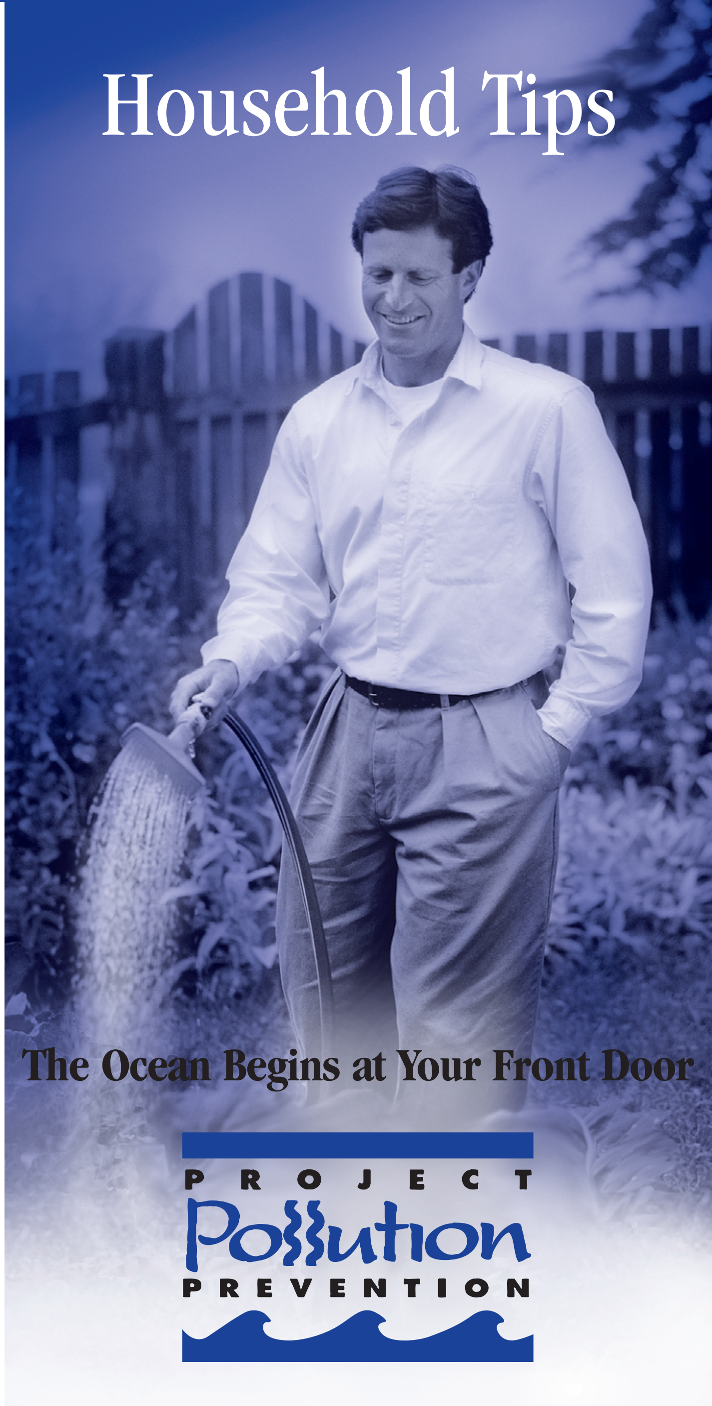
PAPER
50% PRE-CONSUMER
AND
15% POST-CONSUMER

RECYCLE
USED OIL

Help Prevent Ocean Pollution:

Household Tips



The Ocean Begins at Your Front Door

PROJECT
Pollution
PREVENTION

Pollution Prevention

Household Activities

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

Household Hazardous Wastes include:

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

Gardening Activities

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

Washing and Maintaining Your Car

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

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

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

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

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

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

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

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

For emergencies, dial 911.

RECYCLE
USED OIL

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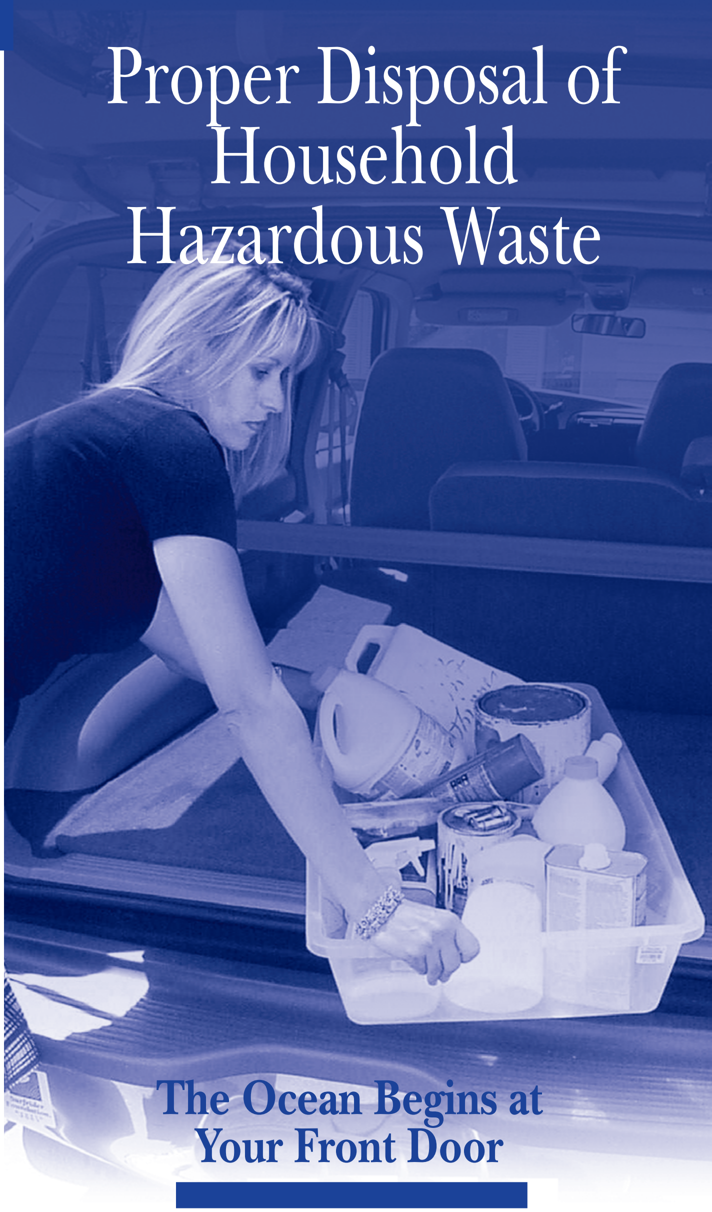
Help Prevent Ocean Pollution:

Proper Disposal of Household Hazardous Waste



The Ocean Begins at Your Front Door

PROJECT
Pollution
PREVENTION

ORANGE COUNTY

Pollution Prevention

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

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.

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.

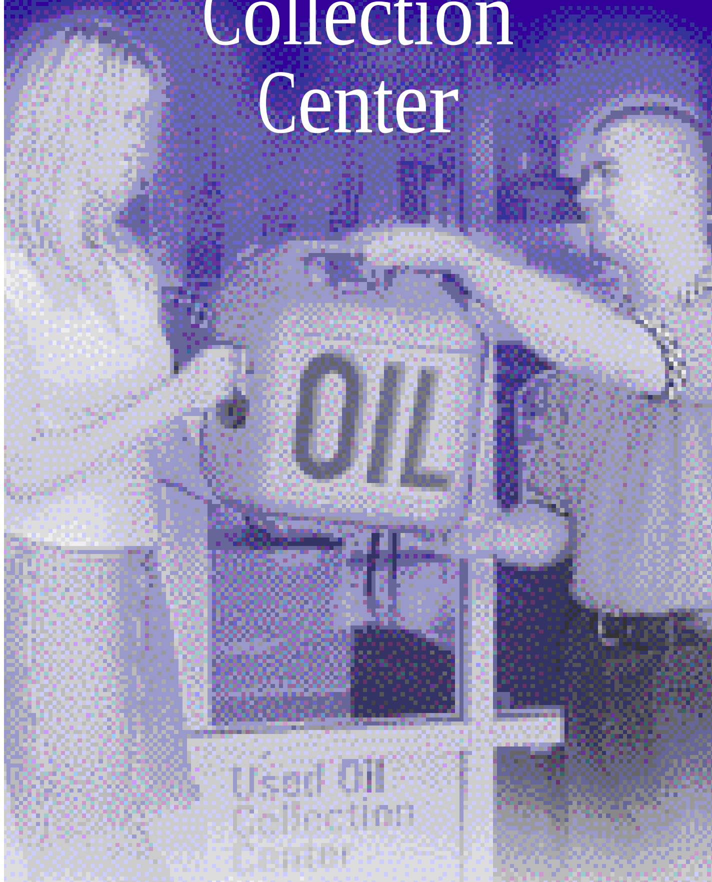
For information about the proper disposal of household hazardous waste, call the Household Waste Hotline at (714) 834-6752 or visit www.oclandfills.com.

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).

HOMEOWNER TIPS

PROTECTING WATER

Before Buying Pest Control Products

- Identify the pest.
- Decide if pest control products are the best control measure or if there are alternatives available.
- Are integrated pest management guidelines available for this pest?
- Read the product label:
  Is the pest listed on the label?
  Is it the best product for the pest?

Before Mixing Your Sprayer

- Read the label carefully.
- Buy only enough pesticide to treat the area affected by the pest.
- Check the weather and don't apply if it's windy or about to rain
- Measure the area you're treating.
- Calculate how much spray to mix.
- Wear long sleeve shirt, long pants, shoes and any other protective equipment listed on the label and follow all the label precautions.
- Be prepared for spills and know how to clean them up.

When You're Ready To Spray

- Mix and load spray in an area where any spilled pesticide will not be able to drain or be washed away into storm drains, ditches, streams, ponds or other bodies of water.
- Mix sprayer on grass, not the sidewalk or driveway.
- Mix only as much as needed.

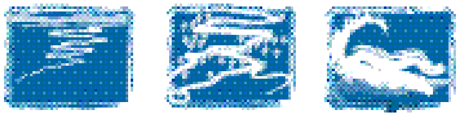
When You're Spraying

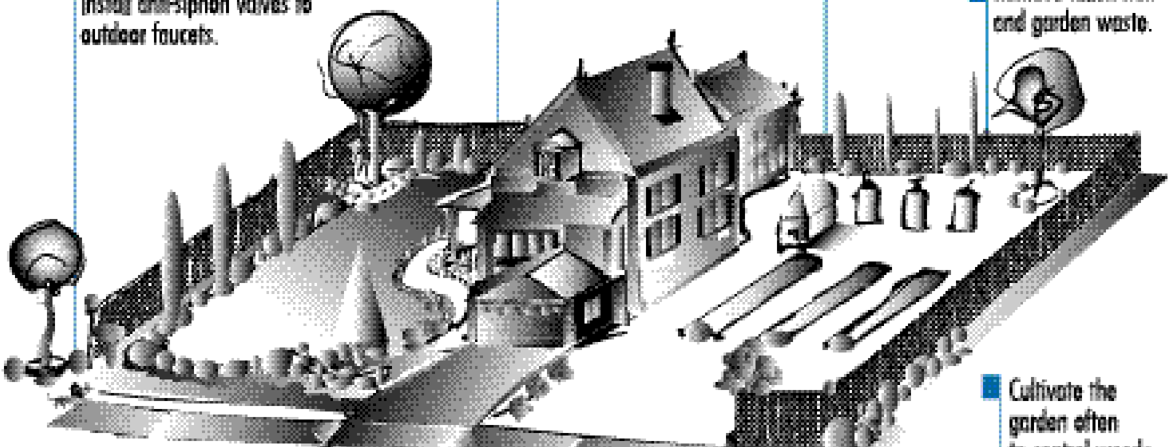
- AVOID spraying in or near storm drains, ditches, streams, and ponds!
- Leave an untreated strip around these areas to protect the water.

When You're done

- Never dump leftovers down any drain; Save for a future application.
- Triple-rinse sprayer and apply rinsewater to treated area.
- Take any old or unwanted pesticides to a Household Hazardous Waste Collection Center (714) 834-6752.

Using Pest Control Products.
It's Your Responsibility To Do It Right!





Fix leaky faucets and eliminate unnecessary water sources. Install anti-siphon valves to outdoor faucets.

Keep wood and leaves away from the walls of your house.

Don't leave pet food sitting outside overnight since it can attract pests.

Remove fallen fruit and garden waste.

Cultivate the garden often to control weeds.

Don't overwater – pest control products and fertilizer runoff can be washed into drains and waterways.

Clean up debris that may harbor pests. Remove weak or dying plants.

Tightly cover garbage cans.

Repair all window/door screens and seal any cracks or openings in walls.

Healthy and well-fed plants are a good defense against insect pests.

IPM... OUTSMARTING PESTS WHILE PROTECTING WATER

With Integrated Pest Management (IPM), homeowners use common sense and nature to make it difficult for pests to survive. IPM techniques include cultural practices (such as mulching to prevent weeds), encouraging natural enemies (good bugs), and judicious use of pest control products.

- First, identify your pest problem. To find the best solution, you need to pin down the problem. Consult gardening books, your county cooperative extension office or your local nursery.
- Decide how much pest control is necessary. If you can live with some pest damage, you can avoid intensive pest control product treatments.
- Choose an effective option. Try various types of controls first: washing bugs off plants, pruning diseased parts of plants. If you need to use pest control products, choose one that targets the problem and poses the least hazard.
- Finally, it's easier to prevent pests than to control them.

Think ahead.

This brochure is being distributed in order to reduce the impacts of pesticides on water quality. It was produced with support from the Orange County Storm Water Program, the Coalition for Urban/Rural Environmental Stewardship (CURES) and a 319(h) grant from the State Water Resources Control Board.

Orange County Storm Water Program Participants:

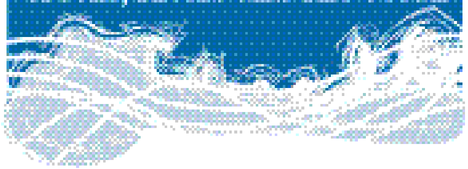
Anaheim Public Works/Engineering	(714) 765-5176
Brea Engineering	(714) 990-7666
Buena Park Public Works	(714) 562-3655
Costa Mesa Public Services	(714) 754-5248
Cypress Engineering	(714) 229-6752
Dana Point Public Works	(949) 248-3562
Fountain Valley Public Works	(714) 593-4400 x347
Fullerton Engineering Dept	(714) 738-6853
Garden Grove Development Services	(714) 741-5554
Huntington Beach Public Works	(714) 536-5432
Irvine Public Works	(949)724-6515
La Habra Public Services	(562) 905-9792
La Palma Public Works	(714) 523-1140 x102
Laguna Beach Municipal Services	(949) 497-0711
Laguna Hills Engineering	(949) 707-2600
Laguna Niguel Public Works	(949) 362-4337
Lake Forest Public Works	(949) 461-3480
Los Alamitos Community Dev	(562) 431-3538 x301
Mission Viejo Public Works	(949) 470-3095
Newport Beach Public works	(949) 644-3311
Orange Public Works	(714) 744-5551
Placentia Engineering	(714) 993-8131
San Clemente Engineering	(949) 361-6100
San Juan Capistrano Engineering	(949) 493-1171
Santa Ana Public Works	(714) 647-3380
Seal Beach Engineering	(562) 431-2527 x318
Stanton Public Works	(714) 379-9222 x204
Tustin Public Works Engineering	(714) 573-3150
Villa Park Engineering	(714) 998-1500
Westminster Public Works Eng.	(714) 898-3311 x215
Yorba Linda Engineering	(714) 961-7170 x174
O.C. Storm Water Program	1-877-89-SPILL (1-877-897-7455)
24 Hour Water Pollution Hotline	(714) 567-6363 or ashbyk@pfrd.co.orange.ca.us
Chemical and Hazardous Material Spill Emergencies	911

Other Important Phone Numbers:

For Additional Brochures	1-877-89-SPILL (1-877-897-7455)
UC Masters & Coop Extension ucmastergardeners@yahoo.com	(714) 708-1646
O.C. Household Hazardous Waste Information or www.oc.ca.gov/IWMD	(714) 834-6752
Information on agriculture chemicals, pesticides and possible alternatives, O.C. Agriculture Commissioner	(714) 447-7115

Original graphics developed with support from:
Coalition For Urban/Rural Environmental Stewardship (CURES)
Western Crop Protection Association (WCPA)
Responsible Industry for a Sound Environment (RISE)

Keeping
Pest Control Products
Out of
Creeks, Rivers and The Ocean



HOMEOWNER TIPS

PROTECTING WATER

Sewage Spill Regulatory Requirements

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

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

Orange County Stormwater Program

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

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

Orange County Health Care Agency Environmental Health

(714) 433-6419

California Health and Safety Code, Sections 5410-5416

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

Regional Water Quality Control Board

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

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

California Office of Emergency Services

(800) 852-7550

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

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

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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

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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

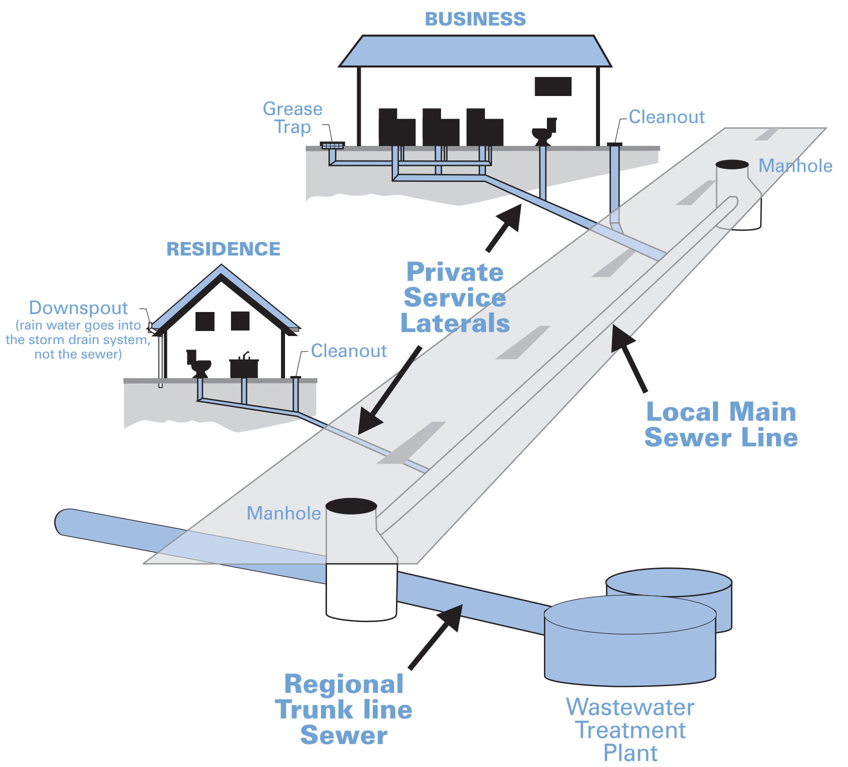
Keep people and pets away from the affected area. Untreated sewage has high levels of disease-causing viruses and bacteria. Call your local health care agency listed on the back for more information.

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

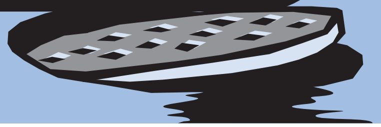
- **City Sewer/Public Works Departments—** Responsible for protecting city property and streets, the local storm drain system, sewage collection system and other public areas.
- **Public Sewer/Sanitation District—** Responsible for collecting, treating and disposing of wastewater.
- **County of Orange 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

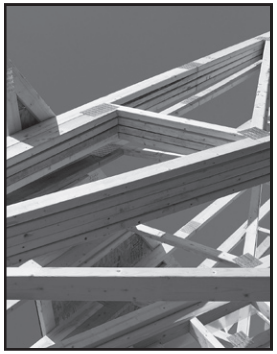
The Ocean Begins at Your Front Door

PROJECT
Pollution
PREVENTION

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



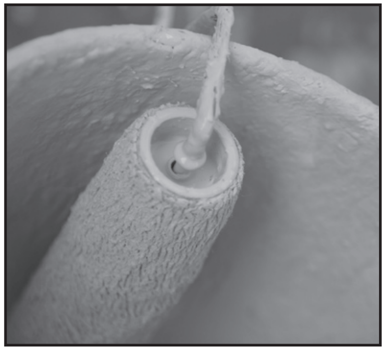
- Schedule projects for dry weather.
- Keep all construction debris away from the street, gutter and storm drain.
- Store materials under cover with temporary roofs or plastic sheets to eliminate or reduce the possibility that rainfall, runoff or wind will carry materials from the project site to the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

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

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

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

UCCE Master Gardener Hotline:
(714) 708-1646

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

For emergencies, dial 911.

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

♻

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Help Prevent Ocean Pollution:

Tips for Landscape & Gardening

The Ocean Begins
at Your Front Door

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Tips for Landscape & Gardening

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

General Landscaping Tips

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.
- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.

- Plant native vegetation to reduce the amount of water, fertilizers, and pesticide applied to the landscape.
- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.

Garden & Lawn Maintenance

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

- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.
- Use slow-release fertilizers to minimize leaching, and use organic fertilizers.
- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.

- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.
- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains. Dispose of empty containers in the trash.
- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting. For more information, visit **www.ipm.ucdavis.edu**.
- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.
- Take unwanted pesticides to a Household Hazardous Waste Collection Center to be recycled. Locations are provided below.

Household Hazardous Waste Collection Centers

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

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

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

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

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

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

For emergencies, dial 911.

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

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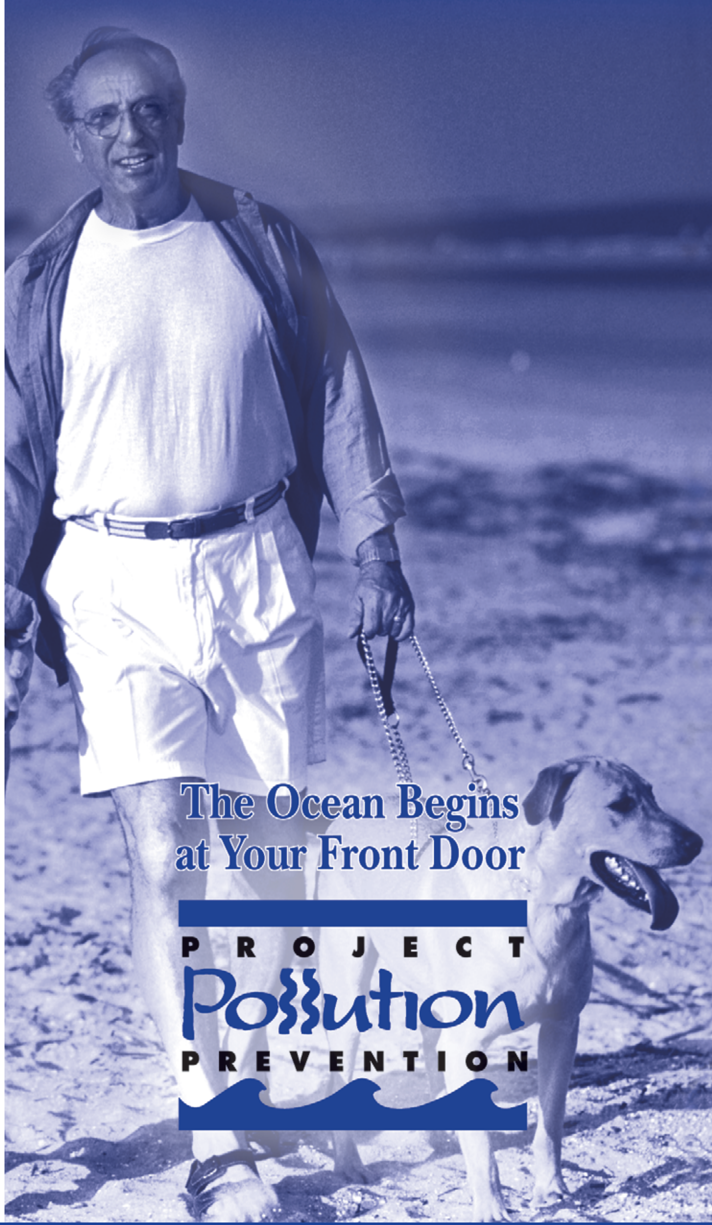
Help Prevent Ocean Pollution:

Tips for Pet Care



The Ocean Begins at Your Front Door

PROJECT
Pollution
PREVENTION

Tips for Pet Care

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

Washing Your Pets

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

- If possible, bathe your pets indoors using less-toxic shampoos or have your pet professionally groomed. Follow instructions on the products and clean up spills.
- If you bathe your pet outside, wash it on your lawn or another absorbent/permeable surface to keep the washwater from running into the street, gutter or storm drain.

Flea Control

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

Why You Should Pick Up After Your Pet

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

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

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

- Take a bag with you on walks to pick up after your pet.
- Dispose of the waste in the trash or in a toilet.

PROJECT POLLUTION PREVENTION

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

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

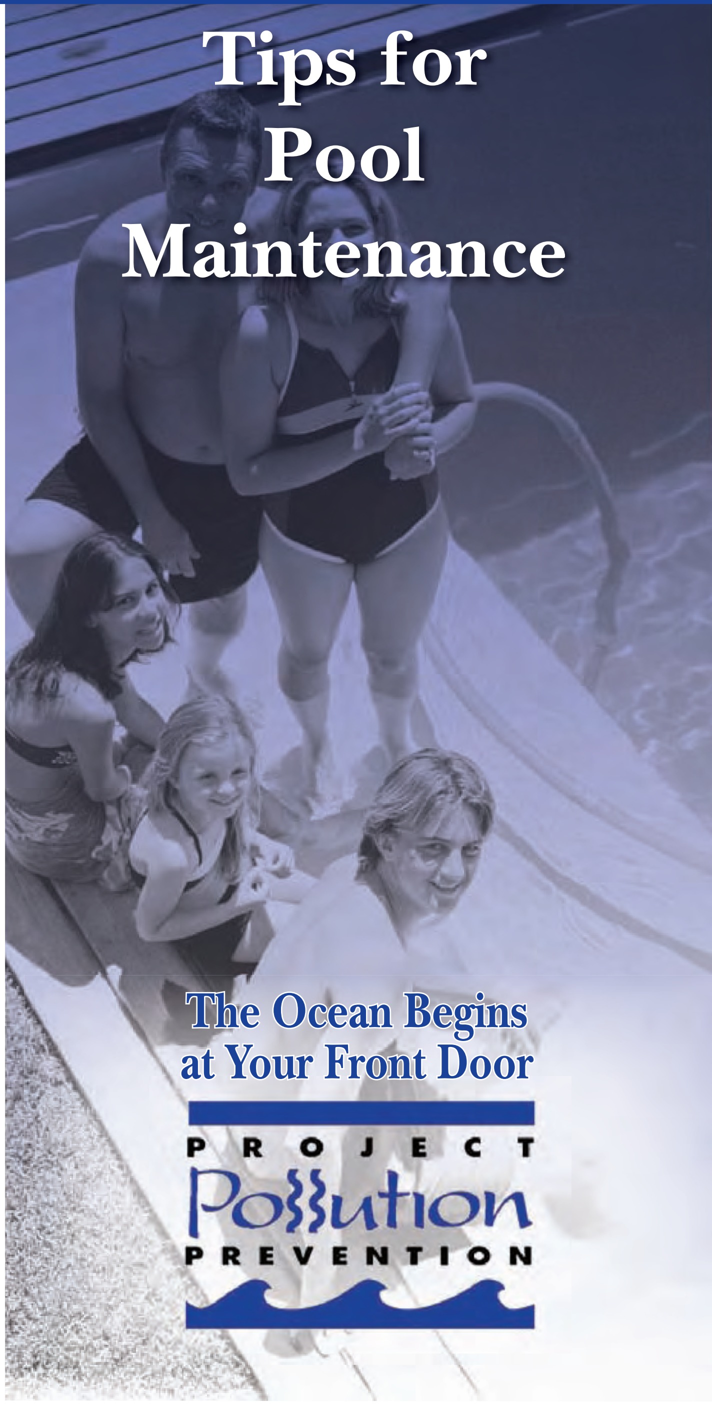
For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

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

For emergencies, dial 911.

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

Help Prevent Ocean Pollution:



Tips for Pool Maintenance

The Ocean Begins at Your Front Door

PROJECT POLLUTION PREVENTION

Tips for Pool Maintenance

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

Acceptable and Preferred Method of Disposal

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

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

How to Know if You're Following the Standards

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

Doing Your Part

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

PROJECT POLLUTION PREVENTION

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

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

For emergencies, dial 911.

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

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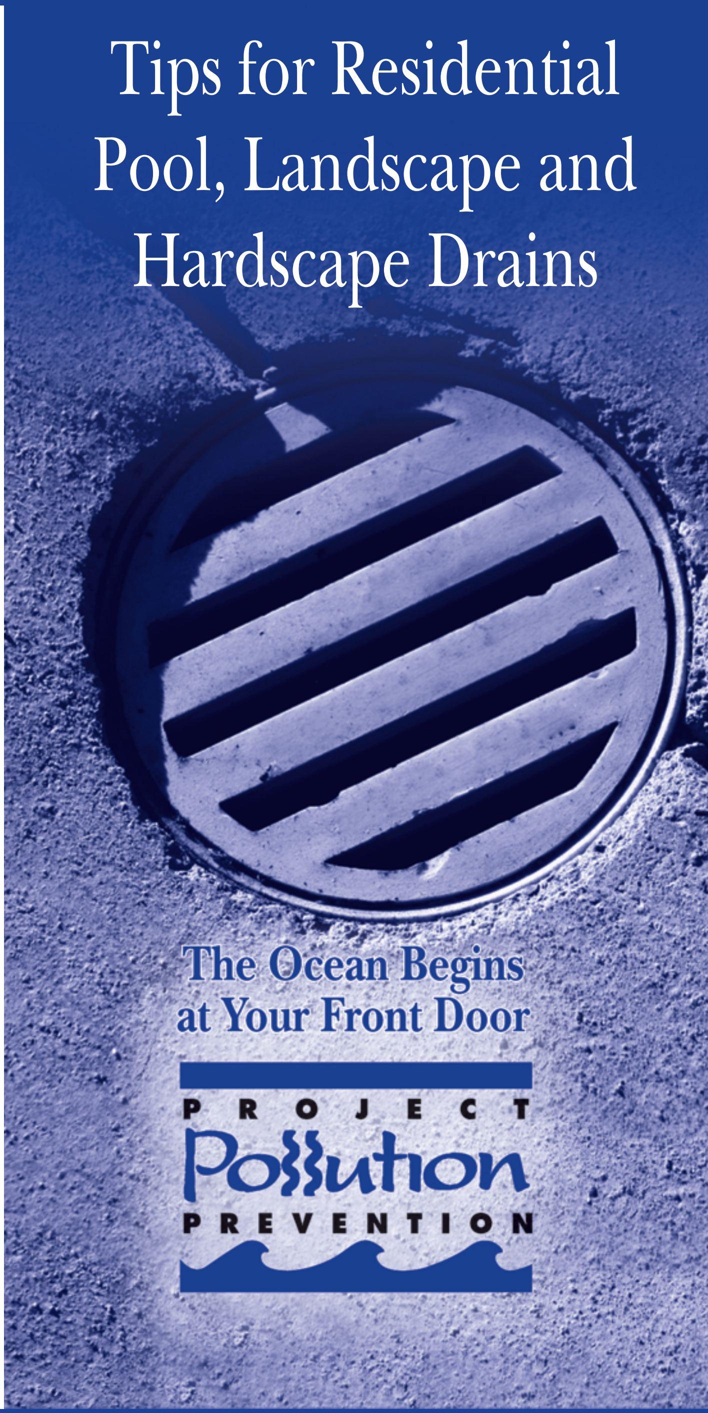
Help Prevent Ocean Pollution:

Tips for Residential Pool, Landscape and Hardscape Drains



The Ocean Begins at Your Front Door

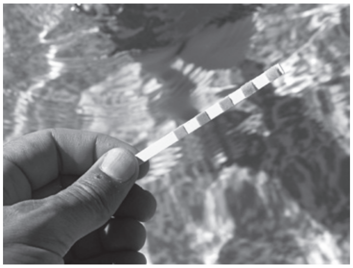
PROJECT
Pollution
PREVENTION

Tips for Residential Pool, Landscape and Hardscape Drains

Pool Maintenance

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

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



Some cities have ordinances that do not allow pool water to be discharged to the storm drain. Check with your city.

Landscape and Hardscape Drains

The following recommendations will help reduce or prevent pollutants from your landscape and hardscape drains from entering the street, gutter or storm drain. Unlike water that enters the sewer (from sinks and toilets), water that enters a landscape or hardscape drain is not treated before entering our creeks, rivers, bays and ocean.

Household Activities

- Do not rinse spills of materials or chemicals to any drain.
- Use dry cleanup methods such as applying cat litter or another absorbent material, then sweep it up and dispose of it in the trash. If the material is hazardous, dispose of it at a Household Hazardous Waste Collection Center (HHWCC). For locations, call **(714) 834-6752** or visit **www.oclandfills.com**.
- Do not hose down your driveways, sidewalks or patios to your landscape or hardscape drain. Sweep up debris and dispose of it in the trash.
- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash.
- Do not store items such as cleaners, batteries, automotive fluids, paint products, TVs, or computer monitors uncovered outdoors. Take them to a HHWCC for disposal.

Yard Maintenance

- Do not overwater. Water by hand or set automated irrigation systems to reflect seasonal water needs.
- Follow directions on pesticides and fertilizers (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Cultivate your garden often to control weeds and reduce the need to use chemicals.

Vehicle Maintenance

- Never pour oil or antifreeze down your landscape or hardscape drain. Recycle these substances at a service station, a waste collection center or used oil recycling center. For locations, contact the Used Oil Program at **1-800-CLEANUP** or visit **www.CLEANUP.org**.
- Whenever possible, take your vehicle to a commercial car wash.
- If you do wash your vehicle at home, do not allow the washwater to go down your landscape or hardscape drain. Instead, dispose of it in the sanitary sewer (a sink or toilet) or onto an absorbent surface such as your lawn.
- Use a spray nozzle that will shut off the water when not in use.

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities such as painting can lead to water pollution if you're not careful. Paint must be used, stored and disposed of properly to ensure that it does not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

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

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

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

For emergencies, dial 911.

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

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Help Prevent Ocean Pollution:

Tips for Projects Using Paint

The Ocean Begins at Your Front Door

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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.

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Appendix B

Operation and Maintenance (O&M) Plan

Water Quality Management Plan

for

Hilltop 3 Development, LLC
APN 350-331-06, 326-021-50
YORBA LINDA, CA 92886
714-742-7965

Exhibit B, Operations and Maintenance Plan

BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Non-Structural Source Control BMPs			
YES	**N1. Education for Property Owners, Tenants and Occupants** Insert BMP narrative from TGD Section 6.2.	Education Materials in Appendix A to be reviewed annually	Hilltop 3 Development, LLC
YES	**N3. Common Area Landscape Management** Insert BMP narrative from TGD Section 6.2.	Maintain landscaping with low drought tolerant plant life. Test irrigation controls	Hilltop 3 Development, LLC
YES	**N4. BMP Maintenance** Insert BMP narrative from TGD Section 6.2.	Inspect BMP's, catchbasin and storm drain to insure no build up or pollutants	Hilltop 3 Development, LLC
YES	**N11. Common Area Litter Control** Insert BMP narrative from TGD Section 6.2.	Clean up litter when seen onsite and keep trash enclosure clean. Keep lids secure	Hilltop 3 Development, LLC
YES	**N14. Common Area Catch Basin Inspection** Insert BMP narrative from TGD Section 6.2.	Inspect and clean for debris and sediment	Hilltop 3 Development, LLC
Structural Source Control BMPs			
YES	**S1. Provide Storm Drain System Stenciling and Signage** Insert BMP narrative TGD Section 6.3.	Inspect and clean debris for sediment	Hilltop 3 Development, LLC
YES	**S3. Design Trash Enclosures to Reduce Pollutant Introduction** Insert BMP narrative from TGD Section 6.3.	Paint, or use permanent placard with statement "NO DUMPING- DRAINS TO OCEAN	Hilltop 3 Development, LLC
YES	**S4. Use Efficient Irrigation Systems and Landscape Design** Insert BMP narrative from TGD Section 6.3.	Visual I Maintenance and Repair	Hilltop 3 Development, LLC
YES	**S5. Protect Slopes and Channels** Insert BMP narrative from TGD Section 6.3.	Visual I Maintenance and Repair	Hilltop 3 Development, LLC

BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Low Impact Development BMPs		
Biotreatment BMP # 1 BioClean Modular Wetland System (Model MWS-L-4-8-V)	BioClean Modular Wetland System (Model MWS-L-8-12-C) is to be serviced and maintained by BioClean (855-566-3938) or the project owner	Hilltop 3 Development, LLC

Required Permits

No permits are required for the implementation of the BMP's for this project site

Forms to Record BMP Implementation, Maintenance, and Inspection

The form that will be used to record implementation, maintenance, and inspection of BMPs is attached.

Recordkeeping

All records must be maintained for at least five (5) years and must be made available for review upon request.

Today's Date:

Name of Person Performing Activity (Printed):

Signature:

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

Appendix C

TGR

Geotechnical
Environmental
Hydrogeology
Material Testing
Construction Inspection

June 28, 2020 Project No. 20-7009

Robert Hoff
Hilltop 3 Development, LLC
3875 Crest Drive
Yorba Linda, CA 92886

Subject: Preliminary Geotechnical Investigation Report, Tentative Parcel Map No. 2020-125, Yorba Linda, California

Reference: TGR Geotechnical, Inc., 2020b, Preliminary Geotechnical Investigation Report, Tentative Parcel Map No. 2020-125, Yorba Linda, California, dated May 8, 2020

TGR Geotechnical, Inc., 2020a, Percolation Testing Report for WQMP, Fairmont Boulevard, Yorba Linda, CA 92886, Parcel 1 (APN: 326-021-50), dated March 20, 2020

City of Yorba Linda Public Works/Engineering Comments dated June 10, 2020

Robert,

In accordance with your request and authorization, TGR Geotechnical, Inc. (TGR) is proving this letter presenting response to comments by City of Yorba Linda Public Works/Engineering dated June 10, 2020. A copy of the review comments is attached.

Item 1:
One page 10, the setback for freestanding walls is 15 feet from the top of the slope and then another phrase says “to the slope face”. The second phrase appears to be a typographical error.

Response:
The paragraph should read as: “A minimum foundation setback of 15 feet from the outer edge of the footing to the slope face is recommended for top of slope freestanding walls.”

Item 2:
One page 11, slab recommendations are given which appear to use CBC Section 1808.6.4 for subgrade stabilization. However, the last sentence says to follow CBC requirements which is CBC Section 1808.6.2 that requires either WRI/CRSI Design of Slab on Grade Foundations or PT DC 10.5.

Response:
At the completion of rough grading the slab subgrade soils shall be tested for expansion index and revised recommendations shall be provided as necessary which will include the effects of differential fill thickness and the expansion characteristics.

Item 3:
The report generally recommends compaction to 95% which is understandable for deep fills to limit settlement, but denser soil increases the expansion potential directly below slabs.

Response:
It is recommended that the upper 5 feet of the fill placed for the building pad shall be compacted to a minimum 90 percent relative compaction to reduce the impact of expansive soils.

Item 4:
Review and approve the grading, foundation and retaining wall plans and details when available. Provide comments/recommendations if/as necessary.

Response:
Acknowledge. TGR will review the grading, foundation and retaining wall plans and details, when available and provide additional recommendations, as necessary.

Item 5:
Provide comment on infiltration infeasibility of water quality best management practices.

Response:
Based on the referenced report (TGR, 2020b), infiltration rates were very low and ranged from 0.44 to 0.56 inch per hour without factor of safety. Infiltration near the toe of the proposed slope may also adversely impacted the stability of the slope. Therefore, infiltration is not recommended from a geotechnical viewpoint.

If you have any questions regarding this letter, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

TGR GEOTECHNICAL, INC.

SANJAY GOVIL
No. 2382
EXP. 6/30/2020

EDWARD LOUIS BURROWS
No. 1750
CERTIFIED ENGINEERING GEOLOGIST

Sanjay Govil, PhD, PE, GE 2382	Edward L. Burrows, M.S, PG, CEG 1750
Principal Geotechnical Engineer	Principal Engineering Geologist

Distribution: (4) Addressee

Attachments

City of Yorba Linda, Public Works/Engineering Comments Dated June 10, 2020

CITY OF YORBA LINDA

4845 Casa Loma Avenue
CALIFORNIA 92885-8714

(714) 961-7170
FAX (714) 986-1010

PUBLIC WORKS / ENGINEERING

June 10, 2020

TGR Geotechnical
Attn: Sanjay Govil
3037 S. Harbor Blvd
Santa Ana, CA 92704

Re: Geotechnical Report Dated May 8, 2020 for Single Family Dwelling, TPM 20-125

Dear Mr. Govil,

The geotechnical report was reviewed and is not acceptable. Please address the following comments below:

1.One page 10, the setback for freestanding walls is 15 feet from the top of the slope and then another phrase says “to the slope face”. The second phrase appears to be a typographical error.

2. One page 11, slab recommendations are given which appear to use CBC Section 1808.6.4 for subgrade stabilization. However, the last sentence says to follow CBC requirements which is CBC Section 1808.6.2 that requires either WRI/CRSI Design of Slab on Grade Foundations or PT DC 10.5.

3. The report generally recommends compaction to 95% which is understandable for deep fills to limit settlement but denser soil increases the expansion potential directly below slabs.

4. Review and approve the grading, foundation and retaining wall plans and details when available. Provide comments/recommendations if/as necessary.

5. Provide comment on infiltration infeasibility of water quality best management practices.

If you have any questions regarding this plan check, please contact me at (714) 961-7174 or email msimonetti@yorbalindaca.gov

Sincerely,

CITY OF YORBA LINDA

Matt Simonetti, PE, QSD
Senior Civil Engineer

cc: File

TGR

Geotechnical
Environmental
Hydrogeology
Material Testing
Construction Inspection

March 23, 2020 Project No. 20-7009

Robert Hoff
Hilltop 3 Development, LLC
3875 Crest Drive
Yorba Linda, CA 92886

Subject: Percolation Testing Report for WQMP, Fairmont Boulevard, Yorba Linda, CA 92886, Parcel 1 (APN: 326-021-50).

Robert,

In accordance with your request and authorization, TGR Geotechnical, Inc. (TGR) has completed the percolation testing at the subject site (Figure 1). The work was performed in accordance with our proposal dated January 27, 2020 and your subsequent authorization to proceed with the following exception: The above-mentioned scope of work called for percolation testing at 0 to 40 feet in P-2. Due to the presence of very dense bedrock the boring could only be advanced to a depth of 10 feet.

The site is currently an undeveloped 49-acre lot, located on Fairmont Boulevard within the City of Yorba Linda. A stormwater infiltration system is proposed along the southwest portion of the property (Plate 1).

SCOPE OF WORK

The proposed scope of work for this investigation included the following:

- Site reconnaissance and mark the locations of borings for infiltration test and notify Dig-Alert.
- Drilling four (4) hollow stem auger borings:
    - P-1, P-2, P-3 and P-4 to a depth of 10 feet
- Percolation testing for the borings at:
    - P-1 and P-4 at a depth of 5-10 feet
    - P-2 at a depth of 5-10 feet
    - P-3 at a depth of 0-10 feet.
- Laboratory testing of select samples to include in situ moisture content and passing No. 200 sieve.
- Preparation of this report summarizing our findings, conclusions, and recommendations.

FIELD INVESTIGATION

Field exploration was performed on March 16, 2020 by a staff engineer from our firm who logged the borings and obtained representative samples, which were subsequently transported

TGR GEOTECHNICAL
DBE & 8(a) firm
3037 S. HARBOR BLVD
SANTA ANA, CA 92704
P 714.641.7189 F 714.641.7190
www.tgrgeotech.com

to the laboratory for further review and testing. The approximate location of the borings are indicated on the enclosed Boring Location Map (Plate 1).

The subsurface conditions were explored by drilling, sampling, and logging four (4) hollow stem auger borings. Drilling was performed with a limited access hollow stem auger drilling rig with 8-inch diameter augers. Borings P-1, P-2, P-3 and P-4 were advanced to a maximum depth of 10 feet below existing grade to perform percolation testing. Subsequent to drilling and testing, all borings were backfilled with soil cuttings.

Driven samples of the earth materials encountered at selected intervals were recovered from the borings. The samples were driven using an automatic 140-pound hammer falling freely from a height of 30 inches. Soil descriptions were entered on the log in general accordance with the Unified Soil Classification System (USCS).

From the borings, all samples were secured in moisture-resistant bags as soon as taken to minimize the loss of field moisture while being transported to the laboratory. The locations and depths of the soil samples recovered are indicated on the boring logs, Plates 2 through 5.

Existing Soil

During our field investigation, the upper 2 feet subsurface soils were classified as clay. Underneath the clay, very dense sandy siltstone bedrock of the Puente Formation was encountered to the maximum depth explored, approximately 10 feet below grade. Detailed descriptions of the earth units encountered are presented in the boring logs, Plates 2 through 5.

Groundwater

No groundwater was encountered during our subsurface exploration to a maximum depth of 10 feet below existing grade during this investigation. Based on our review of available historical groundwater information for the Yorba Linda 7.5-minute quadrangle, (CDMG, 2005) regional historic high groundwater has not been mapped in the general area. (Figure 2). Per USGS groundwater well data for the surrounding area, the historic high groundwater is approximately 25 feet below existing grade, at an elevation of approximately 304 feet above NVGD 1929.

Seasonal and long-term fluctuations in the groundwater may occur as a result of variations in subsurface conditions, rainfall, run-off conditions and other factors. Therefore, variations from our observations may occur.

LABORATORY TESTING

Laboratory tests were performed on representative samples to verify the field classification of the recovered samples and to evaluate the geotechnical properties of the subsurface soils. Laboratory tests for geotechnical characteristics were performed in general accordance with the ASTM procedures. The following tests were performed:

Moisture and Density Determination Tests: Moisture content and dry density determinations were performed on relatively undisturbed samples obtained from the test borings. The results of these tests are presented in the boring logs. Where applicable, only moisture content was determined from "undisturbed" or disturbed samples.

Wash Sieve Test: Typical materials were washed over No. 200 sieve (ASTM Test Method D1140). The test results are presented below:

Sample Location	% Passing No. 200 Sieve
P-1 @ 4 feet	29.7
P-1 @ 9 feet	15.6
P-2 @ 4 feet	40.9
P-2 @ 9 feet	37.4
P-3 @ 4 feet	30.8
P-3 @ 9 feet	27.5
P-4 @ 4 feet	32.1
P-9 @ 9 feet	25.3

PERCOLATION TESTING

Percolation testing was performed at the subject site utilizing the Porchet Method. Presented below are the infiltration rates from the percolation tests performed at the subject site. These do not include any factor of safety.

• P-1 at 5-10 feet	0.85 inches per hour
• P-2 at 5-10 feet	0.92 inches per hour
• P-3 at 0-10 feet	0.44 inches per hour
• P-4 at 5-10 feet	0.97 inches per hour

The infiltration test rates were determined in general accordance with Orange County Public Works Technical Guidance Document (2011).

CONCLUSIONS

Based on the results of our percolation testing we have determined the infiltration rates in the proposed locations to range from 0.44 inches per hour to 0.97 inches per hour, with no factor of safety.

Although we were unable to achieve the proposed drilling depth of 40 feet below existing grade in P-2 due to refusal in very dense bedrock, it is our opinion that the infiltration rates to a depth of 40 feet below existing grade would be equal to or less than the values obtained.

Depending on the distance of the infiltration area to the toe of the proposed slope, the stability of the slope may be adversely impacted due to water mounding from infiltration.

LIMITATIONS

This report was prepared for the subject project based on the client’s needs, directions and requirements at the time.

This report was necessarily based in part upon data obtained from a limited number of observances, site visits, soil and/or other samples, tests, analyses, histories of occurrences, spaced subsurface exploration and limited information on historical events and observations. Such information is necessarily incomplete. Variations can be experienced within small distances and under various climatic conditions. Changes in subsurface conditions can and do occur over time.

This report is not authorized for use by, and is not to be relied upon by, any party except the client with whom TGR contracted for the work. Use or reliance on this report by any other party is that party's sole risk. Unauthorized use of or reliance on this report constitutes an agreement to defend and indemnify TGR from and against any liability which may arise as a result of such use or reliance, regardless of any fault, negligence, or strict liability of TGR.

If you have any questions regarding this report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

TGR GEOTECHNICAL, INC.

SANJAY GOVIL
No. 2382
EXP. 6/30/2020

EDWARD LOUIS BURROWS
No. 1750

Sanjay Govil, PhD, PE, GE 2382
Principal Geotechnical Engineer

Edward L. Burrows, M.S, PG, CEG 1750
Principal Engineering Geologist

ATTACHMENTS

Plate 1 – Boring Location Map

Figure 1 – Site Location Map
Figure 2 – Historic High Groundwater Map

Plates 2 through 5 – Log of Borings

Table 1 – Percolation Test Worksheet

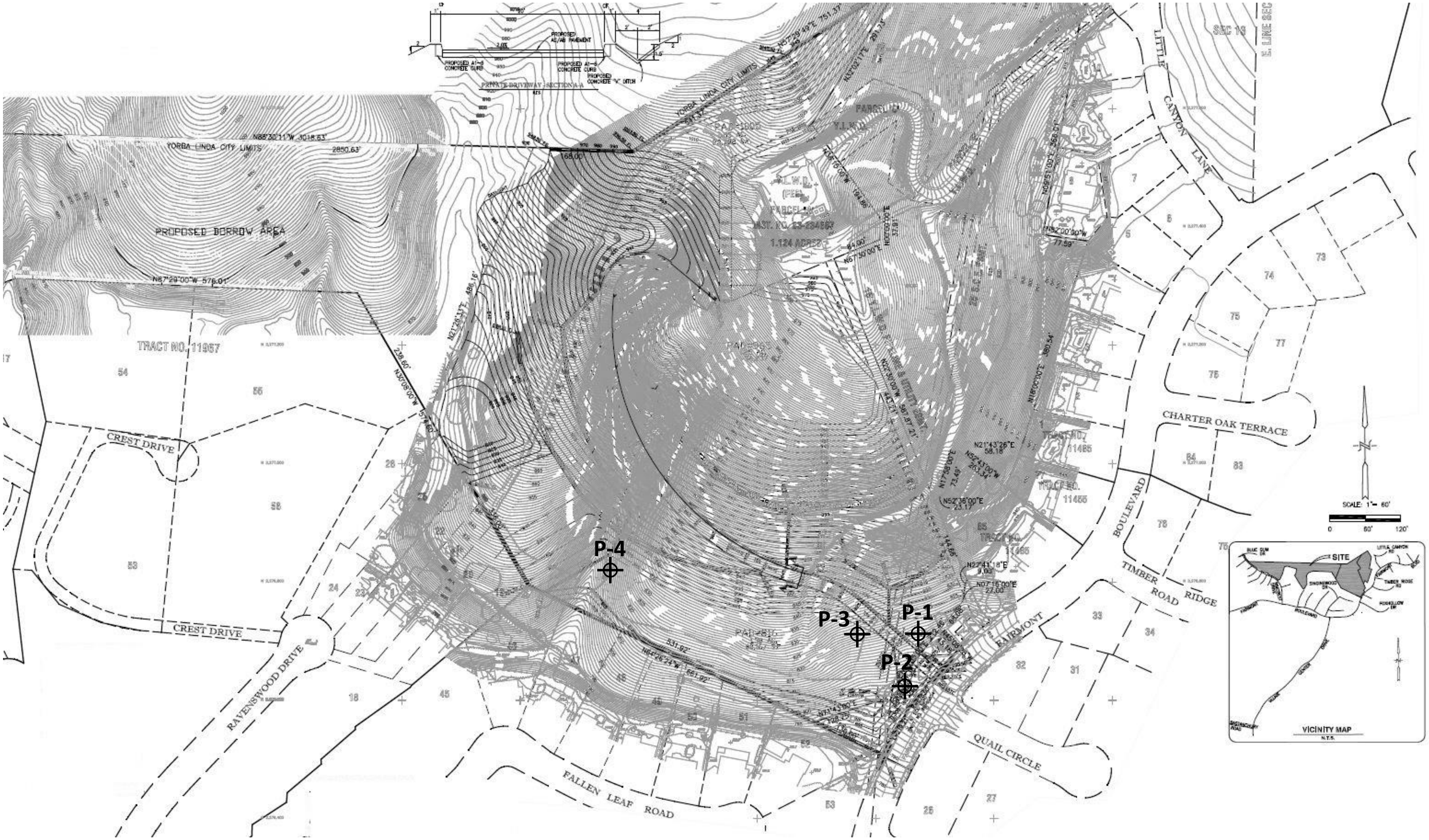
Distribution: (1) Addressee

REFERENCES

California, State of, Department of Conservation, Division of Mines and Geology, 1998, Seismic Hazard Zone Report for the Yorba Linda 7.5-Minute Quadrangle, Los Angeles, Orange and San Bernardino Counties, California, Seismic Hazard Zone Report 010.

County of Orange, OC Public Works, OC Watersheds, 2011, Orange County Public Works Technical Guidance Document.

International Code Council, 2019, California Building Code, Title 24, Part 1 and 2.



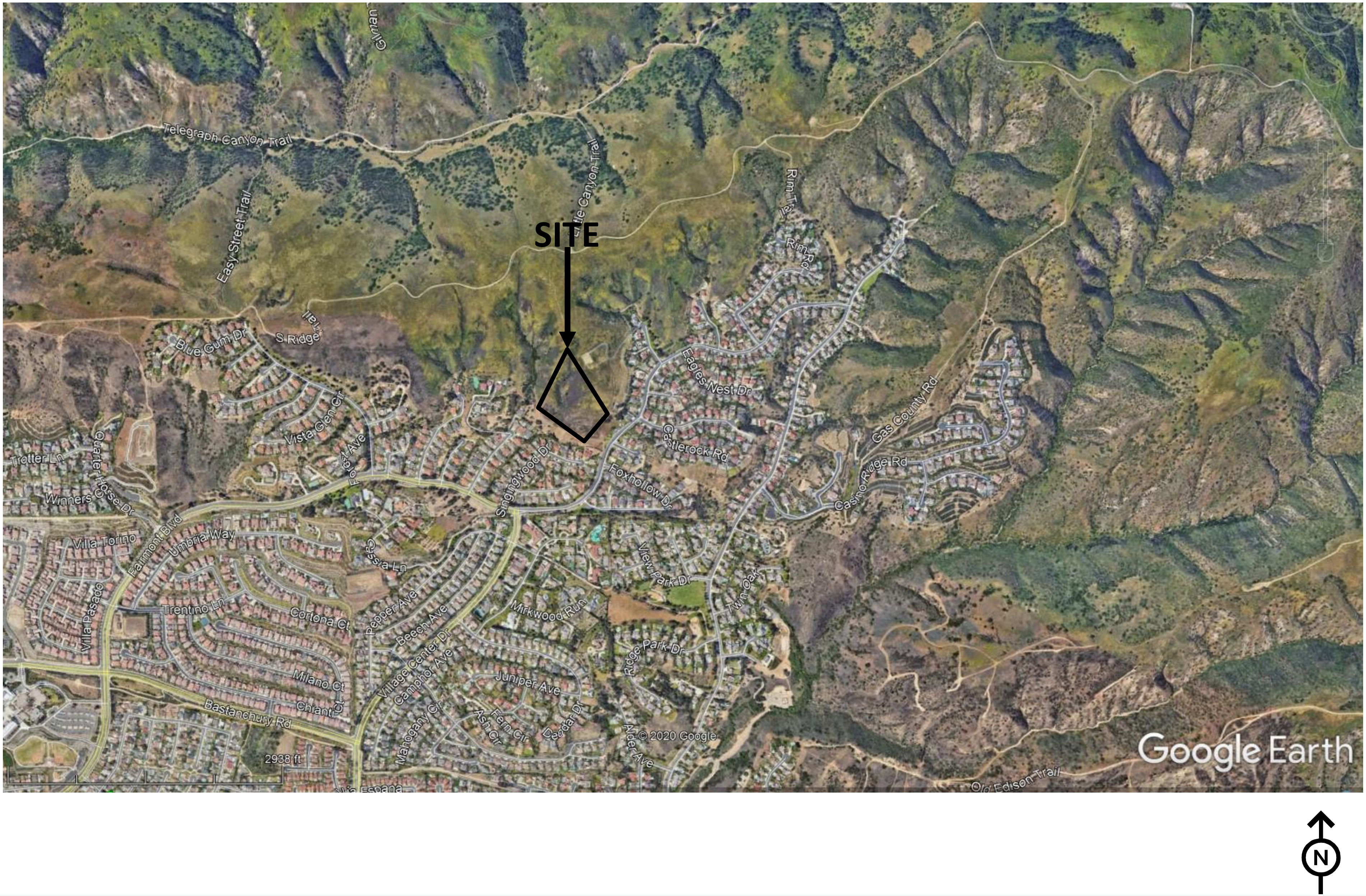
P-2
⌖ APPROXIMATE LOCATION OF PERCOLATION TEST BORINGS

Geotechnical
Environmental
Hydrogeology
Material Testing
Construction Inspection

BORING LOCATION MAP
YORBA LINDA WQMP
FAIRMONT BOULEVARD, YORBA LINDA, CALIFORNIA

PROJECT NO. 20-7009

PLATE 1



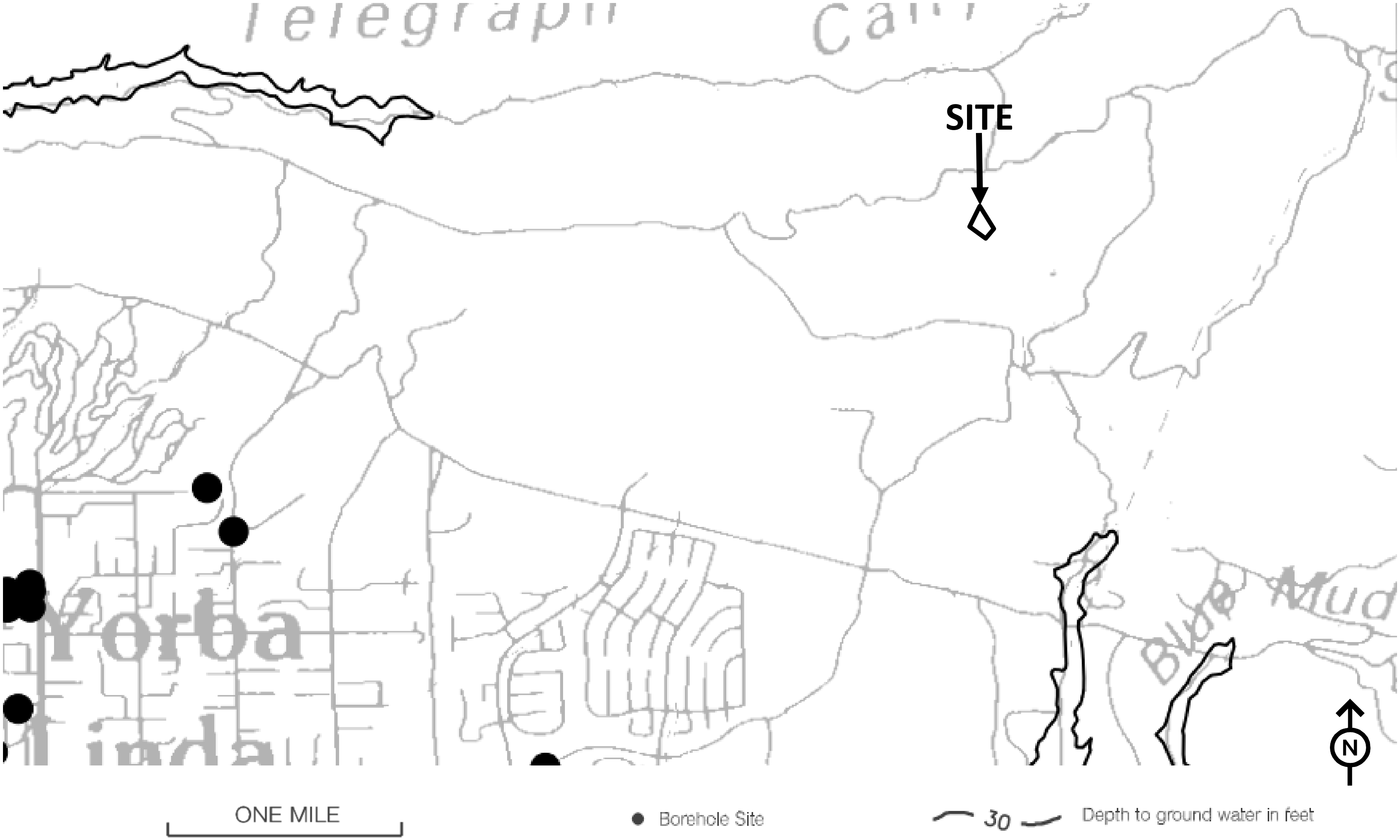
TGR

Geotechnical
Environmental
Hydrogeology
Material Testing
Construction Inspection

SITE LOCATION MAP
YORBA LINDA WQMP
FAIRMONT BOULEVARD, YORBA LINDA, CALIFORNIA

PROJECT NO. 20-7009

FIGURE 1



Modified From: California Department of Conservation, Division of Mines and Geology, 2005, Seismic Hazard Zone Report for the Yorba Linda 7.5-Minute Quadrangles, Los Angeles, Orange and San Bernardino Counties, California, Report 010.

TGR
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HISTORIC HIGH GROUNDWATER MAP
YORBA LINDA WQMP
FAIRMONT BOULEVARD, YORBA LINDA, CALIFORNIA

PROJECT NO. 20-7009

FIGURE 2

LOG OF EXPLORATORY BORING P-1

Sheet **1** of **1**

Project Number:	**20-7009**	Logged By:	**RA**
Project Name:	**Yorba Linda WQMP**	Project Engineer:	**SG**
Date Drilled:	**3/16/20 - 3/16/20**	Drill Type:	**Limited Access**
Ground Elev:		Drive Wt & Drop:	**140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS Moisture Content (%)	Dry Density, (pcf)	Other Tests
							Surface is a vegetation covered hillside.			
	▨						Clay- brown, very moist, soft to firm, some small pieces of gravel and bedrock.			
	▨						Bedrock: Puente Formation (Tpl): Sandy Siltstone- tan, moist, very dense, some fine to medium grained sand.			
	▨		☒	>50			...Same as above.	7		-200= 29.7%
5	▨									
	▨		☒	>50			...Same as above.	5		-200= 15.6%
10							Total Depth: 10 feet. No groundwater encountered during drilling. No caving observed. Boring utilized for percolation testing.			
15										
20										
25										

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 2

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING P-2

Sheet **1** of **1**

Project Number: **20-7009**
Project Name: **Yorba Linda WQMP**
Date Drilled: **3/16/20 - 3/16/20**
Ground Elev:

Logged By: **RA**
Project Engineer: **SG**
Drill Type: **Limited Access**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS Moisture Content (%)	Dry Density, (pcf)	Other Tests
							Surface is a vegetation covered hillside.			
	▨						Clay- brown, very moist, soft to firm, some small pieces of gravel and bedrock.			
	▩						Bedrock: Puente Formation (Tpl): Sandy Siltstone- tan, moist, very dense, some fine to medium grained sand.			
5	▩		☒	>50			...Same as above.	9		-200= 32.1%
	▩		☒	>50			...Same as above.	13		-200= 25.3%
10							Total Depth: 10 feet due to refusal in hard bedrock. No groundwater encountered during drilling. No caving observed. Boring utilized for percolation testing.			
15										
20										
25										

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 3

TGR GEOTECHNICAL, INC.

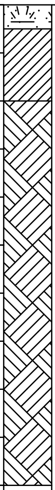
LOG OF EXPLORATORY BORING P-3

Sheet **1** of **1**

Project Number: **20-7009**
Project Name: **Yorba Linda WQMP**
Date Drilled: **3/16/20 - 3/16/20**
Ground Elev:

Logged By: **RA**
Project Engineer: **SG**
Drill Type: **Limited Access**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧓ Modified California
▼ Water Table ATD



Depth (ft)	Graphic Log	FIELD RESULTS: Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS: Moisture Content (%)	Dry Density, (pcf)	Other Tests
							Surface is a vegetation covered hillside.			
							Clay- brown, very moist, soft to firm, some pieces of bedrock and gravel.			
							Bedrock: Puente Formation (Tpl): Sandy Siltstone- tan, moist, very dense, some fine to medium grained sand.			
5			☒	58			...Same as above.	16		-200= 30.8%
10			☒	>50			...Same as above, reddish brown, some orange oxidation.	14		-200= 27.5%
							Total Depth: 10 feet. No groundwater encountered during drilling. No caving observed. Boring utilized for percolation testing.			
15										
20										
25										

PLATE 4

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING P-4

Sheet **1** of **1**

Project Number: **20-7009**
Project Name: **Yorba Linda WQMP**
Date Drilled: **3/16/20 - 3/16/20**
Ground Elev:

Logged By: **RA**
Project Engineer: **SG**
Drill Type: **Limited Access**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧓ Modified California
▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS					SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS		
		Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS		Moisture Content (%)	Dry Density, (pcf)	Other Tests
							Surface is a vegetation covered hillside.			
	▨						Clay- brown, very moist, soft to firm, some pieces of bedrock and gravel.			
	▨						Bedrock: Puente Formation (Tpl): Sandy Siltstone- tan, moist, dense, some fine to medium grained sand.			
5	▨		☒	40			...Same as above.	15		-200= 40.9%
10	▨		☒	57			...Same as above, reddish brown, very dense, some orange oxidation.	13		-200= 37.4%
							Total Depth: 10 feet. No groundwater encountered during drilling. No caving observed. Boring utilized for percolation testing.			
15										
20										
25										

20-7009

Percolation Test Worksheet

Table 1

Test Hole	Total Depth (in)	Initial Depth (in)	Final Depth (in)	∆Water Level (in)	Initial Time (min)	Final Time (min)	∆ Time (min)	Initial Height of Water (in)	Final Height of Water (in)	Average Height of Water (in)	Infiltration Rate (in/hr)
P-1	120	61.25	64.5	3.25	0.0	5.0	5.0	58.75	55.5	57.13	1.32
	120	64.5	66.5	2	5.0	10.0	5.0	55.5	53.5	54.50	0.85
	120	66.5	69.25	2.75	10.0	15.0	5.0	53.5	50.75	52.13	1.22
	120	69.25	71.25	2	15.0	20.0	5.0	50.75	48.75	49.75	0.93
	120	71.25	73.25	2	20.0	25.0	5.0	48.75	46.75	47.75	0.96
	120	73.25	75.5	2.25	25.0	30.0	5.0	46.75	44.5	45.63	1.13
	120	75.5	85.5	10	30.0	35.0	5.0	44.5	34.5	39.50	5.78
	120	85.5	87.25	1.75	35.0	40.0	5.0	34.5	32.75	33.63	1.18
	120	87.25	88.75	1.5	40.0	45.0	5.0	32.75	31.25	32.00	1.06
P-2	120	62	64.25	2.25	0.0	5.0	5.0	58	55.75	56.88	0.92
	120	64.25	67	2.75	5.0	10.0	5.0	55.75	53	54.38	1.17
	120	67	69.25	2.25	10.0	15.0	5.0	53	50.75	51.88	1.00
	120	69.25	71.5	2.25	15.0	20.0	5.0	50.75	48.5	49.63	1.05
	120	71.5	73.75	2.25	20.0	25.0	5.0	48.5	46.25	47.38	1.09
	120	73.75	76	2.25	25.0	30.0	5.0	46.25	44	45.13	1.15
P-3	120	15.25	17.5	2.25	0.0	5.0	5.0	104.75	102.5	103.63	0.51
	120	17.5	20	2.5	5.0	10.0	5.0	102.5	100	101.25	0.58
	120	20	22.25	2.25	10.0	15.0	5.0	100	97.75	98.88	0.54
	120	22.5	25	2.5	15.0	20.0	5.0	97.5	95	96.25	0.61
	120	25	26.75	1.75	20.0	25.0	5.0	95	93.25	94.13	0.44
	120	26.75	28.5	1.75	25.0	30.0	5.0	93.25	91.5	92.38	0.45
P-4	120	58.25	62	3.75	0.0	5.0	5.0	61.75	58	59.88	1.45
	120	62	65.25	3.25	5.0	10.0	5.0	58	54.75	56.38	1.34
	120	65.25	67.5	2.25	10.0	15.0	5.0	54.75	52.5	53.63	0.97
	120	67.5	70.25	2.75	15.0	20.0	5.0	52.5	49.75	51.13	1.24
	120	70.25	72.75	2.5	20.0	25.0	5.0	49.75	47.25	48.50	1.19
	120	72.75	75.25	2.5	25.0	30.0	5.0	47.25	44.75	46.00	1.25

$$I_t = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

ΔH = Change in height

Δt = Time interval

r = Radius

I_t Infiltration Rate

H_{ave} Average Head Height over the time interval

TGR

Geotechnical
Environmental
Hydrogeology
Material Testing
Construction Inspection

May 8, 2020

Project No. 20-7009

Robert Hoff
Hilltop 3 Development, LLC
3875 Crest Drive
Yorba Linda, CA 92886

Subject: Preliminary Geotechnical Investigation Report, Tentative Parcel Map No. 2020-125, Yorba Linda, California

Robert,

In accordance with your request and authorization, TGR Geotechnical, Inc. (TGR) has performed a preliminary geotechnical investigation for the proposed development at the subject site. This report presents the findings of our limited geotechnical investigation, including site seismicity and provides preliminary design geotechnical recommendations for the proposed development. The work was performed in general accordance with our proposal dated February 5, 2020 and your subsequent authorization to proceed.

It is our understanding that the proposed development will consist of the construction of a single-family residence. The proposed development is suitable from a geotechnical viewpoint provided the recommendations presented in this report are incorporated during design and construction.

If you have any questions regarding this report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

TGR GEOTECHNICAL, INC.

SANJAY GOVIL
No. 2382
EXP. 6/30/2020

EDWARD LOUIS BURROWS
No. 1750

Sanjay Govil, PhD, PE, GE 2382
Principal Geotechnical Engineer

Edward L. Burrows, M.S, PG, CEG 1750
Principal Engineering Geologist

Distribution: (4) Addressee

TGR GEOTECHNICAL
DBE & 8(a) firm
3037 S. HARBOR BLVD
SANTA ANA, CA 92704
P 714.641.7189 F 714.641.7190
www.tgrgeotech.com

Attachments

Plate 1 – Geotechnical Map
Plate 2 – Geotechnical Cross-Section A-A’, B-B’ and C-C’
Figure 1 – Site Location Map
Figure 2 – Geologic Map
Figure 3 – Historic High Groundwater Map
Figure 4 – Regional Fault Map
Figure 5 – Seismic Hazard Zone Map

Appendix A – References
Appendix B – Log of Borings
Appendix C – Laboratory Test Results
Appendix D – Slope Stability Analysis
Appendix E – Earthwork and Grading Guidelines

INTRODUCTION

Site Description and Proposed Project Development

It is our understanding that the proposed development consists of a single-family residence located off of Fairmont Boulevard, Yorba Linda, California. The subject property is an ascending slope and hilltop. The site is bounded on the north by the Yorba Linda Water District (YLWD) Little Canyon Reservoir; on the south by residential development and Fallen Leaf Road; on the east by residential development and Fairmont Blvd; and on the west by undeveloped land The approximate site location is presented in the Site Location Map (Figure 1).

The proposed residential development will consist of a single building pad at the northeast portion of the site with a pad elevation of 965 feet above mean sea level (amsl). A large fill/cut slope ranging up to approximately 185 feet in height is proposed to the south and west of the building pad. Access to the pad area will be via a road constructed within the slope area. The maximum anticipated cut is approximately 50 feet at the southwest portion of the site. The maximum anticipated fill is approximately 50 feet in the central portion of the site. The maximum proposed cut slope is 185 feet and the maximum proposed fill slope is 150 feet. Fill and cut slope gradients are 2H:1V (horizontal:vertical).

Reports by Others

A geotechnical investigation report was previously prepared by Converse Ward Davis Dixon, Inc. (Converse, 1981) for the existing YLWD Little Canyon Reservoir which is located directly north of the subject site. TGR reviewed Converse’s report in preparing this report.

Scope of Work

The scope of work for this geotechnical investigation included the following:

- Site reconnaissance.
- Review of readily available geotechnical and geologic reports for nearby properties.
- Sampling and logging three (3) large diameter (24”) borings utilizing a bucket auger drill rig to depths ranging from 31 to 75 feet at the subject site to evaluate subsurface soil conditions. The borings were backfilled with cuttings and any excess soil was disposed onsite.
- Laboratory testing of selected samples to include in-situ moisture density, maximum density and optimum moisture content, shear, expansion, and sulfate.
- Engineering analysis including static slope stability, seismic slope stability including evaluation of seismic displacement, foundation and retaining wall design.
- Preparation of this appropriately illustrated report, including geologic cross-sections. The report summarizes the results of the geologic and geotechnical investigation, evaluate subsurface soil condition, site seismicity, and slope stability.

Field Investigation

Field exploration was performed on April 20 and 21, 2020 by a certified engineering geologist from our firm who logged the borings and obtained representative samples, which were subsequently transported to the laboratory for further review and testing. The approximate locations of the borings are indicated on the enclosed Geotechnical Map (Plate 1).

The subsurface conditions were explored by drilling, sampling, and down-hole logging three borings with a truck mounted bucket auger drill rig to approximate depths ranging from thirty-one (31) to seventy-five (75) feet below existing grade. Subsequent to drilling and logging, all borings were backfilled with cuttings. Soil descriptions were entered on the logs in general accordance with the Unified Soil Classification System (USCS). The logs of borings presenting soil conditions and descriptions are given in Appendix B.

The drill rig was equipped with a sampling apparatus to allow for recovery of driven modified California Ring Sampler (CRS), 3-inch outside diameter, and 2.42-inch inside diameter. Driven samples and bulk samples of the earth materials encountered at selected intervals were recovered from the borings.

The samples were driven using a Kelly bar falling freely from a height of 30 inches. The weight of the Kelly bar changed with increasing depth and was 3300 pounds in the upper 25 feet below ground surface, 2200 pounds between 25 and 50 feet below ground surface and 1100 pounds between 50 and 75 feet below ground surface. The locations and depths of the soil samples recovered are indicated on the logs in Appendix B.

Laboratory Testing

Laboratory tests were performed on representative samples to verify the field classification of the recovered samples and to evaluate the geotechnical properties of the subsurface soils. The following tests were performed:

- In-situ moisture content (ASTM D2216) and dry density (ASTM D7263);
- Maximum Dry Density and Optimum Moisture Content (ASTM D1557);
- Direct Shear Strength (ASTM D3080);
- Expansion Potential (ASTM D4829);
- Atterberg (ASTM D423); and
- Soluble Sulfate (CAL.417A)

Laboratory tests for geotechnical characteristics were performed in general accordance with the ASTM procedures. The results of the in-situ moisture content and density tests are shown on the borings logs. The results of the laboratory tests are presented in Appendix C.

GEOTECHNICAL FINDINGS

Earth Units/Geology

The Bedrock exposed at the surface and underlying the general site area is part of the late Miocene aged Puente Formation. According to the USGS Professional Paper 420-B, Geologic Map of the Prado Dam and Yorba Linda Quadrangles, (Dunham and Yerkes, 1964), the bedrock at the subject site is the La Vida member of the Puente Formation which generally consists of interbedded siltstone and sandstone.

Groundwater

During the field exploration, groundwater was not encountered to the maximum depth drilled (approximately 75 feet). This site is underlain by bedrock and a review of the seismic hazard zone maps for the Yorba Linda quadrangle does not show groundwater mapped beneath the subject site.

Generally, seasonal and long-term fluctuations in the groundwater may occur as a result of variations in subsurface conditions, rainfall, run-off conditions and other factors. Therefore, variations from our observations may occur.

Faulting and Seismicity

We consider the most significant geologic hazard to be the potential for moderate to strong seismic shaking that is likely to occur at the subject site. The subject site is located in the highly seismic Southern California region within the influence of several faults that are considered to be active or potentially active. An active fault is defined by the State of California as a “sufficiently active and well-defined fault” that has exhibited surface displacement within the Holocene time (about the last 11,000 years). A potentially active fault is defined by the State as a fault with a history of movement within Pleistocene time (between 11,000 and 1.6 million years ago).

These active and potentially active faults are capable of producing potentially damaging seismic shaking at the site. It is anticipated that the subject site will periodically experience ground acceleration as a result of small to moderate magnitude earthquakes. Other active faults without surface expression (blind faults) or other potentially active seismic sources that are not currently zoned and may be capable of generating an earthquake are known to be present under the region.

Based on our review of the referenced geologic maps, as well as our field reconnaissance, the subject site is not included within any Earthquake Fault Zones as created by the Alquist-Priolo Earthquake Fault Zoning Act (Hart, 1997). Our review of geologic literature pertaining to the site area indicates that there are no known active or potentially active faults located within or immediately adjacent to the subject property. The nearest fault is the Whittier Fault located approximately 0.5 miles from the subject site. Other faults close to the site are Chino Fault (5.0 miles away), and Peralta Hills Fault (5.5 miles away). The Regional Fault Map (Figure 4) presents the location of the site with respect to the regional faults

Surface Fault Rupture and Ground Shaking

Since no known faults are located within the site, surface fault rupture is not anticipated. However, due to the close proximity of known active and potentially active faults, severe ground shaking should be expected during the life of the proposed structures.

Liquefaction

Liquefaction is a seismic phenomenon in which loose, saturated, fine-grained granular soils behave similarly to a fluid when subjected to high-intensity ground shaking. Liquefaction occurs when these ground conditions exist: 1) Shallow groundwater; 2) Low density, fine, clean sandy soils; and 3) High-intensity ground motion. Effects of liquefaction can include sand boils, settlement, and bearing capacity failures below foundations.

The site is underlain by bedrock. A review of the seismic hazard zone map of the Yorba Linda Quadrangle indicates that the subject site is not located within an area having a potential for earthquake induced liquefaction (Figure 5). As such, the potential for liquefaction at the subject site is considered to be negligible.

Seismically Induced Settlement

Ground accelerations generated from a seismic event can produce settlements in sands or in granular earth materials both above and below the groundwater table. This phenomenon is often referred to as seismic settlement and is most common in relatively clean sands, although it can also occur in other soil materials. Based on the nature of the soils (bedrock) underlying the site the potential for seismically induced settlement is considered negligible.

Lateral Spreading

Seismically induced lateral spreading involves primarily movement of earth materials due to earth shaking. Lateral spreading is demonstrated by near-vertical cracks with predominantly horizontal movement of the soil mass involved. Based on the nature of the soils (bedrock) underlying the site the potential for lateral spreading at the subject site is considered negligible.

Earthquake Induced Landsliding

A review of the seismic hazard zone map of the Yorba Linda Quadrangle indicates that the subject site is not located within an area having a potential for earthquake induced landsliding (Figure 5). The site is underlain by bedrock. The bedrock is overlain by approximately 2 to 3.5 feet of topsoil/colluvium. Evidence of ancient or recent landsliding was not observed on the property at the time of our field study and site visit. In addition, the property did not reveal the presence of past surficial slope failures.

Slope Stability

Slope stability calculations are presented in Appendix D on geologic cross-sections A-A', B-B' and C-C'. Based on the calculations, site slopes are considered grossly stable. Seismic displacement was calculated by evaluating the yield acceleration that corresponds to a safety factor of 1.0 and calculating seismic displacement per Bray and Travasarou (2007; 2009), Rathje and Antonakos (2011) and Song and Marek (2015) and taking the average of the two. The design minimum factors of safety under static loading conditions is 1.5. The acceptable seismic displacement is 5 cm for slide planes going through structures, 15 cm otherwise.

Presented below are the results of our slope stability analyses for cross sections A-A', B-B' and C-C':

Cross Section	Static Safety Factor	Ky (g)	Displacement (cm)	Seismic Safety Factor
A – A’	1.62	0.30	3.75	1.00
B – B’	1.70	0.36	1.22	1.01
C-C’	1.61	0.35	2.25	1.02

The soil shear strength parameters utilized in the slope stability calculations are presented below.

Geologic Unit	Unit Weight (pcf)	Static Stability (Ultimate)		Seismic Stability (Ultimate)	
		Cohesion (Psf)	Friction Angle (degree)	Cohesion (Psf)	Friction Angle (degree)
Fill (95%)	130	275	28	460	30
(Tpl) Bedrock: Across Bedding	130	198	36	428	47
(Tpl) Bedrock: Along Bedding	130	336	18	336	18

The surficial stability analysis indicated an adequate factor of safety. Calculations are presented in Appendix D.

DISCUSSIONS AND CONCLUSIONS

General

Based on our field exploration by others and geotechnical engineering analysis, the proposed development is considered suitable from a geotechnical viewpoint, provided the recommendations contained in this report are incorporated into the design and construction phases of the project. It is our opinion that the proposed development and proposed grading will be safe against hazard from landslide, settlement, or slippage, and the proposed construction will have no adverse effect on the geologic stability of the adjacent properties provided our recommendations presented in this report are followed.

Conclusions

Based on our findings and analyses, the subject site is likely to be subjected to moderate to severe ground shaking due to the proximity of known active and potentially active faults. This may reasonably be expected during the life of the structure and should be designed accordingly.

The engineering evaluation performed concerning site preparation and the recommendations presented are based on information provided to us and obtained by us during our office and fieldwork. This report is prepared for the proposed residential development at the subject site. In the event that any significant changes are made to the proposed development, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed, and the recommendations of this report are verified or modified in writing by TGR.

RECOMMENDATIONS

Seismic Design Parameters

When reviewing the 2019 California Building Code, the following data should be incorporated into the design:

Latitude (degree)	33.908
Longitude (degree)	-117.769
Site Class	C
Site Coefficient, F_a	1.2
Site Coefficient, F_v	1.4
Mapped Spectral Acceleration at 0.2-sec Period, S_s	1.986 g
Mapped Spectral Acceleration at 1.0-sec Period, S_1	0.694 g
Spectral Acceleration at 0.2-sec Period Adjusted for Site Class, S_{MS}	2.383 g
Spectral Acceleration at 1.0-sec Period Adjusted for Site Class, S_{M1}	0.972 g
Design Spectral Acceleration at 0.2-sec Period, S_{DS}	1.589 g
Design Spectral Acceleration at 1.0-sec Period, S_{D1}	0.648 g

The structural consultant should review the above parameters and the 2019 California Building Code to evaluate the seismic design.

Conformance to the criteria presented in the above table for seismic design does not constitute any type of guarantee or assurance that significant structural damage or ground failure will not occur during a large earthquake event. The intent of the code is “life safety” and not to completely prevent damage of the structure, since such design may be economically prohibitive.

Shallow Foundation Design Recommendations

Shallow foundations may be utilized to support the proposed development. Continuous or pad footings shall be supported on a minimum of three feet of engineered fill. It is recommended that the continuous footings be a minimum of 18 inches wide and a minimum of 24 inches deep. An allowable bearing capacity of 2500 psf is recommended for both pad and continuous footings. The minimum horizontal foundation setback for descending slopes is H/3 (maximum 40 feet), where H is the height of the slope. Deepened footings may be required to meet the setback requirement. The minimum horizontal setback for ascending slopes is H/2 (maximum 15 feet).

Fill slopes and pad areas consisting of expansive soils are expected to have some degree of slope creep and lot stretching/lateral fill extension. Slope creep and lot stretching/lateral fill extension are expected to be particularly prevalent within the outer fifteen (15) feet of the slope face. The amount of movement is difficult to determine and is dependent to some extent upon the height and angle of the slope, the degree of the expansion potential, and irrigation practices.

A minimum foundation setback of 15 feet from the outer edge of the top of slope for free-sanding walls to the slope face daylight is recommended.

The total settlement is not expected to exceed 1 inch. The differential settlement between columns is estimated as 1/2 inch.

The above values may be increased by one-third when considering short duration seismic or wind loads. The reinforcement should be designed by the project structural engineer.

Resistance to lateral loads including wind and seismic forces may be provided by frictional resistance between the bottom of concrete and the underlying fill soils and by passive pressure against the sides of the foundations. A coefficient of friction of 0.40 may be used between concrete foundation and underlying soil. The recommended passive pressure of the engineered fill may be taken as an equivalent fluid pressure of 250 pounds per cubic foot (2,500 psf max).

Retaining Wall Design Recommendations

Proposed retaining walls may be supported on shallow foundations or drilled piers as described below. The following soil parameters may be used for the design of retaining walls up to 10 feet high with level backfill or 2:1 backfill:

Conditions	Equivalent Fluid Pressure (psf/ft)
Active (Level)	45
Active (2:1 Backfill)	65
At Rest (Level)	60
Allowable Passive	275 (maximum 2750)

- An allowable coefficient of friction between on-site soil and concrete of 0.35 may be used with the dead-load forces.

- Passive pressure and frictional resistance could be combined in determining the total lateral resistance. However, one of them shall be reduced by 50 percent.

- Walls near ascending slopes should be designed for creep loading.

- The passive pressure of the soil within the creep zone shall be ignored in the design.

- Retaining walls over 6 feet high shall be designed for a seismic lateral load of $17H^2$ pounds. The seismic load shall be applied at a distance of 0.6H above the base of the wall.
- Drilled piers should be designed for the passive pressure presented above.

Retaining structures should be provided with a drainage system to prevent buildup of hydrostatic pressure behind the walls unless the wall is designed for the added hydrostatic pressure. Provisions should be made to collect and dispose of excess water away from the wall. Wall drainage may be provided by a perforated pipe encased in gravel or crushed rock and enclosed by geo-synthetic filter fabric. We do not recommend omitting the drains behind walls.

In addition to the above lateral forces due to retained earth, surcharge due to improvements, such as an adjacent walkway, should be considered in the design of the retaining wall. A minimum vertical surcharge load of 300 psf should be used in design of walls due to adjacent traffic unless the traffic is kept at least 10 feet from the walls. Loads applied within a 1:1 projection from any surcharging structure on the stem of the wall shall be considered as lateral surcharge. For uniform lateral surcharge conditions applied to free-to-deflect walls we recommend utilizing a minimum horizontal load equal to 33 percent of the vertical load and should be applied uniformly over the entire height of the wall.

Cement Type and Corrosion

Preliminary testing indicates that concrete used should be designed in accordance with the provisions of ACI 318 for Exposure Class S0. However, due to the presence of gypsum within the bedrock, testing of soils at the completion of grading should be performed to determine sulfate content.

TGR does not practice corrosion engineering. If needed, a qualified specialist should review the site conditions and evaluate the corrosion potential of the site soil to the proposed improvements and to provide the appropriate corrosion mitigations for the project.

Expansive Soils

The near surface site soils have an expansion index of 41-58, which correlates to a low to medium expansion potential.

Shrinkage/Bulking

Removal and recompaction of the near surface soils (topsoil/colluvium) is estimated to result in shrinkage ranging from 10 to 15 percent. Removal and recompaction of the bedrock is estimated to result in bulking ranging from 0 to 5 percent.

Excavatability of Onsite Bedrock

The major portion of the proposed excavation is expected to be within bedrock. This material is expected to be excavatable by conventional earth-moving equipment. It is anticipated that, within the expected depth of excavation, no blasting will be required; However, some well cemented discontinuous zones which might require heavy ripping might be encountered during excavation. Zones of well cemented sandstone were encountered in boring BA-1 at depths ranging from 31 to 32 feet, 38 to 41 feet and 48 to 51 feet.

Slabs on Grade

Interior slabs may be supported on grade. The slab should be a minimum of 5-inches thick and reinforced with a minimum of No. 4 rebars at 12-inches on center. The slabs shall be supported on a minimum of three feet of engineered fill. All the interior slabs should be underlain by a minimum of fifteen- (15) mil thick Visqueen vapor barrier with all laps sealed. Two (2) inches of sand should be placed over the membrane as well as under the membrane. The subgrade material should be compacted to a minimum of 95 percent of the maximum laboratory dry density (ASTM 1557). Prior to placement of concrete, the subgrade soils should be well moistened to at least optimum moisture content to a depth of 18 inches. The slab should also be designed in accordance with 2019 CBC to include the expansive nature of the soil.

The structural details, such as slab thickness, concrete strength, amount and type of reinforcements, joint spacing, etc., should be established by the structural engineer.

Depending on the location of the building footprint, the slab may be underlain by a differential fill thickness. As such, consideration should be given to the use of a post-tensioned slab or interior grade beams to limit differential movement. Geotechnical recommendations can be provided upon request.

Flatwork Design

Flatwork should be a minimum of 4-inches thick should be reinforced with a minimum of No. 3 reinforcing bar on 12-inch centers in two horizontally perpendicular directions. Reinforcing should be properly supported to ensure placement near the vertical midpoint of the slab. "Hooking" of the reinforcement is not considered an acceptable method of positioning the steel. The slab should not be structurally connected to the buildings. The actual thickness, reinforcement, and spacing of control joints of the slab shall be designed by the structural engineer and should include the anticipated loading condition. The subgrade material should be compacted to a minimum of 95 percent of the maximum laboratory dry density (ASTM 1557) to a minimum depth of 12-inches. Prior to placement of concrete, the subgrade soils should be well moistened to at least optimum moisture content and verified by our field representative.

Site Development Recommendations

General

During earthwork construction, all site preparation and the general procedures of the contractor should be observed, and the fill selectively tested by a representative of TGR. If unusual or unexpected conditions are exposed in the field, they should be reviewed by this office and if warranted, modified and/or additional recommendations will be offered.

Grading

All grading should conform to the guidelines presented in the Appendix E, California Building Code (2019 edition), except where specifically superseded in the text of this report. Prior to grading, TGR's representative should be present at the pre-construction meeting to provide grading guidelines, if needed, and review any earthwork.

Site Preparation

Prior to initiating grading operations, any existing vegetation, debris, oversized materials (greater than 4 inches), and other deleterious materials within fill areas should be removed.

Surficial Soil Removals

The existing fill, topsoil, colluvium and weathered bedrock materials should be removed to expose competent bedrock as directed by the project geotechnical engineer or engineering geologist. Based on our subsurface exploration the upper approximately 3 to 9 feet of onsite materials will require removal. The actual removal depths should be determined in the field as conditions are exposed.

Treatment of Removal Bottoms

Soils exposed within areas approved for fill placement should be scarified to a depth of 6 inches, conditioned to near-optimum moisture content, then compacted in-place to project standards.

Fill Placement

The onsite soils may be used as compacted fill provided, they are free or organic materials and debris. Fills should be placed in relatively thin lifts, brought to near optimum moisture content, then compacted to at least 95 percent relative compaction based on laboratory standard ASTM D-1557.

Compaction

Prior to fill placement, the exposed surface should be scarified to a minimum depth of six (6) inches, fill placed in six (6) inches loose lifts, moisture conditioned to at least optimum moisture content, and compacted to a minimum relative compaction of ninety-five (95) percent in accordance with ASTM D 1557.

Fill Slopes

Permanent fill slopes should be constructed no steeper than 2H:1V and keyed and benched into approved bedrock materials. A minimum relative compaction of 95 percent out to the finish slope face for fill slopes is required. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment, or by any other procedure which produces the required compaction.

The fill slopes shall have a subdrain system. Vertical spacing, outlet spacing, pipe and filter material should be in accordance with the recommendations presented in Appendix E – Earthwork and Grading Guidelines, Typical Stabilization and Buttress Fill Subdrain Detail.

Fill Keys and Benching

Fill keys should be constructed at the toe of the fill slope at the southeast portion of the site near the site entrance off Fairmont Blvd. See Plate 1, Geotechnical Map, for proposed fill key locations. The fill keys should have a minimum width of 25 feet and a minimum depth of 5 feet into competent bedrock. All fill keys should be observed and approved by the project geotechnical consultant prior to placing fill. Fills placed on slopes steeper than 5H:1V should be keyed and benched into competent bedrock as the fills are placed. See Appendix E. Earthwork and grading Guidelines (Typical Fill over Natural Slope detail) for benching recommendations.

Cut Slopes

The proposed cut slope located in the west-southwest portion of the site is anticipated to expose bedrock with bedding favorable to slope stability. As such, this slope is anticipated to be grossly stable. The cut slope should be observed during excavation to verify that existing conditions are consistent with those anticipated. If adverse bedrock conditions are encountered, appropriate remedial recommendations shall be provided by the geotechnical consultant.

Cut/Fill Transition

The building pad will have a cut/fill transition. Typical recommendations for over-excavation of the cut portion of the cut/fill transition are presented in Appendix E, Earthwork and grading Guidelines (Typical Overexcavation of Daylight Line detail). However, due to the anticipated differential pad fill thickness, TGR recommends that the cut portion of the cut fill transition be overexcavated a minimum of 10 feet below pad grade.

Trenching

All excavations should conform to CAL-OSHA and local safety codes.

Drainage

Positive site drainage should be maintained at all times. Drainage should not flow uncontrolled down any descending slope or retaining wall. Water should be directed away from foundations and not allowed to pond and/or seep into the ground. Pad drainage should be directed towards the street/parking or other approved area. Roof gutters and down spouts should be utilized to control roof drainage. Down spouts should outlet a minimum of 5 feet from the proposed structure or into an approved subsurface drainage system. We would recommend that any proposed open-bottom planters adjacent to proposed structures be eliminated for a minimum distance of 10 feet. As an alternative, closed-bottom type planters could be utilized. An outlet placed in the bottom of the planter could be installed to direct drainage away from structures or any exterior concrete flatwork.

Utility Trench Backfill

All utility trench backfills in structural areas and beneath hardscape features should be brought to at least optimum moisture content and compacted to a minimum relative compaction of 90 percent of the laboratory standard. Flooding/jetting is not recommended.

Sand backfill, (unless trench excavation material), should not be allowed in parallel exterior trenches adjacent to and within an area extending below a 1:1 plane projected from the outside bottom edge of the footing. All trench excavations should minimally conform to CAL-OSHA and local safety codes. Soils generated from utility trench excavations may be used provided it is moisture conditioned and compacted to 90 percent minimum relative compaction.

Temporary Excavation Recommendations

Soils may be cut vertically without shoring to a depth of approximately four (4) feet below adjacent grade. For deeper cuts, the slopes should be properly shored or sloped back to at least 1H:1V or flatter. The exposed slope face should be kept moist (but not saturated) during construction to reduce local sloughing. No surcharge loads should be permitted within a horizontal distance equal to the height of cut from the toe of excavation unless the cut is properly shored. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of any nearby adjacent existing site facilities should be properly shored to maintain foundation support for the adjacent structures.

Preventative Slope Maintenance

For the slopes, it is important to reduce the risk of problems relating to slope instability. It is recommended that a program be implemented for aggressive slope maintenance to include; annual cleanout of drains, elimination of burrowing rodents, maintaining drought and fire resistant, deep-rooted ground cover, and proper irrigation.

Hillside properties are typically subject to potential geotechnical hazards including mudslides, spalling of slopes, erosion, and concentrated flows. It must be emphasized that responsible maintenance of these slopes, and the property in general, by the owner, using proper methods, can reduce the risk of these hazards significantly.

Geotechnical Review of Plans

All grading and foundation plans should be reviewed and accepted by the geotechnical consultant prior to construction. If significant time elapses since preparation of this report, the geotechnical consultant should verify the current site conditions, and provide any additional recommendations (if necessary) prior to construction.

Geotechnical Observation/Testing During Construction

Per sections 1705.6 and table 1705.6 of the 2019 California Building Code, periodic special inspection shall be performed to:

- Verify materials below shallow foundations are adequate to achieve the design bearing capacity;
- Verify excavations are extended to the proper depth and have reached proper material;
- Verify classification and test compacted materials; and
- Prior to placement of compacted fill, inspect subgrade and verify that the site has been prepared properly

Per sections 1705.6 and table 1705.6 of the 2019 California Building Code, continuous special inspection shall be performed to:

- Verify use of proper materials, densities and lift thickness during placement and compaction of compacted fill.

The geotechnical consultant should also perform observation and/or testing at the following stages:

- During any grading and fill placement;
- Prior to pouring foundation or flatwork concrete;
- During trench excavation;
- Excavation bottom;
- Placement of bedding material;
- During trench backfill;
- Subgrade for flatwork;
- When any unusual soil conditions are encountered during any construction operation subsequent to issuance of this report.

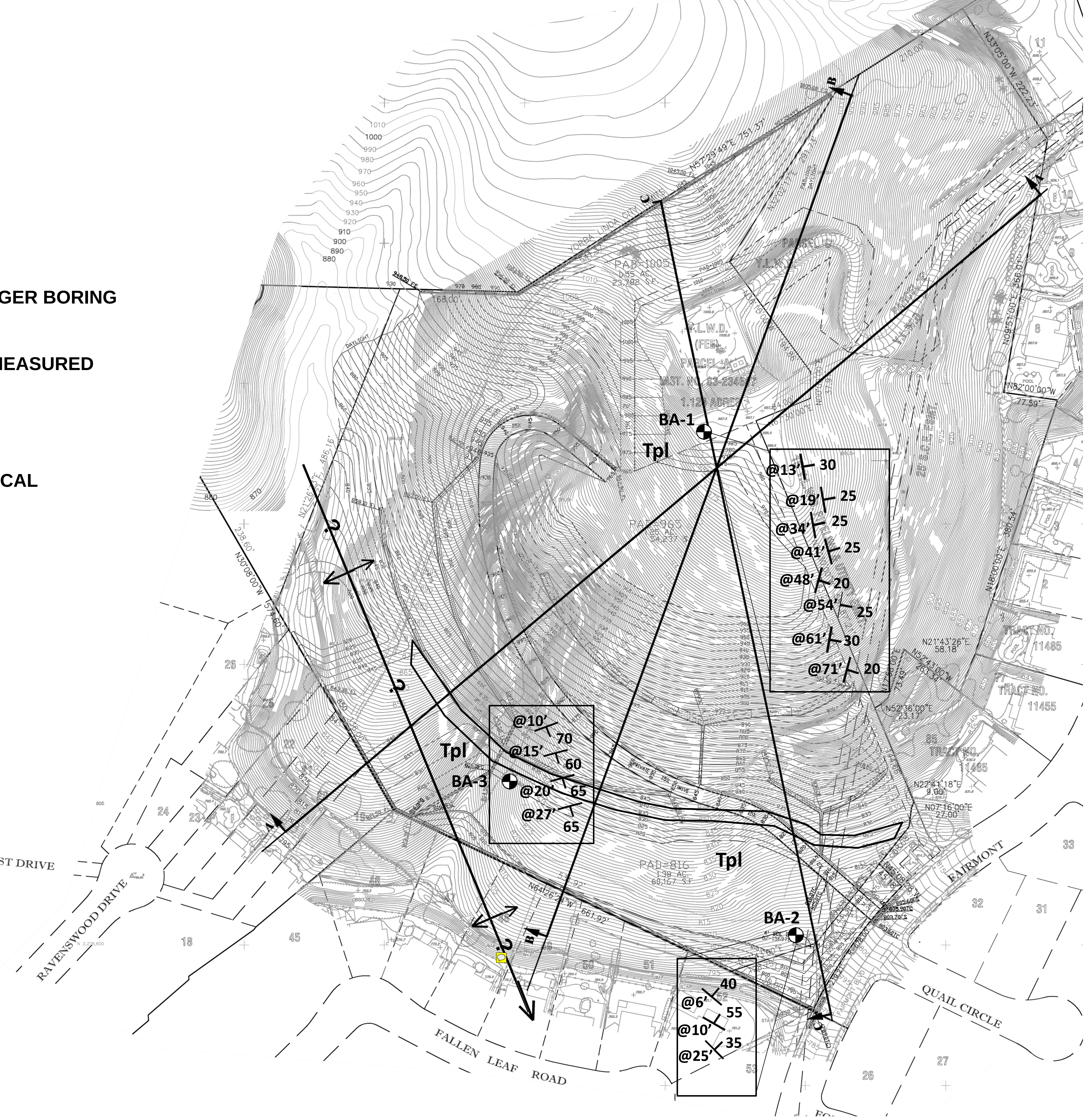
Limitations

This report was prepared for a specific client and a specific project, based on the client's needs, directions and requirements at the time.

This report was necessarily based in part upon data obtained from a limited number of observances, site visits, soil and/or other samples, tests, analyses, histories of occurrences, spaced subsurface exploration and limited information on historical events and observations. Such information is necessarily incomplete. Variations can be experienced within small distances and under various climatic conditions. Changes in subsurface conditions can and do occur over time.

This report is not authorized for use by and is not to be relied upon by any party except the client with whom TGR contracted for the work. Use or reliance on this report by any other party is that party's sole risk. Unauthorized use of or reliance on this report constitutes and agreement to defend and indemnify TGR from and against any liability which may arise as a result of such use or reliance, regardless of any fault, negligence, or strict liability of TGR.

PRELIMINARY GRADING PLAN
TENTATIVE PARCEL MAP NO. 2020-125



EXPLANATION:

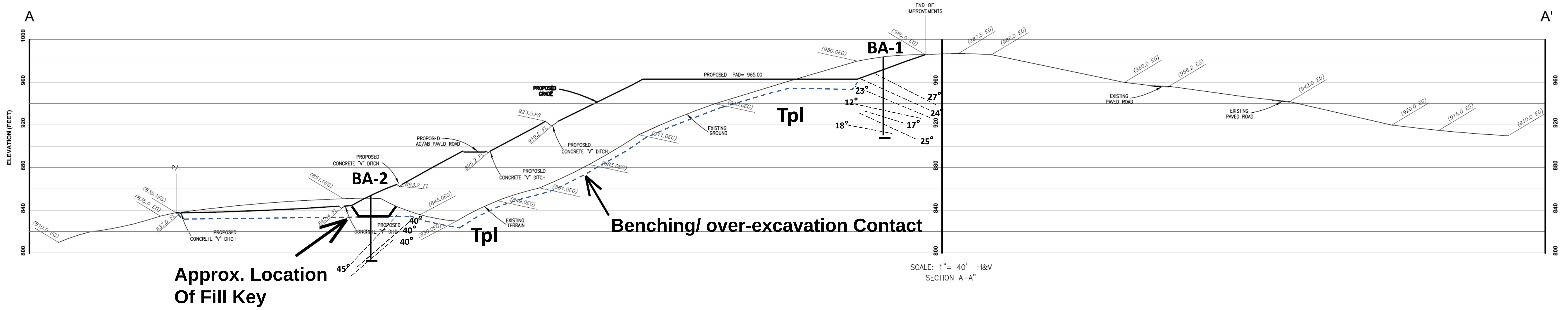
BA-1	APPROXIMATE LOCATION OF BUCKET AUGER BORING BY TGR
@10' 25	STRIKE AND DIP OF BEDDING, At DEPTH MEASURED
	ANTICLINAL FOLD AXIS
	APPROXIMATE LOCATION OF GEOTECHNICAL BORINGS
Tpl	PUENTE FORMATION, SILTY SANDSTONE
	APPROXIMATE LOCATION OF FILL KEY

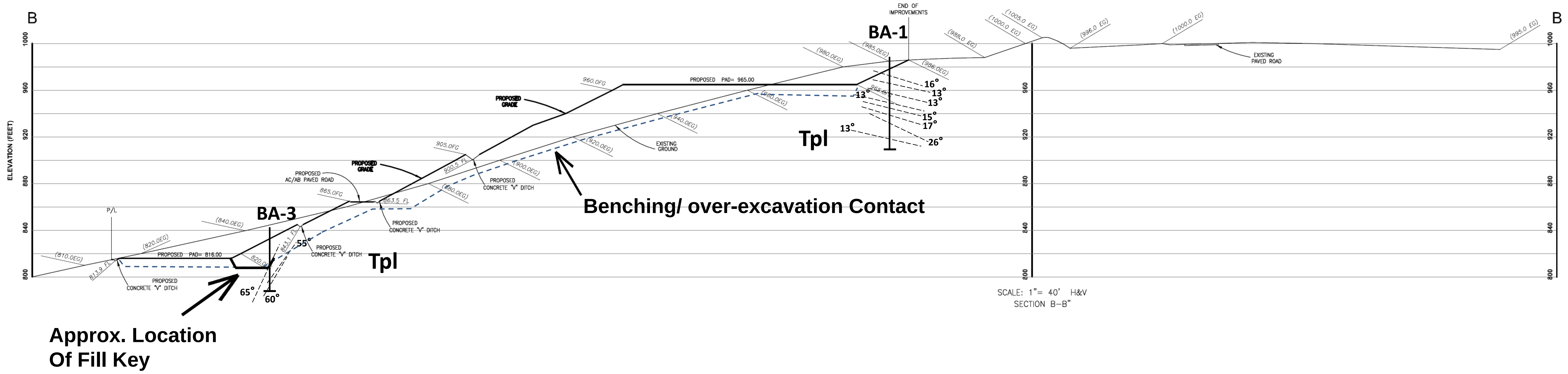
TGR Geotechnical Environmental Hydrogeology Material Testing Construction Inspection

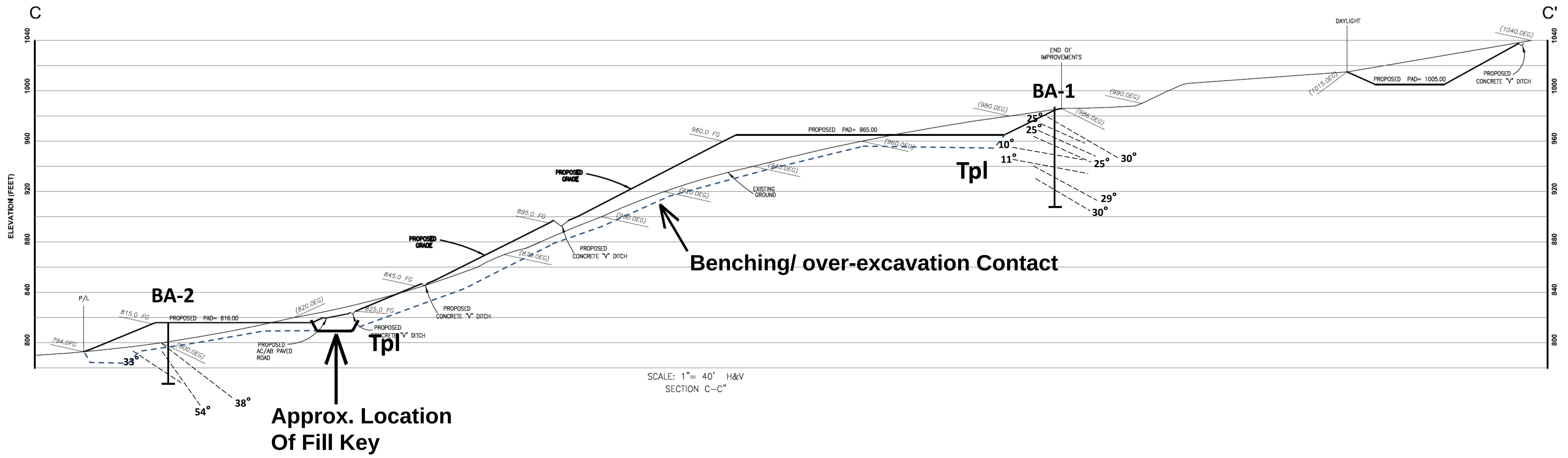
GEOTECHNICAL MAP
HOFF PROPERTY, FAIRMONT BOULEVARD
YORBA LINDA, CALIFORNIA

PROJECT NO. 20-7009

PLATE 1





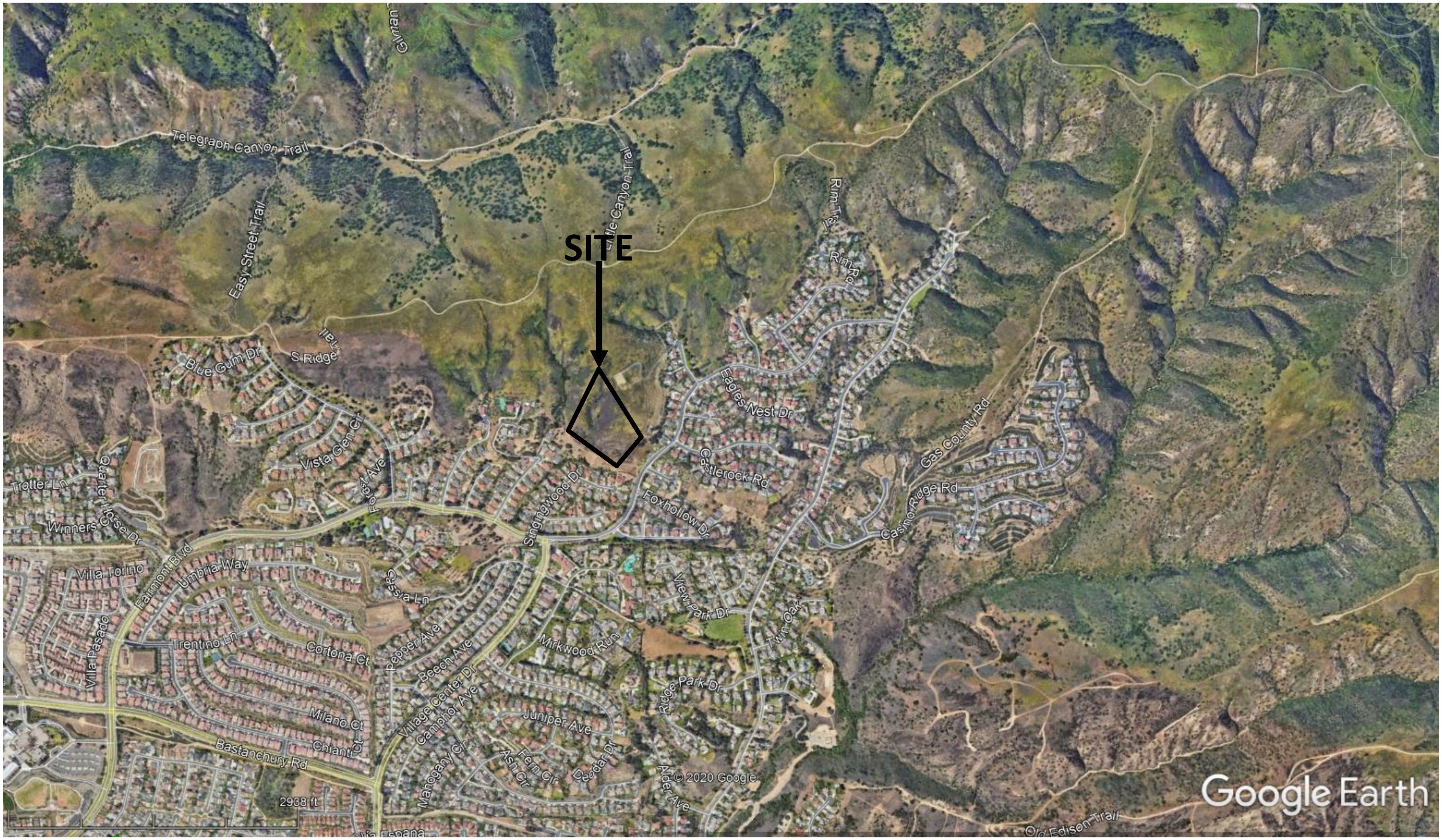


SEE PLATE 1 FOR EXPLANATION

GEOTECHNICAL CROSS-SECTIONS
HOFF PROPERTY, FAIRMONT BOULEVARD
YORBA LINDA, CALIFORNIA

PROJECT NO. 20-7009

PLATE 2



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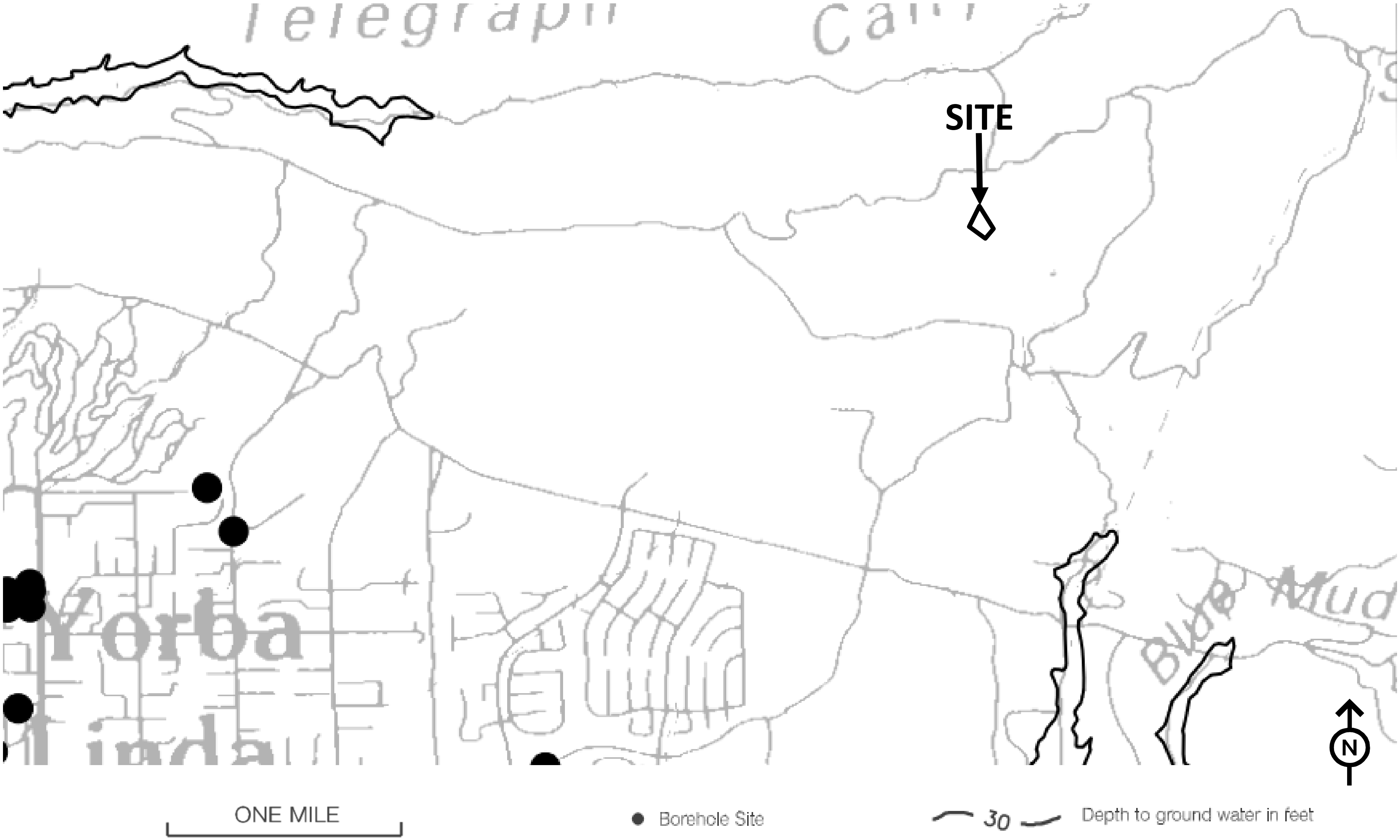
SITE LOCATION MAP
HOFF PROPERTY
FAIRMONT BOULEVARD, YORBA LINDA, CALIFORNIA

PROJECT NO. 20-7009

FIGURE 1



Modified From: California Department of Conservation, Division of Mines and Geology, 2005, Seismic Hazard Zone Report for the Yorba Linda 7.5-Minute Quadrangles, Los Angeles, Orange and San Bernardino Counties, California, Report 010.

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HISTORIC HIGH GROUNDWATER MAP
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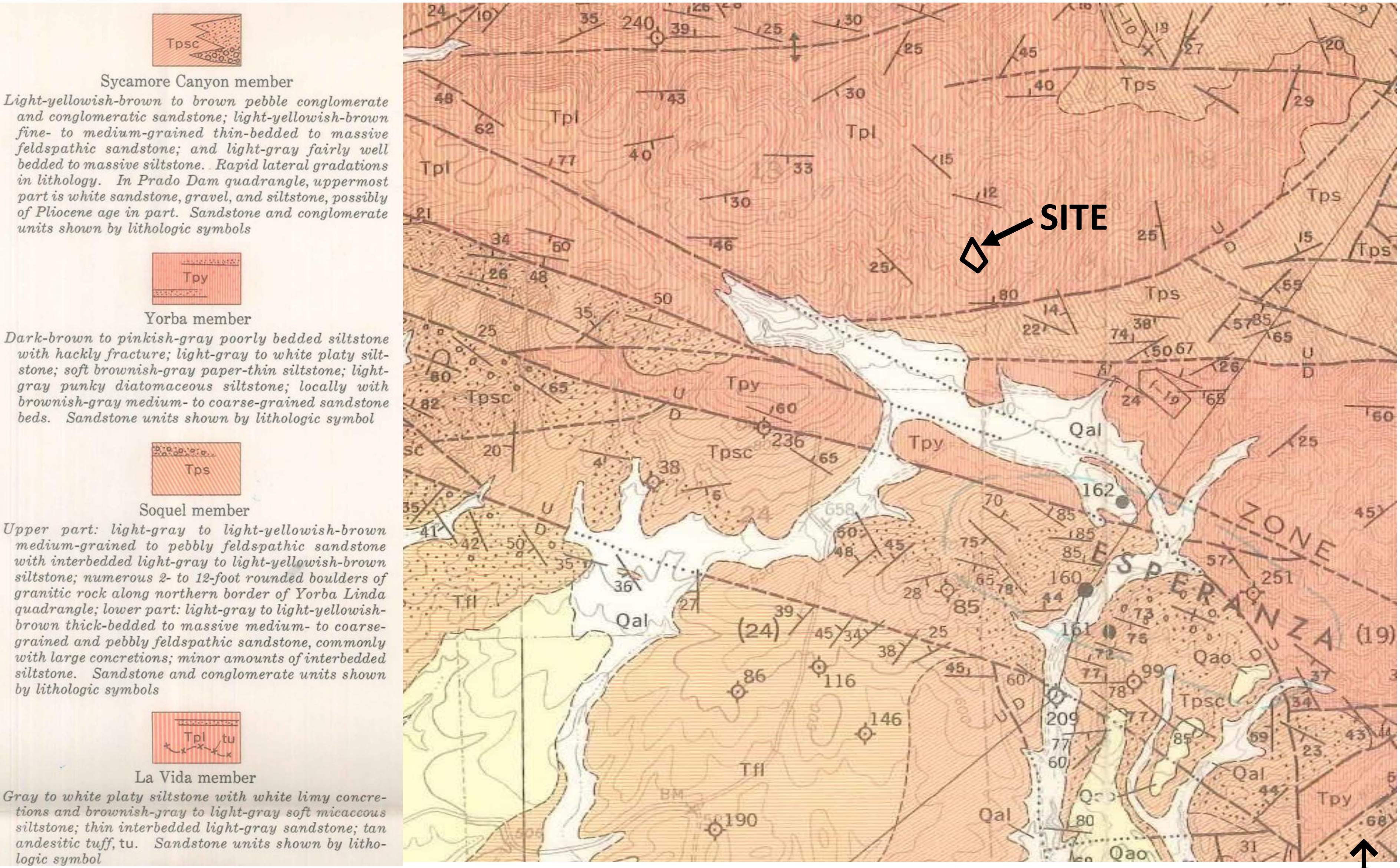
PROJECT NO. 20-7009

FIGURE 2



Sycamore Canyon member

Light-yellowish-brown to brown pebble conglomerate and conglomeratic sandstone; light-yellowish-brown fine- to medium-grained thin-bedded to massive feldspathic sandstone; and light-gray fairly well bedded to massive siltstone. Rapid lateral gradations in lithology. In Prado Dam quadrangle, uppermost part is white sandstone, gravel, and siltstone, possibly of Pliocene age in part. Sandstone and conglomerate units shown by lithologic symbols

Yorba member

Dark-brown to pinkish-gray poorly bedded siltstone with hackly fracture; light-gray to white platy siltstone; soft brownish-gray paper-thin siltstone; light-gray punky diatomaceous siltstone; locally with brownish-gray medium- to coarse-grained sandstone beds. Sandstone units shown by lithologic symbol

Soquel member

Upper part: light-gray to light-yellowish-brown medium-grained to pebbly feldspathic sandstone with interbedded light-gray to light-yellowish-brown siltstone; numerous 2- to 12-foot rounded boulders of granitic rock along northern border of Yorba Linda quadrangle; lower part: light-gray to light-yellowish-brown thick-bedded to massive medium- to coarse-grained and pebbly feldspathic sandstone, commonly with large concretions; minor amounts of interbedded siltstone. Sandstone and conglomerate units shown by lithologic symbols

La Vida member

Gray to white platy siltstone with white limy concretions and brownish-gray to light-gray soft micaceous siltstone; thin interbedded light-gray sandstone; tan andesitic tuff, tu. Sandstone units shown by lithologic symbol

D.L. Durham and R.F. Yerkes, Geologic map of the Prado Dam and Yorba Linda (eastern Puente Hills), Los Angeles, Orange, Riverside and San Bernardino Counties, California: U.S. Department of the Interior Geological Survey, Professional Paper 420-B, Plate 1, scale 1:24,000.

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REGIONAL GEOLOGY MAP
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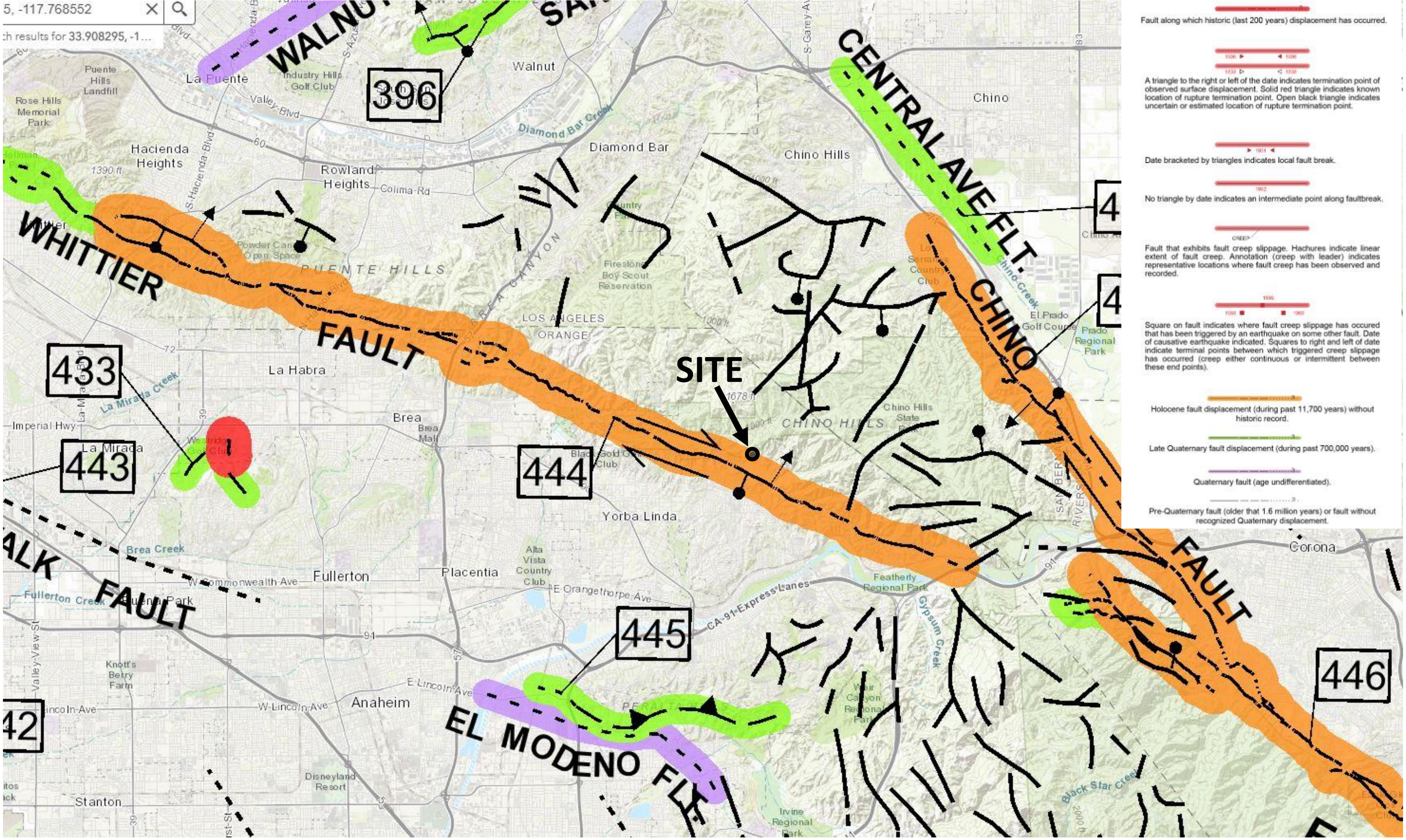
FAIRMONT BOULEVARD, YORBA LINDA, CALIFORNIA

PROJECT NO. 19-6969

FIGURE 3



Modified From: Jennings, C. W., 2010, Fault Activity Map of California and Adjacent Areas, California Division of Mines and Geology, Geologic Data Map Series, No. 6, Scale 1:750,000.

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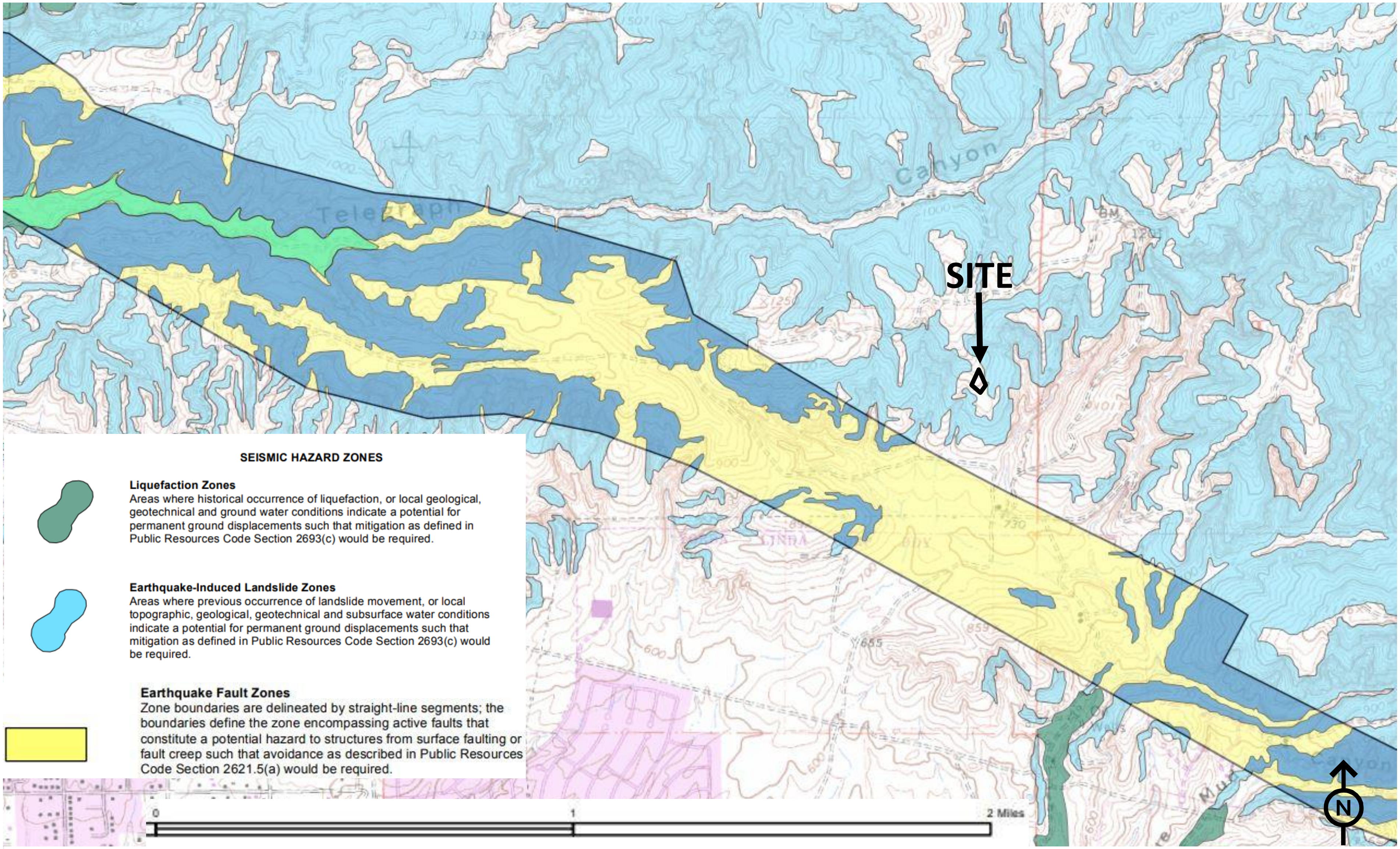
REGIONAL FAULT MAP
HOFF PROPERTY
FAIRMONT BOULEVARD, YORBA LINDA, CALIFORNIA

PROJECT NO. 20-7009

FIGURE 4



SEISMIC HAZARD ZONES

Liquefaction Zones
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.

Earthquake-Induced Landslide Zones
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.

Earthquake Fault Zones
Zone boundaries are delineated by straight-line segments; the boundaries define the zone encompassing active faults that constitute a potential hazard to structures from surface faulting or fault creep such that avoidance as described in Public Resources Code Section 2621.5(a) would be required.

Modified From: State of California Division of Mines and Geology, Earthquake Zones of Required Investigation, Yorba Linda Quadrangle Released December 4, 2015, scale 1:24,000

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SEISMIC HAZARD ZONE MAP
HOFF PROPERTY
FAIRMONT BOULEVARD, YORBA LINDA, CALIFORNIA

PROJECT NO. 20-7009

FIGURE 5

APPENDIX A
REFERENCES

APPENDIX A

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Fault Activity Map of California, 2010, California Geological Survey, Geologic Data Map No. 6 Compilation and Interpretation by: Charles W. Jennings and William A. Bryant, Graphics by: Milind Patel, Ellen Sander, Jim Thompson, Barbara Wanish and Milton Fonseca

APPENDIX B
LOG OF BORINGS

THE FOLLOWING DESCRIBES THE TERMS AND SYMBOLS USED ON THE LOG OF BORINGS TO SUMMARIZE THE RESULTS OBTAINED IN THE FIELD INVESTIGATION AND SUBSEQUENT LABORATORY TESTING.

DENSITY AND CONSISTENCY

The consistency of fine grained soils and the density of coarse grained soils are described on the basis of the Standard Penetration Test as follows:

COARSE GRAINED SOILS		**Estimated Unconfined Compressive Strength (Tsf)**	**FINE GRAINED SOILS**	
Very Loose	< 4	< 0.25	Very soft	< 2
Loose	4 – 10	0.35 – 0.50	Soft	2 – 4
Medium	10 – 30	0.50 – 1.0	Firm (medium)	4 – 8
Dense	30 – 50	1.0 – 2.0	Stiff	8 – 15
Very dense	> 50	2.0 – 4.0	Very stiff	15 – 30
		> 4.0	Hard	> 30

PARTICULE SIZE DEFINITION (As per ASTM D2487 And D422)

Boulder	⇒ Larger than 12 inches	Coarse Sands	⇒ No. 10 to No. 4 sieve
Cobbles	⇒ 3 to 12 inches	Medium Sands	⇒ No. 40 to No. 10 sieve
Coarse Gravel	⇒ 3/4 to 3 inches	Fine Sands	⇒ No. 200 to 40 sieve
Fine Gravel	⇒ No. 4 to 3/4 inches	Silt	⇒ 5µm to No. 200 sieve
		Clay	⇒ Smaller than 5µm

SOIL CLASSIFICATION

Soils and bedrock are classified and described based on their engineering properties and characteristics and using ASTM D2487 and D2488.

Percentage description of minor components

Trace	1-10 %	Some	20-35 %
Little	10-20 %	And or y	35-50 %

Stratified soils description

Parting	0 to 1/16 inch thick	Layer	½ to 12 inches thick
Seam	1/16 to ½ inch thick	Stratum	> 12 inches thick

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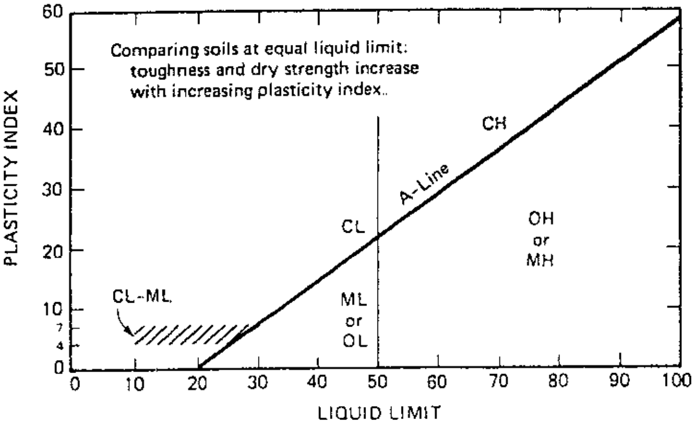
LOG OF BORING EXPLANATION

Page 1 of 2

PLATE 1

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS	CLASSIFICATION CRITERIA
			GRAPH	LETTER		
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)	▨	GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 4$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3
			▨	GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	Not meeting all above requirements
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	▨	GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES	Atterberg limits below "A" line or $I_p<4$
			▨	GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES	Atterberg limits above "A" line or $I_p>7$
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)	▨	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 6$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3
			▨	SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES	Not meeting all above requirements
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	▨	SM	SILTY SANDS, SAND - SILT MIXTURES	Atterberg limits below "A" line or $I_p<4$
			▨	SC	CLAYEY SANDS, SAND - CLAY MIXTURES	Atterberg limits above "A" line or $I_p>7$
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50	▨	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	$W_L < 50$
			▨	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	$W_L < 30$
			▨	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	$W_L < 50$
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50	▨	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS	$W_L > 50$
			▨	CH	INORGANIC CLAYS OF HIGH PLASTICITY	$W_L > 50$
			▨	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	$W_L > 50$
HIGHLY ORGANIC SOILS			▨	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	Strong color or odor and often fibrous texture



LABORATORY TEST DESIGNATIONS

BR	Bearing Ration	PP	Pocket Penetrometer
C	Consolidation	R	R-Value
COR	Corrosion Test	S	Direct Shear
Chl	Water Soluble Chlorides	SA	Sieve Analysis
EI	Expansive Index	SE	Sand Equivalent
ER	Electrical Resistivity	Sg	Specific Gravity
K	Permeability	SO_4	Water Soluble Sulfates
MC	Moisture Content	SV	Shear Vane
OC	Organic Content	TC	Triaxial Compression
PH	PH Test	UC	Unconfined Compression

ADDITIONAL SOIL CLASSIFICATION

▨	▨	▨	▨
Fill	Ss Sandstone	Ms Siltstone	Bdr Bedrock

PARTICLE SIZE LIMITS

SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

NO. 200 NO. 40 NO. 10 NO. 4 ¾ in. 3 in. (12 in.)

U. S. STANDARD SIEVE SIZE

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LOG OF BORING EXPLANATION

Page 2 of 2

PLATE 1

LOG OF EXPLORATORY BORING BA-1

Sheet **1** of **3**

Project Number:	**20-7009**	Logged By:	**ELB**
Project Name:	**Hoff Property, Yorba Linda**	Project Engineer:	**SG**
Date Drilled:	**4/20/20 - 4/20/20**	Drill Type:	**Bucket Auger**
Ground Elev:		Drive Wt & Drop:	**140lbs / 30in**

■ Shelby Tube ☒ Standard Split Spoon ◉ No recovery

⧓ Modified California ▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS Moisture Content (%)	Dry Density, (pcf)	Other Tests
0		▬					Fill/ Slopewash/ Colluvium: Sandy Silt- brown, moist, loose			
3		▬								EI, Sulfate Max, Remolded Shear
9							BEDROCK: Puente Formation(Tpl)- Silty Sandstone- light brown-tan, slightly moist, medium dense, upper 5 feet highly weathered, bedrock contact N70W, 15SW, moderately fractured, orange oxidation			
10			⧓	2				20	109	
13							@13': Sandstone and siltstone beds, bedding attitude- N10W, 30NE			
15							@15: increase from medium dense to dense			
19							@19': bedding attitude- N10W, 25NE			
20			⧓	2			@20': Silty Sandstone- light brown to tan, slightly moist, dense, moderately fractured, orange oxidation	20	105	
25										
30			⧓	4			@30': bedding attitude- N10E, 20SE	21	107	Shear
31							@ 31-32'- well cemented sandstone layer			
34							@34': Sandstone and siltstone beds- moderately fractured, dense, moderately oxidized, bedding attitude- N10W, 25NE			

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 2

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING BA-1

Sheet **2** of **3**

Project Number: **20-7009**
Project Name: **Hoff Property, Yorba Linda**
Date Drilled: **4/20/20 - 4/20/20**
Ground Elev:

Logged By: **ELB**
Project Engineer: **SG**
Drill Type: **Bucket Auger**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

		FIELD RESULTS						LAB RESULTS		
Depth (ft)	Graphic Log	Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	Moisture Content (%)	Dry Density, (pcf)	Other Tests
							@38-41': Sandstone- well cemented			
40			⧗	9				10	125	
							@41': bedding attitude- N15W, 25NE			
45		▬								EI, Max, Remolded Shear
							@48-51': Sandstone layer- well cemented, gypsum along fractures, bedding attitude @ 48'- N15E, 20SE			
50			⧗	12				18	117	Shear
							@54': bedding attitude- N10E, 25SE			
55										
							@56': Siltstone- gray to dark gray, slightly moist, hard, minor fracturing, minor oxidation, gypsum along fracture, bedding			
60			⧗	22				14	115	Shear
							@61': bedding attitude- N10W, 30NE			
65							---increase in hardness			

PLATE 3

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING BA-1

Sheet **3** of **3**

Project Number: **20-7009**
Project Name: **Hoff Property, Yorba Linda**
Date Drilled: **4/20/20 - 4/20/20**
Ground Elev:
Logged By: **ELB**
Project Engineer: **SG**
Drill Type: **Bucket Auger**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧓ Modified California
▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS					SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS		
		Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS		Moisture Content (%)	Dry Density, (pcf)	Other Tests
	▨		⧓	23			@71': bedding attitude- N15W, 20NE	11	131	Shear
75							Total Depth: 75' No groundwater No caving Hole backfilled with cuttings Kelly Weight: 0'-25': 3300lbs, 25'-50': 2200lbs, 50'-75': 1100lbs			

PLATE 4

TGR GEOTECHNICAL, INC.

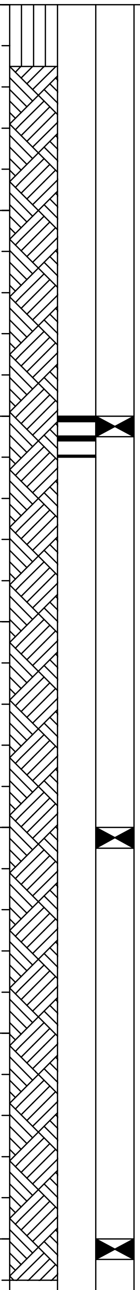
LOG OF EXPLORATORY BORING BA-2

Sheet **1** of **1**

Project Number:	**20-7009**	Logged By:	**ELB**
Project Name:	**Hoff Property, Yorba Linda**	Project Engineer:	**SG**
Date Drilled:	**4/21/20 - 4/21/20**	Drill Type:	**Bucket Auger**
Ground Elev:		Drive Wt & Drop:	**140lbs / 30in**

■ Shelby Tube ☒ Standard Split Spoon ◉ No recovery

⧗ Modified California ▼ Water Table ATD



Depth (ft)	FIELD RESULTS Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS Moisture Content (%)	Dry Density, (pcf)	Other Tests
						Topsoil: Sandy Silt- light brown, moist, loose			
						BEDROCK: Puente Formation(Tpl)- Silty Sandstone- light brown-tan, slightly moist, dense, moderately fractured, orange oxidation			
5									
						@6': bedding attitude- N50W, 40NE			
10	═	⧗	4			@10': Sandstone and siltstone beds, light brown to dark gray, slightly moist, dense, moderately fractured, orange oxidation, bedding attitude- N60W, 55NE	12	115	Max, Remolded Shear
15									
20		⧗	5			............Same as above	13	125	
25						@25': bedding attitude- N45W, 35NE			
30		⧗	10				14	117	
						Total Depth: 31' No Groundwater. No caving. Hole backfilled with cuttings Kelly Weight: 0'-25': 3300lbs, 25'-50': 2200lbs, 50'-75': 1100lbs			

PLATE 5

TGR GEOTECHNICAL, INC.

LOG OF BORING 20-7009 HOFF PROPERTY, YORBA LINDA.GPJ TGR GEOTECH.GDT 5/8/20

LOG OF EXPLORATORY BORING BA-3

Sheet **1** of **1**

Project Number: **20-7009**
Project Name: **Hoff Property, Yorba Linda**
Date Drilled: **4/21/20 - 4/21/20**
Ground Elev:

Logged By: **ELB**
Project Engineer: **SG**
Drill Type: **Bucket Auger**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧓ Modified California
▼ Water Table ATD

Depth (ft)	Graphic Log	Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	Moisture Content (%)	Dry Density, (pcf)	Other Tests
							Topsoil: Sandy Silt- light brown, moist, loose			
5							BEDROCK: Puente Formation(Tpl)- Silty Sandstone- light brown, slightly moist, dense, moderately fractured, orange oxidation			
10			⧓	3			Sandstone- siltstone beds, light brown/tan- light gray/ gray, slightly moist, moderately fractured, orange oxidation, gypsum along bedding, @10': bedding attitude- N70E, 70SE	17	111	
15							@15': bedding attitude- N75E, 60SE			
20			⧓	8/6"			@20': Sandstone, light brown- tan, slightly moist, dense, moderately fractured, orange oxidation, bedding attitude- N75E, 65SE	8	106	
25							@27': Sandstone- siltstone beds, light brown/tan-gray, slightly moist, moderately fractured, orange oxidation, bedding attitude- N75E, 65SE			
30			⧓	9				18	116	
							Total Depth: 31 feet No Ground water. No caving. Hole backfilled with cuttings Kelly Weight: 0'-25': 3300lbs, 25'-50': 2200lbs, 50'-75': 1100lbs			

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 6

TGR GEOTECHNICAL, INC.

APPENDIX C
LABORATORY TEST RESULTS

APPENDIX C

Laboratory Testing Procedures and Results

Moisture and Density Determination Tests: Moisture content and dry density determinations were performed on relatively undisturbed samples obtained from the test borings. The results of these tests are presented in the boring logs. Where applicable, only moisture content was determined from "undisturbed" or disturbed samples.

Maximum Density Tests: The maximum dry density and optimum moisture content of typical materials were determined in accordance with ASTM Test Method D1557. The results of these tests are presented in the test data and in the table below:

Sample Location	Sample Description	Maximum Dry Density (Pcf)	Optimum Moisture Content (%)
BA-1 @ 0-5 feet	Sandy Silt	116.0	15.0
BA-1@ 45 feet	Sandstone	111.0	17.5
BA-2 @ 10 feet	Sandstone and siltstone	108.0	20.0

Direct Shear Tests: Direct shear test was performed on selected remolded and/or undisturbed sample, which was soaked for a minimum of 24 hours under a surcharge equal to the applied normal force during testing. After transfer of the sample to the shear box, and reloading the sample, pore pressures set up in the sample due to the transfer were allowed to dissipate for a period of approximately 1-hour prior to application of shearing force. The sample was tested under various normal loads, a motor-driven, strain-controlled, direct-shear testing apparatus at a strain rate of less than 0.001 to 0.5 inches per minute (depending upon the soil type). The test results are presented in the test data:

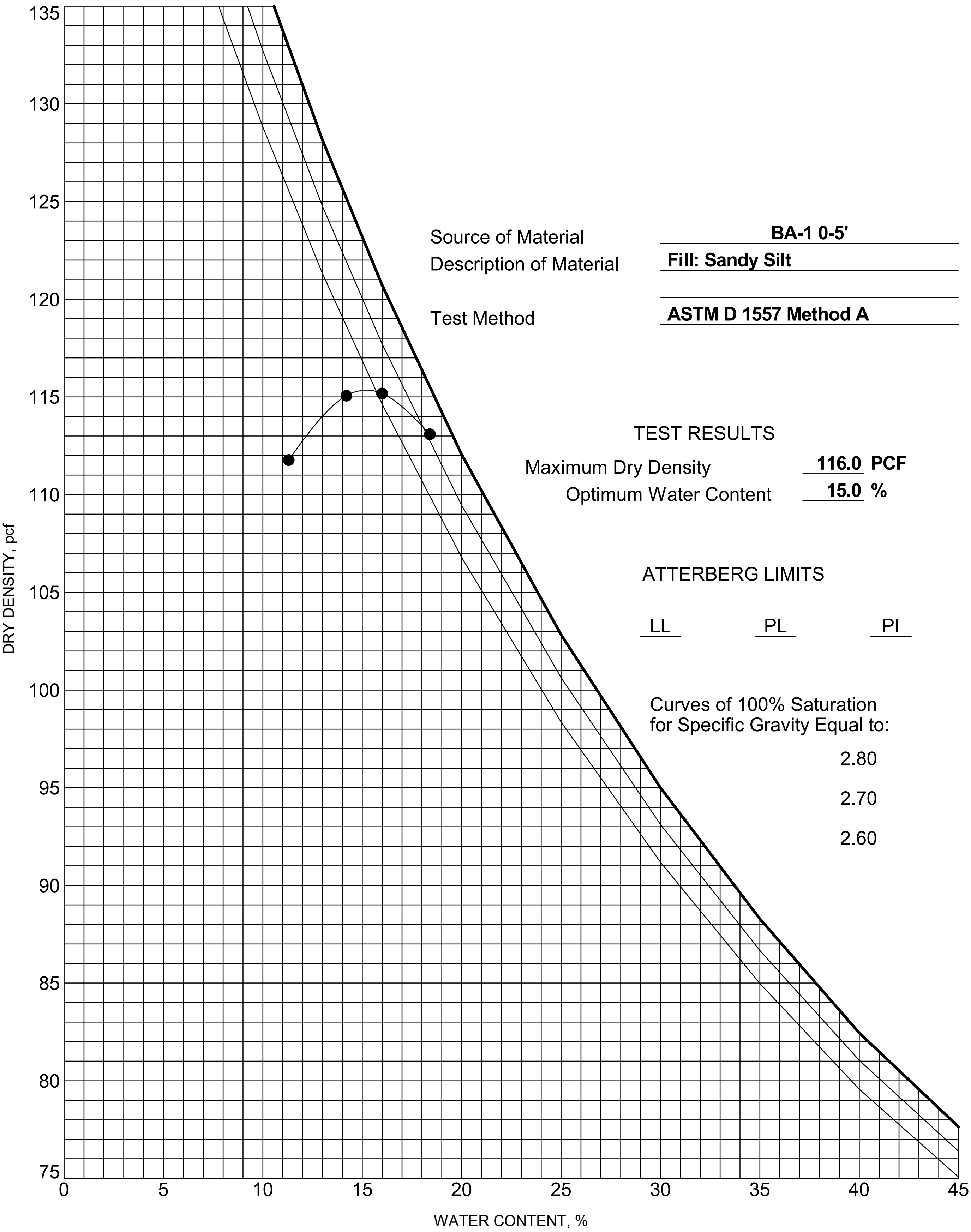
Soluble Sulfates: The soluble sulfate content of selected sample was determined by standard geochemical methods. The test result is presented in the table below:

Sample Location	Sample Description	Water Soluble Sulfate in Soil, (% by Weight)	Sulfate Content (ppm)	Exposure Class*
BA-1 @ 0-5 feet	Sandy Silt	0.0765	765	S0

* Based on the current version of ACI 318-14 Building Code, Table No. 19.3.1.1; Exposure Categories and Classes.

Expansion Index Tests: The expansion potential of selected materials was evaluated by the Expansion Index Test, ASTM D4829. Specimens are molded under a given compactive energy to approximately the optimum moisture content and approximately 50 percent saturation or approximately 90 percent relative compaction. The prepared 1-inch thick by 4-inch diameter specimens are loaded to an equivalent 144 psf surcharge and are inundated with tap water until volumetric equilibrium is reached. The results of these tests are presented in the table below:

Sample Location	Sample Description	Expansion Index	Expansion Potential
BA-1 @ 0-5 feet	Sandy Silt	58	Medium
BA-1 @ 45 feet	Siltstone	41	Low



Source of Material **BA-1 0-5'**

Description of Material **Fill: Sandy Silt**

Test Method **ASTM D 1557 Method A**

TEST RESULTS

Maximum Dry Density **116.0** **PCF**

Optimum Water Content **15.0** **%**

ATTERBERG LIMITS

LL	PL	PI

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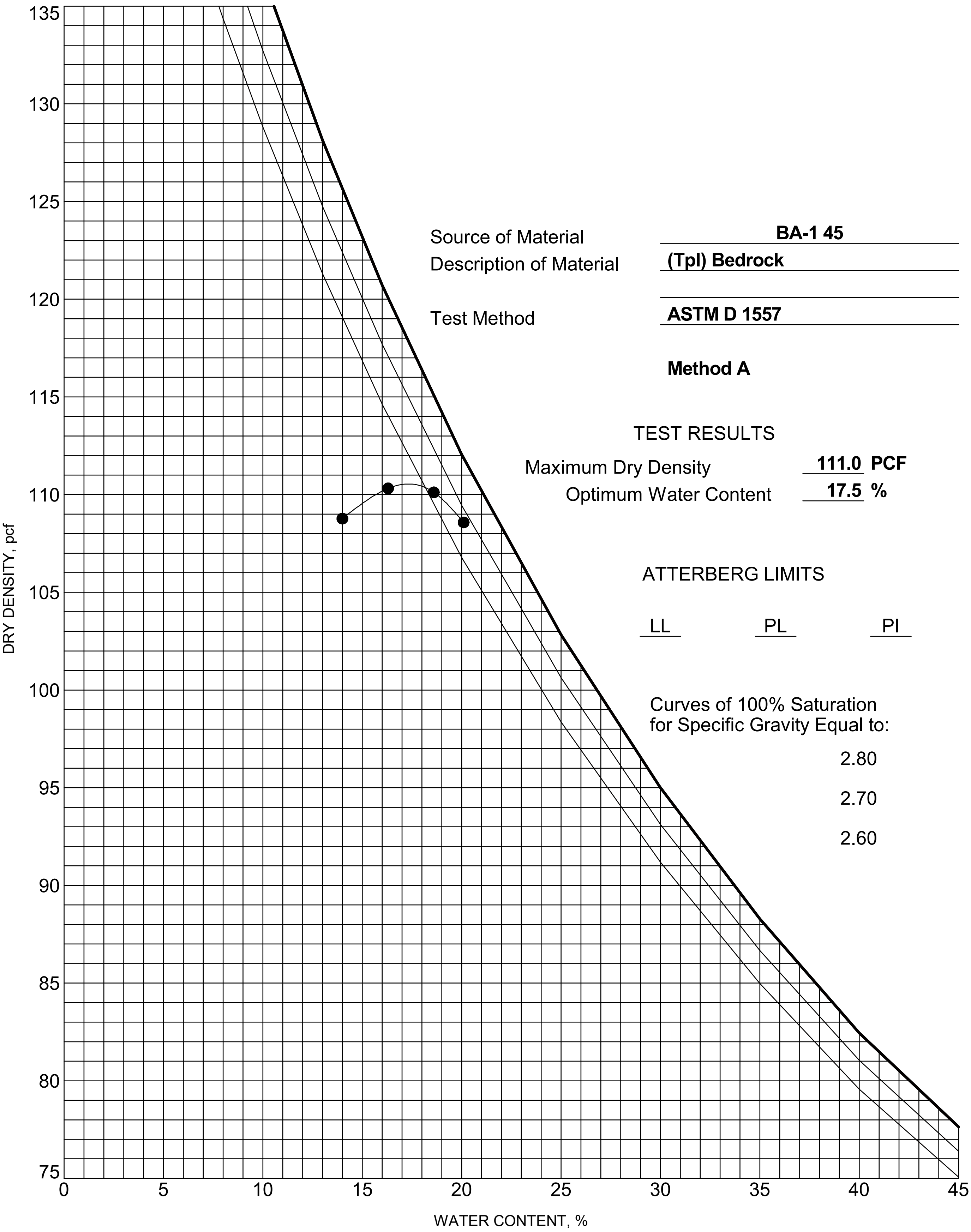
Fax:

MOISTURE-DENSITY RELATIONSHIP

Project Number: 20-7009

Project Name: Hoff Property, Yorba Linda



Source of Material **BA-1 45**

Description of Material **(Tpl) Bedrock**

Test Method **ASTM D 1557**

Method A

TEST RESULTS

Maximum Dry Density **111.0 PCF**

Optimum Water Content **17.5 %**

ATTERBERG LIMITS

LL PL PI

Curves of 100% Saturation
for Specific Gravity Equal to:

US COMPACTION 20-7009 HOFF PROPERTY, YORBA LINDA.GPJ TGR GEOTECH.GDT 5/7/20

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MOISTURE-DENSITY RELATIONSHIP

Project Number: 20-7009

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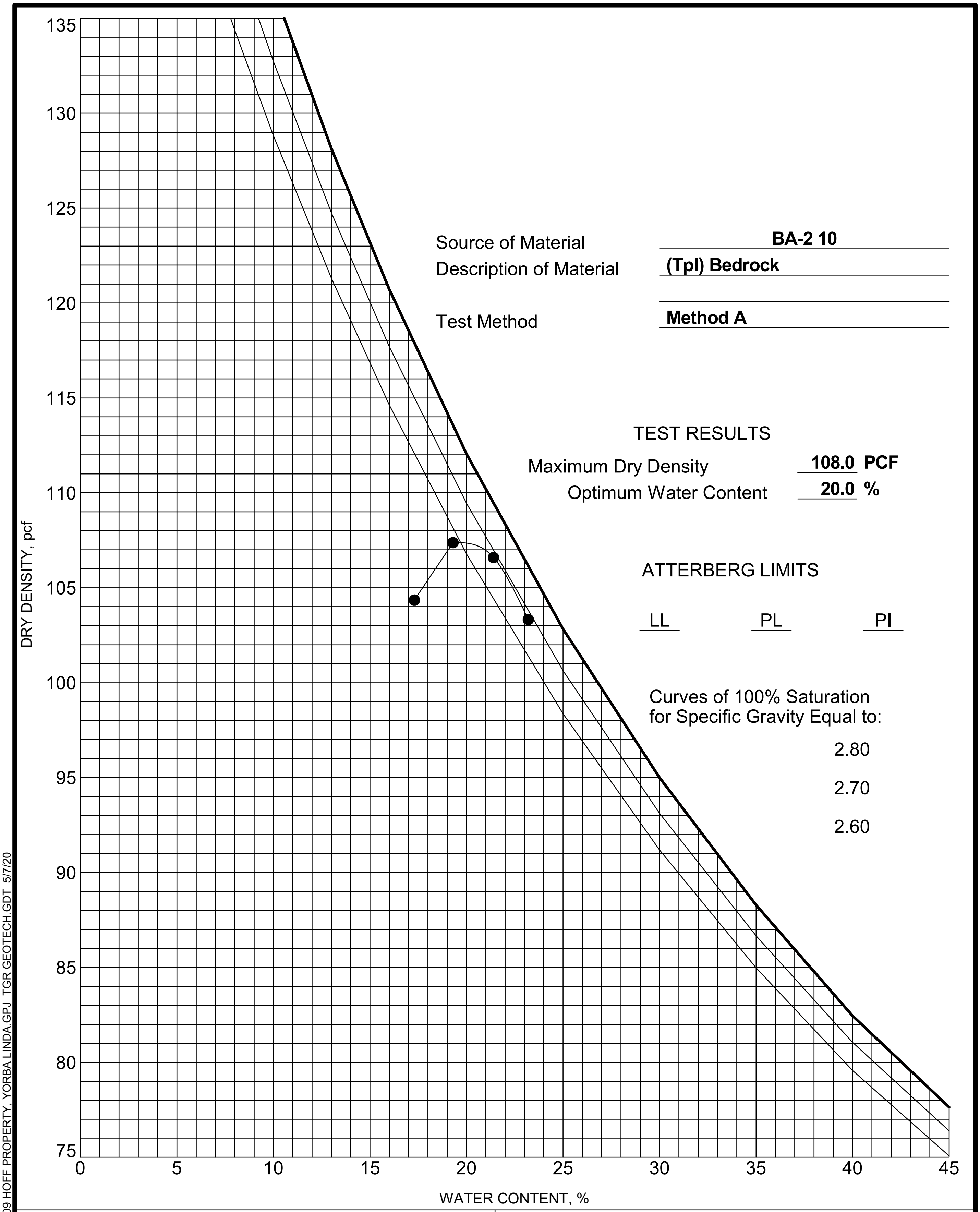

Source of Material **BA-2 10**

Description of Material **(Tpl) Bedrock**

Test Method **Method A**

TEST RESULTS

Maximum Dry Density **108.0** **PCF**

Optimum Water Content **20.0** **%**

ATTERBERG LIMITS

LL	PL	PI

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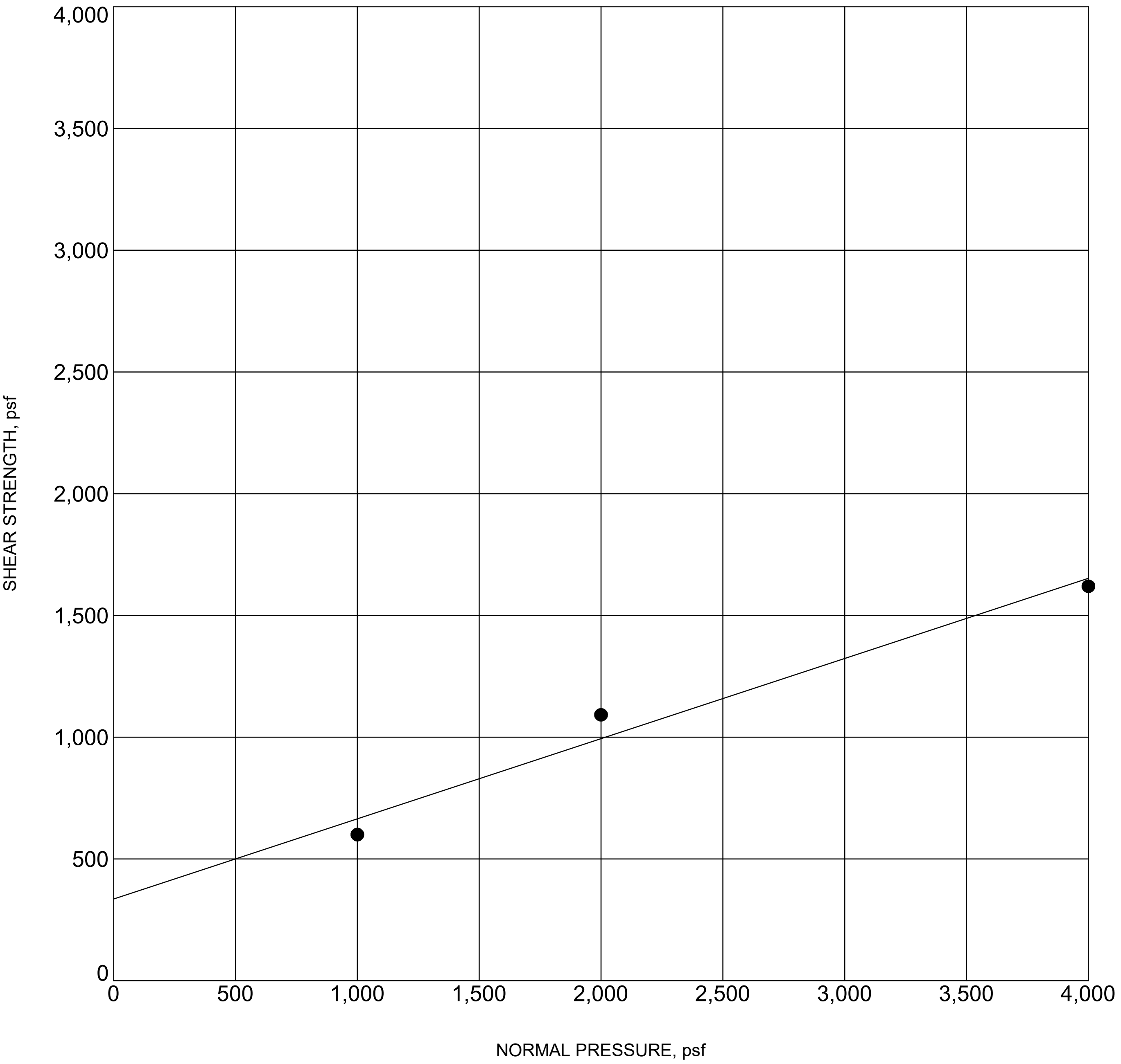
MOISTURE-DENSITY RELATIONSHIP

Project Number: 20-7009

Project Name: Hoff Property, Yorba Linda



Specimen Identification		Classification	γ_d	MC%	c	ϕ
●	**BA-1** **30**	**(Tpl) Bedrock, Resheared, Saturated**	**107**	**21**	**336**	**18**

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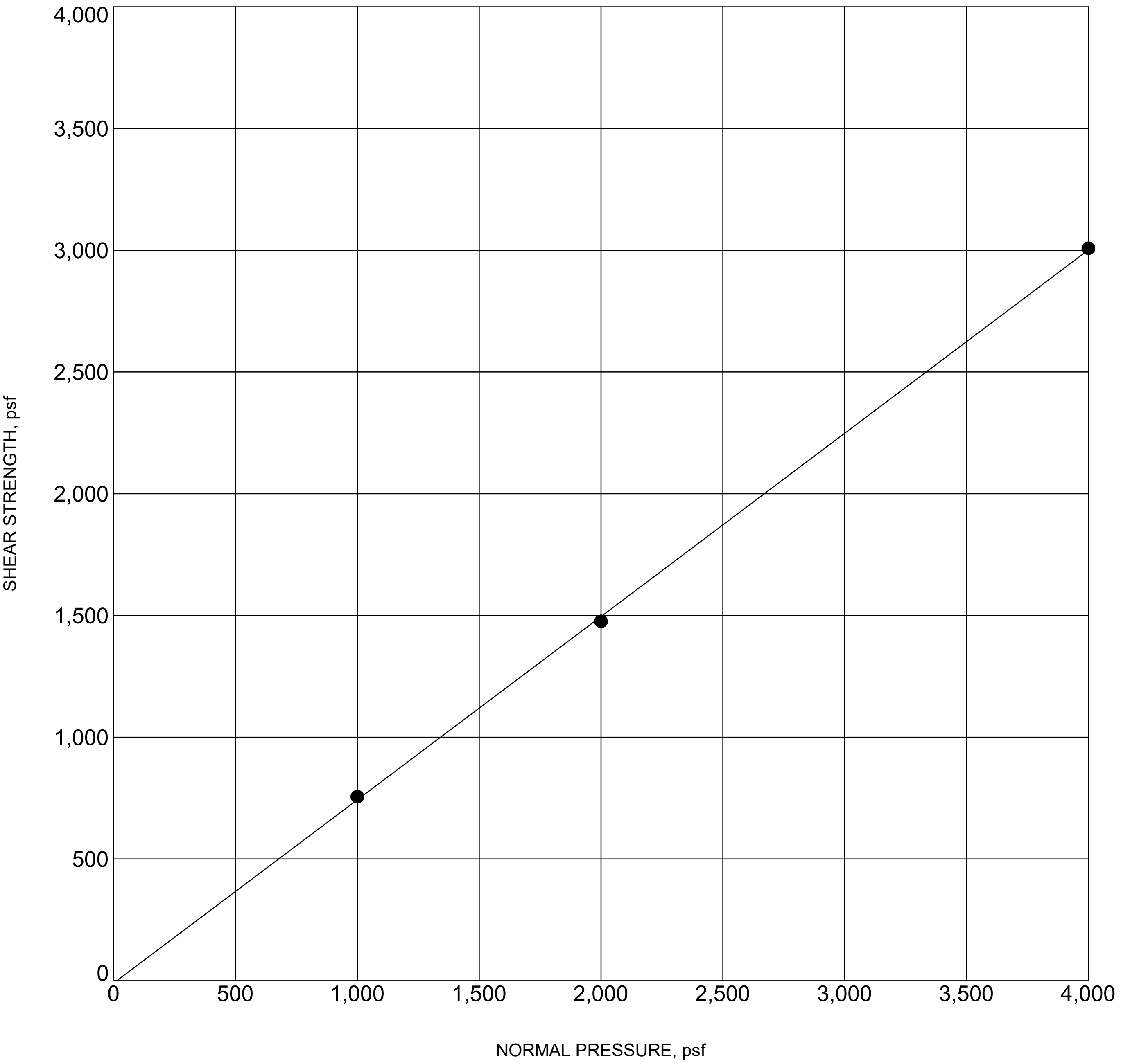
Project Number: 20-7009

Project Name: Hoff Property, Yorba Linda



	Specimen Identification		Classification	γ_d	MC%	c	ϕ
●	**BA-1**	**60**	**(Tpl) Bedrock, Resheared, Saturated**	**115**	**14**	**0**	**37**

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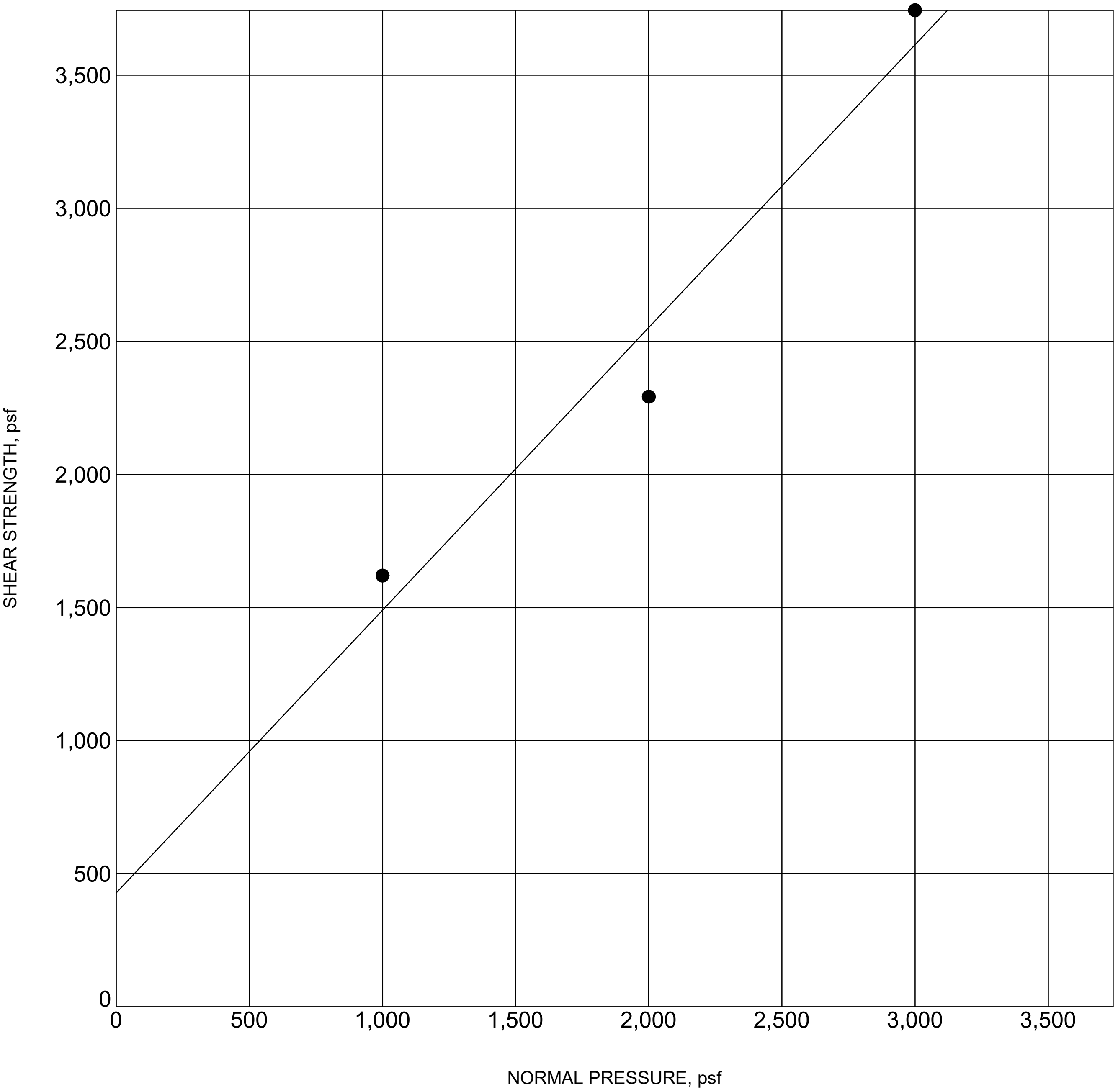
Project Name: Hoff Property, Yorba Linda



	Specimen Identification		Classification	γ_d	MC%	c	ϕ
●	**BA-1**	**60**	**(Tpl) Bedrock, Peak, Saturated**	**115**	**14**	**428**	**47**

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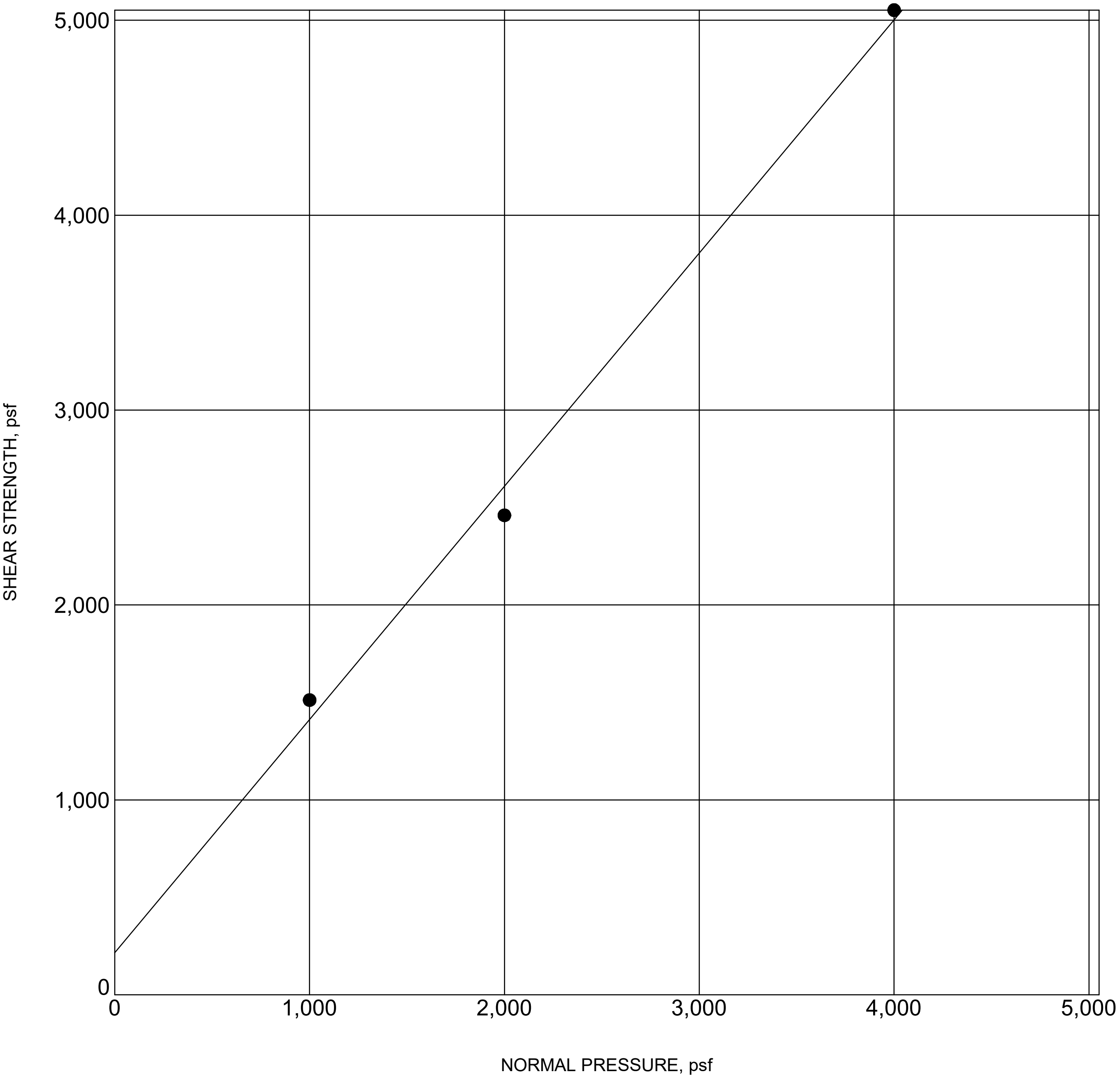

	Specimen Identification		Classification	γ_d	MC%	c	ϕ
●	**BA-1**	**30**	**(Tpl) Bedrock, Peak, Saturated**	**107**	**21**	**216**	**50**

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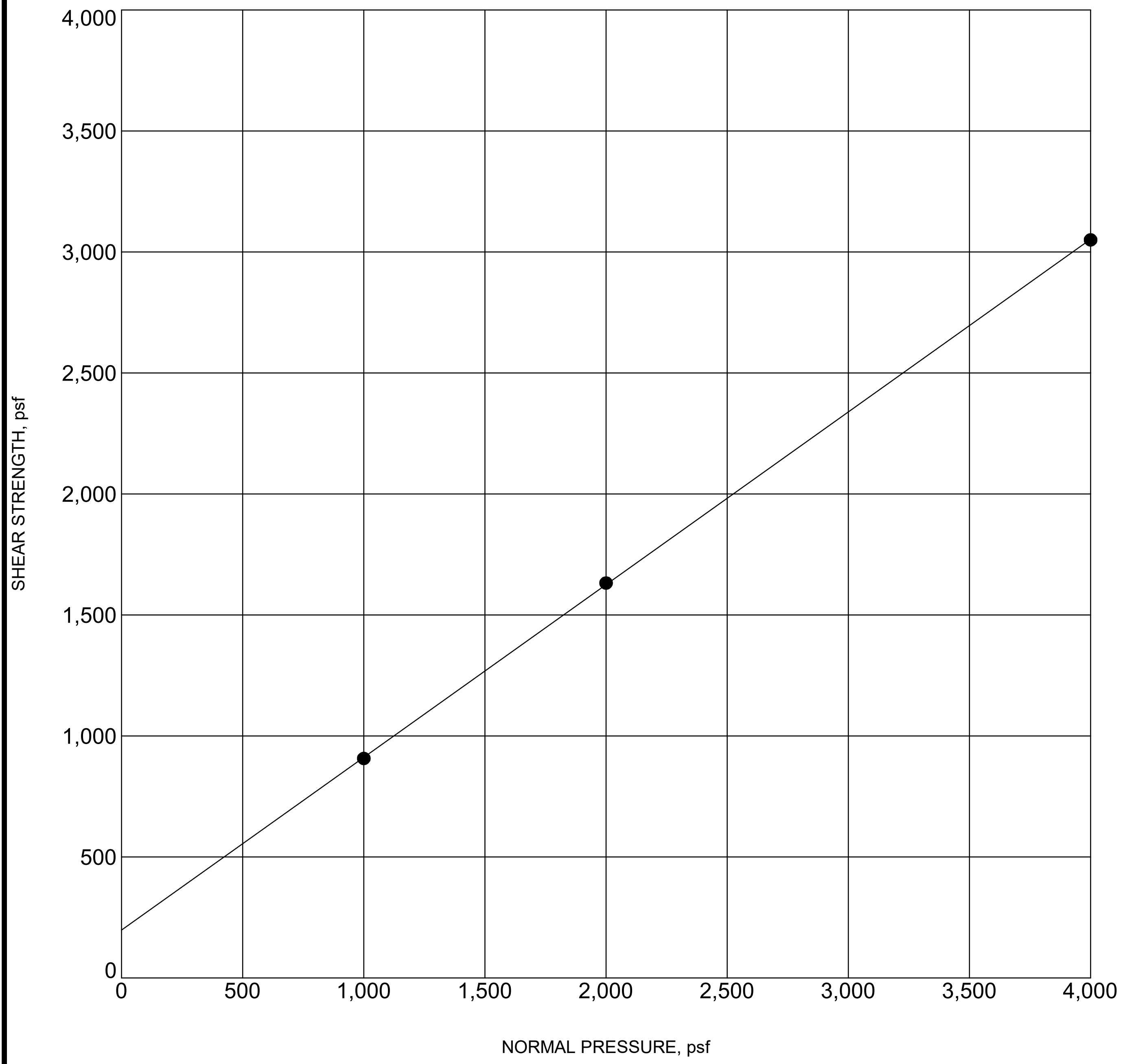

	Specimen Identification	Classification	γ_d	MC%	c	ϕ
●	**BA-1 60**	**(Tpl) Bedrock, Ultimate, Saturated**	**115**	**14**	**198**	**36**

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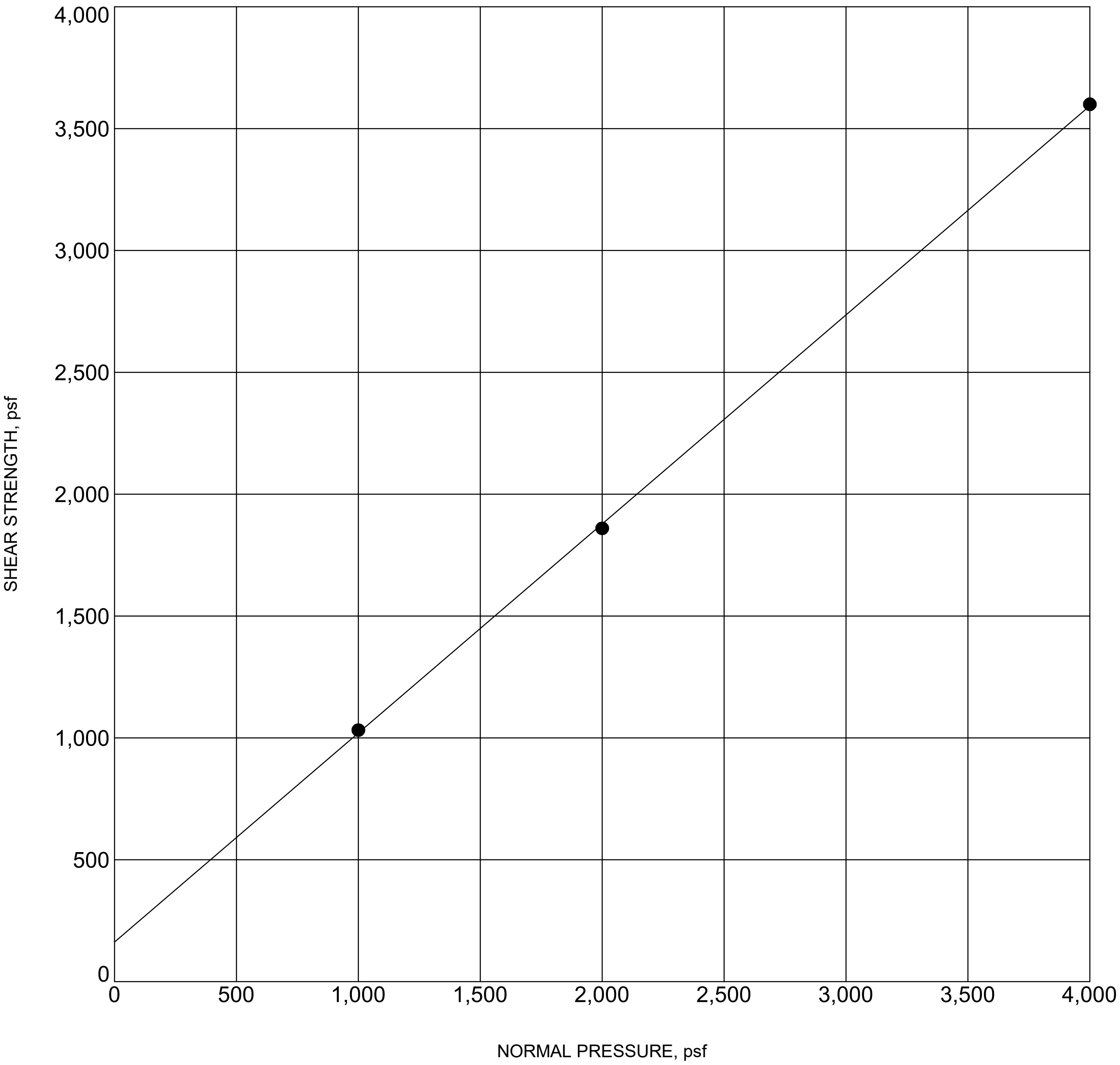

Specimen Identification			Classification	γ_d	MC%	c	ϕ
●	**BA-1**	**30**	**(Tpl) Bedrock, Ultimate, Saturated**	**107**	**21**	**162**	**41**

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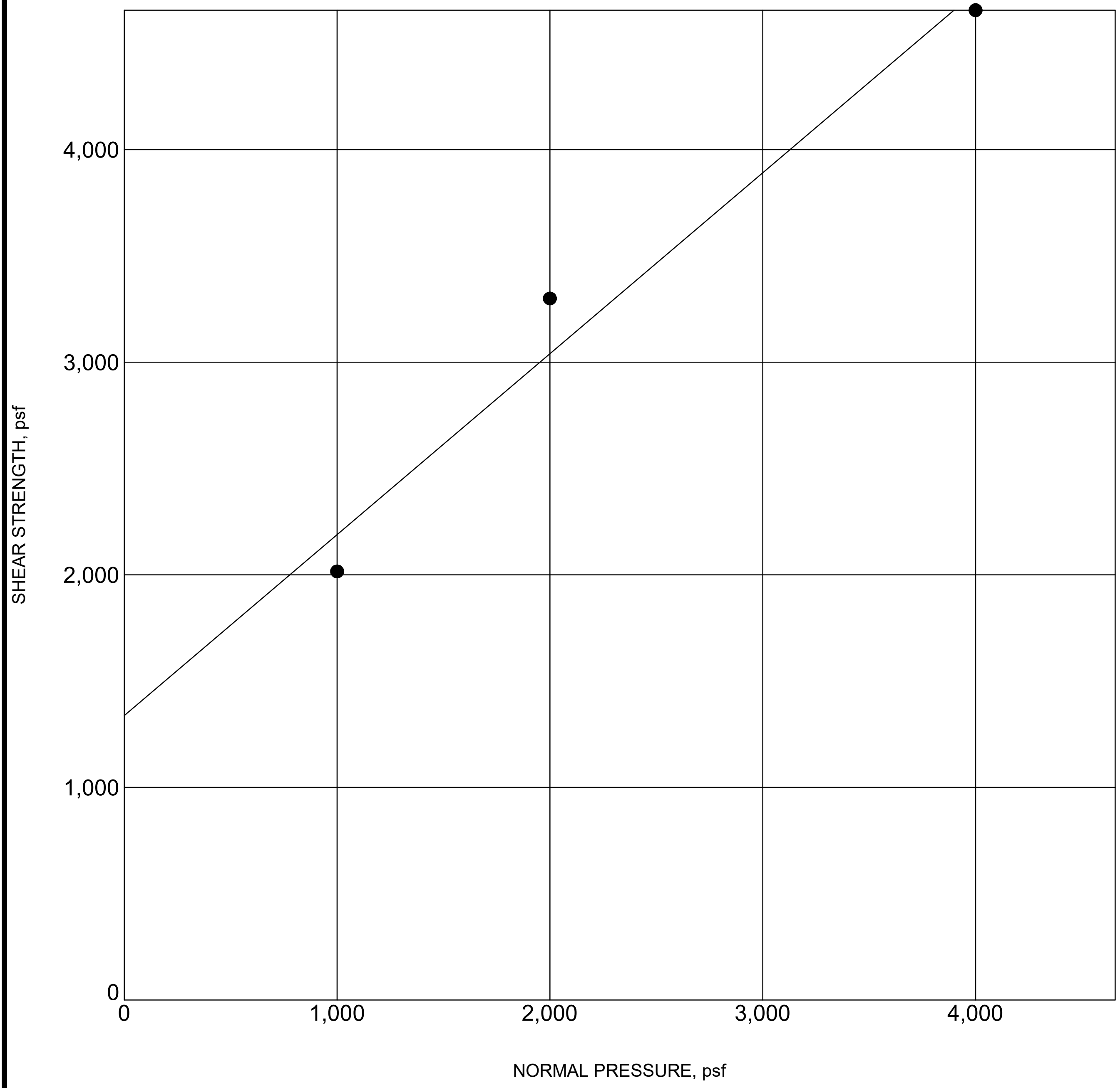

	Specimen Identification		Classification	γ_d	MC%	c	ϕ
●	**BA-1**	**50**	**(Tpl) Bedrock, Peak, Natural**	**117**	**10**	**1338**	**40**

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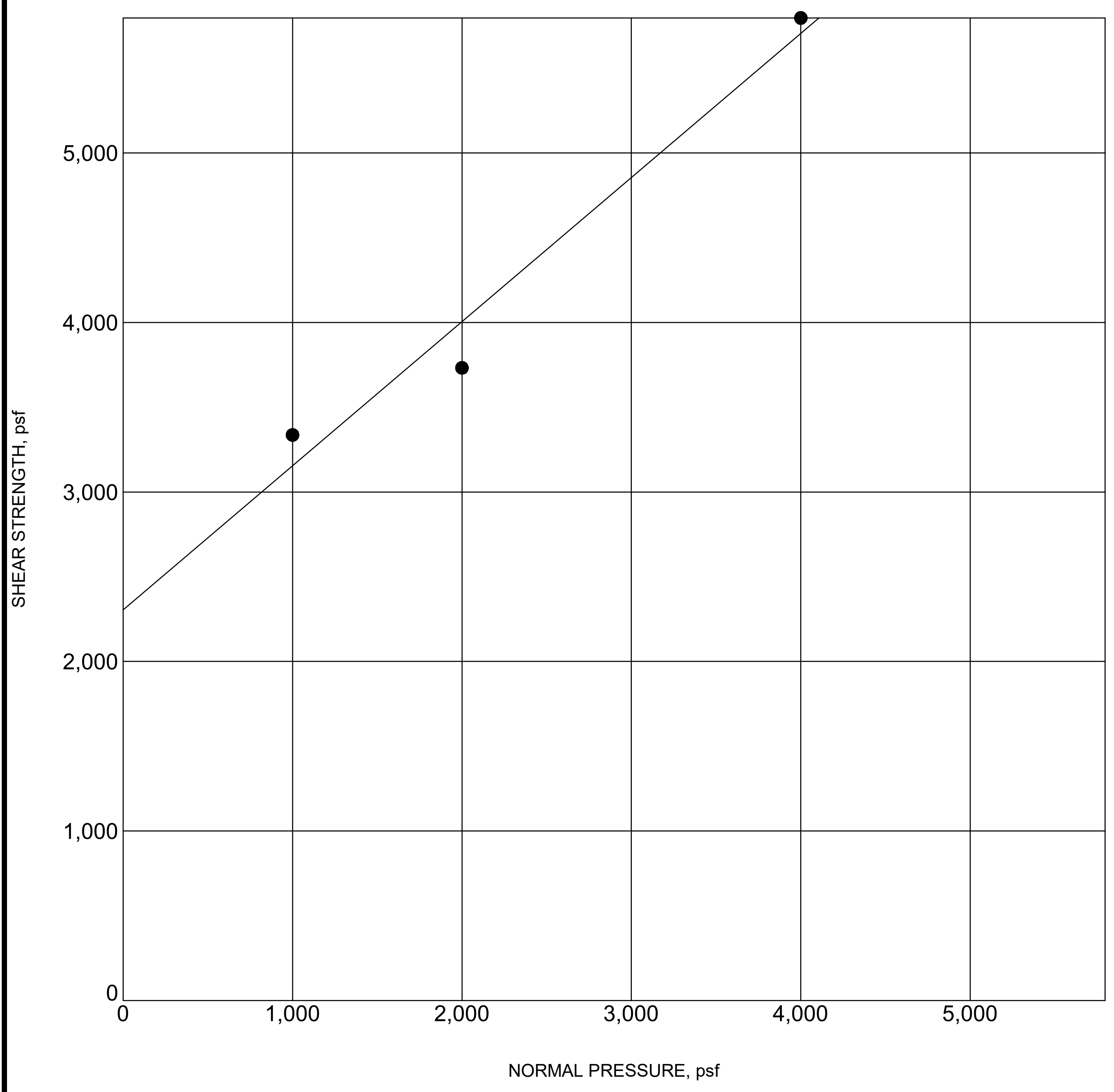

	Specimen Identification		Classification	γ_d	MC%	c	ϕ
●	**BA-1**	**70**	**(Tpl) Bedrock, Peak, Natural**	**131**	**11**	**2304**	**40**

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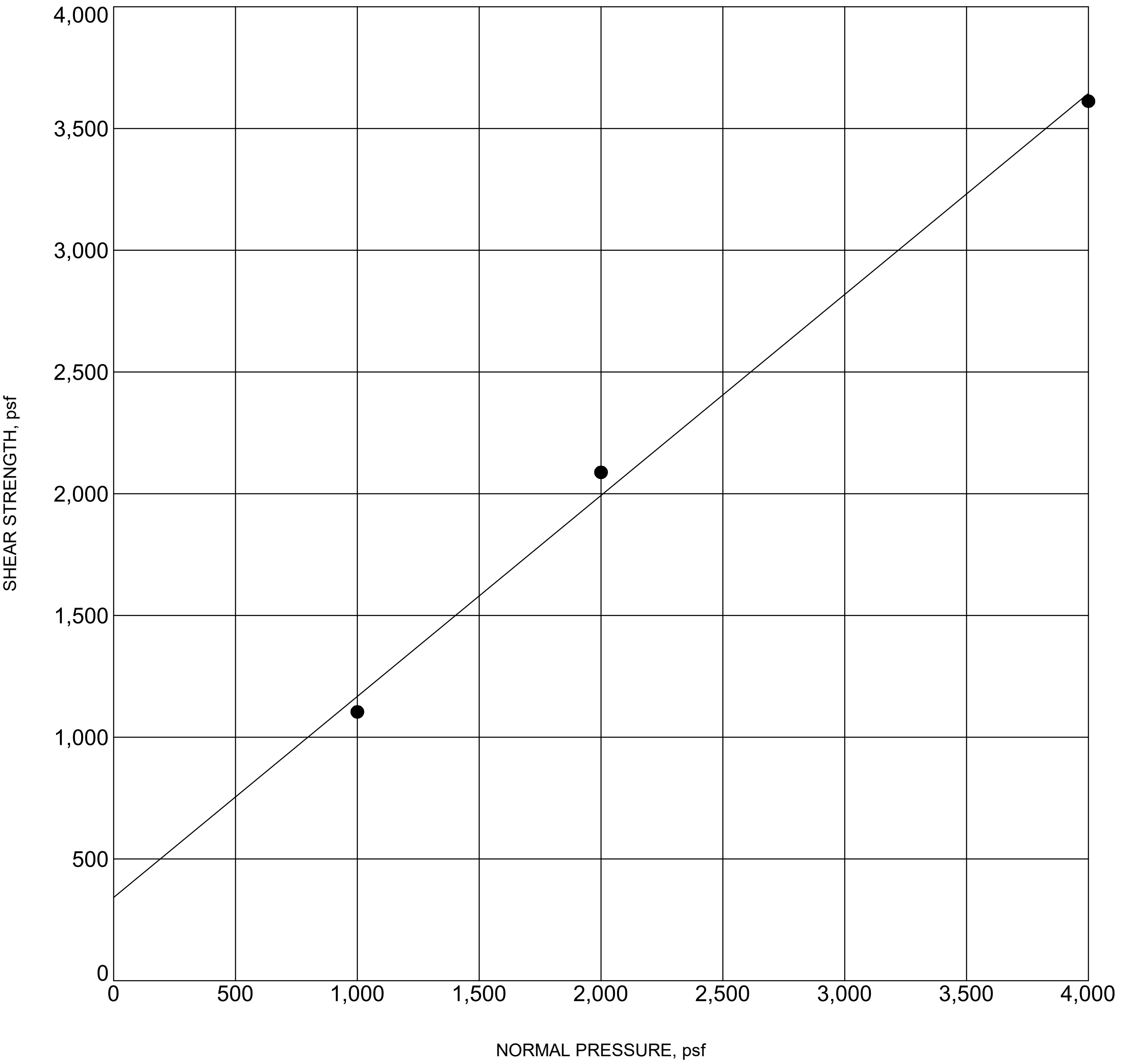
Project Name: Hoff Property, Yorba Linda



	Specimen Identification		Classification	γ_d	MC%	c	ϕ
●	**BA-1**	**50**	**(Tpl) Bedrock, Ultimate, Natural**	**117**	**10**	**342**	**40**

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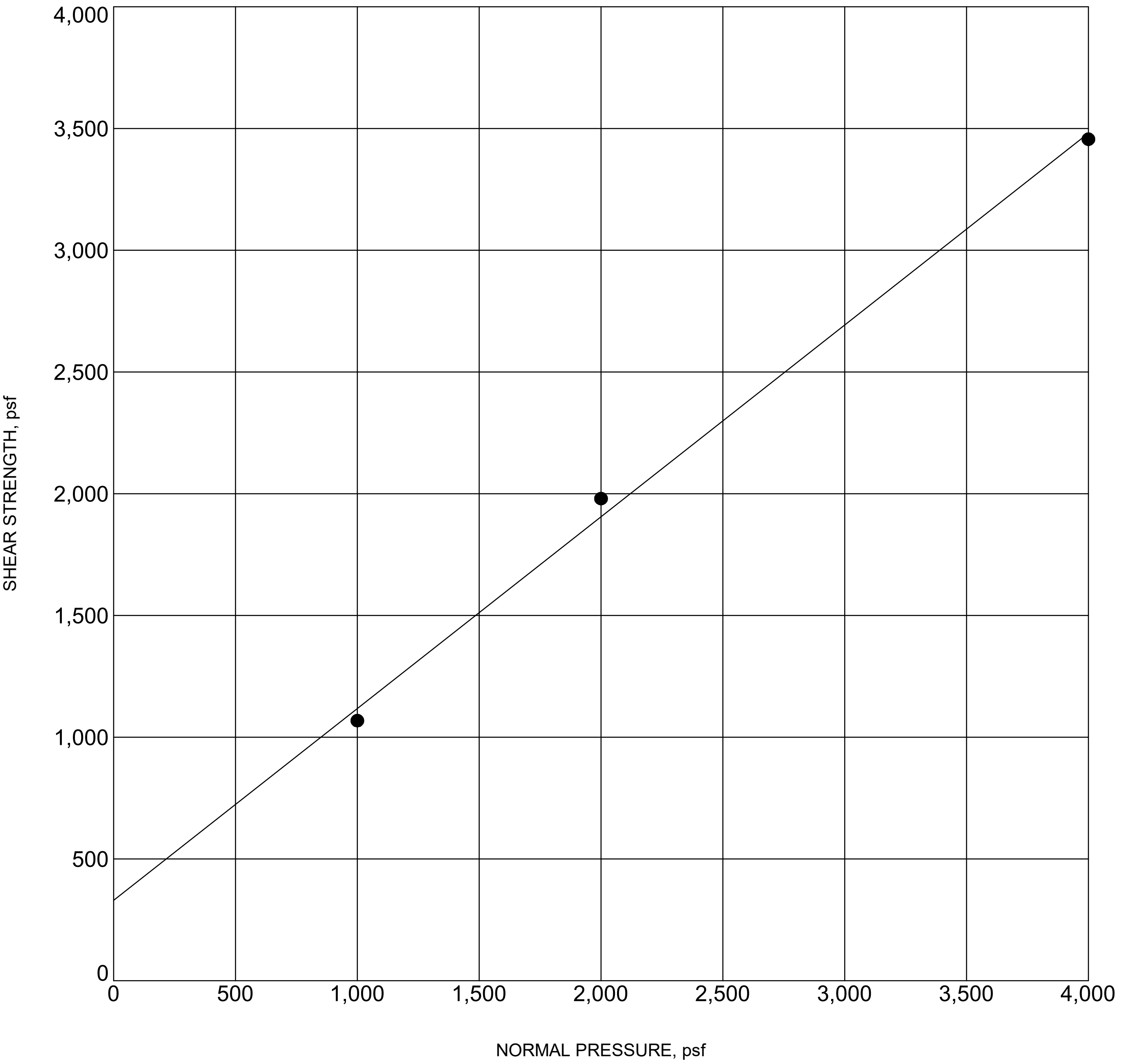
Project Number: 20-7009

Project Name: Hoff Property, Yorba Linda



	Specimen Identification		Classification	γ_d	MC%	c	ϕ
●	**BA-1**	**70**	**(Tpl) Bedrock, Ultimate, Natural**	**131**	**11**	**330**	**38**

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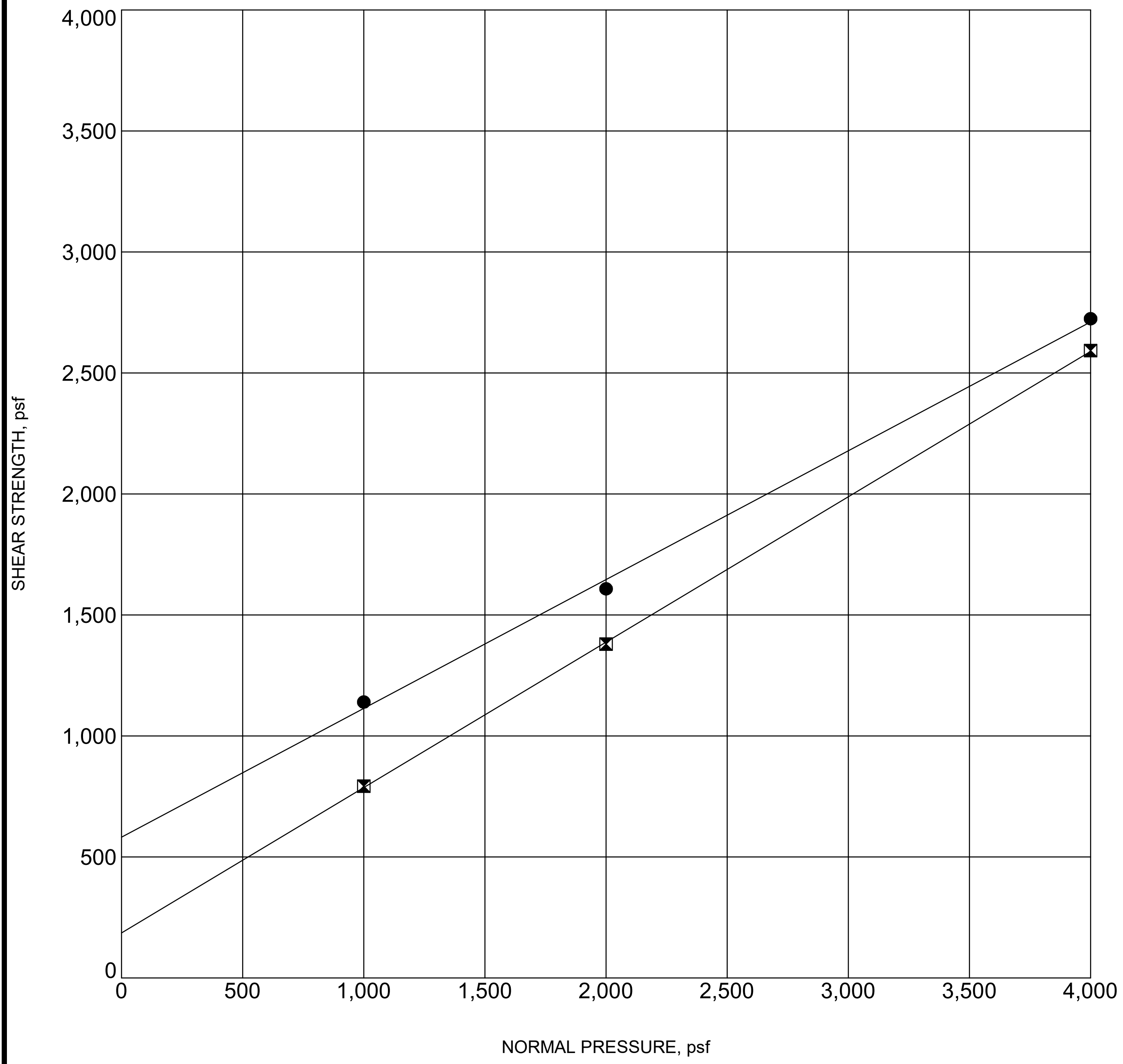
Project Number: 20-7009

Project Name: Hoff Property, Yorba Linda



	Specimen Identification		Classification	γ_d	MC%	c	ϕ
●	**BA-1**	**0-5**	**Fill: Sandy Silt- Remolded Peak, 95% Compaction**	**116**	**15**	**582**	**28**
☒	**BA-1**	**0-5**	**Fill: Sandy Silt- Remolded Ultimate, 95% Compaction**	**116**	**15**	**186**	**31**

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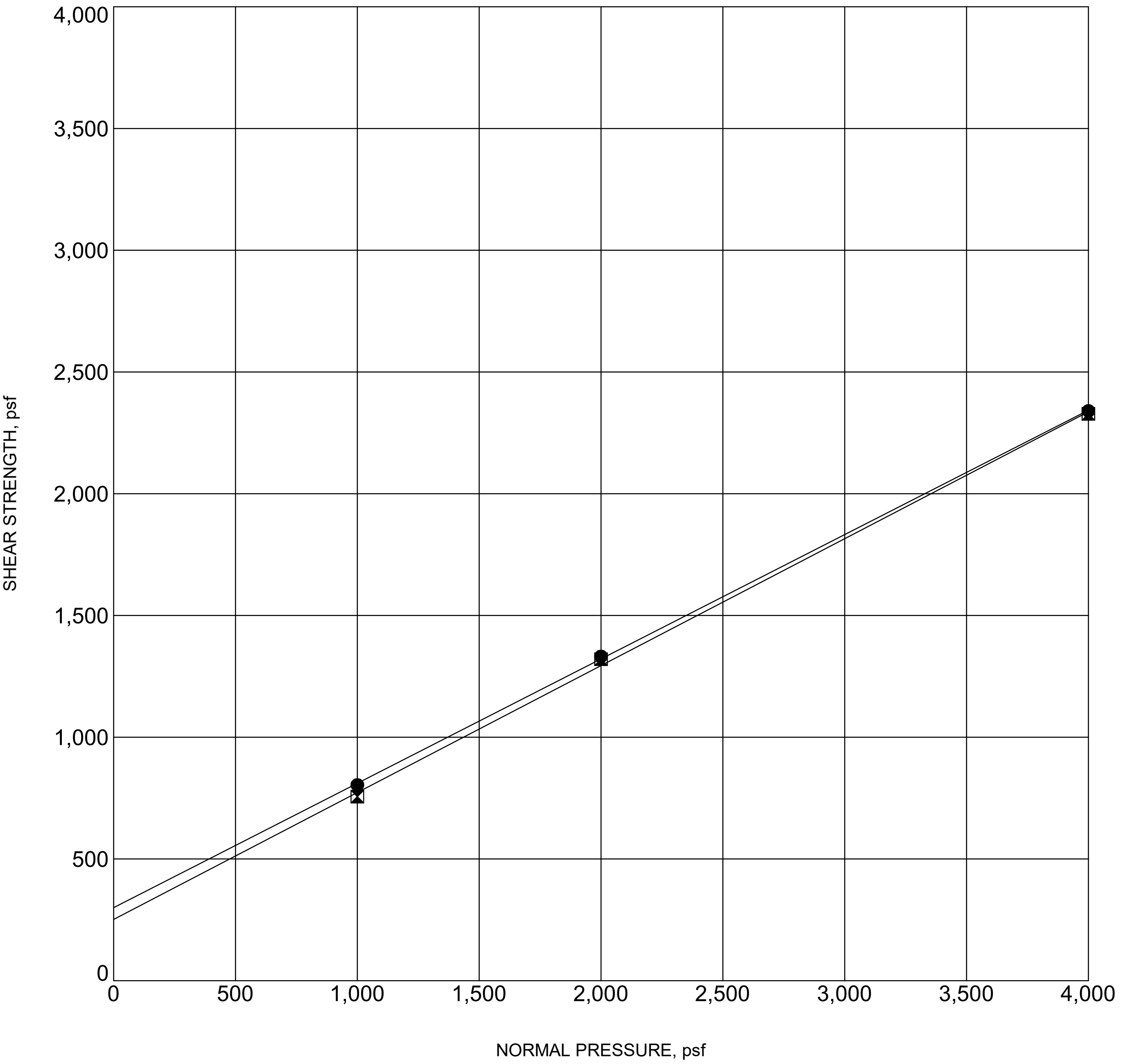

	Specimen Identification		Classification	γ_d	MC%	c	ϕ
●	**BA-1**	**0-5**	**Fill: Sandy Silt- Remolded Peak, 90% Compaction**	**116**	**15**	**300**	**27**
☒	**BA-1**	**0-5**	**Fill: Sandy Silt- Remolded Ultimate, 90% Compaction**	**116**	**15**	**252**	**28**

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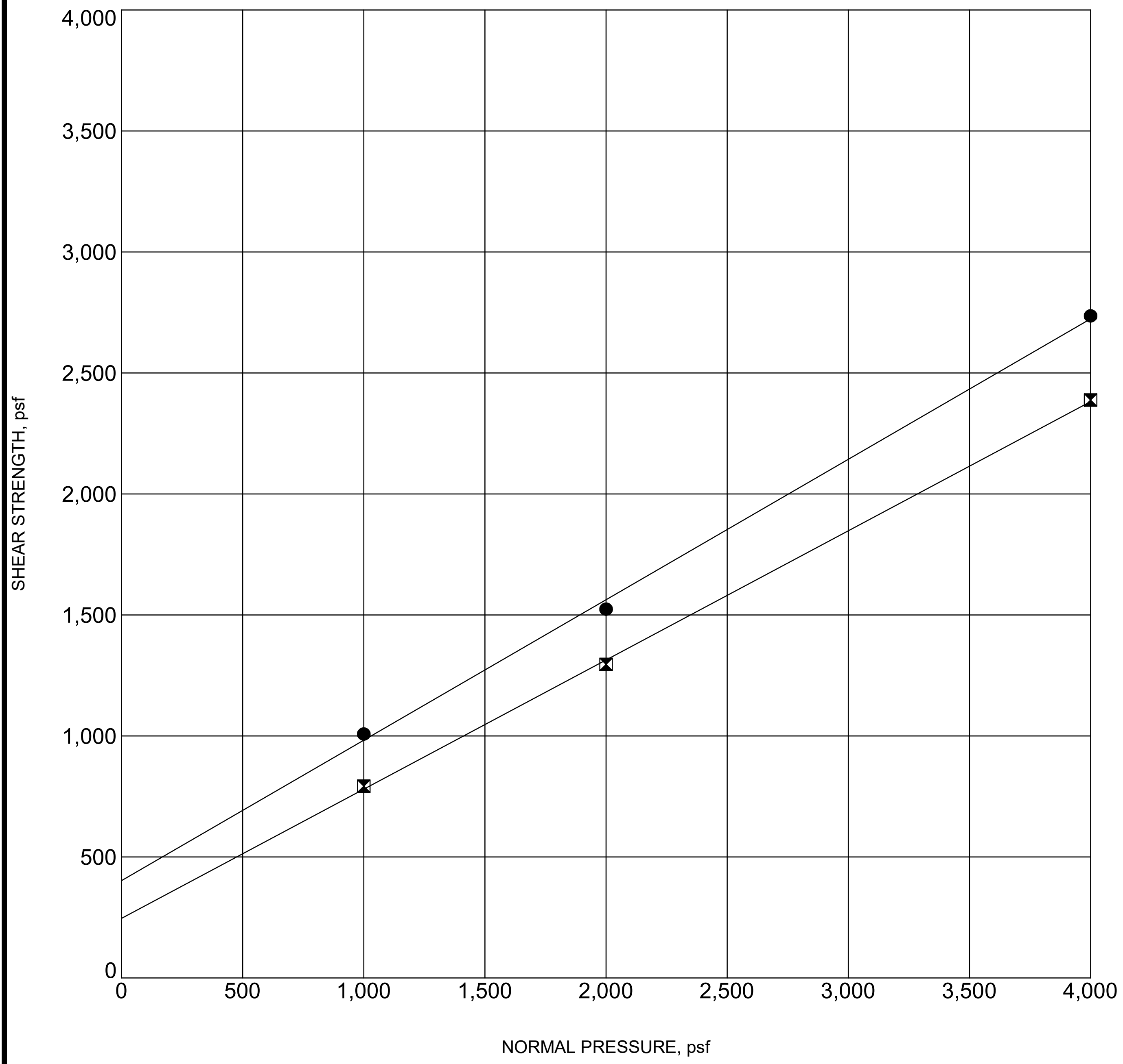

Specimen Identification			Classification	γ_d	MC%	c	ϕ
●	**BA-1**	**45**	**(Tpl) Bedrock- Remolded Peak, 95% Compaction**	**111**	**18**	**402**	**30**
☒	**BA-1**	**45**	**(Tpl) Bedrock- Remolded Ultimate, 95% Compaction**	**111**	**18**	**246**	**28**

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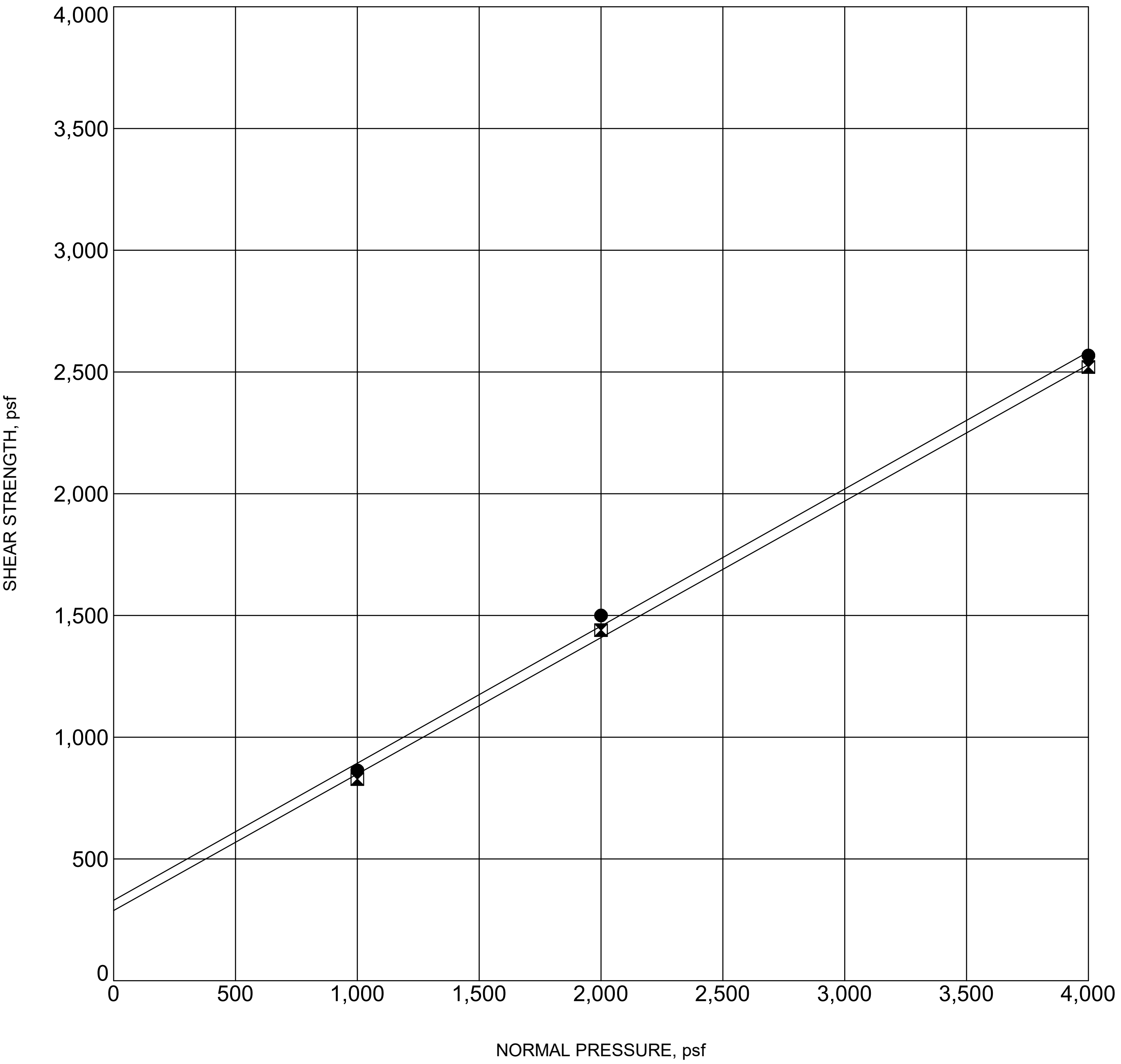

	Specimen Identification		Classification	γ_d	MC%	c	ϕ
●	**BA-1**	**45**	**(Tpl) Bedrock- Remolded Peak, 90% Compaction**	**111**	**18**	**330**	**29**
☒	**BA-1**	**45**	**(Tpl) Bedrock- Remolded Ultimate, 90% Compaction**	**111**	**18**	**288**	**29**

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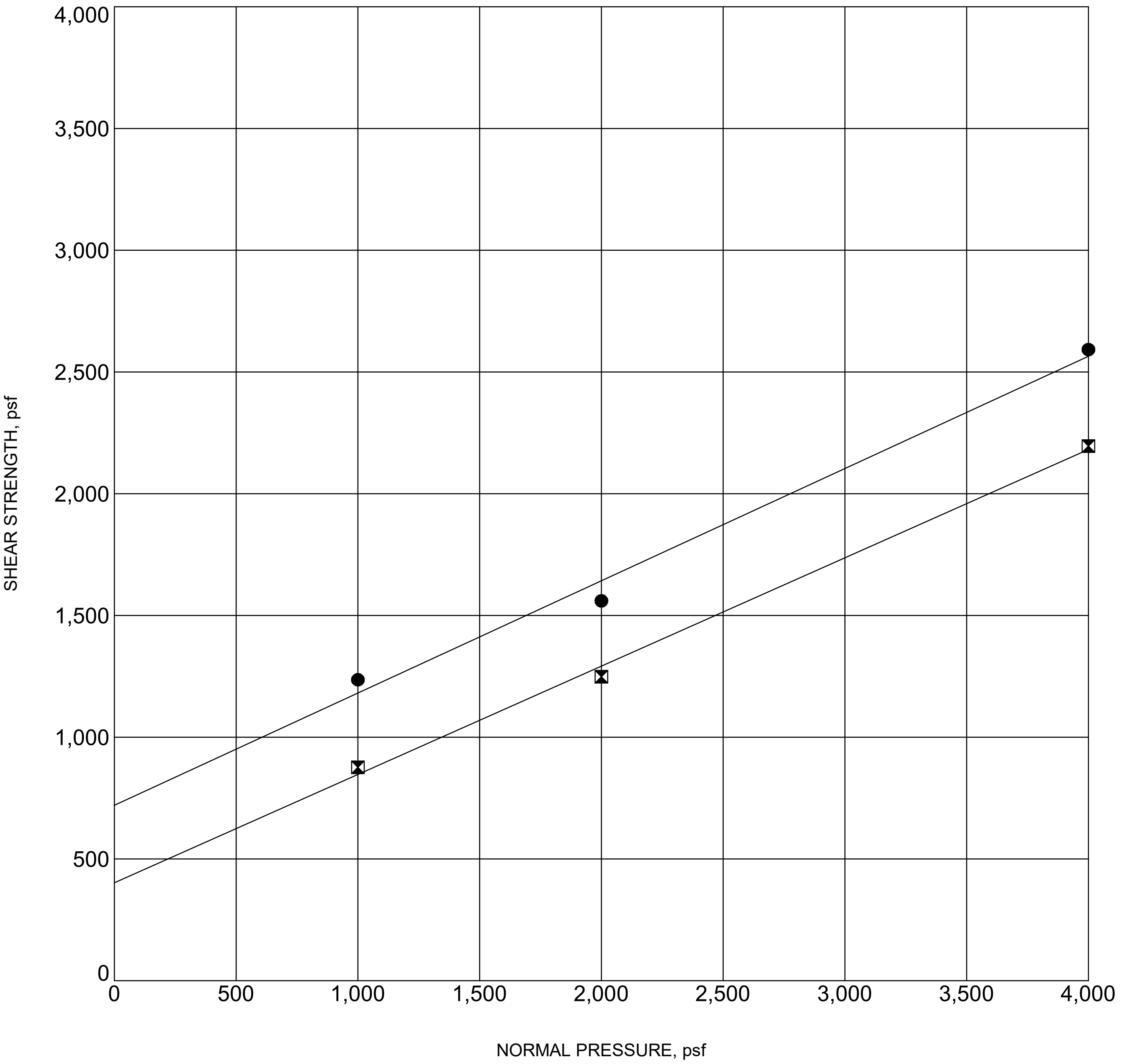

	Specimen Identification		Classification	γ_d	MC%	c	ϕ
●	**BA-2**	**10**	**(Tpl) Bedrock- Remolded Peak, 95% Compaction**	**108**	**20**	**720**	**25**
☒	**BA-2**	**10**	**(Tpl) Bedrock- Remolded Ultimate, 95% Compaction**	**108**	**20**	**402**	**24**

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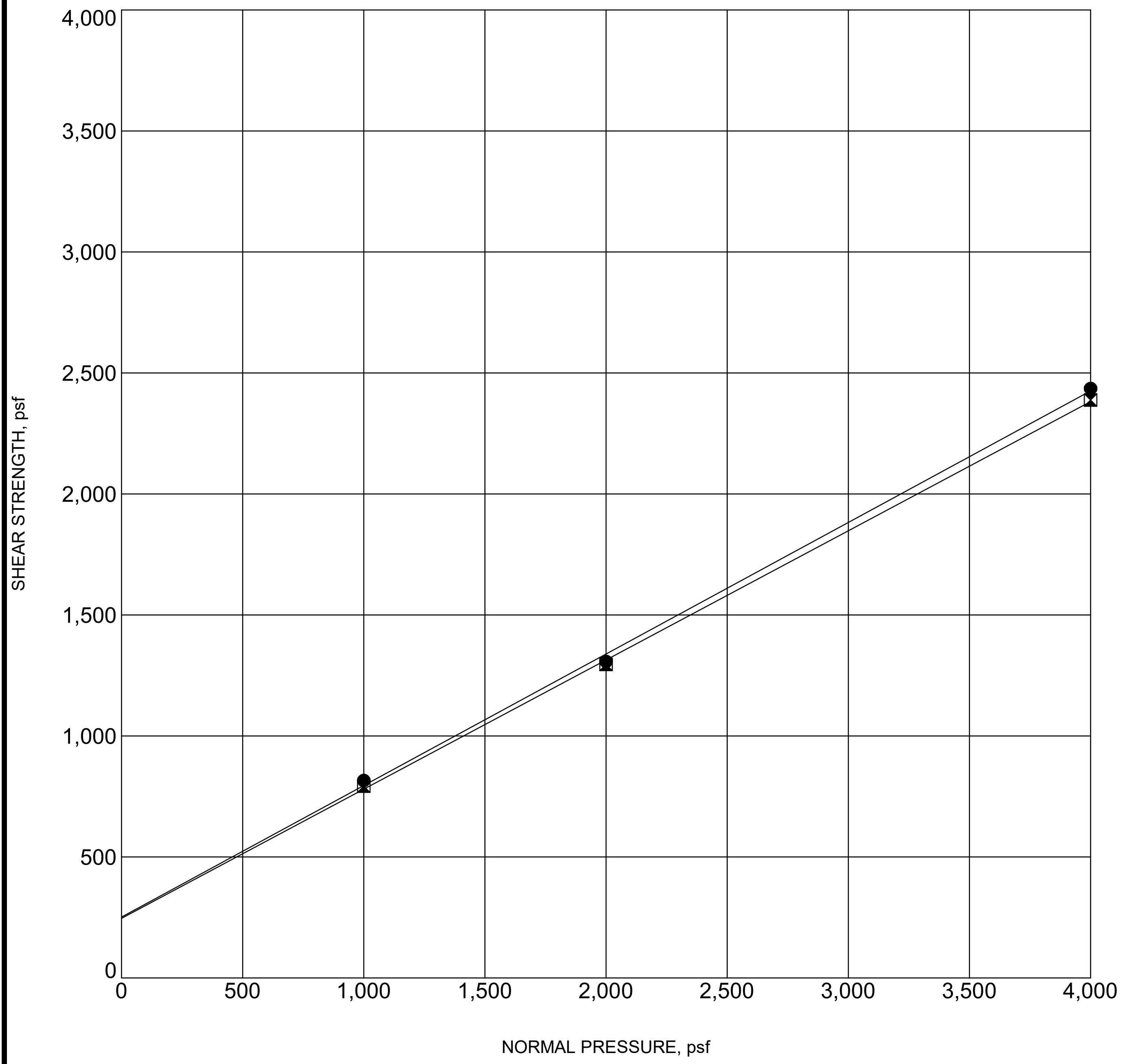
Project Number: 20-7009

Project Name: Hoff Property, Yorba Linda



	Specimen Identification		Classification	γ_d	MC%	c	ϕ
●	**BA-2**	**10**	**(Tpl) Bedrock- Remolded Peak, 90% Compaction**	**108**	**20**	**252**	**29**
☒	**BA-2**	**10**	**(Tpl) Bedrock- Remolded Ultimate, 90% Compaction**	**108**	**20**	**246**	**28**

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DIRECT SHEAR TEST

Project Number: 20-7009

Project Name: Hoff Property, Yorba Linda

ANAHEIM TEST LAB, INC.

196 Technology Drive, Unit D
Irvine, CA 92618
Phone (949)336-6544

TO:

TGR GEOTECHNICAL
3037 S. HARBOR BLVD.
SANTA ANA, CA. 92704

DATE: 04/28/2020

P.O. NO: VERBAL

LAB NO: C-3771

SPECIFICATION: CTM-417

MATERIAL: Soil

Project No.: 20-7009
Project: Huff Property
Yorba Linda, CA
Sample ID: B-1 @ 0'-5', Bulk

ANALYTICAL REPORT

SOLUBLE SULFATES
per CT. 417
ppm

765

RESPECTFULLY SUBMITTED

WES BRIDGER LAB MANAGER

APPENDIX D
SLOPE STABILITY

SURFICIAL SLOPE STABILITY ANALYSIS

SLOPE DESCRIPTION: Fill slope @ 2:1

Friction Angle (degrees)=	28
(radians)=	0.4887
Cohesion (psf)=	275
Saturated Unit Weight (pcf)=	140
Bouyant Unit Weight (pcf)=	77.6
Slope angle (degrees)=	26.6
(radians)=	0.4643

FACTORS OF SAFETY(FOS)

Depth of Saturation (ft)	FOS
1.0	5.5
2.0	3.0
3.0	2.2
4.0	1.8

DATA FOR SEISMIC SLOPE DISPLACEMENT ANALYSES

Project: 20-7009, HOFF Property, Sec A

INPUT:

Slide h (ft):	31.09	
Slide Vs (ft/sec):	1200	For slide mass
Depth to Rx (km):	0.02	(Rx=Vs>5000 ft/s)
Site Vs(30) (m/s):	360	Material below slide
Ave. Site Class:	D	
Mean Magnitude:	6.57	
Mean Dist. (km):	10.28	
ky:	0.300	Insert from slope stability

Average Height Calculation Using CAD Data:		
Slide Mass Area =	9944.48	Insert from slope stability
Horiz.Lengh of Slide Mas	319.88	Insert from slope stability
Average Slide H (ft) =	31.09	

RESULTS:

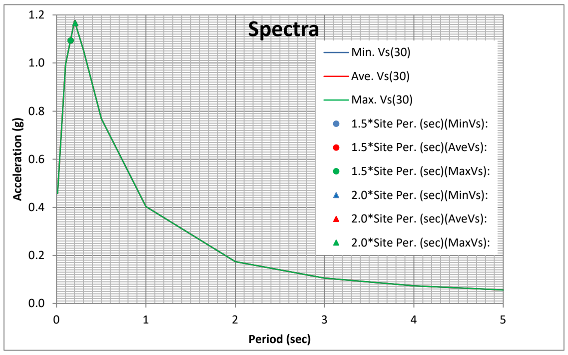
Based on Min. $Vs_{(30)}$		Based on Ave. $Vs_{(30)}$		Based on Max. $Vs_{(30)}$	
Site Period, Ts (sec):	0.1036	Site Period, Ts (sec):	0.1036	Site Period, Ts (sec):	0.1036
1.5*Site Per. (sec)(MinVs):	0.1554	1.5*Site Per. (sec)(AveVs):	0.1554	1.5*Site Per. (sec)(MaxVs):	0.1554
2.0*Site Per. (sec)(MinVs):	0.2073	2.0*Site Per. (sec)(AveVs):	0.2073	2.0*Site Per. (sec)(MaxVs):	0.2073
EQ Mean Period, Tm (sec):	0.556	EQ Mean Period, Tm (sec):	0.556	EQ Mean Period, Tm (sec):	0.556
Ts/Tm:	0.19	Ts/Tm:	0.19	Ts/Tm:	0.19
Estimated PGV (cm/sec):	48.86	Estimated PGV (cm/sec):	48.86	Estimated PGV (cm/sec):	48.86
Duration (D_5-D_{95}) (sec):	12.7	Duration (D_5-D_{95}) (sec):	12.7	Duration (D_5-D_{95}) (sec):	12.7
Sa(1.5Ts) Min $Vs_{(30)}$	1.0941	Sa(1.5Ts) Ave $Vs_{(30)}$	1.0941	Sa(1.5Ts) Max $Vs_{(30)}$	1.0941
Sa(2.0Ts) Min $Vs_{(30)}$	1.1663	Sa(2.0Ts) Ave $Vs_{(30)}$	1.1663	Sa(2.0Ts) Max $Vs_{(30)}$	1.1663
Mean Mag at Site Per Min	6.57	Mean Mag at Site Per Ave	6.57	Mean Mag at Site Per Ave	6.57
Mean Dist at Site Per Min	10.28	Mean Dist at Site Per Ave	10.28	Mean Dist at Site Per Ave	10.28

Largest Sa(1.5Ts):	1.0941	These values flow to
Corresponding Sa(2.0Ts):	1.1663	input table at upper left and
Corresponding PGA:	0.4577	B&T, R&A, and S&R-M calculations
Corresponding PGV:	48.86	on next pages.
Corresponding Mean Mag:	6.57	
Corresponding Mean Dist:	10.28	

Ts: 4h/Vs
Tm: Rathje et al. (2004)
PGV: Watson-Lamprey and Abrahamson (2006)
Duration: Bommer et al. (2009)

5-Percent Damped Spectra

$Vs_{(30)}$	480	480	480
Period	Min. $Vs_{(30)}$	Ave. $Vs_{(30)}$	Max. $Vs_{(30)}$
0.01	0.4577	0.4577	0.4577
0.1	0.9933	0.9933	0.9933
0.2	1.1751	1.1751	1.1751
0.3	1.0542	1.0542	1.0542
0.5	0.7690	0.7690	0.7690
1.0	0.4031	0.4031	0.4031
2.0	0.17402	0.17402	0.17402
3.0	0.10542	0.10542	0.10542
4.0	0.07383	0.07383	0.07383
5.0	0.05620	0.05620	0.05620

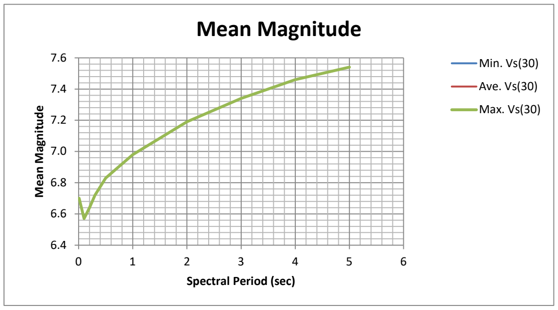


Mean Distance (km)

Period	Min. $Vs_{(30)}$	Ave. $Vs_{(30)}$	Max. $Vs_{(30)}$
0.01	8.4	8.4	8.4
0.1	10.3	10.3	10.3
0.2	10.6	10.6	10.6
0.3	11.0	11.0	11.0
0.5	12.6	12.6	12.6
1.0	15.0	15.0	15.0
2.0	19.7	19.7	19.7
3.0	23.0	23.0	23.0
4.0	26.4	26.4	26.4
5.0	31.0	31.0	31.0

Mean Magnitude

Period	Min. $Vs_{(30)}$	Ave. $Vs_{(30)}$	Max. $Vs_{(30)}$
0.01	6.70	6.70	6.70
0.1	6.57	6.57	6.57
0.2	6.64	6.64	6.64
0.3	6.72	6.72	6.72
0.5	6.83	6.83	6.83
1.0	6.98	6.98	6.98
2.0	7.19	7.19	7.19
3.0	7.34	7.34	7.34
4.0	7.46	7.46	7.46
5.0	7.54	7.54	7.54



Average Seismic Displacement

Seismic Displacement (Bray and Travasarou) = 50% Probability of Exceedance (D2)	7.89 cm	3.11 inch

1cm = 0.393701 in.

🟩 Highlight indicates < 1 cm was estimated

Seismic Displacement (Rathje and Antonakos) = [kmax, k-velmax]	1.20 cm	0.47 inch

Seismic Displacement (Song and Rodriguez-Marek) = 50% Probability of Exceedance (D2)	2.16 cm	0.85 inch

Average Displacement (B&T and R&A) =	4.55 cm	1.79 inch

Average Displacement (B&T, R&A, and S&R-A) =	3.75 cm	1.48 inch

DATA FOR SEISMIC SLOPE DISPLACEMENT ANALYSES

Project: 20-7009, HOFF Property, Sec B

INPUT:	Slide h (ft):	15.26	
	Slide Vs (ft/sec):	1200	For slide mass
	Depth to Rx (km):	0	(Rx=Vs>5000 ft/s)
	Site Vs(30) (m/s):	760	Material below slide
	Ave. Site Class:	C	
	Mean Magnitude:	6.64	
	Mean Dist. (km):	9.25	
	ky:	0.360	Insert from slope stability

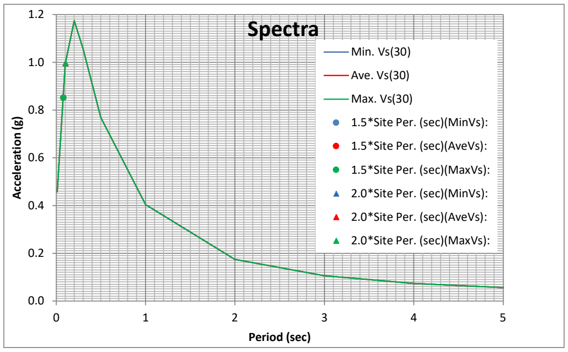
Average Height Calculation Using CAD Data:		
Slide Mass Area =	3693.71	Insert from slope stability
Horiz.Lengh of Slide Mas	242.04	Insert from slope stability
Average Slide H (ft) =	15.26	

Ts: 4h/Vs
Tm: Rathje et al. (2004)
PGV: Watson-Lamprey and Abrahamson (2006)
Duration: Bommer et al. (2009)

RESULTS:

Based on Min. $Vs_{(30)}$		Based on Ave. $Vs_{(30)}$		Based on Max. $Vs_{(30)}$	
Site Period, Ts (sec):	0.0509	Site Period, Ts (sec):	0.0509	Site Period, Ts (sec):	0.0509
1.5*Site Per. (sec)(MinVs):	0.0763	1.5*Site Per. (sec)(AveVs):	0.0763	1.5*Site Per. (sec)(MaxVs):	0.0763
2.0*Site Per. (sec)(MinVs):	0.1017	2.0*Site Per. (sec)(AveVs):	0.1017	2.0*Site Per. (sec)(MaxVs):	0.1017
EQ Mean Period, Tm (sec):	0.462	EQ Mean Period, Tm (sec):	0.462	EQ Mean Period, Tm (sec):	0.462
Ts/Tm:	0.11	Ts/Tm:	0.11	Ts/Tm:	0.11
Estimated PGV (cm/sec):	49.15	Estimated PGV (cm/sec):	49.15	Estimated PGV (cm/sec):	49.15
Duration (D_5-D_{95}) (sec):	9.9	Duration (D_5-D_{95}) (sec):	9.9	Duration (D_5-D_{95}) (sec):	9.9
Sa(1.5Ts) Min $Vs_{(30)}$	0.8523	Sa(1.5Ts) Ave $Vs_{(30)}$	0.8523	Sa(1.5Ts) Max $Vs_{(30)}$	0.8523
Sa(2.0Ts) Min $Vs_{(30)}$	0.9965	Sa(2.0Ts) Ave $Vs_{(30)}$	0.9965	Sa(2.0Ts) Max $Vs_{(30)}$	0.9965
Mean Mag at Site Per Min	6.64	Mean Mag at Site Per Ave	6.64	Mean Mag at Site Per Ave	6.64
Mean Dist at Site Per Min	9.25	Mean Dist at Site Per Ave	9.25	Mean Dist at Site Per Ave	9.25

Largest Sa(1.5Ts):	0.8523	These values flow to
Corresponding Sa(2.0Ts):	0.9965	input table at upper left and
Corresponding PGA:	0.4577	B&T, R&A, and S&R-M calculations
Corresponding PGV:	49.15	on next pages.
Corresponding Mean Mag:	6.64	
Corresponding Mean Dist:	9.25	

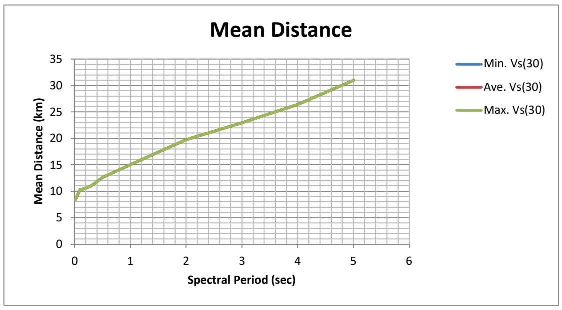


5-Percent Damped Spectra

$Vs_{(30)}$	480	480	480
Period	Min. $Vs_{(30)}$	Ave. $Vs_{(30)}$	Max. $Vs_{(30)}$
0.01	0.4577	0.4577	0.4577
0.1	0.9933	0.9933	0.9933
0.2	1.1751	1.1751	1.1751
0.3	1.0542	1.0542	1.0542
0.5	0.7690	0.7690	0.7690
1.0	0.4031	0.4031	0.4031
2.0	0.17402	0.17402	0.17402
3.0	0.10542	0.10542	0.10542
4.0	0.07383	0.07383	0.07383
5.0	0.05620	0.05620	0.05620

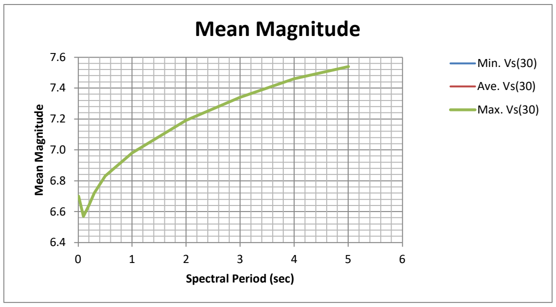
Mean Distance (km)

Period	Min. $Vs_{(30)}$	Ave. $Vs_{(30)}$	Max. $Vs_{(30)}$
0.01	8.4	8.4	8.4
0.1	10.3	10.3	10.3
0.2	10.6	10.6	10.6
0.3	11.0	11.0	11.0
0.5	12.6	12.6	12.6
1.0	15.0	15.0	15.0
2.0	19.7	19.7	19.7
3.0	23.0	23.0	23.0
4.0	26.4	26.4	26.4
5.0	31.0	31.0	31.0



Mean Magnitude

Period	Min. $Vs_{(30)}$	Ave. $Vs_{(30)}$	Max. $Vs_{(30)}$
0.01	6.70	6.70	6.70
0.1	6.57	6.57	6.57
0.2	6.64	6.64	6.64
0.3	6.72	6.72	6.72
0.5	6.83	6.83	6.83
1.0	6.98	6.98	6.98
2.0	7.19	7.19	7.19
3.0	7.34	7.34	7.34
4.0	7.46	7.46	7.46
5.0	7.54	7.54	7.54



Average Seismic Displacement

Seismic Displacement (Bray and Travasarou) = 50% Probability of Exceedance (D2)	2.36 cm	0.93 inch

1cm = 0.393701 in.

🟩 Highlight indicates < 1 cm was estimated

Seismic Displacement (Rathje and Antonakos) = [kmax, k-velmax]	0.29 cm	0.11 inch

Seismic Displacement (Song and Rodriguez-Marek) = 50% Probability of Exceedance (D2)	1.00 cm	0.39 inch

Average Displacement (B&T and R&A) =	1.33 cm	0.52 inch

Average Displacement (B&T, R&A, and S&R-A) =	1.22 cm	0.48 inch

DATA FOR SEISMIC SLOPE DISPLACEMENT ANALYSES

Project: 20-7009, HOFF Property, Sec C

INPUT:

Slide h (ft):	14.17	
Slide Vs (ft/sec):	1200	For slide mass
Depth to Rx (km):	0	(Rx=Vs>5000 ft/s)
Site Vs(30) (m/s):	760	Material below slide
Ave. Site Class:	C	
Mean Magnitude:	6.65	
Mean Dist. (km):	9.17	
ky:	0.350	Insert from slope stability

Average Height Calculation Using CAD Data:		
Slide Mass Area =	3451.00	Insert from slope stability
Horiz.Lengh of Slide Mas	243.50	Insert from slope stability
Average Slide H (ft) =	14.17	

Ts: 4h/Vs
Tm: Rathje et al. (2004)
PGV: Watson-Lamprey and Abrahamson (2006)
Duration: Bommer et al. (2009)

RESULTS:

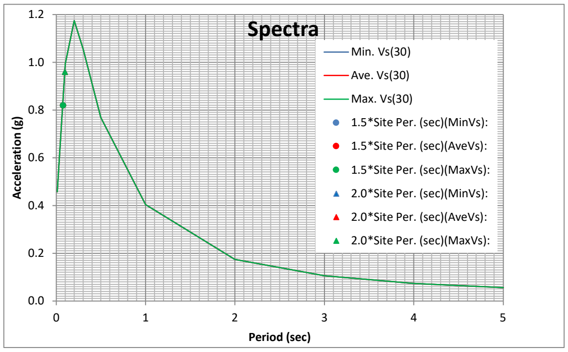
Based on Min. $Vs_{(30)}$		Based on Ave. $Vs_{(30)}$		Based on Max. $Vs_{(30)}$	
Site Period, Ts (sec):	0.0472	Site Period, Ts (sec):	0.0472	Site Period, Ts (sec):	0.0472
1.5*Site Per. (sec)(MinVs):	0.0709	1.5*Site Per. (sec)(AveVs):	0.0709	1.5*Site Per. (sec)(MaxVs):	0.0709
2.0*Site Per. (sec)(MinVs):	0.0945	2.0*Site Per. (sec)(AveVs):	0.0945	2.0*Site Per. (sec)(MaxVs):	0.0945
EQ Mean Period, Tm (sec):	0.463	EQ Mean Period, Tm (sec):	0.463	EQ Mean Period, Tm (sec):	0.463
Ts/Tm:	0.10	Ts/Tm:	0.10	Ts/Tm:	0.10
Estimated PGV (cm/sec):	49.18	Estimated PGV (cm/sec):	49.18	Estimated PGV (cm/sec):	49.18
Duration (D_5-D_{95}) (sec):	9.9	Duration (D_5-D_{95}) (sec):	9.9	Duration (D_5-D_{95}) (sec):	9.9
Sa(1.5Ts) Min $Vs_{(30)}$	0.8199	Sa(1.5Ts) Ave $Vs_{(30)}$	0.8199	Sa(1.5Ts) Max $Vs_{(30)}$	0.8199
Sa(2.0Ts) Min $Vs_{(30)}$	0.9605	Sa(2.0Ts) Ave $Vs_{(30)}$	0.9605	Sa(2.0Ts) Max $Vs_{(30)}$	0.9605
Mean Mag at Site Per Min	6.65	Mean Mag at Site Per Ave	6.65	Mean Mag at Site Per Ave	6.65
Mean Dist at Site Per Min	9.17	Mean Dist at Site Per Ave	9.17	Mean Dist at Site Per Ave	9.17

Largest Sa(1.5Ts):	0.8199
Corresponding Sa(2.0Ts):	0.9605
Corresponding PGA:	0.4577
Corresponding PGV:	49.18
Corresponding Mean Mag:	6.65
Corresponding Mean Dist:	9.17

These values flow to input table at upper left and B&T, R&A, and S&R-M calculations on next pages.

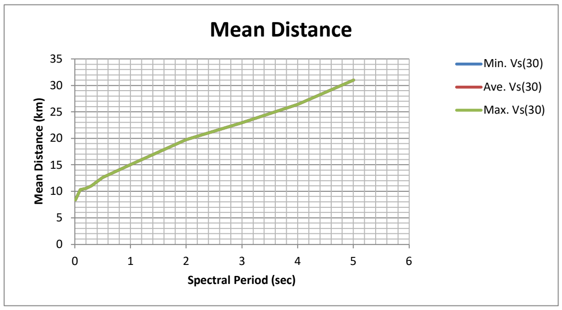
5-Percent Damped Spectra

$Vs_{(30)}$	480	480	480
Period	Min. $Vs_{(30)}$	Ave. $Vs_{(30)}$	Max. $Vs_{(30)}$
0.01	0.4577	0.4577	0.4577
0.1	0.9933	0.9933	0.9933
0.2	1.1751	1.1751	1.1751
0.3	1.0542	1.0542	1.0542
0.5	0.7690	0.7690	0.7690
1.0	0.4031	0.4031	0.4031
2.0	0.17402	0.17402	0.17402
3.0	0.10542	0.10542	0.10542
4.0	0.07383	0.07383	0.07383
5.0	0.05620	0.05620	0.05620



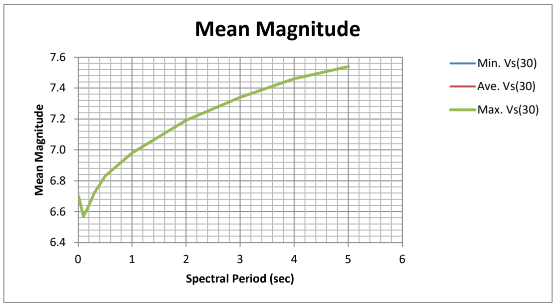
Mean Distance (km)

Period	Min. $Vs_{(30)}$	Ave. $Vs_{(30)}$	Max. $Vs_{(30)}$
0.01	8.4	8.4	8.4
0.1	10.3	10.3	10.3
0.2	10.6	10.6	10.6
0.3	11.0	11.0	11.0
0.5	12.6	12.6	12.6
1.0	15.0	15.0	15.0
2.0	19.7	19.7	19.7
3.0	23.0	23.0	23.0
4.0	26.4	26.4	26.4
5.0	31.0	31.0	31.0



Mean Magnitude

Period	Min. $Vs_{(30)}$	Ave. $Vs_{(30)}$	Max. $Vs_{(30)}$
0.01	6.70	6.70	6.70
0.1	6.57	6.57	6.57
0.2	6.64	6.64	6.64
0.3	6.72	6.72	6.72
0.5	6.83	6.83	6.83
1.0	6.98	6.98	6.98
2.0	7.19	7.19	7.19
3.0	7.34	7.34	7.34
4.0	7.46	7.46	7.46
5.0	7.54	7.54	7.54



Average Seismic Displacement

Seismic Displacement (Bray and Travasarou) = 50% Probability of Exceedance (D2)	5.40 cm	2.13 inch

1cm = 0.393701 in.

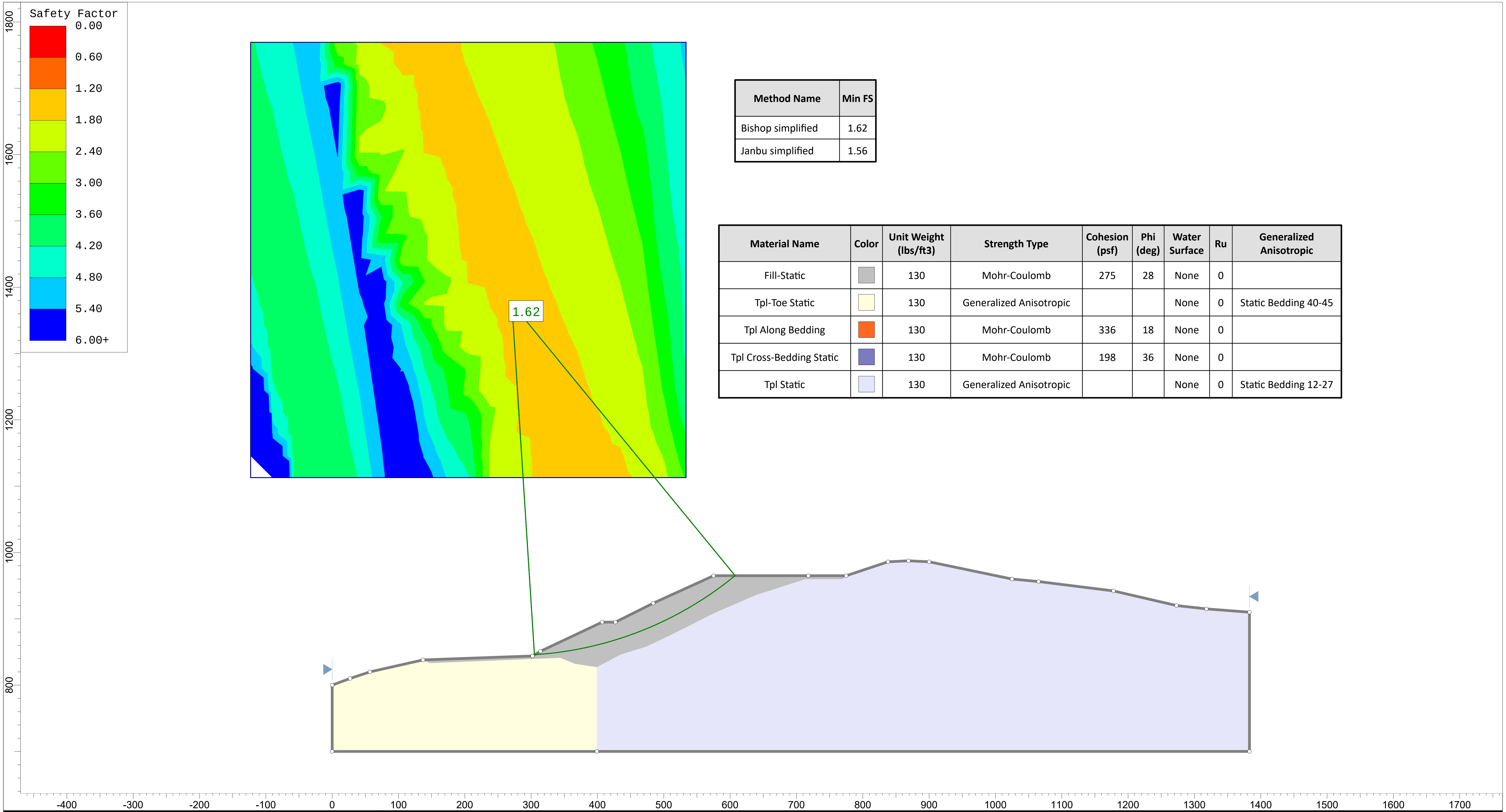
🟩 Highlight indicates < 1 cm was estimated

Seismic Displacement (Rathje and Antonakos) = [kmax, k-velmax]	0.35 cm	0.14 inch

Seismic Displacement (Song and Rodriguez-Marek) = 50% Probability of Exceedance (D2)	🟩 1.00 cm	0.39 inch

Average Displacement (B&T and R&A) =	2.88 cm	1.13 inch

Average Displacement (B&T, R&A, and S&R-A) =	2.25 cm	0.89 inch



Method Name	Min FS
Bishop simplified	1.62
Janbu simplified	1.56

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Generalized Anisotropic
Fill-Static	▨	130	Mohr-Coulomb	275	28	None	0	
Tpl-Toe Static	🟨	130	Generalized Anisotropic			None	0	Static Bedding 40-45
Tpl Along Bedding	🟧	130	Mohr-Coulomb	336	18	None	0	
Tpl Cross-Bedding Static	🟪	130	Mohr-Coulomb	198	36	None	0	
Tpl Static	⬜	130	Generalized Anisotropic			None	0	Static Bedding 12-27

Geotechnical
Environmental
Hydrogeology
Material Testing
Construction Inspection

SLIDEINTERPRET 7.038

Project HOFF Property, Yorba Linda, CA

Analysis Description Cross-section A-A' Static

Drawn By

Scale 1:1644

Company TGR Geotechnical, Inc.

Date 4/15/20

File Name Cross-section A-A' Static.slim

Slide Analysis Information

HOFF Property, Yorba Linda, CA

Project Summary

File Name:	Cross-section A-A' Static
Slide Modeler Version:	7.038
Project Title:	HOFF Property, Yorba Linda, CA
Analysis:	Cross-section A-A' Static
Company:	TGR Geotechnical, Inc.
Date Created:	4/15/20

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Grid Search
Radius Increment:	10
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	Fill-Static	Tpl-Toe Static	Tpl Static
Color	▒	🟨	🟪
Strength Type	Mohr-Coulomb	Generalized Anisotropic	Generalized Anisotropic
Unit Weight [lbs/ft3]	130	130	130
Cohesion [psf]	275		
Friction Angle [deg]	28		
Water Surface	None	None	None
Ru Value	0	0	0

Generalized Anisotropic Functions

Name: Static Bedding 40-45

Angle From	Angle To	Material
40	-90	Tpl Cross-Bedding Static
45	40	Tpl Along Bedding
90	45	Tpl Cross-Bedding Static

Name: Static Bedding 12-27

Angle From	Angle To	Material
-27	-90	Tpl Cross-Bedding Static
-12	-27	Tpl Along Bedding
90	-12	Tpl Cross-Bedding Static

Global Minimums

Method: bishop simplified

FS	1.618140
Center:	270.990, 1375.482
Radius:	530.809
Left Slip Surface Endpoint:	305.025, 845.765
Right Slip Surface Endpoint:	607.536, 965.000
Resisting Moment:	3.08296e+008 lb-ft
Driving Moment:	1.90525e+008 lb-ft
Total Slice Area:	7521.42 ft2
Surface Horizontal Width:	302.511 ft
Surface Average Height:	24.8633 ft

Method: janbu simplified

FS	1.562180
Center:	303.811, 1244.195
Radius:	404.150
Left Slip Surface Endpoint:	259.686, 842.461
Right Slip Surface Endpoint:	596.022, 965.000
Resisting Horizontal Force:	636385 lb
Driving Horizontal Force:	407369 lb
Total Slice Area:	9099.64 ft2
Surface Horizontal Width:	336.336 ft
Surface Average Height:	27.0552 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	4601
Number of Invalid Surfaces:	250

Error Codes:

Error Code -103 reported for 232 surfaces
Error Code -106 reported for 7 surfaces
Error Code -1000 reported for 11 surfaces

Method: janbu simplified

Number of Valid Surfaces:	4596
Number of Invalid Surfaces:	255

Error Codes:

Error Code -103 reported for 232 surfaces
Error Code -106 reported for 7 surfaces
Error Code -108 reported for 5 surfaces
Error Code -1000 reported for 11 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.61814

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	6.05022	1221.42	4.00363	Fill-Static	275	28	230.975	373.75	185.722	0	185.722	201.888	201.888
2	6.05022	3566.92	4.65858	Fill-Static	275	28	354.192	573.132	560.704	0	560.704	589.566	589.566
3	6.05022	5464.42	5.31414	Fill-Static	275	28	452.89	732.84	861.071	0	861.071	903.197	903.197
4	6.05022	7245.68	5.9704	Fill-Static	275	28	544.757	881.493	1140.65	0	1140.65	1197.62	1197.62
5	6.05022	8971.81	6.62744	Fill-Static	275	28	633.058	1024.38	1409.37	0	1409.37	1482.93	1482.93
6	6.05022	10642.6	7.28536	Fill-Static	275	28	717.817	1161.53	1667.33	0	1667.33	1759.1	1759.1
7	6.05022	12257.8	7.94425	Fill-Static	275	28	799.059	1292.99	1914.55	0	1914.55	2026.06	2026.06
8	6.05022	13817.2	8.6042	Fill-Static	275	28	876.797	1418.78	2151.14	0	2151.14	2283.81	2283.81
9	6.05022	15320.4	9.2653	Fill-Static	275	28	951.055	1538.94	2377.13	0	2377.13	2532.28	2532.28
10	6.05022	16767.2	9.92765	Fill-Static	275	28	1021.85	1653.5	2592.58	0	2592.58	2771.43	2771.43
11	6.05022	18157.3	10.5913	Fill-Static	275	28	1089.2	1762.47	2797.52	0	2797.52	3001.19	3001.19
12	6.05022	19490.2	11.2565	Fill-Static	275	28	1153.11	1865.89	2992.03	0	2992.03	3221.53	3221.53
13	6.05022	20765.7	11.9231	Fill-Static	275	28	1213.59	1963.76	3176.1	0	3176.1	3432.35	3432.35
14	6.05022	21983.2	12.5915	Fill-Static	275	28	1270.66	2056.11	3349.77	0	3349.77	3633.6	3633.6
15	6.05022	23142.4	13.2615	Fill-Static	275	28	1324.32	2142.94	3513.09	0	3513.09	3825.21	3825.21
16	6.05022	24242.7	13.9334	Fill-Static	275	28	1374.59	2224.28	3666.06	0	3666.06	4007.09	4007.09
17	6.05022	25260	14.6073	Fill-Static	275	28	1420.28	2298.21	3805.1	0	3805.1	4175.25	4175.25
18	6.05022	24812.2	15.2832	Fill-Static	275	28	1392.55	2253.34	3720.72	0	3720.72	4101.24	4101.24
19	6.05022	23481.5	15.9614	Fill-Static	275	28	1321.15	2137.81	3503.43	0	3503.43	3881.3	3881.3
20	6.05022	22089.8	16.6418	Fill-Static	275	28	1247.23	2018.19	3278.47	0	3278.47	3651.27	3651.27
21	6.05022	21475	17.3247	Fill-Static	275	28	1212.1	1961.34	3171.55	0	3171.55	3549.65	3549.65
22	6.05022	22307.9	18.0101	Fill-Static	275	28	1248.23	2019.81	3281.51	0	3281.51	3687.33	3687.33
23	6.05022	23108.4	18.6982	Fill-Static	275	28	1282.44	2075.17	3385.62	0	3385.62	3819.65	3819.65
24	6.05022	23845.1	19.3891	Fill-Static	275	28	1313.21	2124.95	3479.26	0	3479.26	3941.43	3941.43
25	6.05022	24517.1	20.0829	Fill-Static	275	28	1340.53	2169.17	3562.41	0	3562.41	4052.52	4052.52
26	6.05022	25123.7	20.7798	Fill-Static	275	28	1364.4	2207.79	3635.05	0	3635.05	4152.78	4152.78
27	6.05022	25663.9	21.48	Fill-Static	275	28	1384.81	2240.81	3697.16	0	3697.16	4242.09	4242.09
28	6.05022	26136.7	22.1835	Fill-Static	275	28	1401.74	2268.21	3748.69	0	3748.69	4320.25	4320.25
29	6.05022	26541.3	22.8906	Fill-	275	28	1415.19	2289.97	3789.61	0	3789.61	4387.13	4387.13

				Static									
30	6.05022	26858.1	23.6014	Fill-Static	275	28	1424.26	2304.65	3817.22	0	3817.22	4439.5	4439.5
31	6.05022	26949	24.3161	Fill-Static	275	28	1422.47	2301.76	3811.78	0	3811.78	4454.54	4454.54
32	6.05022	26932.8	25.0348	Fill-Static	275	28	1415.56	2290.57	3790.73	0	3790.73	4451.87	4451.87
33	6.05022	26843.6	25.7577	Fill-Static	275	28	1405.18	2273.77	3759.13	0	3759.13	4437.14	4437.14
34	6.05022	26680.2	26.4851	Fill-Static	275	28	1391.3	2251.32	3716.91	0	3716.91	4410.14	4410.14
35	6.05022	26441.1	27.2171	Fill-Static	275	28	1373.92	2223.19	3664.02	0	3664.02	4370.64	4370.64
36	6.05022	26124.9	27.954	Fill-Static	275	28	1353	2189.35	3600.37	0	3600.37	4318.38	4318.38
37	6.05022	25730	28.6959	Fill-Static	275	28	1328.53	2149.74	3525.88	0	3525.88	4253.1	4253.1
38	6.05022	25254.7	29.4431	Fill-Static	275	28	1300.47	2104.34	3440.49	0	3440.49	4174.55	4174.55
39	6.05022	24697.2	30.1959	Fill-Static	275	28	1268.79	2053.08	3344.08	0	3344.08	4082.41	4082.41
40	6.05022	24055.7	30.9544	Fill-Static	275	28	1233.47	1995.92	3236.57	0	3236.57	3976.38	3976.38
41	6.05022	23328.2	31.7191	Fill-Static	275	28	1194.46	1932.8	3117.88	0	3117.88	3856.14	3856.14
42	6.05022	22512.6	32.4901	Fill-Static	275	28	1151.74	1863.67	2987.86	0	2987.86	3721.32	3721.32
43	6.05022	21606.5	33.2677	Fill-Static	275	28	1105.26	1788.47	2846.42	0	2846.42	3571.55	3571.55
44	6.05022	20607.6	34.0524	Fill-Static	275	28	1055	1707.13	2693.45	0	2693.45	3406.45	3406.45
45	6.05022	19358.5	34.8444	Fill-Static	275	28	994.049	1608.51	2507.96	0	2507.96	3199.99	3199.99
46	6.05022	16416.2	35.644	Fill-Static	275	28	859.178	1390.27	2097.52	0	2097.52	2713.63	2713.63
47	6.05022	12952.5	36.4518	Fill-Static	275	28	702.89	1137.37	1621.9	0	1621.9	2141.09	2141.09
48	6.05022	9384.45	37.2681	Fill-Static	275	28	543.743	879.852	1137.56	0	1137.56	1551.3	1551.3
49	6.05022	5708.79	38.0933	Fill-Static	275	28	381.721	617.678	644.483	0	644.483	943.719	943.719
50	6.05022	1921.8	38.928	Fill-Static	275	28	216.81	350.828	142.612	0	142.612	317.73	317.73

Global Minimum Query (janbu simplified) - Safety Factor: 1.56218

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	6.72673	405.127	-5.78885	Fill-Static	275	28	203.551	317.983	80.8387	0	80.8387	60.2028	60.2028
2	6.72673	1165.79	-4.83105	Fill-Static	275	28	241.977	378.011	193.735	0	193.735	173.284	173.284
3	6.72673	1827.48	-3.87461	Fill-Static	275	28	274.832	429.337	290.267	0	290.267	271.653	271.653
4	6.72673	2390.56	-2.91925	Fill-Static	275	28	302.235	472.146	370.777	0	370.777	355.365	355.365
5	6.72673	2855.35	-1.9647	Fill-Static	275	28	324.295	506.607	435.59	0	435.59	424.466	424.466
6	6.72673	3222.03	-1.01069	Fill-Static	275	28	341.112	532.879	485	0	485	478.982	478.982
7	6.72673	4300.64	-0.0569686	Fill-Static	275	28	393.776	615.149	639.727	0	639.727	639.335	639.335
8	6.72673	7553.17	0.89674	Fill-Static	275	28	555.262	867.419	1114.18	0	1114.18	1122.87	1122.87
9	6.72673	10565.7	1.8507	Fill-	275	28	702.927	1098.1	1548.03	0	1548.03	1570.74	1570.74

				Static									
10	6.72673	13111.4	2.80517	Fill-Static	275	28	825.705	1289.9	1908.74	0	1908.74	1949.2	1949.2
11	6.72673	15557.1	3.76042	Fill-Static	275	28	942.151	1471.81	2250.88	0	2250.88	2312.8	2312.8
12	6.72673	17904.1	4.71672	Fill-Static	275	28	1052.44	1644.1	2574.9	0	2574.9	2661.73	2661.73
13	6.72673	20152.3	5.67434	Fill-Static	275	28	1156.65	1806.89	2881.05	0	2881.05	2995.98	2995.98
14	6.72673	22301	6.63355	Fill-Static	275	28	1254.82	1960.26	3169.52	0	3169.52	3315.45	3315.45
15	6.72673	24349.9	7.59464	Fill-Static	275	28	1347.05	2104.33	3440.47	0	3440.47	3620.07	3620.07
16	6.72673	26298.2	8.55787	Fill-Static	275	28	1433.36	2239.16	3694.06	0	3694.06	3909.75	3909.75
17	6.72673	28145.2	9.52356	Fill-Static	275	28	1513.81	2364.84	3930.41	0	3930.41	4184.38	4184.38
18	6.72673	29890.1	10.492	Fill-Static	275	28	1588.43	2481.41	4149.66	0	4149.66	4443.83	4443.83
19	6.72673	31532	11.4634	Fill-Static	275	28	1657.26	2588.94	4351.88	0	4351.88	4687.96	4687.96
20	6.72673	33069.9	12.4383	Fill-Static	275	28	1720.33	2687.47	4537.19	0	4537.19	4916.63	4916.63
21	6.72673	34502.7	13.4168	Fill-Static	275	28	1777.66	2777.03	4705.63	0	4705.63	5129.68	5129.68
22	6.72673	35815	14.3992	Fill-Static	275	28	1828.62	2856.63	4855.35	0	4855.35	5324.84	5324.84
23	6.72673	35377.3	15.3861	Fill-Static	275	28	1797.88	2808.61	4765.04	0	4765.04	5259.79	5259.79
24	6.72673	33703.5	16.3776	Fill-Static	275	28	1710.49	2672.09	4508.28	0	4508.28	5010.98	5010.98
25	6.72673	31942.6	17.3742	Fill-Static	275	28	1619.97	2530.68	4242.32	0	4242.32	4749.19	4749.19
26	6.72673	31865.5	18.3763	Fill-Static	275	28	1606.91	2510.28	4203.96	0	4203.96	4737.77	4737.77
27	6.72673	32794.8	19.3842	Fill-Static	275	28	1639.32	2560.91	4299.17	0	4299.17	4875.96	4875.96
28	6.72673	33607.4	20.3984	Fill-Static	275	28	1665.92	2602.46	4377.32	0	4377.32	4996.81	4996.81
29	6.72673	34301.1	21.4194	Fill-Static	275	28	1686.68	2634.9	4438.33	0	4438.33	5100	5100
30	6.72673	34873.4	22.4475	Fill-Static	275	28	1701.58	2658.18	4482.11	0	4482.11	5185.1	5185.1
31	6.72673	35321.6	23.4833	Fill-Static	275	28	1710.6	2672.26	4508.59	0	4508.59	5251.79	5251.79
32	6.72673	35642.9	24.5273	Fill-Static	275	28	1713.68	2677.07	4517.64	0	4517.64	5299.59	5299.59
33	6.72673	35834.1	25.5801	Fill-Static	275	28	1710.78	2672.54	4509.13	0	4509.13	5328.07	5328.07
34	6.72673	35836.6	26.6422	Fill-Static	275	28	1699.46	2654.87	4475.88	0	4475.88	5328.47	5328.47
35	6.72673	35514.1	27.7143	Fill-Static	275	28	1674.03	2615.14	4401.16	0	4401.16	5280.57	5280.57
36	6.72673	35034.9	28.797	Fill-Static	275	28	1641.92	2564.98	4306.82	0	4306.82	5209.37	5209.37
37	6.72673	34410.2	29.8911	Fill-Static	275	28	1603.74	2505.33	4194.64	0	4194.64	5116.5	5116.5
38	6.72673	33635.1	30.9974	Fill-Static	275	28	1559.41	2436.08	4064.41	0	4064.41	5001.3	5001.3
39	6.72673	32704.5	32.1166	Fill-Static	275	28	1508.85	2357.1	3915.85	0	3915.85	4862.96	4862.96
40	6.72673	31612.6	33.2498	Fill-Static	275	28	1451.96	2268.22	3748.71	0	3748.71	4700.64	4700.64
41	6.72673	30353.2	34.3978	Fill-Static	275	28	1388.64	2169.31	3562.67	0	3562.67	4513.42	4513.42
42	6.72673	28919.4	35.5618	Fill-	275	28	1318.79	2060.18	3357.43	0	3357.43	4300.26	4300.26

				Static									
43	6.72673	27303.6	36.743	Fill-Static	275	28	1242.27	1940.65	3132.63	0	3132.63	4060.04	4060.04
44	6.72673	25497.3	37.9427	Fill-Static	275	28	1158.96	1810.51	2887.87	0	2887.87	3791.49	3791.49
45	6.72673	23491.2	39.1623	Fill-Static	275	28	1068.72	1669.54	2622.75	0	2622.75	3493.21	3493.21
46	6.72673	21274.8	40.4035	Fill-Static	275	28	971.412	1517.52	2336.84	0	2336.84	3163.68	3163.68
47	6.72673	18815.4	41.668	Fill-Static	275	28	866.04	1352.91	2027.26	0	2027.26	2798	2798
48	6.72673	14485.8	42.9578	Fill-Static	275	28	690.433	1078.58	1511.31	0	1511.31	2154.2	2154.2
49	6.72673	8879.41	44.2753	Fill-Static	275	28	469.646	733.671	862.635	0	862.635	1320.55	1320.55
50	6.72673	3005.85	45.6231	Fill-Static	275	28	243.519	380.42	198.266	0	198.266	447.14	447.14

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.61814

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	305.025	845.765	0	0	0
2	311.075	846.188	1318.09	0	0
3	317.125	846.681	3183.51	0	0
4	323.176	847.244	5437.62	0	0
5	329.226	847.877	8010.11	0	0
6	335.276	848.579	10847.6	0	0
7	341.326	849.353	13898.7	0	0
8	347.376	850.197	17114.2	0	0
9	353.427	851.113	20447.1	0	0
10	359.477	852.1	23852	0	0
11	365.527	853.159	27285.9	0	0
12	371.577	854.29	30707.5	0	0
13	377.628	855.494	34077.6	0	0
14	383.678	856.772	37358.8	0	0
15	389.728	858.123	40515.7	0	0
16	395.778	859.549	43514.7	0	0
17	401.828	861.05	46324.2	0	0
18	407.879	862.627	48913	0	0
19	413.929	864.28	51182.6	0	0
20	419.979	866.011	53109.3	0	0
21	426.029	867.819	54722.5	0	0
22	432.08	869.706	56066.6	0	0
23	438.13	871.673	57160	0	0
24	444.18	873.721	57982.5	0	0
25	450.23	875.85	58515.2	0	0
26	456.28	878.062	58741.4	0	0
27	462.331	880.358	58646.7	0	0
28	468.381	882.739	58218.7	0	0
29	474.431	885.206	57447.1	0	0
30	480.481	887.761	56324.2	0	0
31	486.532	890.404	54846.3	0	0
32	492.582	893.138	53027.4	0	0
33	498.632	895.964	50875.9	0	0
34	504.682	898.883	48399.2	0	0
35	510.732	901.897	45607.7	0	0
36	516.783	905.009	42514.8	0	0
37	522.833	908.22	39136.8	0	0
38	528.883	911.532	35493.5	0	0
39	534.933	914.947	31607.9	0	0
40	540.984	918.468	27506.9	0	0
41	547.034	922.096	23220.9	0	0
42	553.084	925.836	18784.8	0	0
43	559.134	929.689	14237.5	0	0
44	565.184	933.658	9622.63	0	0
45	571.235	937.747	4988.91	0	0
46	577.285	941.959	436.6	0	0
47	583.335	946.298	-3468.06	0	0
48	589.385	950.767	-6465.9	0	0
49	595.436	955.37	-8414.81	0	0
50	601.486	960.113	-9163.17	0	0
51	607.536	965	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.56218

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	259.686	842.461	0	0	0
2	266.412	841.779	1422.78	0	0
3	273.139	841.211	3158.75	0	0
4	279.866	840.755	5137.58	0	0
5	286.593	840.412	7295.47	0	0
6	293.319	840.181	9574.91	0	0
7	300.046	840.063	11924.4	0	0
8	306.773	840.056	14574.4	0	0
9	313.5	840.161	18187.9	0	0
10	320.226	840.379	22574.4	0	0
11	326.953	840.708	27493.1	0	0
12	333.68	841.15	32828.3	0	0
13	340.406	841.705	38470.5	0	0
14	347.133	842.374	44316.3	0	0
15	353.86	843.156	50267.9	0	0
16	360.587	844.053	56232.9	0	0
17	367.313	845.065	62124.2	0	0
18	374.04	846.194	67859.9	0	0
19	380.767	847.44	73363.1	0	0
20	387.494	848.804	78561.7	0	0
21	394.22	850.287	83388.9	0	0
22	400.947	851.892	87782.2	0	0
23	407.674	853.619	91683.3	0	0
24	414.4	855.47	94942.6	0	0
25	421.127	857.447	97522.8	0	0
26	427.854	859.552	99478.5	0	0
27	434.581	861.786	100881	0	0
28	441.307	864.153	101720	0	0
29	448.034	866.655	101964	0	0
30	454.761	869.293	101585	0	0
31	461.488	872.072	100562	0	0
32	468.214	874.995	98878.6	0	0
33	474.941	878.064	96526.2	0	0
34	481.668	881.284	93501.4	0	0
35	488.394	884.659	89815.3	0	0
36	495.121	888.193	85510.4	0	0
37	501.848	891.89	80617.6	0	0
38	508.575	895.757	75173.9	0	0
39	515.301	899.798	69225.6	0	0
40	522.028	904.021	62829.2	0	0
41	528.755	908.431	56052.4	0	0
42	535.482	913.037	48974.7	0	0
43	542.208	917.846	41689.3	0	0
44	548.935	922.867	34304.6	0	0
45	555.662	928.112	26945.7	0	0
46	562.389	933.591	19756.8	0	0
47	569.115	939.317	12903.8	0	0
48	575.842	945.303	6586.46	0	0
49	582.569	951.567	1759.3	0	0
50	589.295	958.125	-742.923	0	0
51	596.022	965	0	0	0

List Of Coordinates

External Boundary

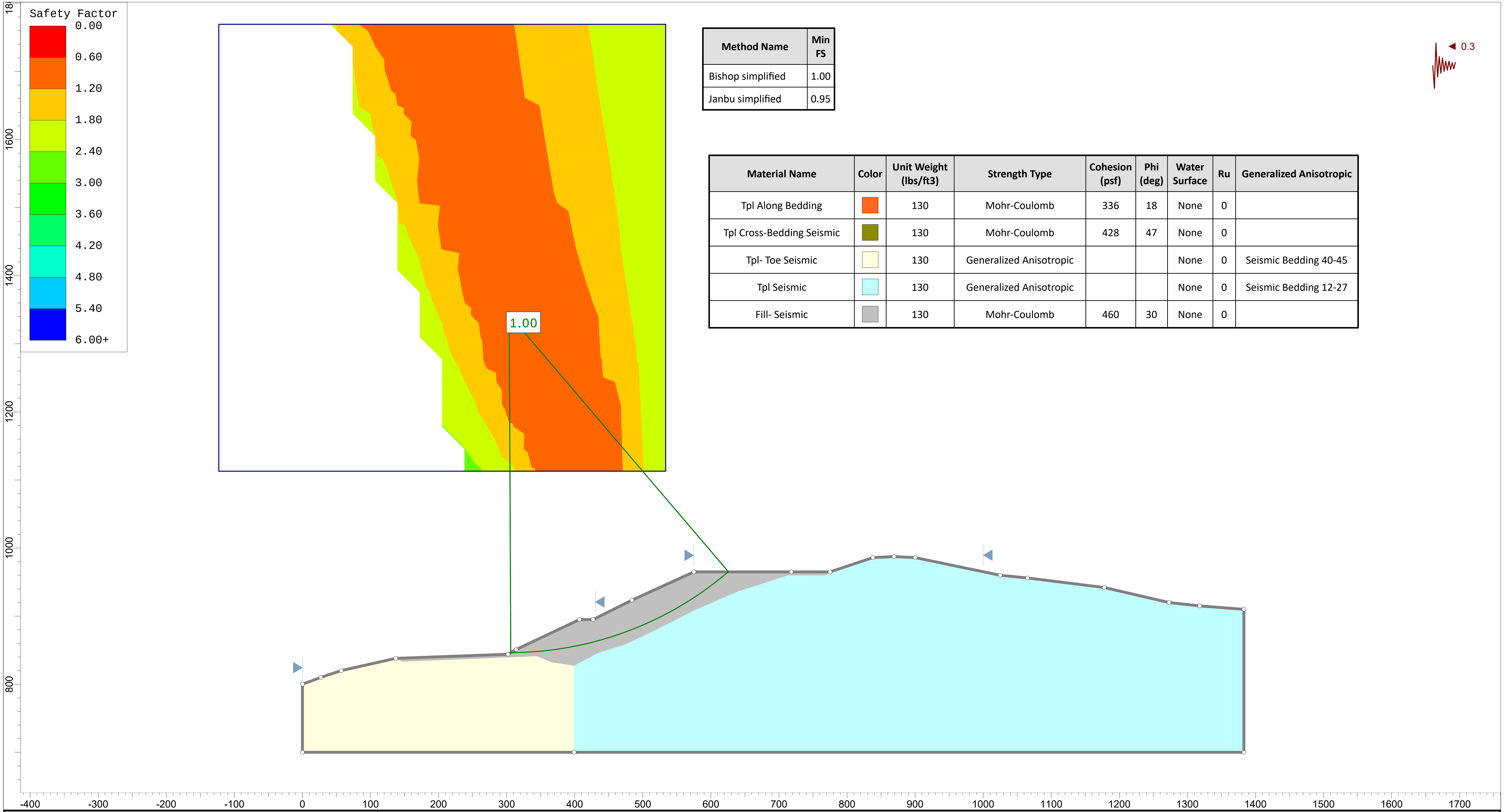
X	Y
0	700
399	700
1383	700
1383	910
1318	915
1273	920
1178	942
1065	956.2
1025	960
900	986
869	987.5
838	986
775	965
718	965
575	965
484	923.5
427	895
407	895
314	851
302	844
137	838
57	820
27	810
0	800

Material Boundary

X	Y
137	838
148	833
344	841
366	832
399	827
435	846
474	858
520	880
575	908
642	937
713	960
770	960
775	965

Material Boundary

X	Y
399	700
399	827



Method Name	Min FS
Bishop simplified	1.00
Janbu simplified	0.95

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Generalized Anisotropic
Tpl Along Bedding	🟧	130	Mohr-Coulomb	336	18	None	0	
Tpl Cross-Bedding Seismic	🟫	130	Mohr-Coulomb	428	47	None	0	
Tpl- Toe Seismic	🟨	130	Generalized Anisotropic			None	0	Seismic Bedding 40-45
Tpl Seismic	🟦	130	Generalized Anisotropic			None	0	Seismic Bedding 12-27
Fill- Seismic	⬜	130	Mohr-Coulomb	460	30	None	0	

TGR
Geotechnical
Environmental
Hydrogeology
Material Testing
Construction Inspection

SLIDEINTERPRET 7.038

Project HOFF Property, Yorba Linda, CA

Analysis Description Cross-section A-A', Seismic

Drawn By

Scale 1:1600

Company TGR Geotechnical, Inc.

Date 4/15/20

File Name Cross-section A-A' Seismic.slim

Slide Analysis Information

HOFF Property, Yorba Linda, CA

Project Summary

File Name:	Cross-section A-A' Seismic
Slide Modeler Version:	7.038
Project Title:	HOFF Property, Yorba Linda, CA
Analysis:	Cross-section A-A', Seismic
Company:	TGR Geotechnical, Inc.
Date Created:	4/15/20

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
	Janbu simplified

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Grid Search
Radius Increment:	10
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal): 0.3

Material Properties

Property	Tpl- Toe Seismic	Tpl Seismic	Fill- Seismic
Color	🟨	🟦	⬜
Strength Type	Generalized Anisotropic	Generalized Anisotropic	Mohr-Coulomb
Unit Weight [lbs/ft3]	130	130	130
Cohesion [psf]			460
Friction Angle [deg]			30
Water Surface	None	None	None
Ru Value	0	0	0

Generalized Anisotropic Functions

Name: Seismic Bedding 40-45

Angle From	Angle To	Material
40	-90	Tpl Cross-Bedding Seismic
45	40	Tpl Along Bedding
90	45	Tpl Cross-Bedding Seismic

Name: Seismic Bedding 12-27

Angle From	Angle To	Material
-27	-90	Tpl Cross-Bedding Seismic
-12	-27	Tpl Along Bedding
90	-12	Tpl Cross-Bedding Seismic

Global Minimums

Method: bishop simplified

FS	1.000960
Center:	303.811, 1342.660
Radius:	496.336
Left Slip Surface Endpoint:	305.991, 846.328
Right Slip Surface Endpoint:	625.872, 965.000
Resisting Moment:	3.95434e+008 lb-ft
Driving Moment:	3.95056e+008 lb-ft
Total Slice Area:	9944.48 ft2
Surface Horizontal Width:	319.88 ft
Surface Average Height:	31.0882 ft

Method: janbu simplified

FS	0.954049
Center:	369.455, 1145.730
Radius:	296.930
Left Slip Surface Endpoint:	318.617, 853.184
Right Slip Surface Endpoint:	605.048, 965.000
Resisting Horizontal Force:	751235 lb
Driving Horizontal Force:	787418 lb
Total Slice Area:	10438.4 ft2
Surface Horizontal Width:	286.43 ft
Surface Average Height:	36.4432 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	2783
Number of Invalid Surfaces:	2068

Error Codes:

Error Code -101 reported for 46 surfaces
Error Code -103 reported for 141 surfaces
Error Code -1000 reported for 1881 surfaces

Method: janbu simplified

Number of Valid Surfaces:	2783
Number of Invalid Surfaces:	2068

Error Codes:

Error Code -101 reported for 46 surfaces
Error Code -103 reported for 141 surfaces
Error Code -1000 reported for 1881 surfaces

Error Codes

The following errors were encountered during the computation:

-101 = Only one (or zero) surface / slope intersections.
-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.00096

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	6.3976	1523.07	0.620949	Fill-Seismic	460	30	593.165	593.734	231.634	0	231.634	238.063	238.063
2	6.3976	4370.77	1.3596	Fill-Seismic	460	30	842.081	842.889	663.183	0	663.183	683.169	683.169
3	6.3976	6746.11	2.09848	Fill-Seismic	460	30	1045.66	1046.66	1016.12	0	1016.12	1054.44	1054.44
4	6.3976	9034.13	2.83771	Fill-Seismic	460	30	1238.61	1239.8	1350.66	0	1350.66	1412.05	1412.05
5	6.3976	11253.3	3.57741	Fill-Seismic	460	30	1422.78	1424.15	1669.96	0	1669.96	1758.91	1758.91
6	6.3976	13403.5	4.31771	Fill-Seismic	460	30	1598.33	1599.86	1974.29	0	1974.29	2094.97	2094.97
7	6.3976	15484.5	5.05874	Fill-Seismic	460	30	1765.39	1767.08	2263.94	0	2263.94	2420.21	2420.21
8	6.3976	17496.1	5.80061	Fill-Seismic	460	30	1924.12	1925.97	2539.14	0	2539.14	2734.6	2734.6
9	6.3976	19438.1	6.54346	Fill-Seismic	460	30	2074.67	2076.66	2800.13	0	2800.13	3038.1	3038.1
10	6.3976	21310.1	7.28741	Fill-Seismic	460	30	2217.14	2219.27	3047.15	0	3047.15	3330.68	3330.68
11	6.3976	23111.8	8.03261	Fill-Seismic	460	30	2351.67	2353.93	3280.38	0	3280.38	3612.25	3612.25
12	6.3976	24842.9	8.77917	Fill-Seismic	460	30	2478.37	2480.75	3500.04	0	3500.04	3882.79	3882.79
13	6.3976	26502.9	9.52724	Fill-Seismic	460	30	2597.34	2599.83	3706.29	0	3706.29	4142.2	4142.2
14	6.3976	28091.4	10.277	Fill-Seismic	460	30	2708.68	2711.28	3899.33	0	3899.33	4390.45	4390.45
15	6.3976	29607.9	11.0285	Fill-Seismic	460	30	2812.48	2815.18	4079.3	0	4079.3	4627.44	4627.44
16	6.3976	30995.5	11.7819	Fill-Seismic	460	30	2904.31	2907.1	4238.5	0	4238.5	4844.28	4844.28
17	6.3976	30631.6	12.5374	Fill-Seismic	460	30	2854.73	2857.47	4152.53	0	4152.53	4787.36	4787.36
18	6.3976	29411.3	13.2951	Fill-Seismic	460	30	2737.73	2740.36	3949.7	0	3949.7	4596.62	4596.62
19	6.3976	28126.3	14.0552	Fill-Seismic	460	30	2617.1	2619.61	3740.57	0	3740.57	4395.76	4395.76
20	6.3976	28304	14.8178	Fill-Seismic	460	30	2612.39	2614.9	3732.39	0	3732.39	4423.49	4423.49
21	6.3976	29518.7	15.5831	Fill-Seismic	460	30	2688.08	2690.66	3863.62	0	3863.62	4613.3	4613.3
22	6.3976	30656.6	16.3513	Fill-Seismic	460	30	2756.56	2759.21	3982.35	0	3982.35	4791.1	4791.1
23	6.3976	31716.8	17.1225	Fill-Seismic	460	30	2817.88	2820.59	4088.66	0	4088.66	4956.77	4956.77
24	6.3976	32698.5	17.897	Fill-Seismic	460	30	2872.1	2874.86	4182.66	0	4182.66	5110.16	5110.16
25	6.3976	33600.6	18.6748	Fill-Seismic	460	30	2919.27	2922.07	4264.43	0	4264.43	5251.11	5251.11
26	6.3976	34422	19.4562	Fill-Seismic	460	30	2959.4	2962.24	4334.01	0	4334.01	5379.44	5379.44
27	6.3976	35161.6	20.2414	Fill-Seismic	460	30	2992.56	2995.43	4391.49	0	4391.49	5495	5495
28	6.3976	35814.5	21.0306	Fill-Seismic	460	30	3018.49	3021.39	4436.45	0	4436.45	5596.99	5596.99
29	6.3976	36232.2	21.824	Fill-Seismic	460	30	3026.46	3029.37	4450.27	0	4450.27	5662.24	5662.24
30	6.3976	36484.7	22.6218	Fill-Seismic	460	30	3021.93	3024.83	4442.41	0	4442.41	5701.66	5701.66
31	6.3976	36650.1	23.4243	Fill-	460	30	3010.77	3013.66	4423.07	0	4423.07	5727.46	5727.46

				Seismic									
32	6.3976	36726.6	24.2316	Fill-Seismic	460	30	2993.02	2995.89	4392.28	0	4392.28	5739.39	5739.39
33	6.3976	36712.7	25.0442	Fill-Seismic	460	30	2968.66	2971.51	4350.07	0	4350.07	5737.17	5737.17
34	6.3976	36606.5	25.8621	Fill-Seismic	460	30	2937.73	2940.55	4296.45	0	4296.45	5720.53	5720.53
35	6.3976	36406.1	26.6858	Fill-Seismic	460	30	2900.23	2903.01	4231.43	0	4231.43	5689.19	5689.19
36	6.3976	36109.6	27.5154	Fill-Seismic	460	30	2856.16	2858.9	4155.01	0	4155.01	5642.81	5642.81
37	6.3976	35714.7	28.3514	Fill-Seismic	460	30	2805.51	2808.2	4067.21	0	4067.21	5581.07	5581.07
38	6.3976	35219.2	29.194	Fill-Seismic	460	30	2748.29	2750.93	3968	0	3968	5503.59	5503.59
39	6.3976	34620.6	30.0435	Fill-Seismic	460	30	2684.48	2687.06	3857.39	0	3857.39	5410	5410
40	6.3976	33916.2	30.9005	Fill-Seismic	460	30	2614.1	2616.61	3735.36	0	3735.36	5299.89	5299.89
41	6.3976	33103.2	31.7651	Fill-Seismic	460	30	2537.1	2539.54	3601.87	0	3601.87	5172.8	5172.8
42	6.3976	32178.5	32.6379	Fill-Seismic	460	30	2453.48	2455.84	3456.91	0	3456.91	5028.27	5028.27
43	6.3976	30040.2	33.5194	Fill-Seismic	460	30	2291.58	2293.78	3176.2	0	3176.2	4694.08	4694.08
44	6.3976	26458.5	34.4099	Fill-Seismic	460	30	2038.75	2040.71	2737.87	0	2737.87	4134.35	4134.35
45	6.3976	22751.9	35.31	Fill-Seismic	460	30	1782.07	1783.78	2292.85	0	2292.85	3555.09	3555.09
46	6.3976	18918.9	36.2202	Fill-Seismic	460	30	1521.75	1523.21	1841.55	0	1841.55	2956.12	2956.12
47	6.3976	14955.3	37.1412	Fill-Seismic	460	30	1257.85	1259.05	1384.01	0	1384.01	2336.73	2336.73
48	6.3976	10856.2	38.0735	Fill-Seismic	460	30	990.406	991.357	920.337	0	920.337	1696.17	1696.17
49	6.3976	6616.46	39.0178	Fill-Seismic	460	30	719.49	720.181	450.647	0	450.647	1033.65	1033.65
50	6.3976	2230.37	39.975	Fill-Seismic	460	30	445.171	445.598	-24.9445	0	-24.9445	348.267	348.267

Global Minimum Query (janbu simplified) - Safety Factor: 0.954049

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	5.72861	1358.45	-9.29815	Fill-Seismic	460	30	694.457	662.546	350.819	0	350.819	237.12	237.12
2	5.72861	4032.72	-8.17969	Fill-Seismic	460	30	994.675	948.969	846.92	0	846.92	703.945	703.945
3	5.72861	6622.1	-7.06437	Fill-Seismic	460	30	1277.49	1218.79	1314.26	0	1314.26	1155.95	1155.95
4	5.72861	9127.24	-5.95173	Fill-Seismic	460	30	1543.72	1472.78	1754.18	0	1754.18	1593.25	1593.25
5	5.72861	11548.7	-4.84135	Fill-Seismic	460	30	1794.08	1711.64	2167.91	0	2167.91	2015.96	2015.96
6	5.72861	13887	-3.73278	Fill-Seismic	460	30	2029.26	1936.01	2556.51	0	2556.51	2424.12	2424.12
7	5.72861	16142.4	-2.62561	Fill-Seismic	460	30	2249.83	2146.45	2921.01	0	2921.01	2817.84	2817.84
8	5.72861	18315.2	-1.51942	Fill-Seismic	460	30	2456.36	2343.49	3262.3	0	3262.3	3197.14	3197.14
9	5.72861	20405.6	-0.413799	Fill-Seismic	460	30	2649.34	2527.6	3581.18	0	3581.18	3562.04	3562.04
10	5.72861	22413.7	0.691669	Fill-Seismic	460	30	2829.23	2699.22	3878.44	0	3878.44	3912.6	3912.6

11	5.72861	24339.4	1.79739	Fill-Seismic	460	30	2996.42	2858.73	4154.72	0	4154.72	4248.75	4248.75
12	5.72861	26182.7	2.90379	Fill-Seismic	460	30	3151.32	3006.51	4410.69	0	4410.69	4570.54	4570.54
13	5.72861	27943.3	4.01127	Fill-Seismic	460	30	3294.24	3142.87	4646.87	0	4646.87	4877.88	4877.88
14	5.72861	29621	5.12026	Fill-Seismic	460	30	3425.53	3268.12	4863.81	0	4863.81	5170.75	5170.75
15	5.72861	31215.4	6.23117	Fill-Seismic	460	30	3545.45	3382.53	5061.97	0	5061.97	5449.08	5449.08
16	5.72861	32396.2	7.34444	Fill-Seismic	460	30	3621.94	3455.51	5188.37	0	5188.37	5655.2	5655.2
17	5.72861	31989.1	8.46051	Fill-Seismic	460	30	3542.56	3379.78	5057.21	0	5057.21	5584.15	5584.15
18	5.72861	31311.8	9.57982	Fill-Seismic	460	30	3438.69	3280.68	4885.56	0	4885.56	5465.93	5465.93
19	5.72861	30555.5	10.7028	Fill-Seismic	460	30	3329.23	3176.25	4704.69	0	4704.69	5333.93	5333.93
20	5.72861	30936.8	11.83	Fill-Seismic	460	30	3328.4	3175.46	4703.32	0	4703.32	5400.48	5400.48
21	5.72861	32132.1	12.9619	Fill-Seismic	460	30	3402.63	3246.28	4825.98	0	4825.98	5609.15	5609.15
22	5.72861	33238.5	14.0989	Fill-Seismic	460	30	3466.56	3307.27	4931.62	0	4931.62	5802.29	5802.29
23	5.72861	34254.6	15.2416	Fill-Seismic	460	30	3520.33	3358.57	5020.48	0	5020.48	5979.69	5979.69
24	5.72861	35179.1	16.3906	Fill-Seismic	460	30	3564.06	3400.29	5092.74	0	5092.74	6141.07	6141.07
25	5.72861	36010.3	17.5464	Fill-Seismic	460	30	3597.86	3432.53	5148.57	0	5148.57	6286.18	6286.18
26	5.72861	36746.5	18.7096	Fill-Seismic	460	30	3621.78	3455.36	5188.12	0	5188.12	6414.71	6414.71
27	5.72861	37385.8	19.8809	Fill-Seismic	460	30	3635.93	3468.86	5211.5	0	5211.5	6526.32	6526.32
28	5.72861	37926.1	21.0609	Fill-Seismic	460	30	3640.35	3473.07	5218.79	0	5218.79	6620.63	6620.63
29	5.72861	38363.5	22.2504	Fill-Seismic	460	30	3634.95	3467.92	5209.88	0	5209.88	6697	6697
30	5.72861	38582	23.45	Fill-Seismic	460	30	3610.28	3444.38	5169.11	0	5169.11	6735.16	6735.16
31	5.72861	38623	24.6607	Fill-Seismic	460	30	3570.34	3406.28	5103.1	0	5103.1	6742.3	6742.3
32	5.72861	38554.2	25.8832	Fill-Seismic	460	30	3521.15	3359.35	5021.81	0	5021.81	6730.31	6730.31
33	5.72861	38372.3	27.1185	Fill-Seismic	460	30	3462.68	3303.57	4925.22	0	4925.22	6698.57	6698.57
34	5.72861	38073.7	28.3676	Fill-Seismic	460	30	3394.95	3238.95	4813.29	0	4813.29	6646.45	6646.45
35	5.72861	37654.1	29.6316	Fill-Seismic	460	30	3317.9	3165.44	4685.96	0	4685.96	6573.21	6573.21
36	5.72861	37109.1	30.9117	Fill-Seismic	460	30	3231.5	3083.01	4543.19	0	4543.19	6478.09	6478.09
37	5.72861	36433.7	32.2091	Fill-Seismic	460	30	3135.68	2991.59	4384.85	0	4384.85	6360.19	6360.19
38	5.72861	35622.3	33.5254	Fill-Seismic	460	30	3030.39	2891.14	4210.85	0	4210.85	6218.55	6218.55
39	5.72861	34668.7	34.862	Fill-Seismic	460	30	2915.53	2781.56	4021.06	0	4021.06	6052.09	6052.09
40	5.72861	33565.9	36.2207	Fill-Seismic	460	30	2791.02	2662.77	3815.32	0	3815.32	5859.59	5859.59
41	5.72861	32306.2	37.6035	Fill-Seismic	460	30	2656.76	2534.68	3593.45	0	3593.45	5639.69	5639.69
42	5.72861	30880.7	39.0124	Fill-Seismic	460	30	2512.62	2397.16	3355.27	0	3355.27	5390.85	5390.85
43	5.72861	29279.6	40.4501	Fill-	460	30	2358.48	2250.11	3100.56	0	3100.56	5111.35	5111.35

				Seismic									
44	5.72861	27491.3	41.9192	Fill-Seismic	460	30	2194.21	2093.38	2829.1	0	2829.1	4799.18	4799.18
45	5.72861	25444.4	43.423	Fill-Seismic	460	30	2015.71	1923.09	2534.15	0	2534.15	4441.86	4441.86
46	5.72861	21849.3	44.9652	Fill-Seismic	460	30	1739.19	1659.27	2077.19	0	2077.19	3814.27	3814.27
47	5.72861	17467	46.5501	Fill-Seismic	460	30	1420.19	1354.93	1550.07	0	1550.07	3049.27	3049.27
48	5.72861	12831	48.1828	Fill-Seismic	460	30	1096.19	1045.82	1014.67	0	1014.67	2239.95	2239.95
49	5.72861	7916.28	49.8693	Fill-Seismic	460	30	767.509	732.241	471.536	0	471.536	1381.99	1381.99
50	5.72861	2692.95	51.617	Fill-Seismic	460	30	434.625	414.653	-78.5428	0	-78.5428	470.151	470.151

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.00096

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	305.991	846.328	0	0	0
2	312.389	846.398	3325.49	0	0
3	318.787	846.549	7306.03	0	0
4	325.184	846.784	11740.1	0	0
5	331.582	847.101	16533.3	0	0
6	337.979	847.501	21600.5	0	0
7	344.377	847.984	26861.1	0	0
8	350.775	848.55	32238.7	0	0
9	357.172	849.2	37661.3	0	0
10	363.57	849.934	43060.7	0	0
11	369.967	850.752	48372.7	0	0
12	376.365	851.655	53537	0	0
13	382.763	852.643	58496.9	0	0
14	389.16	853.717	63199.2	0	0
15	395.558	854.877	67594.3	0	0
16	401.955	856.124	71636	0	0
17	408.353	857.458	75279.9	0	0
18	414.751	858.881	78463.6	0	0
19	421.148	860.392	81201	0	0
20	427.546	861.994	83531.3	0	0
21	433.943	863.687	85452.3	0	0
22	440.341	865.471	86917	0	0
23	446.739	867.348	87897.4	0	0
24	453.136	869.319	88369	0	0
25	459.534	871.385	88310.3	0	0
26	465.931	873.547	87703.3	0	0
27	472.329	875.807	86533	0	0
28	478.727	878.166	84788.1	0	0
29	485.124	880.626	82460.9	0	0
30	491.522	883.188	79570.5	0	0
31	497.92	885.854	76133.6	0	0
32	504.317	888.625	72159.3	0	0
33	510.715	891.505	67660.5	0	0
34	517.112	894.494	62653.8	0	0
35	523.51	897.595	57159.9	0	0
36	529.908	900.811	51203.5	0	0
37	536.305	904.144	44813.9	0	0
38	542.703	907.596	38024.6	0	0
39	549.1	911.17	30874.1	0	0
40	555.498	914.871	23405.8	0	0
41	561.896	918.7	15668.5	0	0
42	568.293	922.661	7716.45	0	0
43	574.691	926.758	-389.943	0	0
44	581.088	930.996	-8186.75	0	0
45	587.486	935.378	-15066.4	0	0
46	593.884	939.909	-20870	0	0
47	600.281	944.595	-25429.8	0	0
48	606.679	949.441	-28568	0	0
49	613.076	954.453	-30094.9	0	0
50	619.474	959.637	-29808.5	0	0
51	625.872	965	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 0.954049

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	318.617	853.184	0	0	0
2	324.346	852.247	3899.31	0	0
3	330.074	851.423	9084.32	0	0
4	335.803	850.713	15348.1	0	0
5	341.532	850.116	22499.9	0	0
6	347.26	849.631	30363.6	0	0
7	352.989	849.257	38776.4	0	0
8	358.717	848.994	47588	0	0
9	364.446	848.842	56659	0	0
10	370.175	848.801	65860.7	0	0
11	375.903	848.87	75074	0	0
12	381.632	849.05	84188.6	0	0
13	387.36	849.34	93102.7	0	0
14	393.089	849.742	101722	0	0
15	398.818	850.256	109961	0	0
16	404.546	850.881	117738	0	0
17	410.275	851.619	124934	0	0
18	416.003	852.471	131320	0	0
19	421.732	853.438	136899	0	0
20	427.461	854.521	141709	0	0
21	433.189	855.721	145849	0	0
22	438.918	857.039	149336	0	0
23	444.647	858.478	152125	0	0
24	450.375	860.039	154177	0	0
25	456.104	861.724	155456	0	0
26	461.832	863.536	155936	0	0
27	467.561	865.476	155592	0	0
28	473.29	867.547	154406	0	0
29	479.018	869.753	152368	0	0
30	484.747	872.097	149469	0	0
31	490.475	874.582	145729	0	0
32	496.204	877.212	141171	0	0
33	501.933	879.991	135815	0	0
34	507.661	882.925	129688	0	0
35	513.39	886.019	122823	0	0
36	519.118	889.277	115263	0	0
37	524.847	892.707	107056	0	0
38	530.576	896.316	98263.2	0	0
39	536.304	900.111	88952.8	0	0
40	542.033	904.102	79205.4	0	0
41	547.761	908.298	69113.8	0	0
42	553.49	912.71	58784.8	0	0
43	559.219	917.351	48340.9	0	0
44	564.947	922.235	37923	0	0
45	570.676	927.379	27692.5	0	0
46	576.405	932.8	17865.8	0	0
47	582.133	938.522	9388	0	0
48	587.862	944.569	2908.97	0	0
49	593.59	950.972	-1158.55	0	0
50	599.319	957.768	-2341.53	0	0
51	605.048	965	0	0	0

List Of Coordinates

External Boundary

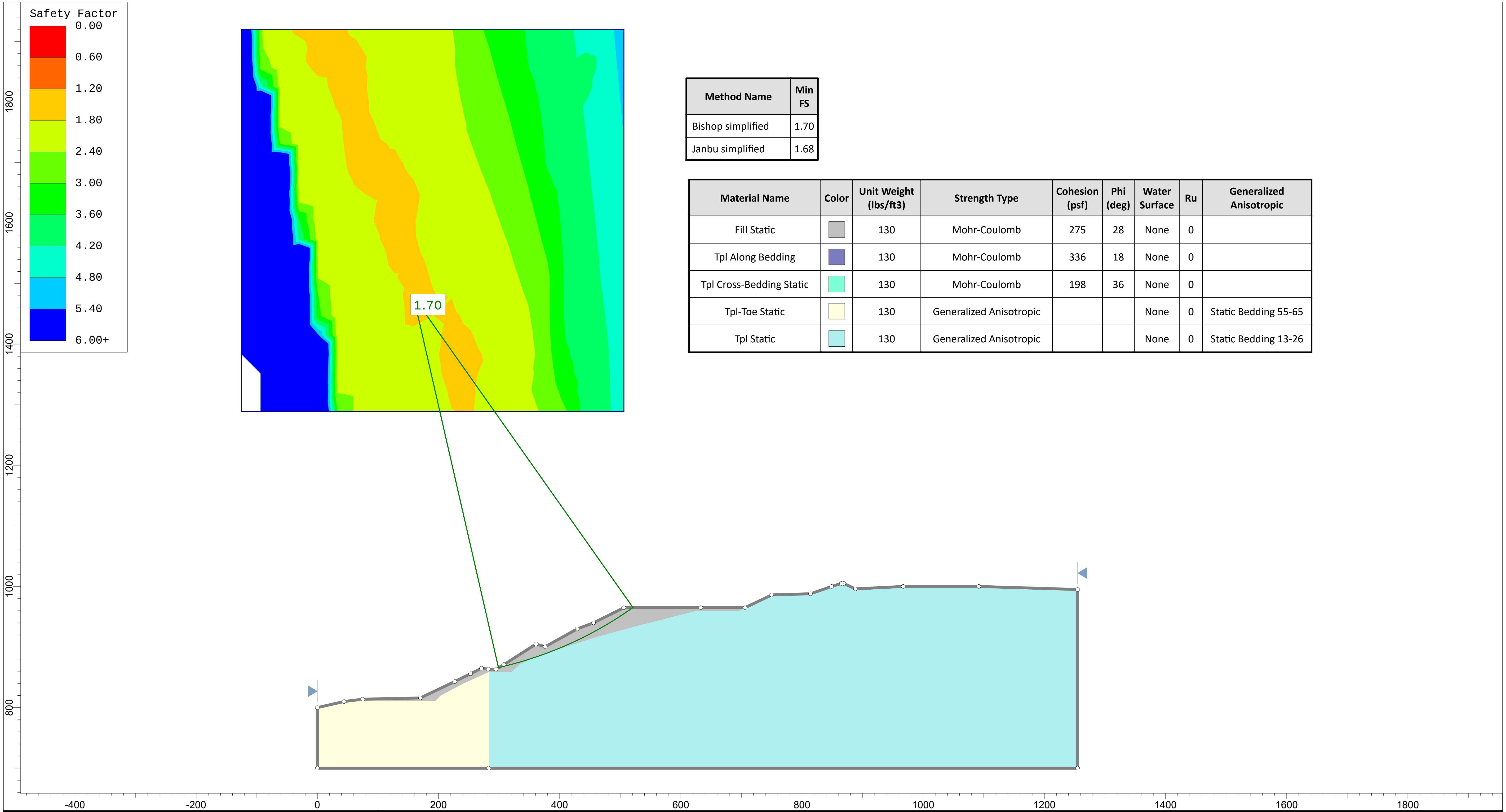
X	Y
0	700
399	700
1383	700
1383	910
1318	915
1273	920
1178	942
1065	956.2
1025	960
900	986
869	987.5
838	986
775	965
718	965
575	965
484	923.5
427	895
407	895
314	851
302	844
137	838
57	820
27	810
0	800

Material Boundary

X	Y
137	838
148	833
344	841
366	832
399	827
435	846
474	858
520	880
575	908
642	937
713	960
770	960
775	965

Material Boundary

X	Y
399	700
399	827



Method Name	Min FS
Bishop simplified	1.70
Janbu simplified	1.68

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Generalized Anisotropic
Fill Static	■	130	Mohr-Coulomb	275	28	None	0	
Tpl Along Bedding	■	130	Mohr-Coulomb	336	18	None	0	
Tpl Cross-Bedding Static	■	130	Mohr-Coulomb	198	36	None	0	
Tpl-Toe Static	■	130	Generalized Anisotropic			None	0	Static Bedding 55-65
Tpl Static	■	130	Generalized Anisotropic			None	0	Static Bedding 13-26

TGR
Geotechnical
Environmental
Hydrogeology
Material Testing
Construction Inspection

SLIDEINTERPRET 7.038

Project HOFF Property, Yorba Linda

Analysis Description Cross-section B-B', Static

Drawn By

Scale 1:1800

Company TGR Geotechnical, Inc.

Date 4/15/20

File Name Cross-section B-B' Static.slim

Slide Analysis Information
HOFF Property, Yorba Linda

Project Summary

File Name:	Cross-section B-B' Static
Slide Modeler Version:	7.038
Project Title:	HOFF Property, Yorba Linda
Analysis:	Cross-section B-B', Static
Company:	TGR Geotechnical, Inc.
Date Created:	4/15/20

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
	Janbu simplified

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Grid Search
Radius Increment:	10
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	Fill Static	Tpl-Toe Static	Tpl Static
Color	⬛	🟨	🟦
Strength Type	Mohr-Coulomb	Generalized Anisotropic	Generalized Anisotropic
Unit Weight [lbs/ft3]	130	130	130
Cohesion [psf]	275		
Friction Angle [deg]	28		
Water Surface	None	None	None
Ru Value	0	0	0

Generalized Anisotropic Functions

Name: Static Bedding 13-26

Angle From	Angle To	Material
-26	-90	Tpl Cross-Bedding Static
-13	-26	Tpl Along Bedding
90	-13	Tpl Cross-Bedding Static

Name: Static Bedding 55-65

Angle From	Angle To	Material
55	-90	Tpl Cross-Bedding Static
65	55	Tpl Along Bedding
90	65	Tpl Cross-Bedding Static

Global Minimums

Method: bishop simplified

FS	1.701430
Center:	158.893, 1478.144
Radius:	628.153
Left Slip Surface Endpoint:	299.023, 865.821
Right Slip Surface Endpoint:	521.190, 965.000
Resisting Moment:	1.67715e+008 lb-ft
Driving Moment:	9.85731e+007 lb-ft
Total Slice Area:	2995.4 ft2
Surface Horizontal Width:	222.168 ft
Surface Average Height:	13.4826 ft

Method: janbu simplified

FS	1.681820
Center:	222.008, 1383.472
Radius:	515.895
Left Slip Surface Endpoint:	316.173, 876.243
Right Slip Surface Endpoint:	523.718, 965.000
Resisting Horizontal Force:	218059 lb
Driving Horizontal Force:	129656 lb
Total Slice Area:	2755.33 ft2
Surface Horizontal Width:	207.545 ft
Surface Average Height:	13.2758 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	4696
Number of Invalid Surfaces:	155

Error Codes:

Error Code -102 reported for 11 surfaces
Error Code -103 reported for 84 surfaces
Error Code -106 reported for 37 surfaces
Error Code -108 reported for 1 surface
Error Code -1000 reported for 22 surfaces

Method: janbu simplified

Number of Valid Surfaces:	4687
Number of Invalid Surfaces:	164

Error Codes:

Error Code -102 reported for 11 surfaces
Error Code -103 reported for 84 surfaces
Error Code -106 reported for 37 surfaces
Error Code -108 reported for 10 surfaces
Error Code -1000 reported for 22 surfaces

Error Codes

The following errors were encountered during the computation:

-102 = Two surface / slope intersections, but resulting arc is actually outside soil region.
-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very

small (0.1 is an arbitrary number).
-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.70143

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	4.37257	427.894	13.0949	Fill Static	275	28	179.195	304.888	56.2118	0	56.2118	97.8949	97.8949
2	4.37257	1274.3	13.5047	Fill Static	275	28	235.075	399.963	235.022	0	235.022	291.478	291.478
3	4.37257	2173.84	13.9152	Fill Static	275	28	294.232	500.615	424.319	0	424.319	497.217	497.217
4	4.37257	3142.81	14.3265	Fill Static	275	28	357.72	608.636	627.477	0	627.477	718.835	718.835
5	4.37257	4092.98	14.7385	Fill Static	275	28	419.682	714.06	825.752	0	825.752	936.155	936.155
6	4.37257	5024.02	15.1513	Fill Static	275	28	480.104	816.863	1019.1	0	1019.1	1149.1	1149.1
7	4.37257	5935.82	15.5649	Fill Static	275	28	538.985	917.046	1207.51	0	1207.51	1357.64	1357.64
8	4.37257	6828.27	15.9794	Fill Static	275	28	596.327	1014.61	1391	0	1391	1561.76	1561.76
9	4.37257	7701.24	16.3947	Fill Static	275	28	652.129	1109.55	1569.56	0	1569.56	1761.43	1761.43
10	4.37257	8554.62	16.8109	Fill Static	275	28	706.39	1201.87	1743.2	0	1743.2	1956.61	1956.61
11	4.37257	9388.27	17.228	Fill Static	275	28	759.109	1291.57	1911.9	0	1911.9	2147.29	2147.29
12	4.37257	10202.1	17.646	Fill Static	275	28	810.289	1378.65	2075.66	0	2075.66	2333.42	2333.42
13	4.74962	11980.3	18.0832	Tpl Cross-Bedding Static	198	36	1047.53	1782.3	2180.61	0	2180.61	2522.65	2522.65
14	4.74962	12891	18.5395	Tpl Cross-Bedding Static	198	36	1115.71	1898.31	2340.27	0	2340.27	2714.44	2714.44
15	4.74962	12399.5	18.9971	Tpl Cross-Bedding Static	198	36	1073.49	1826.46	2241.38	0	2241.38	2610.94	2610.94
16	4.74962	10496.9	19.4559	Tpl Cross-Bedding Static	198	36	921.254	1567.45	1884.89	0	1884.89	2210.33	2210.33
17	4.74962	8567.84	19.916	Tpl Cross-Bedding Static	198	36	767.96	1306.63	1525.9	0	1525.9	1804.14	1804.14
18	4.74962	7499.05	20.3775	Tpl Cross-Bedding Static	198	36	682.431	1161.11	1325.6	0	1325.6	1579.09	1579.09
19	4.41247	7412.28	20.8239	Fill Static	275	28	613.711	1044.19	1446.63	0	1446.63	1680.05	1680.05
20	4.41247	7847.48	21.2551	Fill Static	275	28	639.719	1088.44	1529.85	0	1529.85	1778.69	1778.69
21	4.41247	8260.72	21.6876	Fill Static	275	28	664.205	1130.1	1608.21	0	1608.21	1872.36	1872.36
22	4.41247	8651.8	22.1214	Fill Static	275	28	687.164	1169.16	1681.67	0	1681.67	1961	1961
23	4.41247	9020.51	22.5565	Fill Static	275	28	708.593	1205.62	1750.25	0	1750.25	2044.57	2044.57
24	4.41247	9366.64	22.993	Fill Static	275	28	728.489	1239.47	1813.91	0	1813.91	2123.03	2123.03
25	4.41247	9689.99	23.431	Fill Static	275	28	746.847	1270.71	1872.65	0	1872.65	2196.32	2196.32
26	4.41247	9990.31	23.8703	Fill Static	275	28	763.664	1299.32	1926.46	0	1926.46	2264.4	2264.4
27	4.41247	10267.4	24.3112	Fill Static	275	28	778.933	1325.3	1975.32	0	1975.32	2327.2	2327.2
28	4.41247	10521	24.7536	Fill Static	275	28	792.645	1348.63	2019.21	0	2019.21	2384.68	2384.68
29	4.41247	10750.8	25.1976	Fill Static	275	28	804.805	1369.32	2058.12	0	2058.12	2436.79	2436.79
30	4.41247	10768.6	25.6433	Fill Static	275	28	803.818	1367.64	2054.96	0	2054.96	2440.83	2440.83
31	4.41247	10481.5	26.0906	Fill Static	275	28	784.082	1334.06	1991.8	0	1991.8	2375.76	2375.76
32	4.41247	10167.2	26.5396	Fill Static	275	28	762.758	1297.78	1923.56	0	1923.56	2304.52	2304.52
33	4.41247	9827.98	26.9903	Fill Static	275	28	740.002	1259.06	1850.75	0	1850.75	2227.64	2227.64
34	4.41247	9463.66	27.4429	Fill Static	275	28	715.813	1217.91	1773.35	0	1773.35	2145.07	2145.07
35	4.41247	9073.9	27.8974	Fill Static	275	28	690.185	1174.3	1691.34	0	1691.34	2056.73	2056.73
36	4.41247	8756.69	28.3538	Fill Static	275	28	669.07	1138.38	1623.77	0	1623.77	1984.84	1984.84
37	4.41247	8634.82	28.8121	Fill Static	275	28	659.854	1122.7	1594.29	0	1594.29	1957.22	1957.22
38	4.41247	8494.88	29.2725	Fill Static	275	28	649.577	1105.21	1561.4	0	1561.4	1925.51	1925.51
39	4.41247	8328.16	29.7349	Fill Static	275	28	637.722	1085.04	1523.46	0	1523.46	1887.73	1887.73
40	4.41247	8134.28	30.1995	Fill Static	275	28	624.281	1062.17	1480.45	0	1480.45	1843.79	1843.79
41	4.41247	7912.85	30.6663	Fill Static	275	28	609.247	1036.59	1432.34	0	1432.34	1793.6	1793.6
42	4.41247	7663.49	31.1354	Fill Static	275	28	592.609	1008.28	1379.1	0	1379.1	1737.09	1737.09
43	4.41247	7385.77	31.6068	Fill Static	275	28	574.358	977.23	1320.7	0	1320.7	1674.14	1674.14
44	4.41247	7079.26	32.0806	Fill Static	275	28	554.485	943.417	1257.11	0	1257.11	1604.67	1604.67
45	4.41247	6743.52	32.5568	Fill Static	275	28	532.979	906.826	1188.29	0	1188.29	1528.58	1528.58
46	4.41247	6378.09	33.0356	Fill Static	275	28	509.829	867.439	1114.22	0	1114.22	1445.75	1445.75
47	4.41247	5858.52	33.517	Fill Static	275	28	477.752	812.861	1011.57	0	1011.57	1327.99	1327.99
48	4.41247	4363.28	34.0012	Fill Static	275	28	388.771	661.466	726.836	0	726.836	989.077	989.077
49	4.41247	2640.22	34.488	Fill Static	275	28	287.047	488.391	401.331	0	401.331	598.525	598.525
50	4.41247	885.414	34.9778	Fill Static	275	28	184.117	313.261	71.9592	0	71.9592	200.773	200.773

Global Minimum Query (janbu simplified) - Safety Factor: 1.68182

			Angle		Base	Base	Shear	Shear	Base	Pore	Effective	Base	Effective

Number	[ft]	[lbs]	of Slice Base [degrees]	Material	Cohesion [psf]	Friction Angle [degrees]	Stress [psf]	Strength [psf]	Normal Stress [psf]	Pressure [psf]	Normal Stress [psf]	Vertical Stress [psf]	Vertical Stress [psf]
1	4.1509	505.795	10.7517	Fill Static	275	28	190.61	320.572	85.7088	0	85.7088	121.903	121.903
2	4.1509	1507.86	11.2213	Fill Static	275	28	261.952	440.556	311.366	0	311.366	363.335	363.335
3	4.1509	2490.82	11.6917	Fill Static	275	28	331.564	557.631	531.553	0	531.553	600.166	600.166
4	4.1509	3454.6	12.1629	Fill Static	275	28	399.451	671.805	746.281	0	746.281	832.374	832.374
5	4.1509	4399.08	12.6349	Fill Static	275	28	465.615	783.081	955.562	0	955.562	1059.94	1059.94
6	4.1509	5324.16	13.1078	Fill Static	275	28	530.06	891.465	1159.4	0	1159.4	1282.83	1282.83
7	4.1509	6229.73	13.5816	Fill Static	275	28	592.786	996.96	1357.81	0	1357.81	1501.02	1501.02
8	4.1509	7115.68	14.0563	Fill Static	275	28	653.797	1099.57	1550.79	0	1550.79	1714.48	1714.48
9	4.1509	7981.88	14.5321	Fill Static	275	28	713.094	1199.3	1738.35	0	1738.35	1923.19	1923.19
10	4.1509	8828.22	15.0088	Fill Static	275	28	770.677	1296.14	1920.48	0	1920.48	2127.11	2127.11
11	4.1509	9612.05	15.4866	Fill Static	275	28	823.572	1385.1	2087.79	0	2087.79	2315.98	2315.98
12	4.1509	8982.93	15.9656	Fill Static	275	28	777.473	1307.57	1941.98	0	1941.98	2164.41	2164.41
13	4.1509	7659.96	16.4457	Fill Static	275	28	683.257	1149.12	1643.97	0	1643.97	1845.66	1845.66
14	4.1509	6316.56	16.9269	Fill Static	275	28	588.106	989.088	1343	0	1343	1521.99	1521.99
15	4.1509	5283.23	17.4094	Fill Static	275	28	514.934	866.026	1111.56	0	1111.56	1273.02	1273.02
16	4.1509	5653.64	17.8932	Fill Static	275	28	539.164	906.777	1188.2	0	1188.2	1362.27	1362.27
17	4.1509	6166.7	18.3783	Fill Static	275	28	573.087	963.829	1295.5	0	1295.5	1485.9	1485.9
18	4.1509	6658.67	18.8648	Fill Static	275	28	605.365	1018.12	1397.6	0	1397.6	1604.45	1604.45
19	4.1509	7129.37	19.3527	Fill Static	275	28	635.997	1069.63	1494.49	0	1494.49	1717.87	1717.87
20	4.1509	7578.61	19.8421	Fill Static	275	28	664.979	1118.38	1586.16	0	1586.16	1826.12	1826.12
21	4.1509	8006.2	20.3329	Fill Static	275	28	692.31	1164.34	1672.61	0	1672.61	1929.15	1929.15
22	4.1509	8411.93	20.8254	Fill Static	275	28	717.985	1207.52	1753.82	0	1753.82	2026.92	2026.92
23	4.1509	8795.58	21.3194	Fill Static	275	28	742.002	1247.91	1829.78	0	1829.78	2119.37	2119.37
24	4.1509	9156.93	21.8151	Fill Static	275	28	764.356	1285.51	1900.49	0	1900.49	2206.45	2206.45
25	4.1509	9495.77	22.3126	Fill Static	275	28	785.042	1320.3	1965.93	0	1965.93	2288.1	2288.1
26	4.1509	9811.84	22.8118	Fill Static	275	28	804.058	1352.28	2026.08	0	2026.08	2364.26	2364.26
27	4.1509	10104.9	23.3128	Fill Static	275	28	821.396	1381.44	2080.92	0	2080.92	2434.89	2434.89
28	4.1509	10234.9	23.8158	Fill Static	275	28	827.71	1392.06	2100.88	0	2100.88	2466.21	2466.21
29	4.1509	10070.8	24.3207	Fill Static	275	28	814.356	1369.6	2058.65	0	2058.65	2426.7	2426.7
30	4.1509	9876.09	24.8276	Fill Static	275	28	799.015	1343.8	2010.12	0	2010.12	2379.79	2379.79
31	4.1509	9657.27	25.3366	Fill Static	275	28	782.141	1315.42	1956.74	0	1956.74	2327.07	2327.07

32	4.1509	9414.03	25.8478	Fill Static	275	28	763.72	1284.44	1898.49	0	1898.49	2268.47	2268.47
33	4.1509	9146.06	26.3612	Fill Static	275	28	743.758	1250.87	1835.34	0	1835.34	2203.91	2203.91
34	4.1509	8867.36	26.8768	Fill Static	275	28	723.18	1216.26	1770.25	0	1770.25	2136.77	2136.77
35	4.1509	8771.01	27.3949	Fill Static	275	28	714.633	1201.88	1743.22	0	1743.22	2113.57	2113.57
36	4.1509	8717.19	27.9154	Fill Static	275	28	708.883	1192.21	1725.03	0	1725.03	2100.61	2100.61
37	4.1509	8637.25	28.4383	Fill Static	275	28	701.438	1179.69	1701.48	0	1701.48	2081.35	2081.35
38	4.1509	8530.8	28.9639	Fill Static	275	28	692.289	1164.31	1672.54	0	1672.54	2055.71	2055.71
39	4.1509	8397.44	29.4922	Fill Static	275	28	681.425	1146.03	1638.18	0	1638.18	2023.59	2023.59
40	4.1509	8236.74	30.0232	Fill Static	275	28	668.837	1124.86	1598.36	0	1598.36	1984.88	1984.88
41	4.1509	8048.28	30.5571	Fill Static	275	28	654.514	1100.77	1553.06	0	1553.06	1939.47	1939.47
42	4.1509	7831.59	31.094	Fill Static	275	28	638.443	1073.75	1502.22	0	1502.22	1887.27	1887.27
43	4.1509	7586.19	31.6339	Fill Static	275	28	620.615	1043.76	1445.83	0	1445.83	1828.14	1828.14
44	4.1509	7311.59	32.177	Fill Static	275	28	601.016	1010.8	1383.84	0	1383.84	1761.98	1761.98
45	4.1509	7007.26	32.7233	Fill Static	275	28	579.634	974.84	1316.21	0	1316.21	1688.66	1688.66
46	4.1509	6632.26	33.273	Fill Static	275	28	553.906	931.571	1234.83	0	1234.83	1598.31	1598.31
47	4.1509	5446.44	33.8261	Fill Static	275	28	477.354	802.823	992.69	0	992.69	1312.57	1312.57
48	4.1509	3929.61	34.3829	Fill Static	275	28	380.592	640.087	686.629	0	686.629	947.059	947.059
49	4.1509	2380.71	34.9434	Fill Static	275	28	282.518	475.144	376.416	0	376.416	573.821	573.821
50	4.1509	799.08	35.5077	Fill Static	275	28	183.125	307.984	62.0338	0	62.0338	192.693	192.693

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.70143

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	299.023	865.821	0	0	0
2	303.395	866.838	725.694	0	0
3	307.768	867.888	1505.88	0	0
4	312.14	868.971	2331.64	0	0
5	316.513	870.088	3193.74	0	0
6	320.885	871.238	4077.41	0	0
7	325.258	872.422	4968.26	0	0
8	329.631	873.64	5852.28	0	0
9	334.003	874.892	6715.82	0	0
10	338.376	876.179	7545.64	0	0
11	342.748	877.5	8328.84	0	0
12	347.121	878.856	9052.95	0	0
13	351.493	880.247	9705.84	0	0
14	356.243	881.798	11295.1	0	0
15	360.993	883.39	12862.1	0	0
16	365.742	885.026	14291.3	0	0
17	370.492	886.703	15500.6	0	0
18	375.242	888.424	16519.2	0	0
19	379.991	890.188	17419	0	0
20	384.404	891.867	17696.8	0	0
21	388.816	893.583	17891.4	0	0
22	393.229	895.338	17997.5	0	0
23	397.641	897.132	18010.7	0	0
24	402.054	898.964	17926.7	0	0
25	406.466	900.837	17742.1	0	0
26	410.878	902.749	17453.7	0	0
27	415.291	904.702	17058.8	0	0
28	419.703	906.695	16555.4	0	0
29	424.116	908.729	15941.8	0	0
30	428.528	910.806	15217	0	0
31	432.941	912.924	14407.9	0	0
32	437.353	915.085	13560.9	0	0
33	441.766	917.288	12684.5	0	0
34	446.178	919.536	11787.7	0	0
35	450.591	921.827	10880	0	0
36	455.003	924.163	9971.77	0	0
37	459.416	926.544	9054.92	0	0
38	463.828	928.971	8094.68	0	0
39	468.241	931.445	7096.53	0	0
40	472.653	933.965	6068.3	0	0
41	477.066	936.533	5018.64	0	0
42	481.478	939.15	3956.98	0	0
43	485.891	941.815	2893.61	0	0
44	490.303	944.53	1839.67	0	0
45	494.716	947.296	807.227	0	0
46	499.128	950.113	-190.717	0	0
47	503.54	952.983	-1140.18	0	0
48	507.953	955.905	-1990.18	0	0
49	512.365	958.882	-2439.56	0	0
50	516.778	961.913	-2390.6	0	0
51	521.19	965	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.68182

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	316.173	876.243	0	0	0
2	320.324	877.032	722.525	0	0
3	324.475	877.855	1551.91	0	0
4	328.626	878.714	2469.65	0	0
5	332.777	879.609	3457.72	0	0
6	336.928	880.539	4498.56	0	0
7	341.079	881.506	5575.06	0	0
8	345.23	882.508	6670.55	0	0
9	349.381	883.548	7768.86	0	0
10	353.532	884.624	8854.22	0	0
11	357.682	885.737	9911.34	0	0
12	361.833	886.887	10923.9	0	0
13	365.984	888.074	11840.3	0	0
14	370.135	889.3	12658.1	0	0
15	374.286	890.563	13399.2	0	0
16	378.437	891.864	14086.8	0	0
17	382.588	893.205	14729.3	0	0
18	386.739	894.584	15318.2	0	0
19	390.89	896.002	15845.2	0	0
20	395.041	897.46	16302.5	0	0
21	399.191	898.958	16683	0	0
22	403.342	900.496	16979.9	0	0
23	407.493	902.075	17186.9	0	0
24	411.644	903.695	17298.2	0	0
25	415.795	905.356	17308.8	0	0
26	419.946	907.06	17213.9	0	0
27	424.097	908.806	17009.5	0	0
28	428.248	910.594	16691.9	0	0
29	432.399	912.427	16273.7	0	0
30	436.55	914.303	15787.1	0	0
31	440.7	916.223	15238.8	0	0
32	444.851	918.188	14635	0	0
33	449.002	920.199	13983	0	0
34	453.153	922.256	13290.6	0	0
35	457.304	924.36	12564	0	0
36	461.455	926.511	11776.2	0	0
37	465.606	928.71	10920.8	0	0
38	469.757	930.958	10003.4	0	0
39	473.908	933.256	9030.33	0	0
40	478.059	935.604	8008.85	0	0
41	482.209	938.002	6947.09	0	0
42	486.36	940.453	5854.06	0	0
43	490.511	942.956	4739.76	0	0
44	494.662	945.513	3615.16	0	0
45	498.813	948.125	2492.3	0	0
46	502.964	950.792	1384.28	0	0
47	507.115	953.516	316.76	0	0
48	511.266	956.298	-465.802	0	0
49	515.417	959.138	-838.52	0	0
50	519.568	962.038	-759.233	0	0
51	523.718	965	0	0	0

List Of Coordinates

External Boundary

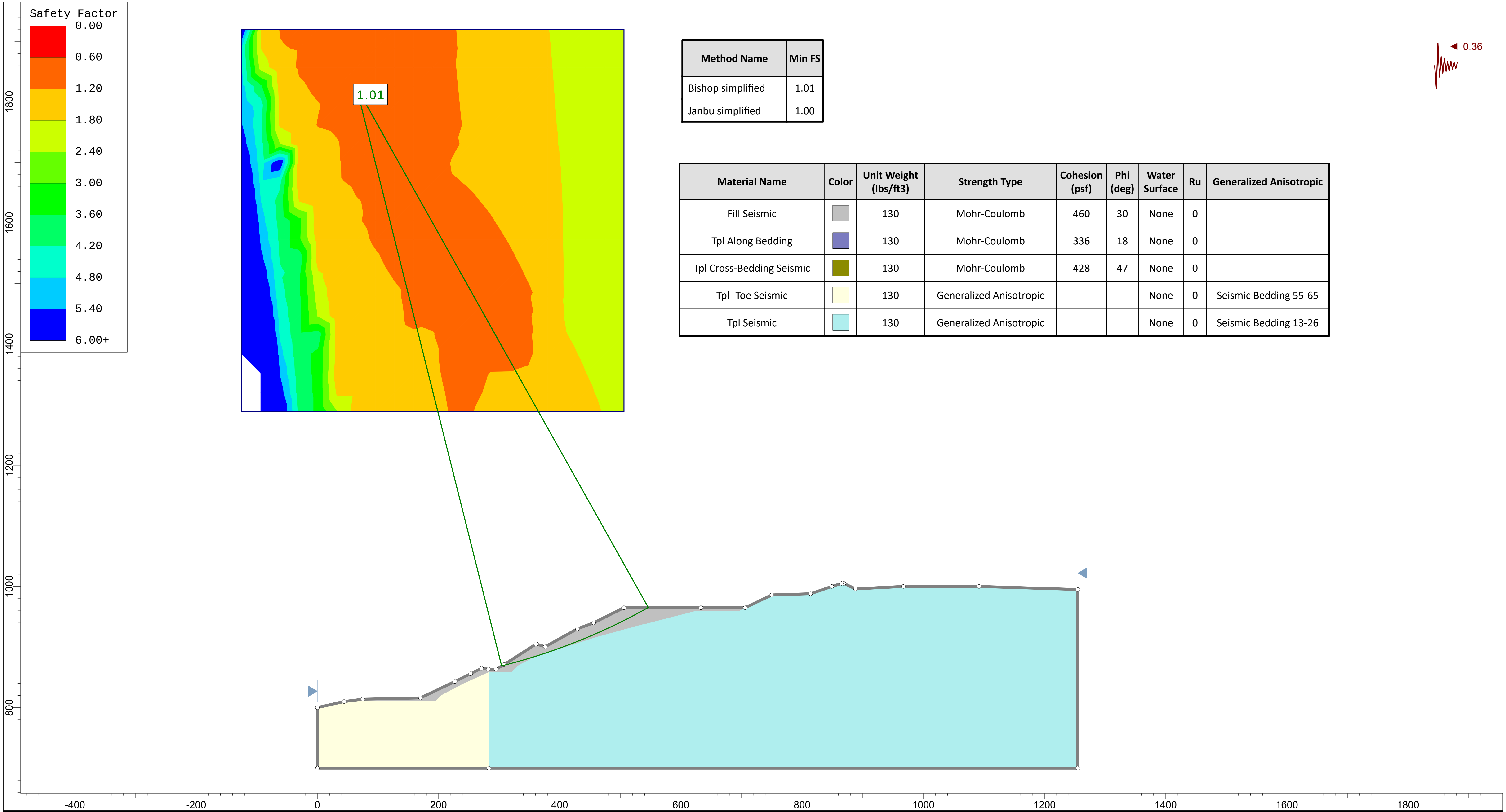
X	Y
0	700
283	700
1255	700
1255	995
1092	1000
967	1000
888	996
869	1005
865	1005
849	1000
814	988
750	986
706	965
633	965
506	965
456	940
429	930
376	900.5
361	905
308	871
295	863.5
282	863.5
271	865
253	856
227	843.1
170	816
75	813.9
44	810
0	800

Material Boundary

X	Y
75	813.9
81	811
195	811
204	820
242	840
283	858.5
320	858.5
324.266	863.03
333	871
353	881
400	897
463	917
536	937
625	960
698	960
706	965

Material Boundary

X	Y
283	700
283	858.5



Method Name	Min FS
Bishop simplified	1.01
Janbu simplified	1.00

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Generalized Anisotropic
Fill Seismic	⬜	130	Mohr-Coulomb	460	30	None	0	
Tpl Along Bedding	🟪	130	Mohr-Coulomb	336	18	None	0	
Tpl Cross-Bedding Seismic	🟩	130	Mohr-Coulomb	428	47	None	0	
Tpl- Toe Seismic	🟨	130	Generalized Anisotropic			None	0	Seismic Bedding 55-65
Tpl Seismic	🟦	130	Generalized Anisotropic			None	0	Seismic Bedding 13-26

Geotechnical
Environmental
Hydrogeology
Material Testing
Construction Inspection

SLIDEINTERPRET 7.038

Project	HOFF Property, Yorba Linda
Analysis Description	Cross-section B-B', Seismic
Drawn By	
Scale	1:1800
Company	TGR Geotechnical, Inc.
Date	4/15/20
File Name	Cross-section B-B' Seismic.slim

Slide Analysis Information

HOFF Property, Yorba Linda

Project Summary

File Name: Cross-section B-B' Seismic
Slide Modeler Version: 7.038
Project Title: HOFF Property, Yorba Linda
Analysis: Cross-section B-B', Seismic
Company: TGR Geotechnical, Inc.
Date Created: 4/15/20

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Right to Left
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Slices Type: Vertical

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 50
Tolerance: 0.005
Maximum number of iterations: 75
Check malpha < 0.2: Yes
Create Interslice boundaries at intersections with water tables and piezos: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]: 62.4
Use negative pore pressure cutoff: Yes
Maximum negative pore pressure [psf]: 0
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Grid Search
Radius Increment:	10
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal): 0.36

Material Properties

Property	Fill Seismic	Tpl- Toe Seismic	Tpl Seismic
Color	▨	🟨	🟦
Strength Type	Mohr-Coulomb	Generalized Anisotropic	Generalized Anisotropic
Unit Weight [lbs/ft3]	130	130	130
Cohesion [psf]	460		
Friction Angle [deg]	30		
Water Surface	None	None	None
Ru Value	0	0	0

Generalized Anisotropic Functions

Name: Seismic Bedding 55-65

Angle From	Angle To	Material
55	-90	Tpl Cross-Bedding Seismic
65	55	Tpl Along Bedding
90	65	Tpl Cross-Bedding Seismic

Name: Seismic Bedding 13-26

Angle From	Angle To	Material
-26	-90	Tpl Cross-Bedding Seismic
-13	-26	Tpl Along Bedding
90	-13	Tpl Cross-Bedding Seismic

Global Minimums

Method: bishop simplified

FS	1.009140
Center:	64.221, 1825.277
Radius:	986.114
Left Slip Surface Endpoint:	304.203, 868.810
Right Slip Surface Endpoint:	546.242, 965.000
Resisting Moment:	3.36486e+008 lb-ft
Driving Moment:	3.3344e+008 lb-ft
Total Slice Area:	3693.71 ft2
Surface Horizontal Width:	242.039 ft
Surface Average Height:	15.2608 ft

Method: janbu simplified

FS	0.995778
Center:	253.565, 1383.472
Radius:	507.219
Left Slip Surface Endpoint:	323.806, 881.140
Right Slip Surface Endpoint:	540.188, 965.000
Resisting Horizontal Force:	294087 lb
Driving Horizontal Force:	295334 lb
Total Slice Area:	3477.65 ft2
Surface Horizontal Width:	216.382 ft
Surface Average Height:	16.0718 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	4697
Number of Invalid Surfaces:	154

Error Codes:

Error Code -102 reported for 11 surfaces
Error Code -103 reported for 84 surfaces
Error Code -106 reported for 37 surfaces
Error Code -1000 reported for 22 surfaces

Method: janbu simplified

Number of Valid Surfaces:	4690
Number of Invalid Surfaces:	161

Error Codes:

Error Code -102 reported for 11 surfaces
Error Code -103 reported for 84 surfaces
Error Code -106 reported for 37 surfaces
Error Code -108 reported for 7 surfaces
Error Code -1000 reported for 22 surfaces

Error Codes

The following errors were encountered during the computation:

-102 = Two surface / slope intersections, but resulting arc is actually outside soil region.
-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.00914

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	4.84078	497.05	14.2301	Fill Seismic	460	30	449.297	453.404	-11.4254	0	-11.4254	102.516	102.516
2	4.84078	1610.01	14.5205	Fill Seismic	460	30	562.628	567.77	186.663	0	186.663	332.383	332.383
3	4.84078	2766.99	14.8112	Fill Seismic	460	30	679.86	686.074	391.572	0	391.572	571.341	571.341
4	4.84078	3907.43	15.1024	Fill Seismic	460	30	794.76	802.024	592.403	0	592.403	806.881	806.881
5	4.84078	5031.24	15.3939	Fill Seismic	460	30	907.334	915.627	789.17	0	789.17	1038.99	1038.99
6	4.84078	6138.38	15.6858	Fill Seismic	460	30	1017.59	1026.89	981.884	0	981.884	1267.64	1267.64
7	4.84078	7228.75	15.9782	Fill Seismic	460	30	1125.54	1135.82	1170.56	0	1170.56	1492.84	1492.84
8	4.84078	8302.29	16.271	Fill Seismic	460	30	1231.18	1242.43	1355.21	0	1355.21	1714.56	1714.56
9	4.84078	9358.93	16.5642	Fill Seismic	460	30	1334.53	1346.72	1535.85	0	1535.85	1932.78	1932.78
10	4.84078	10398.6	16.8578	Fill Seismic	460	30	1435.58	1448.7	1712.49	0	1712.49	2147.5	2147.5
11	4.84078	11421.2	17.152	Fill Seismic	460	30	1534.36	1548.38	1885.13	0	1885.13	2358.69	2358.69
12	4.84078	12324.4	17.4466	Fill Seismic	460	30	1620.62	1635.43	2035.9	0	2035.9	2545.22	2545.22
13	4.84078	11214.9	17.7416	Fill Seismic	460	30	1505.35	1519.11	1834.43	0	1834.43	2316.06	2316.06
14	4.84078	9317.67	18.0372	Fill Seismic	460	30	1312.24	1324.24	1496.9	0	1496.9	1924.21	1924.21
15	4.84078	7440.05	18.3332	Fill Seismic	460	30	1122.12	1132.38	1164.59	0	1164.59	1536.42	1536.42
16	4.84078	7215.08	18.6298	Fill Seismic	460	30	1096.73	1106.76	1120.22	0	1120.22	1489.95	1489.95
17	4.84078	7874.89	18.9269	Fill Seismic	460	30	1158.87	1169.47	1228.83	0	1228.83	1626.21	1626.21
18	4.84078	8517.04	19.2245	Fill Seismic	460	30	1218.91	1230.05	1333.77	0	1333.77	1758.82	1758.82
19	4.84078	9141.43	19.5226	Fill Seismic	460	30	1276.85	1288.52	1435.05	0	1435.05	1887.77	1887.77
20	4.84078	9747.95	19.8213	Fill Seismic	460	30	1332.7	1344.88	1532.66	0	1532.66	2013.02	2013.02
21	4.84078	10336.5	20.1206	Fill Seismic	460	30	1386.46	1399.14	1626.63	0	1626.63	2134.57	2134.57
22	4.84078	10907	20.4204	Fill Seismic	460	30	1438.14	1451.29	1716.96	0	1716.96	2252.38	2252.38
23	4.84078	11459.3	20.7208	Fill Seismic	460	30	1487.74	1501.34	1803.65	0	1803.65	2366.44	2366.44
24	4.84078	11993.4	21.0218	Fill Seismic	460	30	1535.27	1549.3	1886.72	0	1886.72	2476.73	2476.73
25	4.84078	12509.1	21.3235	Fill Seismic	460	30	1580.72	1595.17	1966.16	0	1966.16	2583.21	2583.21
26	4.84078	12992.5	21.6257	Fill Seismic	460	30	1622.79	1637.62	2039.71	0	2039.71	2683.06	2683.06
27	4.84078	13076.5	21.9286	Fill Seismic	460	30	1626.22	1641.08	2045.69	0	2045.69	2700.37	2700.37

28	4.84078	12969	22.2321	Fill Seismic	460	30	1611.26	1625.99	2019.56	0	2019.56	2678.16	2678.16
29	4.84078	12842.6	22.5363	Fill Seismic	460	30	1594.57	1609.14	1990.37	0	1990.37	2652.04	2652.04
30	4.84078	12697.2	22.8411	Fill Seismic	460	30	1576.13	1590.54	1958.15	0	1958.15	2622.03	2622.03
31	4.84078	12532.8	23.1467	Fill Seismic	460	30	1555.95	1570.17	1922.87	0	1922.87	2588.04	2588.04
32	4.84078	12430.5	23.4529	Fill Seismic	460	30	1541.75	1555.84	1898.04	0	1898.04	2566.91	2566.91
33	4.84078	12597.1	23.7599	Fill Seismic	460	30	1552.97	1567.16	1917.65	0	1917.65	2601.29	2601.29
34	4.84078	12769.4	24.0675	Fill Seismic	460	30	1564.63	1578.93	1938.05	0	1938.05	2636.88	2636.88
35	4.84078	12922.1	24.376	Fill Seismic	460	30	1574.35	1588.74	1955.04	0	1955.04	2668.4	2668.4
36	4.84078	13055	24.6851	Fill Seismic	460	30	1582.13	1596.59	1968.64	0	1968.64	2695.84	2695.84
37	4.84078	13168	24.9951	Fill Seismic	460	30	1587.97	1602.48	1978.83	0	1978.83	2719.14	2719.14
38	4.84078	13260.8	25.3058	Fill Seismic	460	30	1591.86	1606.41	1985.65	0	1985.65	2738.32	2738.32
39	4.84078	13333.5	25.6173	Fill Seismic	460	30	1593.83	1608.4	1989.09	0	1989.09	2753.32	2753.32
40	4.84078	13385.7	25.9296	Fill Seismic	460	30	1593.85	1608.42	1989.14	0	1989.14	2764.09	2764.09
41	4.84078	13417.4	26.2428	Fill Seismic	460	30	1591.95	1606.5	1985.8	0	1985.8	2770.62	2770.62
42	4.84078	13353.6	26.5568	Fill Seismic	460	30	1581.25	1595.7	1967.08	0	1967.08	2757.42	2757.42
43	4.84078	12179.8	26.8717	Fill Seismic	460	30	1468.89	1482.32	1770.71	0	1770.71	2515.01	2515.01
44	4.84078	10625.6	27.1874	Fill Seismic	460	30	1322.46	1334.55	1514.76	0	1514.76	2194.04	2194.04
45	4.84078	9050.19	27.5041	Fill Seismic	460	30	1174.96	1185.7	1256.94	0	1256.94	1868.69	1868.69
46	4.84078	7453.35	27.8217	Fill Seismic	460	30	1026.39	1035.77	997.269	0	997.269	1538.92	1538.92
47	4.84078	5834.88	28.1401	Fill Seismic	460	30	876.768	884.782	735.744	0	735.744	1204.68	1204.68
48	4.84078	4194.6	28.4596	Fill Seismic	460	30	726.09	732.726	472.376	0	472.376	865.948	865.948
49	4.84078	2532.32	28.78	Fill Seismic	460	30	574.361	579.611	207.171	0	207.171	522.668	522.668
50	4.84078	847.826	29.1014	Fill Seismic	460	30	421.586	425.439	-59.8606	0	-59.8606	174.805	174.805

Global Minimum Query (janbu simplified) - Safety Factor: 0.995778

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	4.32764	605.367	8.20698	Fill Seismic	460	30	501.311	499.195	67.8869	0	67.8869	140.189	140.189
2	4.32764	1805.37	8.7012	Fill Seismic	460	30	646.685	643.955	318.618	0	318.618	417.589	417.589
3	4.32764	2983.86	9.19609	Fill Seismic	460	30	788.056	784.729	562.447	0	562.447	690.029	690.029
4	4.32764	4140.76	9.69166	Fill Seismic	460	30	925.459	921.552	799.431	0	799.431	957.484	957.484
5	4.32764	5275.97	10.188	Fill Seismic	460	30	1058.93	1054.46	1029.63	0	1029.63	1219.94	1219.94
6	4.32764	6389.39	10.6851	Fill Seismic	460	30	1188.5	1183.48	1253.11	0	1253.11	1477.36	1477.36
7	4.32764	7480.91	11.183	Fill	460	30	1314.21	1308.66	1469.92	0	1469.92	1729.73	1729.73

8	4.32764	8550.43	11.6817	Seismic Fill	460	30	1436.07	1430.01	1680.11	0	1680.11	1977.03	1977.03
9	4.32764	9409.36	12.1814	Seismic Fill	460	30	1531.68	1525.21	1845.01	0	1845.01	2175.64	2175.64
10	4.32764	8547.29	12.682	Seismic Fill	460	30	1422.29	1416.29	1656.34	0	1656.34	1976.4	1976.4
11	4.32764	7257.78	13.1835	Seismic Fill	460	30	1263.45	1258.11	1382.37	0	1382.37	1678.33	1678.33
12	4.32764	5945.77	13.6862	Seismic Fill	460	30	1103.4	1098.75	1106.34	0	1106.34	1375.04	1375.04
13	4.32764	5531.37	14.1898	Seismic Fill	460	30	1049.77	1045.34	1013.84	0	1013.84	1279.27	1279.27
14	4.32764	6255.66	14.6947	Seismic Fill	460	30	1129.1	1124.34	1150.66	0	1150.66	1446.76	1446.76
15	4.32764	6960.82	15.2006	Seismic Fill	460	30	1205.43	1200.35	1282.32	0	1282.32	1609.84	1609.84
16	4.32764	7642.86	15.7078	Seismic Fill	460	30	1278.34	1272.94	1408.06	0	1408.06	1767.57	1767.57
17	4.32764	8301.61	16.2163	Seismic Fill	460	30	1347.84	1342.15	1527.93	0	1527.93	1919.93	1919.93
18	4.32764	8936.9	16.7261	Seismic Fill	460	30	1413.96	1407.99	1641.96	0	1641.96	2066.87	2066.87
19	4.32764	9548.53	17.2372	Seismic Fill	460	30	1476.69	1470.46	1750.18	0	1750.18	2208.34	2208.34
20	4.32764	10136.3	17.7498	Seismic Fill	460	30	1536.09	1529.6	1852.61	0	1852.61	2344.31	2344.31
21	4.32764	10700.1	18.2638	Seismic Fill	460	30	1592.14	1585.42	1949.28	0	1949.28	2474.72	2474.72
22	4.32764	11239.6	18.7794	Seismic Fill	460	30	1644.86	1637.92	2040.22	0	2040.22	2599.52	2599.52
23	4.32764	11754.6	19.2965	Seismic Fill	460	30	1694.28	1687.13	2125.45	0	2125.45	2718.66	2718.66
24	4.32764	12244.9	19.8153	Seismic Fill	460	30	1740.4	1733.05	2205	0	2205	2832.11	2832.11
25	4.32764	12601.5	20.3358	Seismic Fill	460	30	1771.23	1763.75	2258.16	0	2258.16	2914.62	2914.62
26	4.32764	12609.6	20.8581	Seismic Fill	460	30	1763.41	1755.96	2244.67	0	2244.67	2916.58	2916.58
27	4.32764	12570.9	21.3821	Seismic Fill	460	30	1750.45	1743.06	2222.32	0	2222.32	2907.68	2907.68
28	4.32764	12506.4	21.9081	Seismic Fill	460	30	1734.72	1727.4	2195.2	0	2195.2	2892.84	2892.84
29	4.32764	12415.9	22.436	Seismic Fill	460	30	1716.25	1709	2163.33	0	2163.33	2871.98	2871.98
30	4.32764	12299.1	22.9659	Seismic Fill	460	30	1695.03	1687.87	2126.73	0	2126.73	2845.03	2845.03
31	4.32764	12188.2	23.4979	Seismic Fill	460	30	1674.54	1667.47	2091.4	0	2091.4	2819.44	2819.44
32	4.32764	12286.4	24.032	Seismic Fill	460	30	1676.44	1669.36	2094.68	0	2094.68	2842.2	2842.2
33	4.32764	12404.4	24.5684	Seismic Fill	460	30	1680.31	1673.22	2101.37	0	2101.37	2869.55	2869.55
34	4.32764	12494.7	25.1071	Seismic Fill	460	30	1681.13	1674.03	2102.76	0	2102.76	2890.51	2890.51
35	4.32764	12557.1	25.6482	Seismic Fill	460	30	1678.89	1671.8	2098.9	0	2098.9	2905.03	2905.03
36	4.32764	12591.2	26.1917	Seismic Fill	460	30	1673.59	1666.52	2089.75	0	2089.75	2912.95	2912.95
37	4.32764	12596.5	26.7378	Seismic Fill	460	30	1665.23	1658.2	2075.35	0	2075.35	2914.26	2914.26
38	4.32764	12572.6	27.2865	Seismic Fill	460	30	1653.83	1646.85	2055.68	0	2055.68	2908.79	2908.79
39	4.32764	12519.1	27.838	Seismic Fill	460	30	1639.37	1632.45	2030.75	0	2030.75	2896.48	2896.48
				Seismic									

40	4.32764	12435.6	28.3922	Fill Seismic	460	30	1621.88	1615.03	2000.57	0	2000.57	2877.23	2877.23
41	4.32764	12321.6	28.9494	Fill Seismic	460	30	1601.33	1594.57	1965.13	0	1965.13	2850.92	2850.92
42	4.32764	12176.5	29.5096	Fill Seismic	460	30	1577.74	1571.08	1924.44	0	1924.44	2817.43	2817.43
43	4.32764	11507	30.0729	Fill Seismic	460	30	1501.6	1495.26	1793.12	0	1793.12	2662.62	2662.62
44	4.32764	10087.1	30.6395	Fill Seismic	460	30	1351.27	1345.56	1533.84	0	1533.84	2334.24	2334.24
45	4.32764	8628.51	31.2093	Fill Seismic	460	30	1198.68	1193.62	1270.67	0	1270.67	1996.88	1996.88
46	4.32764	7136.7	31.7827	Fill Seismic	460	30	1044.46	1040.05	1004.68	0	1004.68	1651.83	1651.83
47	4.32764	5611.07	32.3596	Fill Seismic	460	30	888.618	884.866	735.89	0	735.89	1298.95	1298.95
48	4.32764	4050.97	32.9402	Fill Seismic	460	30	731.168	728.081	464.329	0	464.329	938.071	938.071
49	4.32764	2455.72	33.5246	Fill Seismic	460	30	572.123	569.707	190.018	0	190.018	569.052	569.052
50	4.32764	824.613	34.1131	Fill Seismic	460	30	411.497	409.76	-87.0188	0	-87.0188	191.723	191.723

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.00914

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	304.203	868.81	0	0	0
2	309.044	870.037	2013.17	0	0
3	313.885	871.291	3927.01	0	0
4	318.726	872.571	5725.47	0	0
5	323.566	873.877	7397.7	0	0
6	328.407	875.21	8933.15	0	0
7	333.248	876.57	10321.6	0	0
8	338.089	877.956	11553.1	0	0
9	342.93	879.369	12617.9	0	0
10	347.77	880.808	13506.8	0	0
11	352.611	882.275	14210.7	0	0
12	357.452	883.769	14720.8	0	0
13	362.293	885.291	15043.1	0	0
14	367.133	886.839	15462.2	0	0
15	371.974	888.416	16109.7	0	0
16	376.815	890.02	17002.9	0	0
17	381.656	891.652	17894.1	0	0
18	386.497	893.311	18637.3	0	0
19	391.337	895	19228.7	0	0
20	396.178	896.716	19664.6	0	0
21	401.019	898.461	19941.7	0	0
22	405.86	900.234	20057	0	0
23	410.7	902.036	20007.9	0	0
24	415.541	903.868	19791.9	0	0
25	420.382	905.728	19407	0	0
26	425.223	907.618	18851.3	0	0
27	430.064	909.537	18126.4	0	0
28	434.904	911.485	17315.8	0	0
29	439.745	913.464	16462	0	0
30	444.586	915.473	15570.6	0	0
31	449.427	917.512	14647.7	0	0
32	454.268	919.581	13699.5	0	0
33	459.108	921.681	12712.4	0	0
34	463.949	923.812	11619.3	0	0
35	468.79	925.974	10417	0	0
36	473.631	928.168	9108.9	0	0
37	478.471	930.393	7698.68	0	0
38	483.312	932.65	6190.47	0	0
39	488.153	934.938	4588.73	0	0
40	492.994	937.26	2898.28	0	0
41	497.835	939.613	1124.32	0	0
42	502.675	942	-727.581	0	0
43	507.516	944.419	-2628.82	0	0
44	512.357	946.872	-4236.02	0	0
45	517.198	949.358	-5416.71	0	0
46	522.038	951.879	-6146.87	0	0
47	526.879	954.433	-6402	0	0
48	531.72	957.023	-6157.12	0	0
49	536.561	959.646	-5386.76	0	0
50	541.402	962.306	-4064.91	0	0
51	546.242	965	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 0.995778

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	323.806	881.14	0	0	0
2	328.134	881.764	1900.03	0	0
3	332.461	882.426	3825.87	0	0
4	336.789	883.127	5753.64	0	0
5	341.117	883.866	7660.26	0	0
6	345.444	884.644	9523.46	0	0
7	349.772	885.46	11321.7	0	0
8	354.1	886.316	13034.4	0	0
9	358.427	887.211	14641.5	0	0
10	362.755	888.145	16131.1	0	0
11	367.083	889.119	17570.3	0	0
12	371.41	890.132	19000.8	0	0
13	375.738	891.186	20449.4	0	0
14	380.065	892.28	21872.5	0	0
15	384.393	893.415	23180.3	0	0
16	388.721	894.591	24361.3	0	0
17	393.048	895.808	25405	0	0
18	397.376	897.067	26301.6	0	0
19	401.704	898.367	27042.2	0	0
20	406.031	899.71	27618.4	0	0
21	410.359	901.095	28022.6	0	0
22	414.687	902.524	28247.7	0	0
23	419.014	903.995	28287.6	0	0
24	423.342	905.51	28136.7	0	0
25	427.669	907.07	27790.2	0	0
26	431.997	908.674	27264.6	0	0
27	436.325	910.323	26623	0	0
28	440.652	912.017	25875.3	0	0
29	444.98	913.757	25028	0	0
30	449.308	915.544	24088.5	0	0
31	453.635	917.378	23065	0	0
32	457.963	919.26	21958.5	0	0
33	462.291	921.189	20717.7	0	0
34	466.618	923.168	19335.8	0	0
35	470.946	925.196	17818.2	0	0
36	475.274	927.274	16171.1	0	0
37	479.601	929.402	14402	0	0
38	483.929	931.583	12518.8	0	0
39	488.256	933.815	10530.6	0	0
40	492.584	936.1	8447.32	0	0
41	496.912	938.439	6280.06	0	0
42	501.239	940.833	4040.77	0	0
43	505.567	943.283	1742.52	0	0
44	509.895	945.789	-422.46	0	0
45	514.222	948.352	-2162.53	0	0
46	518.55	950.974	-3434.76	0	0
47	522.878	953.655	-4196.99	0	0
48	527.205	956.397	-4405.5	0	0
49	531.533	959.201	-4014.95	0	0
50	535.86	962.069	-2978.32	0	0
51	540.188	965	0	0	0

List Of Coordinates

External Boundary

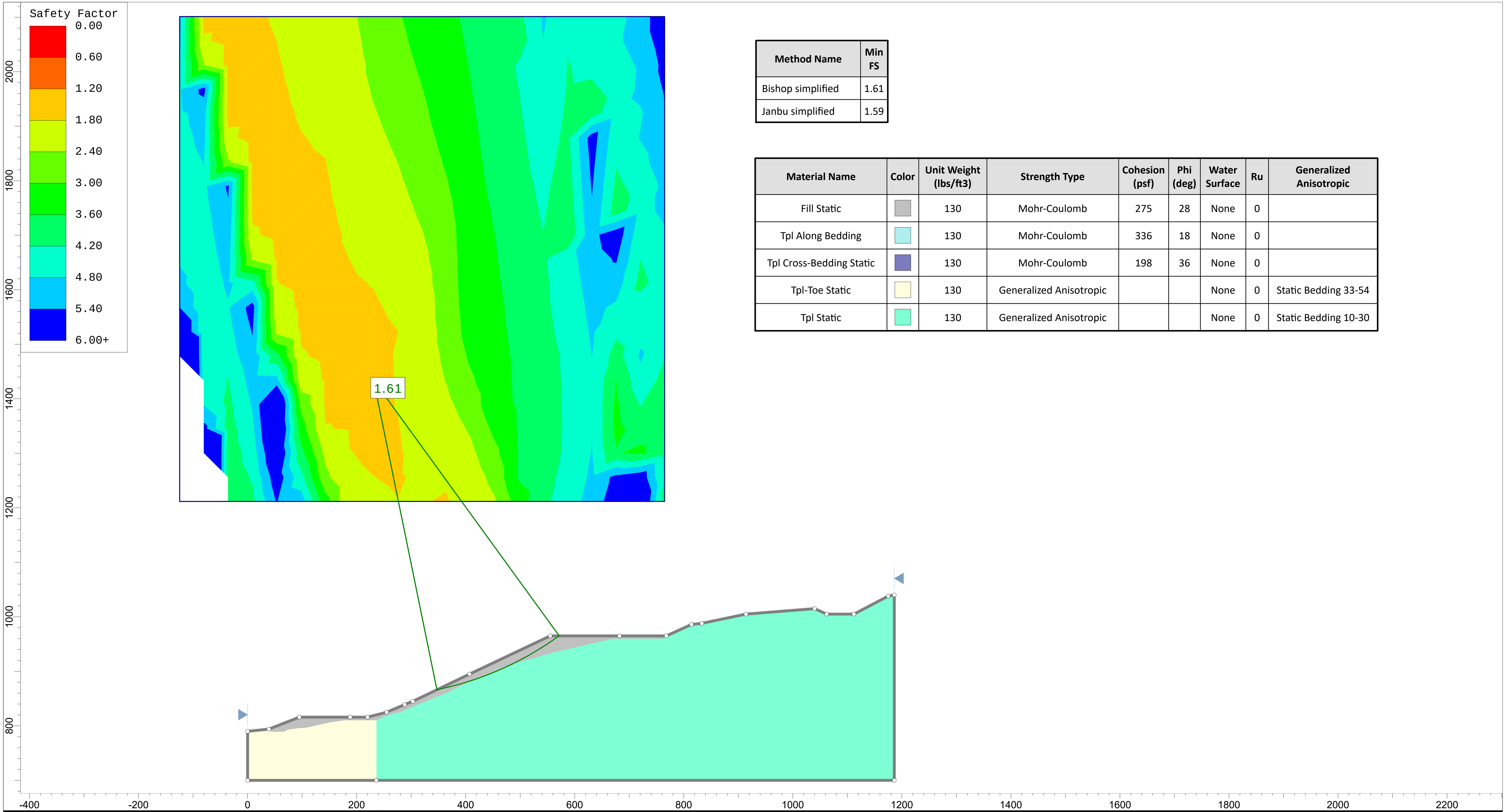
X	Y
0	700
283	700
1255	700
1255	995
1092	1000
967	1000
888	996
869	1005
865	1005
849	1000
814	988
750	986
706	965
633	965
506	965
456	940
429	930
376	900.5
361	905
308	871
295	863.5
282	863.5
271	865
253	856
227	843.1
170	816
75	813.9
44	810
0	800

Material Boundary

X	Y
75	813.9
81	811
195	811
204	820
242	840
283	858.5
320	858.5
324.266	863.03
333	871
353	881
400	897
463	917
536	937
625	960
698	960
706	965

Material Boundary

X	Y
283	700
283	858.5



Method Name	Min FS
Bishop simplified	1.61
Janbu simplified	1.59

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Generalized Anisotropic
Fill Static	⬜	130	Mohr-Coulomb	275	28	None	0	
Tpl Along Bedding	🟦	130	Mohr-Coulomb	336	18	None	0	
Tpl Cross-Bedding Static	🟪	130	Mohr-Coulomb	198	36	None	0	
Tpl-Toe Static	🟨	130	Generalized Anisotropic			None	0	Static Bedding 33-54
Tpl Static	🟩	130	Generalized Anisotropic			None	0	Static Bedding 10-30

TGR
Geotechnical
Environmental
Hydrogeology
Material Testing
Construction Inspection

SLIDEINTERPRET 7.038

Project HOFF Property, Yorba Linda

Analysis Description Cross-section C-C' Static

Drawn By

Scale 1:2000

Company TGR Geotechnical, Inc.

Date 4/15/20

File Name Cross-section C-C' Static.slim

Slide Analysis Information

HOFF Property, Yorba Linda

Project Summary

File Name:	Cross-section C-C' Static
Slide Modeler Version:	7.038
Project Title:	HOFF Property, Yorba Linda
Analysis:	Cross-section C-C' Static
Company:	TGR Geotechnical, Inc.
Date Created:	4/15/20

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
	Janbu simplified

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Minimum Area: Not Defined
Minimum Weight: Not Defined

Seismic

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Material Properties

Property	Fill Static	Tpl-Toe Static	Tpl Static
Color	▨	⬜	🟩
Strength Type	Mohr-Coulomb	Generalized Anisotropic	Generalized Anisotropic
Unit Weight [lbs/ft3]	130	130	130
Cohesion [psf]	275		
Friction Angle [deg]	28		
Water Surface	None	None	None
Ru Value	0	0	0

Generalized Anisotropic Functions

Name: Static Bedding 33-54

Angle From	Angle To	Material
33	-90	Tpl Cross-Bedding Static
54	33	Tpl Along Bedding
90	54	Tpl Cross-Bedding Static

Name: Static Bedding 10-30

Angle From	Angle To	Material
-30	-90	Tpl Cross-Bedding Static
-10	-30	Tpl Along Bedding
90	-10	Tpl Cross-Bedding Static

Global Minimums

Method: bishop simplified

FS	1.612850
Center:	231.114, 1433.951
Radius:	579.453
Left Slip Surface Endpoint:	347.182, 866.242
Right Slip Surface Endpoint:	571.483, 965.000
Resisting Moment:	1.49473e+008 lb-ft
Driving Moment:	9.26766e+007 lb-ft
Total Slice Area:	2993.65 ft2
Surface Horizontal Width:	224.3 ft
Surface Average Height:	13.3466 ft

Method: janbu simplified

FS	1.593630
Center:	231.114, 1433.951
Radius:	579.453
Left Slip Surface Endpoint:	347.182, 866.242
Right Slip Surface Endpoint:	571.483, 965.000
Resisting Horizontal Force:	233586 lb
Driving Horizontal Force:	146575 lb
Total Slice Area:	2993.65 ft2
Surface Horizontal Width:	224.3 ft
Surface Average Height:	13.3466 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	4640
Number of Invalid Surfaces:	211

Error Codes:

Error Code -103 reported for 89 surfaces
Error Code -106 reported for 43 surfaces
Error Code -108 reported for 2 surfaces
Error Code -1000 reported for 77 surfaces

Method: janbu simplified

Number of Valid Surfaces:	4640
Number of Invalid Surfaces:	211

Error Codes:

Error Code -103 reported for 89 surfaces
Error Code -106 reported for 43 surfaces
Error Code -108 reported for 2 surfaces
Error Code -1000 reported for 77 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.61285

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	4.48601	356.054	11.7814	Fill Static	275	28	184.027	296.807	41.0137	0	41.0137	79.3966	79.3966
2	4.48601	1057.34	12.2349	Fill Static	275	28	231.659	373.631	185.498	0	185.498	235.732	235.732
3	4.48601	1736.92	12.6892	Fill Static	275	28	277.561	447.664	324.734	0	324.734	387.23	387.23
4	4.48601	2394.7	13.1443	Fill Static	275	28	321.737	518.913	458.734	0	458.734	533.867	533.867
5	4.48601	3030.53	13.6003	Fill Static	275	28	364.189	587.382	587.506	0	587.506	675.615	675.615
6	4.48601	3644.31	14.0571	Fill Static	275	28	404.92	653.076	711.058	0	711.058	812.444	812.444
7	4.48601	4235.9	14.5148	Fill Static	275	28	443.933	715.998	829.395	0	829.395	944.326	944.326
8	4.48601	4805.16	14.9735	Fill Static	275	28	481.23	776.151	942.528	0	942.528	1071.23	1071.23
9	4.48601	5351.96	15.4332	Fill Static	275	28	516.811	833.539	1050.46	0	1050.46	1193.13	1193.13
10	4.48601	5876.15	15.8938	Fill Static	275	28	550.679	888.163	1153.19	0	1153.19	1309.99	1309.99
11	4.48601	6377.56	16.3556	Fill Static	275	28	582.835	940.025	1250.73	0	1250.73	1421.78	1421.78
12	4.48601	6856.05	16.8184	Fill Static	275	28	613.278	989.125	1343.07	0	1343.07	1528.45	1528.45
13	4.48601	7311.45	17.2824	Fill Static	275	28	642.009	1035.47	1430.23	0	1430.23	1629.97	1629.97
14	4.48601	7739.06	17.7475	Fill Static	275	28	668.729	1078.56	1511.27	0	1511.27	1725.3	1725.3
15	4.48601	8128.48	18.2139	Fill Static	275	28	692.76	1117.32	1584.17	0	1584.17	1812.12	1812.12
16	4.48601	8493.14	18.6815	Fill Static	275	28	715.009	1153.2	1651.66	0	1651.66	1893.42	1893.42
17	4.48601	8833.97	19.1504	Fill Static	275	28	735.553	1186.34	1713.97	0	1713.97	1969.41	1969.41
18	4.48601	9150.77	19.6206	Fill Static	275	28	754.387	1216.71	1771.1	0	1771.1	2040.04	2040.04
19	4.48601	9443.34	20.0923	Fill Static	275	28	771.511	1244.33	1823.05	0	1823.05	2105.26	2105.26
20	4.48601	9711.45	20.5653	Fill Static	275	28	786.923	1269.19	1869.8	0	1869.8	2165.04	2165.04
21	4.48601	9954.89	21.0398	Fill Static	275	28	800.62	1291.28	1911.34	0	1911.34	2219.31	2219.31
22	4.48601	10173.4	21.5158	Fill Static	275	28	812.599	1310.6	1947.68	0	1947.68	2268.03	2268.03
23	4.48601	10366.8	21.9934	Fill Static	275	28	822.86	1327.15	1978.8	0	1978.8	2311.14	2311.14
24	4.48601	10534.7	22.4726	Fill Static	275	28	831.392	1340.91	2004.68	0	2004.68	2348.59	2348.59
25	4.48601	10677	22.9535	Fill Static	275	28	838.199	1351.89	2025.33	0	2025.33	2380.32	2380.32
26	4.48601	10793.4	23.4361	Fill Static	275	28	843.271	1360.07	2040.71	0	2040.71	2406.26	2406.26
27	4.48601	10883.5	23.9204	Fill Static	275	28	846.607	1365.45	2050.83	0	2050.83	2426.36	2426.36
28	4.48601	10947.1	24.4066	Fill Static	275	28	848.194	1368.01	2055.67	0	2055.67	2440.54	2440.54

29	4.48601	10983.8	24.8947	Fill Static	275	28	848.039	1367.76	2055.19	0	2055.19	2448.74	2448.74
30	4.48601	10993.5	25.3847	Fill Static	275	28	846.136	1364.69	2049.39	0	2049.39	2450.89	2450.89
31	4.48601	10975.7	25.8767	Fill Static	275	28	842.465	1358.77	2038.28	0	2038.28	2446.94	2446.94
32	4.48601	10930	26.3707	Fill Static	275	28	837.028	1350	2021.79	0	2021.79	2436.76	2436.76
33	4.48601	10856.2	26.8669	Fill Static	275	28	829.823	1338.38	1999.91	0	1999.91	2420.3	2420.3
34	4.48601	10753.9	27.3652	Fill Static	275	28	820.833	1323.88	1972.65	0	1972.65	2397.5	2397.5
35	4.48601	10622.6	27.8659	Fill Static	275	28	810.051	1306.49	1939.96	0	1939.96	2368.24	2368.24
36	4.48601	10462	28.3688	Fill Static	275	28	797.477	1286.21	1901.81	0	1901.81	2332.45	2332.45
37	4.48601	10271.7	28.8741	Fill Static	275	28	783.097	1263.02	1858.19	0	1858.19	2290.02	2290.02
38	4.48601	10051.2	29.3819	Fill Static	275	28	766.902	1236.9	1809.07	0	1809.07	2240.88	2240.88
39	4.48601	9800.14	29.8923	Fill Static	275	28	748.884	1207.84	1754.41	0	1754.41	2184.9	2184.9
40	4.48601	9517.97	30.4052	Fill Static	275	28	729.031	1175.82	1694.19	0	1694.19	2122	2122
41	4.48601	9204.21	30.9209	Fill Static	275	28	707.334	1140.82	1628.38	0	1628.38	2052.06	2052.06
42	4.48601	8858.38	31.4394	Fill Static	275	28	683.781	1102.84	1556.93	0	1556.93	1974.96	1974.96
43	4.48601	8479.93	31.9608	Fill Static	275	28	658.362	1061.84	1479.83	0	1479.83	1890.59	1890.59
44	4.48601	8068.31	32.4851	Fill Static	275	28	631.065	1017.81	1397.03	0	1397.03	1798.83	1798.83
45	4.48601	7622.94	33.0125	Fill Static	275	28	601.877	970.737	1308.49	0	1308.49	1699.54	1699.54
46	4.48601	7143.21	33.5431	Fill Static	275	28	570.786	920.592	1214.18	0	1214.18	1592.59	1592.59
47	4.48601	6347.22	34.077	Fill Static	275	28	520.875	840.093	1062.79	0	1062.79	1415.14	1415.14
48	4.48601	4625.13	34.6142	Fill Static	275	28	415.843	670.693	744.189	0	744.189	1031.21	1031.21
49	4.48601	2801.06	35.155	Fill Static	275	28	305.479	492.691	409.418	0	409.418	624.55	624.55
50	4.48601	939.927	35.6994	Fill Static	275	28	193.721	312.444	70.4213	0	70.4213	209.621	209.621

Global Minimum Query (janbu simplified) - Safety Factor: 1.59363

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	4.48601	356.054	11.7814	Fill Static	275	28	186.107	296.586	40.5975	0	40.5975	79.4144	79.4144
2	4.48601	1057.34	12.2349	Fill Static	275	28	234.272	373.342	184.955	0	184.955	235.756	235.756
3	4.48601	1736.92	12.6892	Fill Static	275	28	280.684	447.306	324.06	0	324.06	387.259	387.259
4	4.48601	2394.7	13.1443	Fill Static	275	28	325.347	518.483	457.926	0	457.926	533.902	533.902
5	4.48601	3030.53	13.6003	Fill Static	275	28	368.266	586.879	586.559	0	586.559	675.654	675.654
6	4.48601	3644.31	14.0571	Fill Static	275	28	409.442	652.499	709.972	0	709.972	812.491	812.491
7	4.48601	4235.9	14.5148	Fill Static	275	28	448.878	715.345	828.169	0	828.169	944.381	944.381
8	4.48601	4805.16	14.9735	Fill	275	28	486.576	775.422	941.159	0	941.159	1071.29	1071.29

				Static									
9	4.48601	5351.96	15.4332	Fill Static	275	28	522.538	832.733	1048.94	0	1048.94	1193.2	1193.2
10	4.48601	5876.15	15.8938	Fill Static	275	28	556.767	887.28	1151.53	0	1151.53	1310.07	1310.07
11	4.48601	6377.56	16.3556	Fill Static	275	28	589.261	939.064	1248.92	0	1248.92	1421.85	1421.85
12	4.48601	6856.05	16.8184	Fill Static	275	28	620.023	988.087	1341.12	0	1341.12	1528.53	1528.53
13	4.48601	7311.45	17.2824	Fill Static	275	28	649.052	1034.35	1428.13	0	1428.13	1630.07	1630.07
14	4.48601	7739.06	17.7475	Fill Static	275	28	676.045	1077.37	1509.03	0	1509.03	1725.4	1725.4
15	4.48601	8128.48	18.2139	Fill Static	275	28	700.32	1116.05	1581.79	0	1581.79	1812.23	1812.23
16	4.48601	8493.14	18.6815	Fill Static	275	28	722.793	1151.86	1649.14	0	1649.14	1893.53	1893.53
17	4.48601	8833.97	19.1504	Fill Static	275	28	743.538	1184.92	1711.32	0	1711.32	1969.52	1969.52
18	4.48601	9150.77	19.6206	Fill Static	275	28	762.555	1215.23	1768.32	0	1768.32	2040.16	2040.16
19	4.48601	9443.34	20.0923	Fill Static	275	28	779.843	1242.78	1820.13	0	1820.13	2105.39	2105.39
20	4.48601	9711.45	20.5653	Fill Static	275	28	795.398	1267.57	1866.75	0	1866.75	2165.17	2165.17
21	4.48601	9954.89	21.0398	Fill Static	275	28	809.222	1289.6	1908.18	0	1908.18	2219.46	2219.46
22	4.48601	10173.4	21.5158	Fill Static	275	28	821.301	1308.85	1944.4	0	1944.4	2268.18	2268.18
23	4.48601	10366.8	21.9934	Fill Static	275	28	831.649	1325.34	1975.4	0	1975.4	2311.3	2311.3
24	4.48601	10534.7	22.4726	Fill Static	275	28	840.252	1339.05	2001.18	0	2001.18	2348.75	2348.75
25	4.48601	10677	22.9535	Fill Static	275	28	847.104	1349.97	2021.72	0	2021.72	2380.48	2380.48
26	4.48601	10793.4	23.4361	Fill Static	275	28	852.205	1358.1	2037.01	0	2037.01	2406.43	2406.43
27	4.48601	10883.5	23.9204	Fill Static	275	28	855.55	1363.43	2047.04	0	2047.04	2426.54	2426.54
28	4.48601	10947.1	24.4066	Fill Static	275	28	857.131	1365.95	2051.79	0	2051.79	2440.72	2440.72
29	4.48601	10983.8	24.8947	Fill Static	275	28	856.949	1365.66	2051.25	0	2051.25	2448.93	2448.93
30	4.48601	10993.5	25.3847	Fill Static	275	28	854.998	1362.55	2045.39	0	2045.39	2451.09	2451.09
31	4.48601	10975.7	25.8767	Fill Static	275	28	851.264	1356.6	2034.19	0	2034.19	2447.11	2447.11
32	4.48601	10930	26.3707	Fill Static	275	28	845.748	1347.81	2017.66	0	2017.66	2436.95	2436.95
33	4.48601	10856.2	26.8669	Fill Static	275	28	838.438	1336.16	1995.75	0	1995.75	2420.51	2420.51
34	4.48601	10753.9	27.3652	Fill Static	275	28	829.327	1321.64	1968.45	0	1968.45	2397.69	2397.69
35	4.48601	10622.6	27.8659	Fill Static	275	28	818.415	1304.25	1935.73	0	1935.73	2368.44	2368.44
36	4.48601	10462	28.3688	Fill Static	275	28	805.683	1283.96	1897.58	0	1897.58	2332.64	2332.64
37	4.48601	10271.7	28.8741	Fill Static	275	28	791.13	1260.77	1853.96	0	1853.96	2290.22	2290.22
38	4.48601	10051.2	29.3819	Fill Static	275	28	774.745	1234.66	1804.85	0	1804.85	2241.08	2241.08
39	4.48601	9800.14	29.8923	Fill Static	275	28	756.518	1205.61	1750.22	0	1750.22	2185.1	2185.1
40	4.48601	9517.97	30.4052	Fill Static	275	28	736.438	1173.61	1690.04	0	1690.04	2122.2	2122.2

41	4.48601	9204.21	30.9209	Fill Static	275	28	714.498	1138.65	1624.28	0	1624.28	2052.25	2052.25
42	4.48601	8858.38	31.4394	Fill Static	275	28	690.684	1100.7	1552.91	0	1552.91	1975.15	1975.15
43	4.48601	8479.93	31.9608	Fill Static	275	28	664.986	1059.74	1475.89	0	1475.89	1890.78	1890.78
44	4.48601	8068.31	32.4851	Fill Static	275	28	637.393	1015.77	1393.18	0	1393.18	1799.02	1799.02
45	4.48601	7622.94	33.0125	Fill Static	275	28	607.892	968.755	1304.76	0	1304.76	1699.72	1699.72
46	4.48601	7143.21	33.5431	Fill Static	275	28	576.471	918.681	1210.59	0	1210.59	1592.77	1592.77
47	4.48601	6347.22	34.077	Fill Static	275	28	526.044	838.32	1059.45	0	1059.45	1415.3	1415.3
48	4.48601	4625.13	34.6142	Fill Static	275	28	419.956	669.254	741.483	0	741.483	1031.35	1031.35
49	4.48601	2801.06	35.155	Fill Static	275	28	308.489	491.617	407.397	0	407.397	624.649	624.649
50	4.48601	939.927	35.6994	Fill Static	275	28	195.623	311.751	69.119	0	69.119	209.685	209.685

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.61285

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	347.182	866.242	0	0	0
2	351.668	867.177	786.595	0	0
3	356.154	868.15	1644.65	0	0
4	360.64	869.16	2560.91	0	0
5	365.126	870.208	3522.66	0	0
6	369.612	871.293	4517.65	0	0
7	374.099	872.416	5534.18	0	0
8	378.585	873.578	6561.02	0	0
9	383.071	874.777	7587.47	0	0
10	387.557	876.016	8603.34	0	0
11	392.043	877.293	9598.94	0	0
12	396.529	878.61	10565.1	0	0
13	401.015	879.966	11493.2	0	0
14	405.501	881.361	12375	0	0
15	409.987	882.797	13203	0	0
16	414.473	884.273	13970.1	0	0
17	418.959	885.79	14670.2	0	0
18	423.445	887.348	15297.5	0	0
19	427.931	888.947	15846.9	0	0
20	432.417	890.588	16314	0	0
21	436.903	892.271	16694.6	0	0
22	441.389	893.997	16985.5	0	0
23	445.875	895.765	17183.8	0	0
24	450.361	897.577	17287.2	0	0
25	454.847	899.433	17294.3	0	0
26	459.333	901.333	17203.9	0	0
27	463.819	903.277	17015.7	0	0
28	468.305	905.267	16730.1	0	0
29	472.791	907.303	16348.1	0	0
30	477.277	909.385	15871.2	0	0
31	481.763	911.513	15301.8	0	0
32	486.249	913.689	14643.2	0	0
33	490.735	915.913	13899	0	0
34	495.221	918.186	13073.9	0	0
35	499.707	920.508	12173.4	0	0
36	504.193	922.88	11203.5	0	0
37	508.679	925.302	10171.5	0	0
38	513.165	927.776	9085.35	0	0
39	517.651	930.302	7953.81	0	0
40	522.137	932.88	6786.75	0	0
41	526.623	935.513	5594.99	0	0
42	531.109	938.2	4390.37	0	0
43	535.595	940.942	3185.77	0	0
44	540.081	943.741	1995.24	0	0
45	544.567	946.598	833.949	0	0
46	549.053	949.512	-281.693	0	0
47	553.539	952.486	-1334	0	0
48	558.025	955.521	-2224.14	0	0
49	562.511	958.617	-2664.23	0	0
50	566.997	961.777	-2588.26	0	0
51	571.483	965	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.59363

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	347.182	866.242	0	0	0
2	351.668	867.177	795.936	0	0
3	356.154	868.15	1665.76	0	0
4	360.64	869.16	2596.13	0	0
5	365.126	870.208	3574.26	0	0
6	369.612	871.293	4587.81	0	0
7	374.099	872.416	5625	0	0
8	378.585	873.578	6674.53	0	0
9	383.071	874.777	7725.61	0	0
10	387.557	876.016	8767.97	0	0
11	392.043	877.293	9791.86	0	0
12	396.529	878.61	10788	0	0
13	401.015	879.966	11747.7	0	0
14	405.501	881.361	12662.8	0	0
15	409.987	882.797	13525.4	0	0
16	414.473	884.273	14328.5	0	0
17	418.959	885.79	15065.8	0	0
18	423.445	887.348	15731.6	0	0
19	427.931	888.947	16320.5	0	0
20	432.417	890.588	16828.1	0	0
21	436.903	892.271	17250.3	0	0
22	441.389	893.997	17583.6	0	0
23	445.875	895.765	17825	0	0
24	450.361	897.577	17972.4	0	0
25	454.847	899.433	18023.9	0	0
26	459.333	901.333	17978.6	0	0
27	463.819	903.277	17836	0	0
28	468.305	905.267	17596.3	0	0
29	472.791	907.303	17260.5	0	0
30	477.277	909.385	16830	0	0
31	481.763	911.513	16307.3	0	0
32	486.249	913.689	15695.2	0	0
33	490.735	915.913	14997.6	0	0
34	495.221	918.186	14218.9	0	0
35	499.707	920.508	13364.5	0	0
36	504.193	922.88	12440.5	0	0
37	508.679	925.302	11454	0	0
38	513.165	927.776	10412.7	0	0
39	517.651	930.302	9325.35	0	0
40	522.137	932.88	8201.8	0	0
41	526.623	935.513	7052.69	0	0
42	531.109	938.2	5889.74	0	0
43	535.595	940.942	4725.75	0	0
44	540.081	943.741	3574.61	0	0
45	544.567	946.598	2451.38	0	0
46	549.053	949.512	1372.34	0	0
47	553.539	952.486	355.044	0	0
48	558.025	955.521	-502.862	0	0
49	562.511	958.617	-916.979	0	0
50	566.997	961.777	-821.754	0	0
51	571.483	965	0	0	0

List Of Coordinates

External Boundary

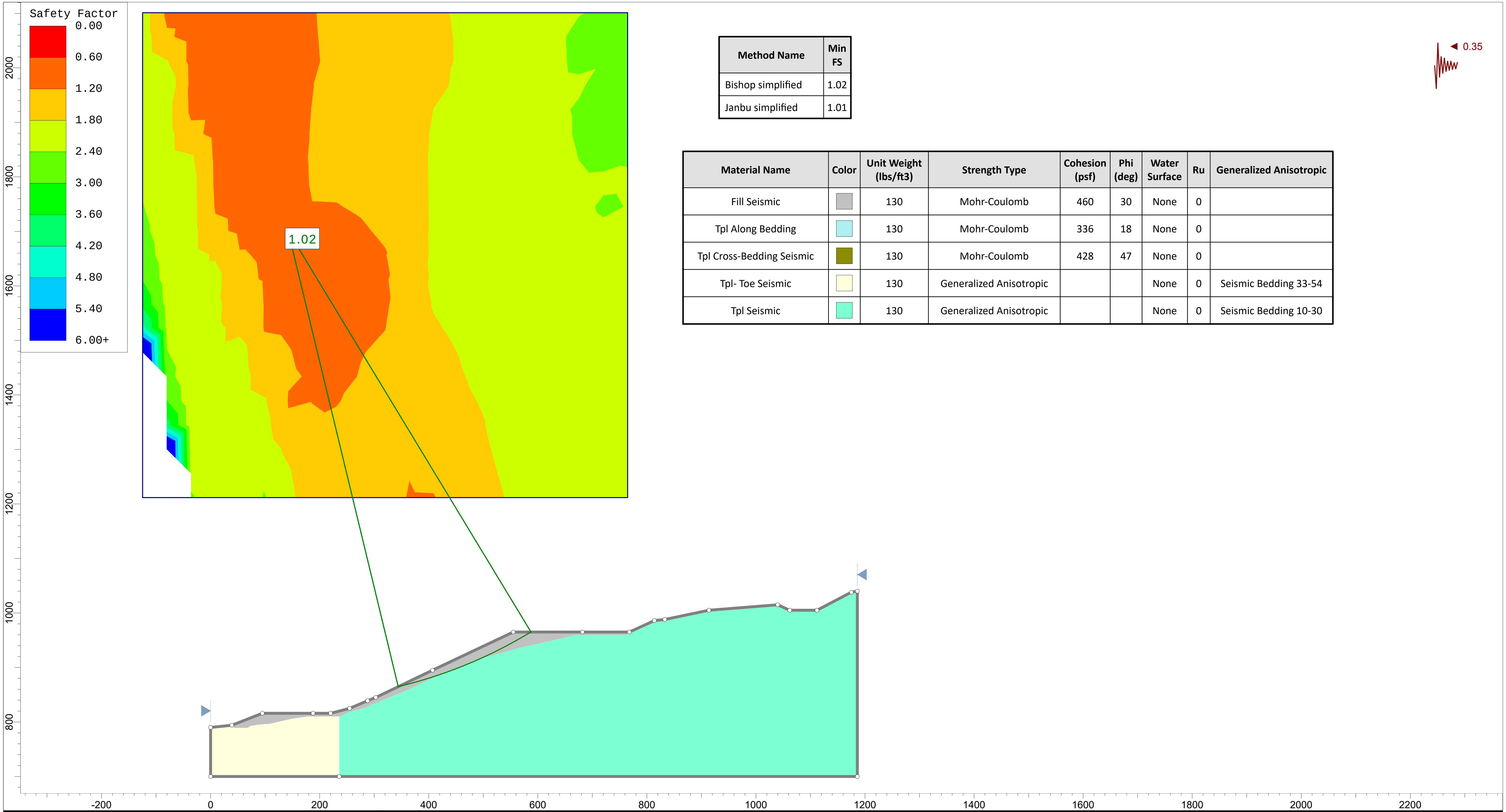
X	Y
0	700
236	700
1186	700
1186	1040
1175	1038
1112	1005
1062	1005
1040	1015
914	1005
833	988
814	986
768	965
682	965
555	965
407	895
303	845
288	839
255	825
220	816
188	816
95	816
39	794
0	790

Material Boundary

X	Y
39	794
44	789
67	789
73	793
93	796
111	797
150	806
178	810
236	810
256	819
280	825
313	839
364	860
404	879
449	897
500	917
570	937
657	957
669	960
763	960
768	965

Material Boundary

X	Y
236	700
236	810



Method Name	Min FS
Bishop simplified	1.02
Janbu simplified	1.01

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Generalized Anisotropic
Fill Seismic	■	130	Mohr-Coulomb	460	30	None	0	
Tpl Along Bedding	■	130	Mohr-Coulomb	336	18	None	0	
Tpl Cross-Bedding Seismic	■	130	Mohr-Coulomb	428	47	None	0	
Tpl- Toe Seismic	■	130	Generalized Anisotropic			None	0	Seismic Bedding 33-54
Tpl Seismic	■	130	Generalized Anisotropic			None	0	Seismic Bedding 10-30

TGR
Geotechnical
Environmental
Hydrogeology
Material Testing
Construction Inspection

Project	HOFF Property, Yorba Linda
Analysis Description	Cross-section C-C' Seismic
Drawn By	
Scale	1:2000
Company	TGR Geotechnical, Inc.
Date	4/15/20
File Name	Cross-section C-C' Seismic.slim

SLIDEINTERPRET 7.038

Slide Analysis Information

HOFF Property, Yorba Linda

Project Summary

File Name:	Cross-section C-C' Seismic
Slide Modeler Version:	7.038
Project Title:	HOFF Property, Yorba Linda
Analysis:	Cross-section C-C' Seismic
Company:	TGR Geotechnical, Inc.
Date Created:	4/15/20

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
	Janbu simplified

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Grid Search
Radius Increment:	10
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal): 0.35

Material Properties

Property	Fill Seismic	Tpl- Toe Seismic	Tpl Seismic
Color	⬜	🟨	🟩
Strength Type	Mohr-Coulomb	Generalized Anisotropic	Generalized Anisotropic
Unit Weight [lbs/ft3]	130	130	130
Cohesion [psf]	460		
Friction Angle [deg]	30		
Water Surface	None	None	None
Ru Value	0	0	0

Generalized Anisotropic Functions

Name: Seismic Bedding 33-54

Angle From	Angle To	Material
33	-90	Tpl Cross-Bedding Seismic
54	33	Tpl Along Bedding
90	54	Tpl Cross-Bedding Seismic

Name: Seismic Bedding 10-30

Angle From	Angle To	Material
-30	-90	Tpl Cross-Bedding Seismic
-10	-30	Tpl Along Bedding
90	-10	Tpl Cross-Bedding Seismic

Global Minimums

Method: bishop simplified

FS	1.022610
Center:	142.164, 1700.801
Radius:	860.104
Left Slip Surface Endpoint:	344.011, 864.717
Right Slip Surface Endpoint:	587.558, 965.000
Resisting Moment:	2.80396e+008 lb-ft
Driving Moment:	2.74198e+008 lb-ft
Total Slice Area:	3451.05 ft2
Surface Horizontal Width:	243.548 ft
Surface Average Height:	14.1699 ft

Method: janbu simplified

FS	1.008500
Center:	231.114, 1433.951
Radius:	579.453
Left Slip Surface Endpoint:	347.182, 866.242
Right Slip Surface Endpoint:	571.483, 965.000
Resisting Horizontal Force:	261244 lb
Driving Horizontal Force:	259042 lb
Total Slice Area:	2993.65 ft2
Surface Horizontal Width:	224.3 ft
Surface Average Height:	13.3466 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	4642
Number of Invalid Surfaces:	209

Error Codes:

Error Code -103 reported for 89 surfaces
Error Code -106 reported for 43 surfaces
Error Code -1000 reported for 77 surfaces

Method: janbu simplified

Number of Valid Surfaces:	4640
Number of Invalid Surfaces:	211

Error Codes:

Error Code -103 reported for 89 surfaces
Error Code -106 reported for 43 surfaces
Error Code -108 reported for 2 surfaces
Error Code -1000 reported for 77 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.02261

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	4.87095	364.365	13.7396	Fill Seismic	460	30	432.184	441.956	-31.253	0	-31.253	74.4187	74.4187
2	4.87095	1083.55	14.0739	Fill Seismic	460	30	503.847	515.239	95.6772	0	95.6772	221.991	221.991
3	4.87095	1783.59	14.4086	Fill Seismic	460	30	573.127	586.085	218.385	0	218.385	365.631	365.631
4	4.87095	2464.4	14.7439	Fill Seismic	460	30	640.033	654.504	336.891	0	336.891	505.325	505.325
5	4.87095	3125.9	15.0797	Fill Seismic	460	30	704.577	720.507	451.211	0	451.211	641.053	641.053
6	4.87095	3768	15.416	Fill Seismic	460	30	766.766	784.103	561.362	0	561.362	772.796	772.796
7	4.87095	4390.6	15.7529	Fill Seismic	460	30	826.611	845.301	667.361	0	667.361	900.535	900.535
8	4.87095	4993.6	16.0903	Fill Seismic	460	30	884.122	904.112	769.225	0	769.225	1024.25	1024.25
9	4.87095	5576.92	16.4283	Fill Seismic	460	30	939.306	960.544	866.968	0	866.968	1143.92	1143.92
10	4.87095	6140.43	16.7669	Fill Seismic	460	30	992.173	1014.61	960.606	0	960.606	1259.54	1259.54
11	4.87095	6684.05	17.1061	Fill Seismic	460	30	1042.73	1066.3	1050.15	0	1050.15	1371.06	1371.06
12	4.87095	7207.66	17.4459	Fill Seismic	460	30	1090.98	1115.65	1135.62	0	1135.62	1478.47	1478.47
13	4.87095	7711.1	17.7863	Fill Seismic	460	30	1136.94	1162.65	1217.02	0	1217.02	1581.75	1581.75
14	4.87095	8180.74	18.1274	Fill Seismic	460	30	1179.28	1205.95	1292.02	0	1292.02	1678.09	1678.09
15	4.87095	8619.6	18.4692	Fill Seismic	460	30	1218.34	1245.88	1361.19	0	1361.19	1768.11	1768.11
16	4.87095	9037.99	18.8116	Fill Seismic	460	30	1255.13	1283.51	1426.36	0	1426.36	1853.93	1853.93
17	4.87095	9435.78	19.1548	Fill Seismic	460	30	1289.68	1318.84	1487.55	0	1487.55	1935.52	1935.52
18	4.87095	9812.86	19.4986	Fill Seismic	460	30	1321.98	1351.87	1544.76	0	1544.76	2012.86	2012.86
19	4.87095	10169.1	19.8432	Fill Seismic	460	30	1352.04	1382.61	1598	0	1598	2085.92	2085.92
20	4.87095	10504.3	20.1886	Fill Seismic	460	30	1379.87	1411.06	1647.29	0	1647.29	2154.67	2154.67
21	4.87095	10818.4	20.5347	Fill Seismic	460	30	1405.47	1437.24	1692.63	0	1692.63	2219.09	2219.09
22	4.87095	11111.2	20.8816	Fill Seismic	460	30	1428.84	1461.15	1734.04	0	1734.04	2279.14	2279.14
23	4.87095	11382.6	21.2293	Fill Seismic	460	30	1450.01	1482.79	1771.52	0	1771.52	2334.79	2334.79
24	4.87095	11632.5	21.5778	Fill Seismic	460	30	1468.95	1502.16	1805.08	0	1805.08	2386.02	2386.02
25	4.87095	11860.6	21.9271	Fill Seismic	460	30	1485.69	1519.28	1834.73	0	1834.73	2432.79	2432.79
26	4.87095	12066.8	22.2774	Fill Seismic	460	30	1500.22	1534.14	1860.47	0	1860.47	2475.06	2475.06
27	4.87095	12251	22.6285	Fill Seismic	460	30	1512.56	1546.76	1882.32	0	1882.32	2512.82	2512.82
28	4.87095	12413	22.9804	Fill Seismic	460	30	1522.7	1557.13	1900.28	0	1900.28	2546.02	2546.02
29	4.87095	12552.6	23.3334	Fill	460	30	1530.65	1565.26	1914.36	0	1914.36	2574.62	2574.62

				Seismic									
30	4.87095	12669.6	23.6872	Fill Seismic	460	30	1536.41	1571.15	1924.57	0	1924.57	2598.59	2598.59
31	4.87095	12763.9	24.042	Fill Seismic	460	30	1539.99	1574.81	1930.91	0	1930.91	2617.91	2617.91
32	4.87095	12835.3	24.3978	Fill Seismic	460	30	1541.39	1576.24	1933.39	0	1933.39	2632.53	2632.53
33	4.87095	12883.5	24.7546	Fill Seismic	460	30	1540.61	1575.44	1931.99	0	1931.99	2642.37	2642.37
34	4.87095	12908.4	25.1125	Fill Seismic	460	30	1537.64	1572.41	1926.75	0	1926.75	2647.44	2647.44
35	4.87095	12909.7	25.4714	Fill Seismic	460	30	1532.51	1567.16	1917.66	0	1917.66	2647.69	2647.69
36	4.87095	12887.4	25.8313	Fill Seismic	460	30	1525.21	1559.69	1904.73	0	1904.73	2643.07	2643.07
37	4.87095	12841	26.1924	Fill Seismic	460	30	1515.74	1550.01	1887.94	0	1887.94	2633.53	2633.53
38	4.87095	12770.5	26.5545	Fill Seismic	460	30	1504.09	1538.1	1867.32	0	1867.32	2619.02	2619.02
39	4.87095	12675.6	26.9179	Fill Seismic	460	30	1490.29	1523.99	1842.88	0	1842.88	2599.53	2599.53
40	4.87095	12556	27.2824	Fill Seismic	460	30	1474.32	1507.65	1814.59	0	1814.59	2574.97	2574.97
41	4.87095	12411.6	27.6481	Fill Seismic	460	30	1456.19	1489.11	1782.47	0	1782.47	2545.31	2545.31
42	4.87095	12242	28.015	Fill Seismic	460	30	1435.89	1468.36	1746.53	0	1746.53	2510.49	2510.49
43	4.87095	12047.1	28.3832	Fill Seismic	460	30	1413.44	1445.4	1706.76	0	1706.76	2470.47	2470.47
44	4.87095	11485	28.7526	Fill Seismic	460	30	1358.64	1389.36	1609.69	0	1609.69	2355.14	2355.14
45	4.87095	9852.41	29.1234	Fill Seismic	460	30	1209.86	1237.22	1346.18	0	1346.18	2020.23	2020.23
46	4.87095	8120.83	29.4955	Fill Seismic	460	30	1053.44	1077.26	1069.13	0	1069.13	1665.02	1665.02
47	4.87095	6362.76	29.869	Fill Seismic	460	30	895.809	916.063	789.923	0	789.923	1304.39	1304.39
48	4.87095	4577.9	30.2439	Fill Seismic	460	30	736.97	753.633	508.588	0	508.588	938.271	938.271
49	4.87095	2765.94	30.6202	Fill Seismic	460	30	576.934	589.978	225.128	0	225.128	566.601	566.601
50	4.87095	926.575	30.998	Fill Seismic	460	30	415.703	425.102	-60.4451	0	-60.4451	189.315	189.315

Global Minimum Query (janbu simplified) - Safety Factor: 1.0085

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	4.48601	356.054	11.7814	Fill Seismic	460	30	448.047	451.856	-14.1066	0	-14.1066	79.3439	79.3439
2	4.48601	1057.34	12.2349	Fill Seismic	460	30	525.768	530.237	121.655	0	121.655	235.665	235.665
3	4.48601	1736.92	12.6892	Fill Seismic	460	30	600.371	605.474	251.968	0	251.968	387.149	387.149
4	4.48601	2394.7	13.1443	Fill Seismic	460	30	671.876	677.587	376.873	0	376.873	533.771	533.771
5	4.48601	3030.53	13.6003	Fill Seismic	460	30	740.304	746.597	496.401	0	496.401	675.503	675.503
6	4.48601	3644.31	14.0571	Fill Seismic	460	30	805.675	812.523	610.586	0	610.586	812.316	812.316
7	4.48601	4235.9	14.5148	Fill Seismic	460	30	868.005	875.383	719.464	0	719.464	944.185	944.185
8	4.48601	4805.16	14.9735	Fill Seismic	460	30	927.314	935.196	823.063	0	823.063	1071.08	1071.08

9	4.48601	5351.96	15.4332	Fill Seismic	460	30	983.617	991.978	921.414	0	921.414	1192.96	1192.96
10	4.48601	5876.15	15.8938	Fill Seismic	460	30	1036.93	1045.75	1014.54	0	1014.54	1309.8	1309.8
11	4.48601	6377.56	16.3556	Fill Seismic	460	30	1087.28	1096.52	1102.48	0	1102.48	1421.57	1421.57
12	4.48601	6856.05	16.8184	Fill Seismic	460	30	1134.66	1144.3	1185.25	0	1185.25	1528.22	1528.22
13	4.48601	7311.45	17.2824	Fill Seismic	460	30	1179.1	1189.12	1262.88	0	1262.88	1629.73	1629.73
14	4.48601	7739.06	17.7475	Fill Seismic	460	30	1220.13	1230.5	1334.54	0	1334.54	1725.05	1725.05
15	4.48601	8128.48	18.2139	Fill Seismic	460	30	1256.65	1267.34	1398.34	0	1398.34	1811.85	1811.85
16	4.48601	8493.14	18.6815	Fill Seismic	460	30	1290.17	1301.14	1456.9	0	1456.9	1893.13	1893.13
17	4.48601	8833.97	19.1504	Fill Seismic	460	30	1320.82	1332.04	1510.43	0	1510.43	1969.1	1969.1
18	4.48601	9150.77	19.6206	Fill Seismic	460	30	1348.6	1360.06	1558.95	0	1558.95	2039.71	2039.71
19	4.48601	9443.34	20.0923	Fill Seismic	460	30	1373.53	1385.2	1602.5	0	1602.5	2104.93	2104.93
20	4.48601	9711.45	20.5653	Fill Seismic	460	30	1395.61	1407.47	1641.07	0	1641.07	2164.69	2164.69
21	4.48601	9954.89	21.0398	Fill Seismic	460	30	1414.86	1426.89	1674.7	0	1674.7	2218.95	2218.95
22	4.48601	10173.4	21.5158	Fill Seismic	460	30	1431.29	1443.46	1703.39	0	1703.39	2267.65	2267.65
23	4.48601	10366.8	21.9934	Fill Seismic	460	30	1444.9	1457.18	1727.17	0	1727.17	2310.75	2310.75
24	4.48601	10534.7	22.4726	Fill Seismic	460	30	1455.7	1468.07	1746.03	0	1746.03	2348.18	2348.18
25	4.48601	10677	22.9535	Fill Seismic	460	30	1463.7	1476.14	1760	0	1760	2379.9	2379.9
26	4.48601	10793.4	23.4361	Fill Seismic	460	30	1468.89	1481.38	1769.08	0	1769.08	2405.83	2405.83
27	4.48601	10883.5	23.9204	Fill Seismic	460	30	1471.3	1483.81	1773.29	0	1773.29	2425.91	2425.91
28	4.48601	10947.1	24.4066	Fill Seismic	460	30	1470.93	1483.43	1772.64	0	1772.64	2440.08	2440.08
29	4.48601	10983.8	24.8947	Fill Seismic	460	30	1467.77	1480.25	1767.13	0	1767.13	2448.28	2448.28
30	4.48601	10993.5	25.3847	Fill Seismic	460	30	1461.84	1474.27	1756.77	0	1756.77	2450.42	2450.42
31	4.48601	10975.7	25.8767	Fill Seismic	460	30	1453.15	1465.5	1741.57	0	1741.57	2446.45	2446.45
32	4.48601	10930	26.3707	Fill Seismic	460	30	1441.67	1453.93	1721.53	0	1721.53	2436.27	2436.27
33	4.48601	10856.2	26.8669	Fill Seismic	460	30	1427.44	1439.57	1696.67	0	1696.67	2419.81	2419.81
34	4.48601	10753.9	27.3652	Fill Seismic	460	30	1410.44	1422.43	1666.98	0	1666.98	2397	2397
35	4.48601	10622.6	27.8659	Fill Seismic	460	30	1390.69	1402.51	1632.47	0	1632.47	2367.74	2367.74
36	4.48601	10462	28.3688	Fill Seismic	460	30	1368.17	1379.8	1593.14	0	1593.14	2331.94	2331.94
37	4.48601	10271.7	28.8741	Fill Seismic	460	30	1342.9	1354.31	1548.99	0	1548.99	2289.52	2289.52
38	4.48601	10051.2	29.3819	Fill Seismic	460	30	1314.87	1326.04	1500.03	0	1500.03	2240.37	2240.37
39	4.48601	9800.14	29.8923	Fill Seismic	460	30	1284.08	1294.99	1446.25	0	1446.25	2184.4	2184.4
40	4.48601	9517.97	30.4052	Fill Seismic	460	30	1250.54	1261.17	1387.66	0	1387.66	2121.5	2121.5
41	4.48601	9204.21	30.9209	Fill	460	30	1214.24	1224.56	1324.25	0	1324.25	2051.56	2051.56

				Seismic									
42	4.48601	8858.38	31.4394	Fill Seismic	460	30	1175.18	1185.17	1256.03	0	1256.03	1974.47	1974.47
43	4.48601	8479.93	31.9608	Fill Seismic	460	30	1133.36	1143	1182.98	0	1182.98	1890.11	1890.11
44	4.48601	8068.31	32.4851	Fill Seismic	460	30	1088.79	1098.04	1105.12	0	1105.12	1798.36	1798.36
45	4.48601	7622.94	33.0125	Fill Seismic	460	30	1041.45	1050.3	1022.43	0	1022.43	1699.08	1699.08
46	4.48601	7143.21	33.5431	Fill Seismic	460	30	991.348	999.774	934.918	0	934.918	1592.15	1592.15
47	4.48601	6347.22	34.077	Fill Seismic	460	30	912.607	920.364	797.374	0	797.374	1414.72	1414.72
48	4.48601	4625.13	34.6142	Fill Seismic	460	30	749.945	756.32	513.241	0	513.241	1030.87	1030.87
49	4.48601	2801.06	35.155	Fill Seismic	460	30	579.771	584.699	215.985	0	215.985	624.287	624.287
50	4.48601	939.927	35.6994	Fill Seismic	460	30	408.135	411.604	-83.8249	0	-83.8249	209.443	209.443

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.02261

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	344.011	864.717	0	0	0
2	348.882	865.908	2022.51	0	0
3	353.753	867.129	3989.59	0	0
4	358.624	868.38	5893.88	0	0
5	363.495	869.662	7728.42	0	0
6	368.365	870.975	9486.63	0	0
7	373.236	872.318	11162.3	0	0
8	378.107	873.692	12749.7	0	0
9	382.978	875.097	14243.4	0	0
10	387.849	876.533	15638.3	0	0
11	392.72	878.001	16929.8	0	0
12	397.591	879.5	18113.7	0	0
13	402.462	881.03	19186.2	0	0
14	407.333	882.593	20143.7	0	0
15	412.204	884.188	20985.3	0	0
16	417.075	885.814	21710	0	0
17	421.946	887.474	22315.9	0	0
18	426.817	889.166	22801.4	0	0
19	431.688	890.89	23165.3	0	0
20	436.559	892.648	23406.8	0	0
21	441.43	894.439	23525.6	0	0
22	446.301	896.264	23521.8	0	0
23	451.172	898.122	23395.8	0	0
24	456.043	900.014	23148.5	0	0
25	460.914	901.941	22781.1	0	0
26	465.784	903.901	22295.5	0	0
27	470.655	905.897	21693.7	0	0
28	475.526	907.927	20978.4	0	0
29	480.397	909.993	20152.5	0	0
30	485.268	912.094	19219.7	0	0
31	490.139	914.231	18183.8	0	0
32	495.01	916.404	17049.1	0	0
33	499.881	918.613	15820.7	0	0
34	504.752	920.859	14503.7	0	0
35	509.623	923.142	13104.1	0	0
36	514.494	925.463	11628	0	0
37	519.365	927.821	10082.4	0	0
38	524.236	930.217	8474.48	0	0
39	529.107	932.651	6812.12	0	0
40	533.978	935.124	5103.64	0	0
41	538.849	937.636	3357.93	0	0
42	543.72	940.188	1584.43	0	0
43	548.591	942.78	-206.882	0	0
44	553.462	945.411	-2005.44	0	0
45	558.333	948.084	-3685.27	0	0
46	563.204	950.798	-4872.16	0	0
47	568.074	953.553	-5510.31	0	0
48	572.945	956.351	-5567.68	0	0
49	577.816	959.19	-5011.49	0	0
50	582.687	962.073	-3808.16	0	0
51	587.558	965	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.0085

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	347.182	866.242	0	0	0
2	351.668	867.177	1899.08	0	0
3	356.154	868.15	3769.92	0	0
4	360.64	869.16	5601.51	0	0
5	365.126	870.208	7383.44	0	0
6	369.612	871.293	9105.94	0	0
7	374.099	872.416	10759.9	0	0
8	378.585	873.578	12336.7	0	0
9	383.071	874.777	13828.4	0	0
10	387.557	876.016	15227.9	0	0
11	392.043	877.293	16528.3	0	0
12	396.529	878.61	17723.6	0	0
13	401.015	879.966	18808.3	0	0
14	405.501	881.361	19777.6	0	0
15	409.987	882.797	20627.8	0	0
16	414.473	884.273	21357.6	0	0
17	418.959	885.79	21964.5	0	0
18	423.445	887.348	22446.5	0	0
19	427.931	888.947	22802.1	0	0
20	432.417	890.588	23030.7	0	0
21	436.903	892.271	23132.1	0	0
22	441.389	893.997	23106.9	0	0
23	445.875	895.765	22956.2	0	0
24	450.361	897.577	22682.1	0	0
25	454.847	899.433	22287	0	0
26	459.333	901.333	21774.2	0	0
27	463.819	903.277	21147.6	0	0
28	468.305	905.267	20411.9	0	0
29	472.791	907.303	19572.6	0	0
30	477.277	909.385	18635.6	0	0
31	481.763	911.513	17608.1	0	0
32	486.249	913.689	16497.5	0	0
33	490.735	915.913	15312.4	0	0
34	495.221	918.186	14062.1	0	0
35	499.707	920.508	12756.8	0	0
36	504.193	922.88	11407.3	0	0
37	508.679	925.302	10025.7	0	0
38	513.165	927.776	8624.68	0	0
39	517.651	930.302	7218.01	0	0
40	522.137	932.88	5820.4	0	0
41	526.623	935.513	4447.6	0	0
42	531.109	938.2	3116.39	0	0
43	535.595	940.942	1844.61	0	0
44	540.081	943.741	651.268	0	0
45	544.567	946.598	-443.493	0	0
46	549.053	949.512	-1418.3	0	0
47	553.539	952.486	-2250.51	0	0
48	558.025	955.521	-2796.68	0	0
49	562.511	958.617	-2639.44	0	0
50	566.997	961.777	-1700.59	0	0
51	571.483	965	0	0	0

List Of Coordinates

External Boundary

X	Y
0	700
236	700
1186	700
1186	1040
1175	1038
1112	1005
1062	1005
1040	1015
914	1005
833	988
814	986
768	965
682	965
555	965
407	895
303	845
288	839
255	825
220	816
188	816
95	816
39	794
0	790

Material Boundary

X	Y
39	794
44	789
67	789
73	793
93	796
111	797
150	806
178	810
236	810
256	819
280	825
313	839
364	860
404	879
449	897
500	917
570	937
657	957
669	960
763	960
768	965

Material Boundary

X	Y
236	700
236	810

APPENDIX E
EARTHWORK AND GRADING GUIDELINES

STANDARD GRADING SPECIFICATIONS

These specifications present the usual and minimum requirements for grading operations performed under the observation and testing of TGR Geotechnical, Inc.

No deviation from these specifications will be allowed, except where specifically superseded in the Preliminary Geotechnical Investigation report, or in other written communication signed by the Soils Engineer or Engineering Geologist.

1.0 GENERAL

- The Soils Engineer and Engineering Geologist are the Owner's or Builder's representatives on the project. For the purpose of these specifications, observation and testing by the Soils Engineer includes that observation and testing performed by any person or persons employed by, and responsible to, the licensed Geotechnical Engineer or Geologist signing the grading report.

- All clearing, site preparation or earthwork performed on the project shall be conducted by the Contractor under the observation of the Geotechnical Engineer.

- It is the Contractor's responsibility to prepare the ground surface to receive the fills to the satisfaction of the Geotechnical Engineer and to place, spread, mix, water and compact the fill in accordance with the specifications of the Geotechnical Engineer. The Contractor shall also remove all material considered unsatisfactory by the Geotechnical Engineer.

- It is also the Contractor's responsibility to have suitable and sufficient compaction equipment on the job site to handle the amount of fill being placed. If necessary, excavation equipment will be shut down to permit completion of Compaction. Sufficient watering apparatus will also be provided by the Contractor, with due consideration for the fill material, rate of placement and time of year.

- A final report will be issued by the Geotechnical Engineer and Engineering Geologist attesting to the Contractor's conformance with these specifications.

2.0 SITE PREPARATION

- All vegetation and deleterious material such as rubbish shall be disposed of off-site. The removal must be concluded prior to placing fill.

- The Civil Engineer shall locate all houses, sheds, sewage disposal systems, large trees or structures on the site, or on the grading plan to the best of his knowledge prior to preparing the ground surface.

- Soil, alluvium or rock materials determined by the Geotechnical Engineer as being unsuitable for placement in compacted fills shall be removed and wasted from the site. Any material incorporated as part of a compacted fill must be approved by the Geotechnical Engineer.

- After the ground surface to receive fill has been cleared, it shall be scarified, disced or bladed by the Contractor until it is uniform and free from ruts, hollows, hummocks or other uneven features which may prevent uniform compaction.

  The scarified ground surface shall then be brought to optimum moisture content, mixed as required, and compacted as specified. If the scarified zone is greater than twelve inches in depth, the excess shall be removed and placed in lifts restricted to six inches. Prior to placing fill, the ground surface to receive fill shall be inspected, tested and approved by the Geotechnical Engineer.

- Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipe lines or others not located prior to grading are to be removed or treated in a manner prescribed by the Geotechnical Engineer.

3.0 COMPACTED FILLS

- Any material imported or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable by the Geotechnical Engineer. Roots, tree branches and other matter missed during clearing shall be removed from the fill as directed by the Geotechnical Engineer.
- Rock fragments less than six inches in diameter may be utilized in the fill, provided:

  - ■ They are not placed in concentrated pockets.
  - ■ There is a sufficient percentage of fine-grained material to surround the rocks.
  - ■ The distribution of the rocks is observed by the Geotechnical Engineer.

- Rocks greater than six inches in diameter shall be taken off-site, or placed in accordance with the recommendations of the Geotechnical Engineer in areas designated as suitable for rock disposal. Details for rock disposal such as location, moisture control, percentage of the rock placed, etc., will be referred to in the "Conclusions and Recommendations" section of the Geotechnical Report, if applicable.

  If rocks greater than six inches in diameter were not anticipated in the Preliminary Geotechnical report, rock disposal recommendations may not have been made in the "Conclusions and Recommendations" section. In this case, the Contractor shall notify the Geotechnical Engineer if rocks greater than six inches in diameter are encountered. The Geotechnical Engineer will then prepare a rock disposal recommendation or request that such rocks be taken off-site.

- Material that is spongy, subject to decay, or otherwise considered unsuitable shall not be used in the compacted fill.

- Representative samples of materials to be utilized as compacted fill shall be analyzed in the laboratory by the Geotechnical Engineer to determine their physical properties. If any material other than that previously tested is encountered during grading, the appropriate analysis of this material shall be conducted by the Geotechnical Engineer as soon as possible.

- Material used in the compacting process shall be evenly spread, watered or dried, processed and compacted in thin lifts not to exceed six inches in thickness to obtain a uniformly dense layer. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Geotechnical Engineer.

- If the moisture content or relative compaction varies from that required by the Geotechnical Engineer, the Contractor shall rework the fill until it is approved by the Geotechnical Engineer.

- Each layer shall be compacted to 90 percent of the maximum dry density in compliance with the testing method specified by the controlling governmental agency; (in general, ASTM D1557 will be used.)

  If compaction to a lesser percentage is authorized by the controlling governmental agency because of a specific land use of expansive soil conditions, the area to receive fill compacted to less than 90 percent shall either be delineated on the grading plan or appropriate reference made to the area in the grading report.

- All fill shall be keyed and benched through all topsoil, colluvium, alluvium or creep material, into sound bedrock or firm material where the slope receiving fill exceeds a ratio of five horizontal to one vertical, in accordance with the recommendations of the Geotechnical Engineer.

- The key for side hill fills shall be a minimum of 15 feet within bedrock or firm materials, unless otherwise specified in the Preliminary report. (See details)

- Drainage terraces and subdrainage devices shall be constructed in compliance with the ordinances of the controlling governmental agency, or with the recommendation of the Geotechnical Engineer and Engineer Geologist.

- The Contractor will be required to obtain a minimum relative compaction of 90 percent out to the finish slope face of fill slopes, buttresses and stabilization fills. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment, or by any other procedure which produces the required compaction.

The Contractor shall prepare a written detailed description of the method or methods he will employ to obtain the required slope compaction. Such documents shall be submitted to the Geotechnical Engineer for review and comments prior to the start of grading.

If a method other than overbuilding and cutting back to the compacted core is to be employed, slope tests will be made by the Geotechnical Engineer during construction of the slopes to determine if the required compaction is being achieved. Where failing tests occur or other field problems arise, the contractor will be notified by the Geotechnical Engineer.

If the method of achieving the required slope compaction selected by the Contractor fails to produce the necessary results, the Contractor shall rework or rebuild such slopes until the required degree of compaction is obtained, at no additional cost to the Owner or Geotechnical Engineer.

- All fill slopes should be planted or protected from erosion by methods specified in the preliminary report or by means approved by the governing authorities.

- Fill-over-cut slopes shall be properly keyed through topsoil, colluvium or creep material into rock or firm materials; and the transition shall be stripped of all soil prior to placing fill. (See detail)

4.0 CUT SLOPES

- The Engineering Geologist shall inspect all cut slopes excavated in rock, lithified or formation material at vertical intervals not exceeding ten feet.

- If any conditions not anticipated in the preliminary report such as perched water, seepage, lenticular or confined strata of a potentially adverse nature, unfavorably inclined bedding, joints or fault planes are encountered during grading, these conditions shall be analyzed by the Engineering Geologist and Geotechnical Engineer; and recommendations shall be made to treat these problems.

- Cut slopes that face in the same direction as the prevailing drainage shall be protected from slope wash by a non-erosive interceptor swale placed at the top of the slope.

- Unless otherwise specified in the soils and geological report, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies.

- Drainage terraces shall be constructed in compliance with the ordinances of controlling governmental agencies, or with the recommendations of the Geotechnical Engineer or Engineering Geologist.

5.0 GRADING CONTROL

- Inspection of the fill placement shall be provided by the Geotechnical Engineer during the progress of grading.

- In general, density tests should be made at intervals not exceeding two feet of fill height or every 500 cubic yards of fill placed. This criteria will vary depending on soil conditions and the size of the job. In any event, an adequate number of field density tests shall be made to verify that the required compaction of being achieved.
- Density tests should be made on the surface material to receive fill as required by the Geotechnical Engineer.

- All cleanout, processed ground to receive fill, key excavations, subdrains and rock disposal must be inspected and approved by the Geotechnical Engineer (and often by the governing authorities) prior to placing any fill. It shall be the Contractor’s responsibility to notify the Geotechnical Engineer and governing authorities when such areas are ready for inspection.

6.0 CONSTRUCTION CONSIDERATIONS

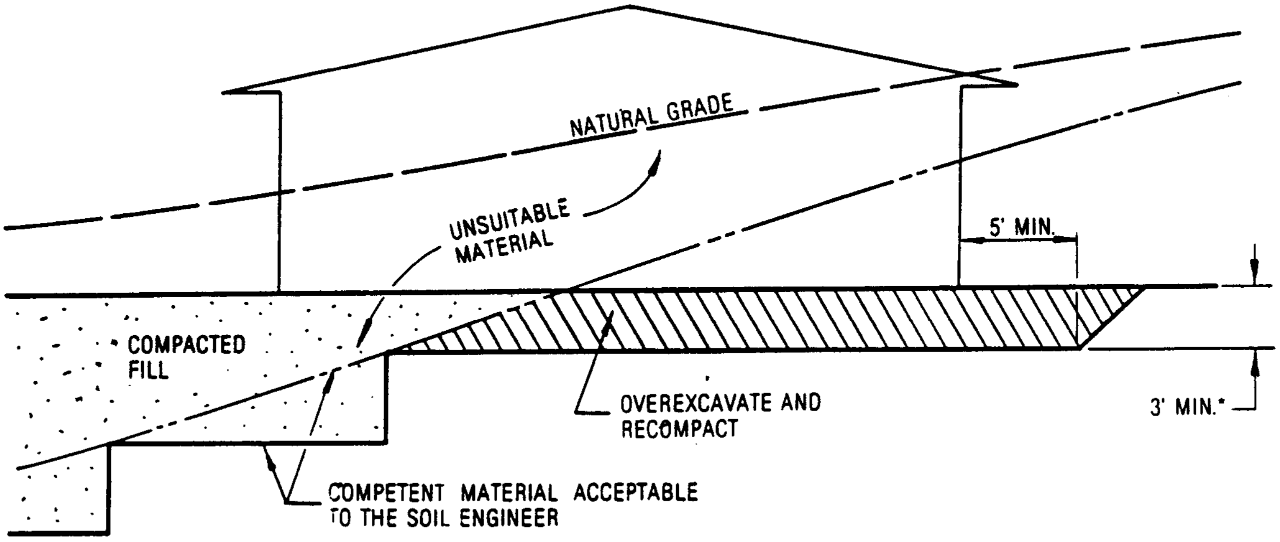
- Erosion control measures, when necessary, shall be provided by the Contractor during grading and prior to the completion and construction of permanent drainage controls.

- Upon completion of grading and termination of observations by the Geotechnical Engineer, no further filling or excavating, including that necessary for footings, foundations, large tree wells, retaining walls, or other features shall be performed without the approval of the Geotechnical Engineer or Engineering Geologist.

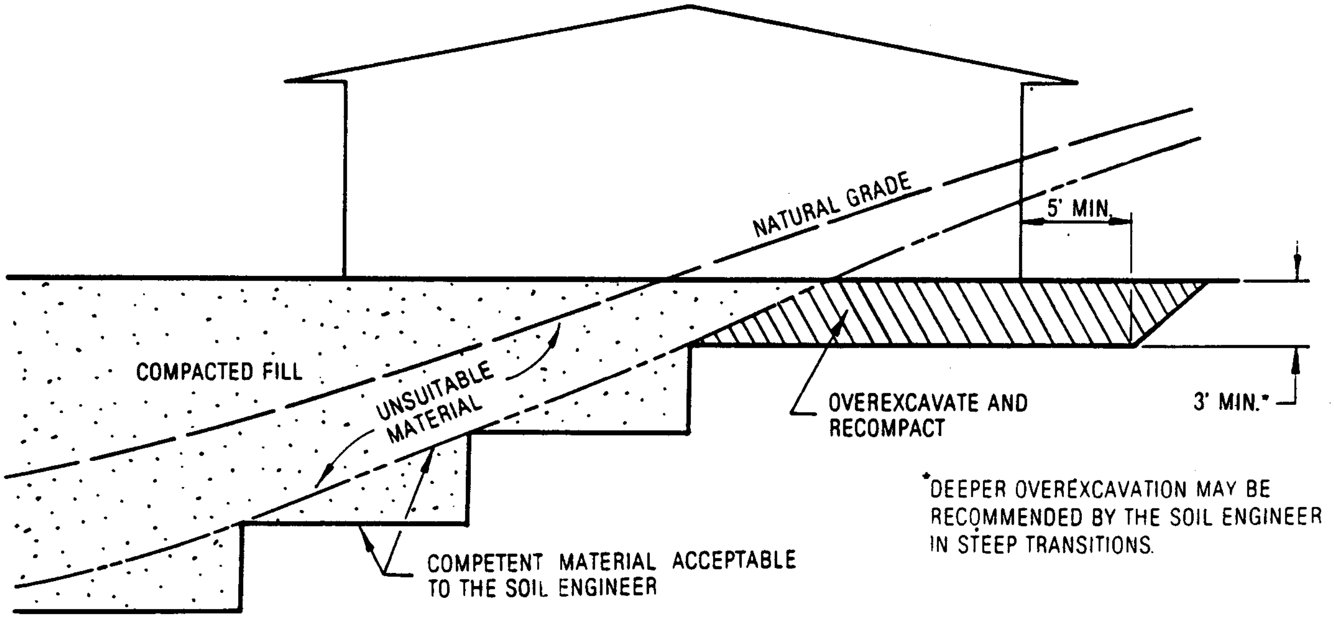
- Care shall be taken by the Contractor during final grading to preserve any berms, drainage terraces, interceptor swales, or other devices of a permanent nature on or adjacent to the property.

TYPICAL OVEREXCAVATION OF DAYLIGHT LINE

CUT LOT

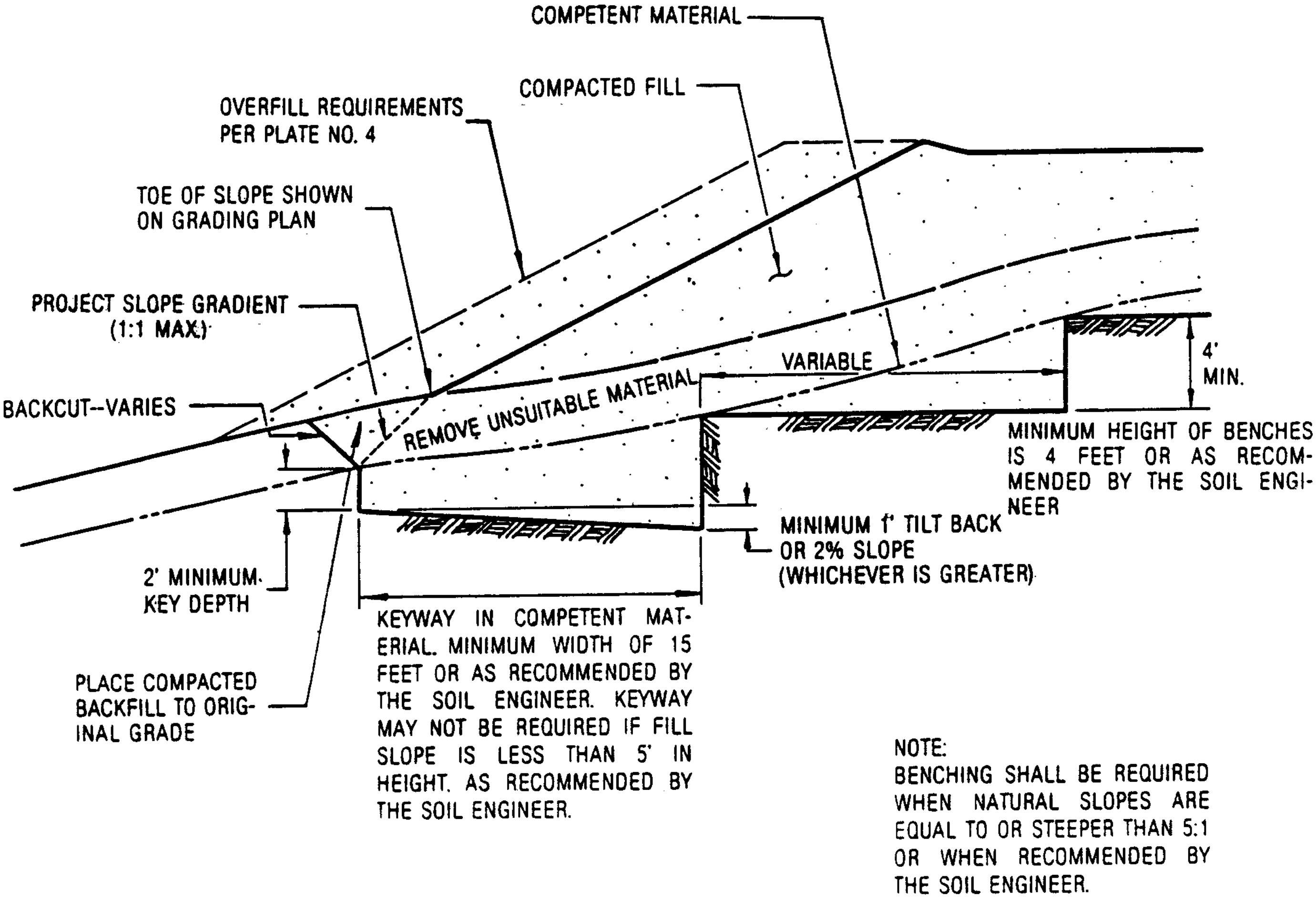


CUT FILL LOT (TRANSITION)



*DEEPER OVEREXCAVATION MAY BE RECOMMENDED BY THE SOIL ENGINEER IN STEEP TRANSITIONS.

TYPICAL FILL OVER NATURAL SLOPE

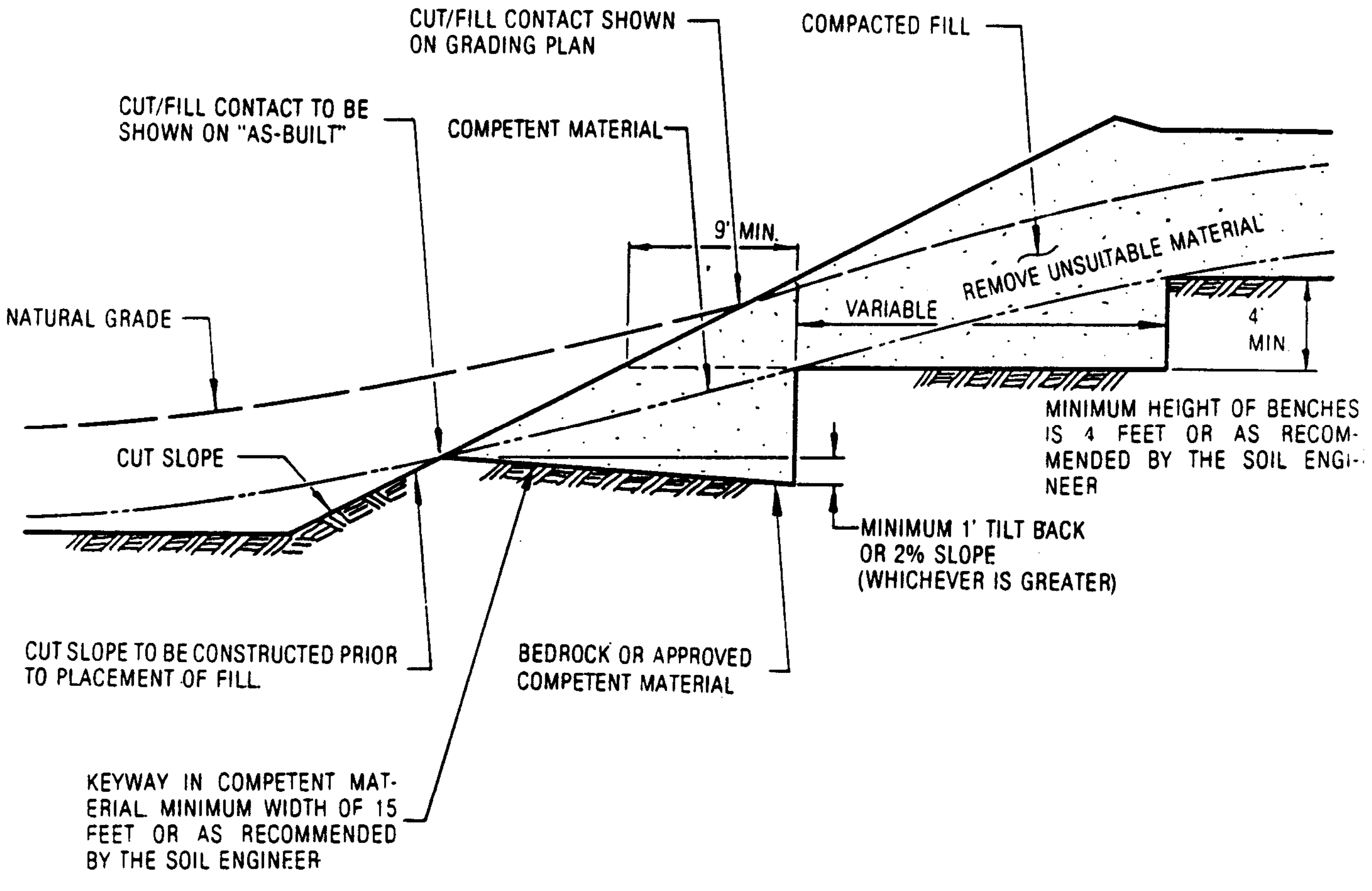


MINIMUM HEIGHT OF BENCHES IS 4 FEET OR AS RECOMMENDED BY THE SOIL ENGINEER

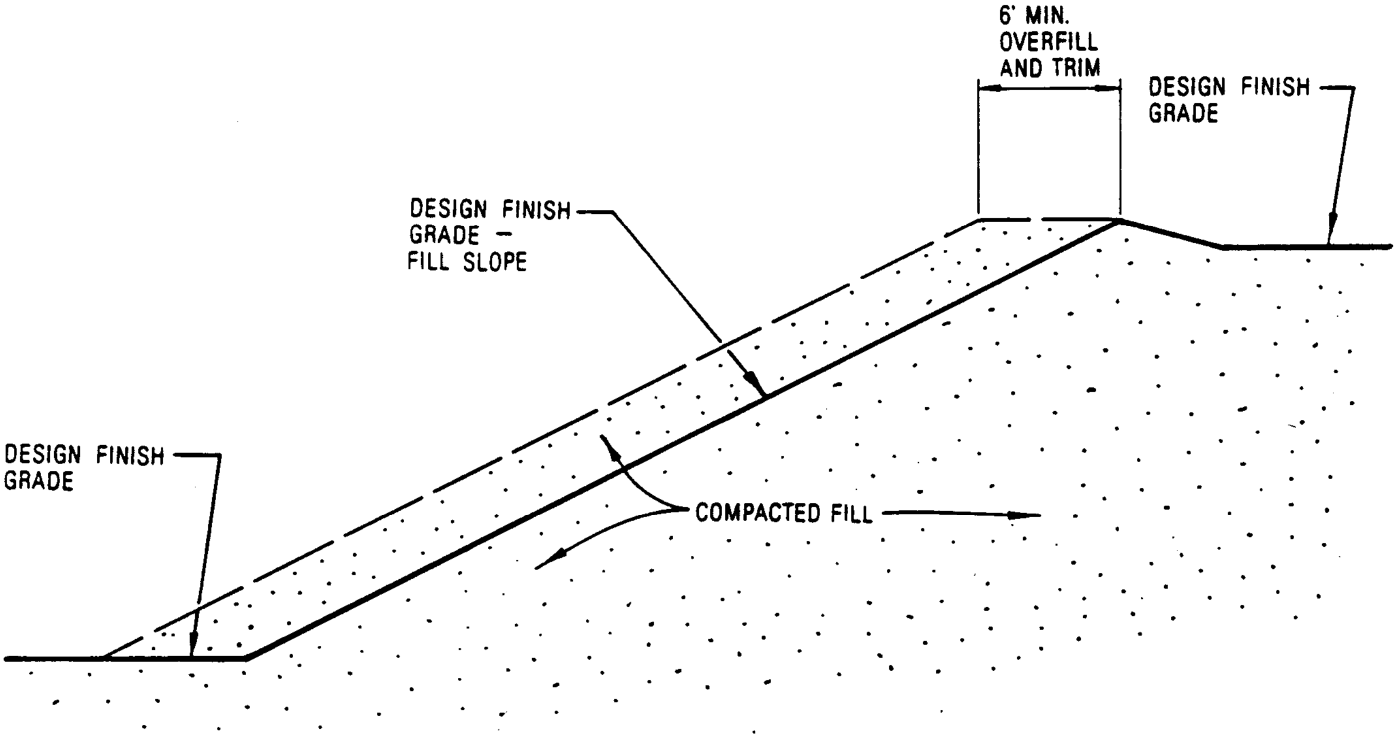
KEYWAY IN COMPETENT MATERIAL. MINIMUM WIDTH OF 15 FEET OR AS RECOMMENDED BY THE SOIL ENGINEER. KEYWAY MAY NOT BE REQUIRED IF FILL SLOPE IS LESS THAN 5' IN HEIGHT. AS RECOMMENDED BY THE SOIL ENGINEER.

NOTE:
BENCHING SHALL BE REQUIRED WHEN NATURAL SLOPES ARE EQUAL TO OR STEEPER THAN 5:1 OR WHEN RECOMMENDED BY THE SOIL ENGINEER.

TYPICAL FILL-OVER-CUT SLOPE



TYPICAL FILL SLOPE CONSTRUCTION

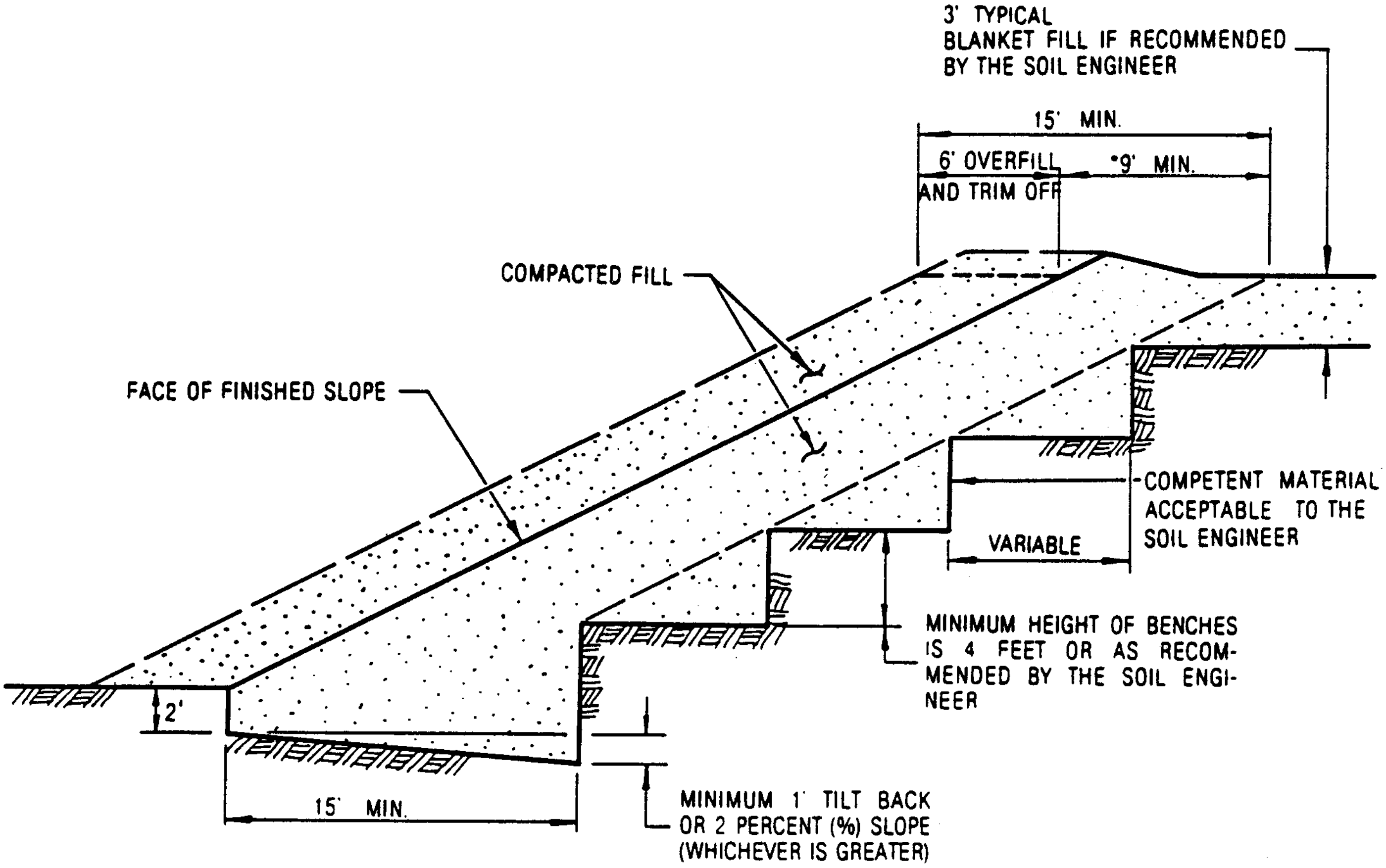


NOTES:

1. ALL FILL SLOPES, INCLUDING BUTTRESS AND STABILIZATION FILLS, SHALL BE OVERFILLED A MINIMUM OF SIX FEET HORIZONTALLY WITH COMPACTED FILL AND TRIMMED TO THE DESIGN FINISH GRADE.

   EXCEPTIONS:
   A. FILL SLOPE OVER CUT SLOPE.
   B. FILL SLOPE ADJACENT TO EXISTING IMPROVEMENTS.
2. THE EXCEPTIONS ABOVE WHICH DO NOT HAVE THE 6 FOOT SLOPE OVERFILL AND TRIM SHALL BE COMPACTED AS STATED IN THE PROJECT SPECIFICATIONS.

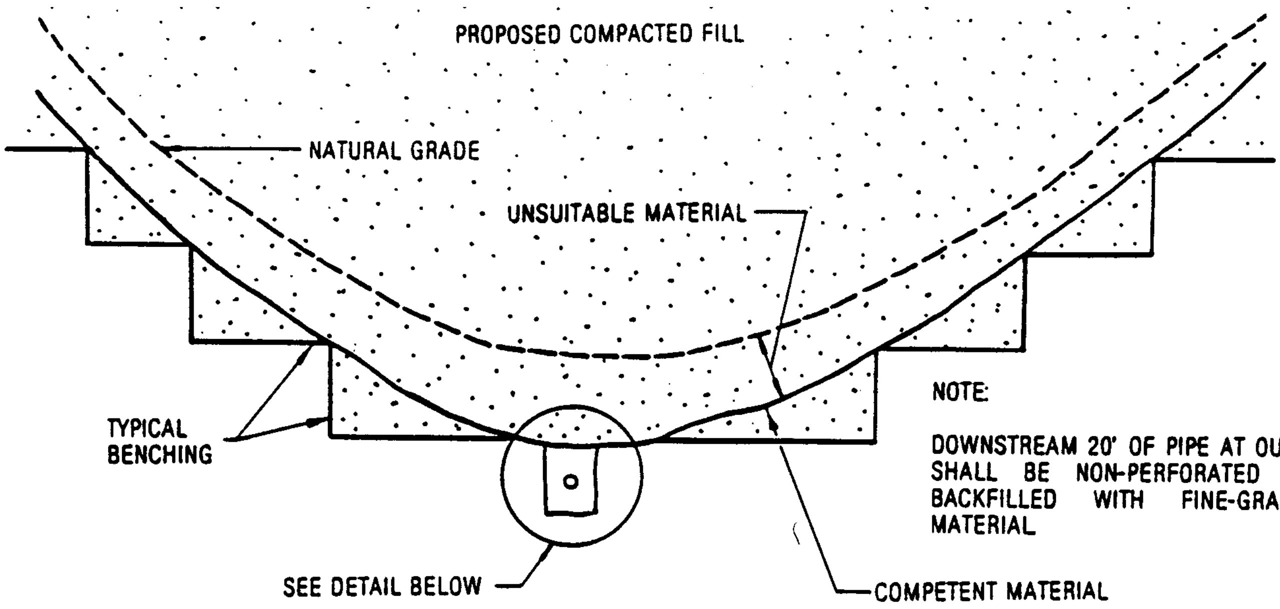
TYPICAL STABILIZATION FILL



NOTE:
SEE PLATE 6 FOR TYPICAL SUBDRAIN DETAILS FOR STABILIZATION FILLS. IF RECOMMENDED BY THE SOIL ENGINEER.

*GREATER THAN 9' IF RECOMMENDED BY THE SOIL ENGINEER; 15' WHERE NO 6' OVERFILL

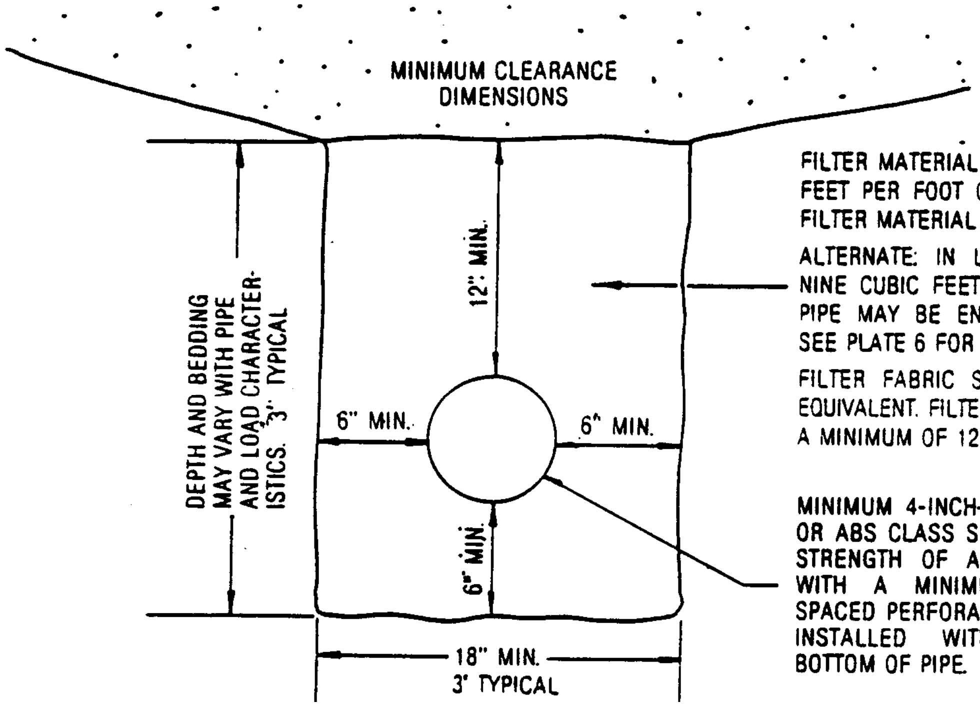
TYPICAL CANYON SUBDRAIN



NOTE:

DOWNSTREAM 20' OF PIPE AT OUTLET SHALL BE NON-PERFORATED AND BACKFILLED WITH FINE-GRAINED MATERIAL

NOTES:
PIPE SHALL BE A MINIMUM OF 4 INCHES DIAMETER AND RUNS OF 500 FEET OR MORE USE 6-INCH DIAMETER PIPE, OR AS RECOMMENDED BY THE SOIL ENGINEER



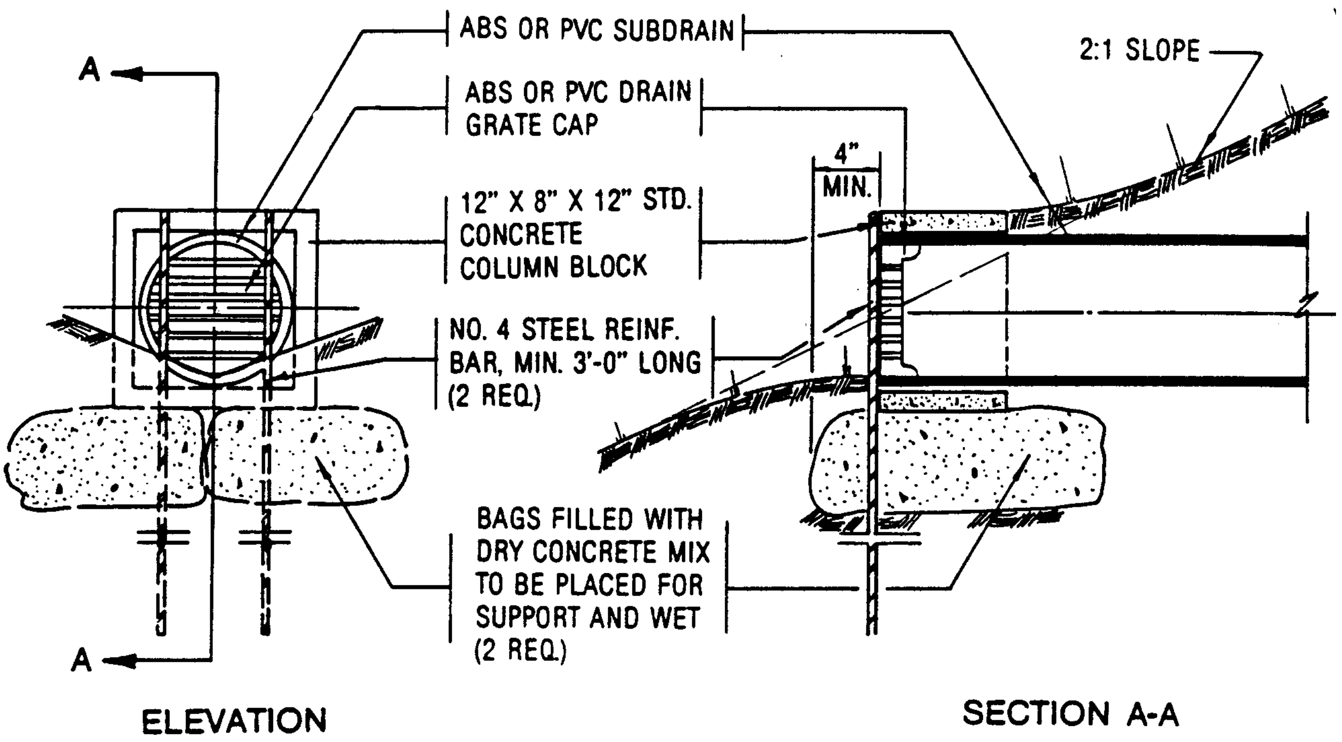
FILTER MATERIAL - MINIMUM OF NINE CUBIC FEET PER FOOT OF PIPE. SEE PLATE 6 FOR FILTER MATERIAL SPECIFICATION.

ALTERNATE: IN LIEU OF FILTER MATERIAL NINE CUBIC FEET OF GRAVEL PER FOOT OF PIPE MAY BE ENCASED IN FILTER FABRIC. SEE PLATE 6 FOR GRAVEL SPECIFICATIONS.

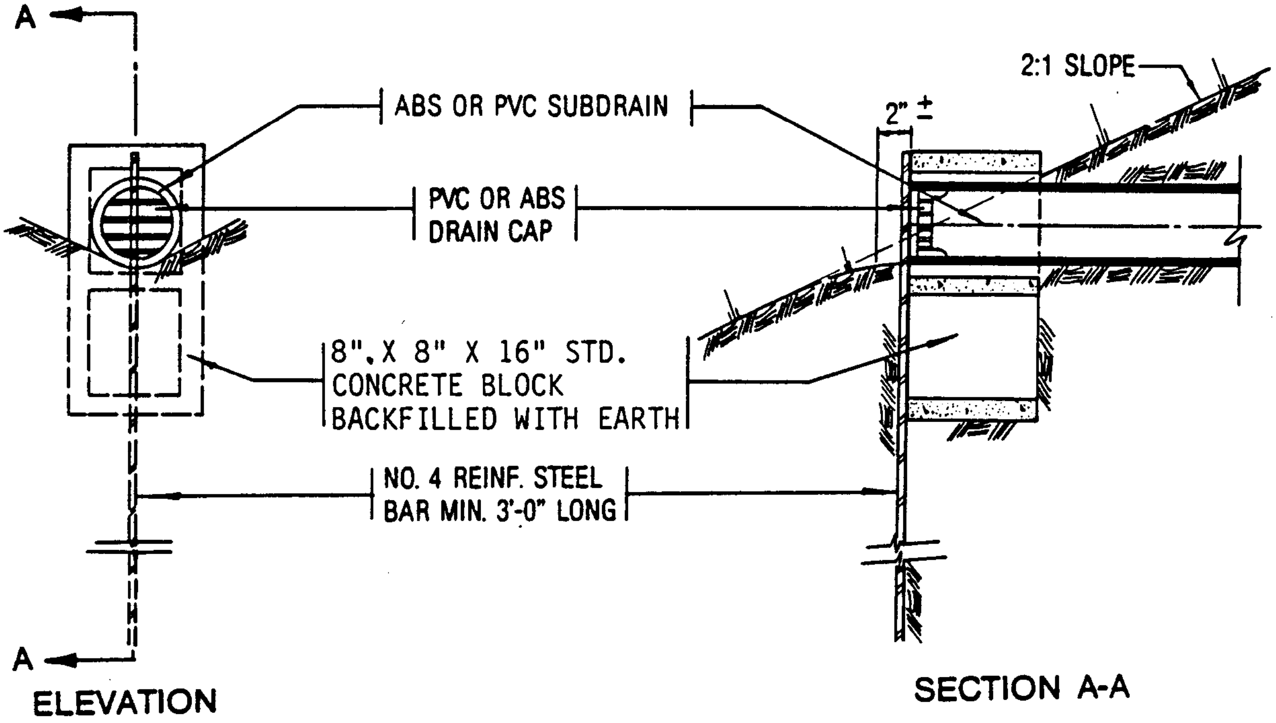
FILTER FABRIC SHALL BE MIRAFI 140 OR EQUIVALENT. FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 12 INCHES ON ALL JOINTS.

MINIMUM 4-INCH-DIAMETER, PVC SCH. 40 OR ABS CLASS SDR-35 WITH A CRUSHING STRENGTH OF AT LEAST 1000 POUNDS, WITH A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE, INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE.

SUBDRAIN OUTLET MARKER

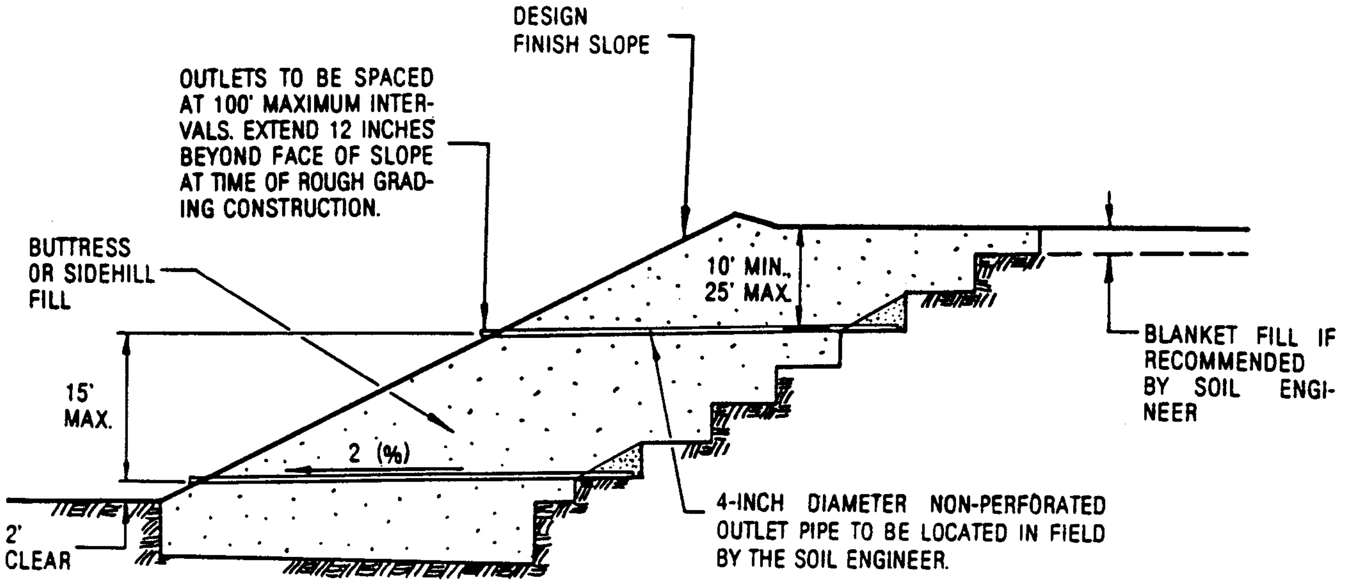


SUBDRAIN OUTLET MARKER FOR 6" AND 8" PIPES



SUBDRAIN OUTLET MARKER – 4" PIPE

TYPICAL STABILIZATION AND BUTTRESS FILL SUBDRAIN



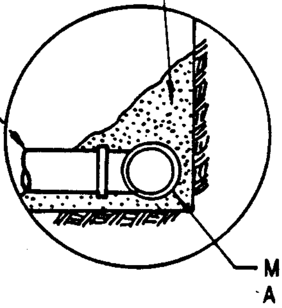
FILTER MATERIAL" TO MEET FOLLOWING SPECIFI-
ATION OR APPROVED EQUIVALENT: (CONFORMS TO
MA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1½"	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT = MINIMUM OF 50



OUTLET PIPE TO BE CONNECTED TO SUBDRAIN PIPE WITH TEE OR ELBOW

FILTER MATERIAL - MINIMUM OF FIVE CUBIC FEET PER FOOT OF PIPE. SEE ABOVE FOR FILTER MATERIAL SPECIFICATION.

ALTERNATIVE: IN LIEU OF FILTER MATERIAL, FIVE CUBIC FEET OF GRAVEL PER FOOT OF PIPE MAY BE ENCASED IN FILTER FABRIC. SEE ABOVE FOR GRAVEL SPECIFICATION.

FILTER FABRIC SHALL BE MIRAFI 140 OR EQUIVALENT. FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 12 INCHES ON ALL JOINTS.

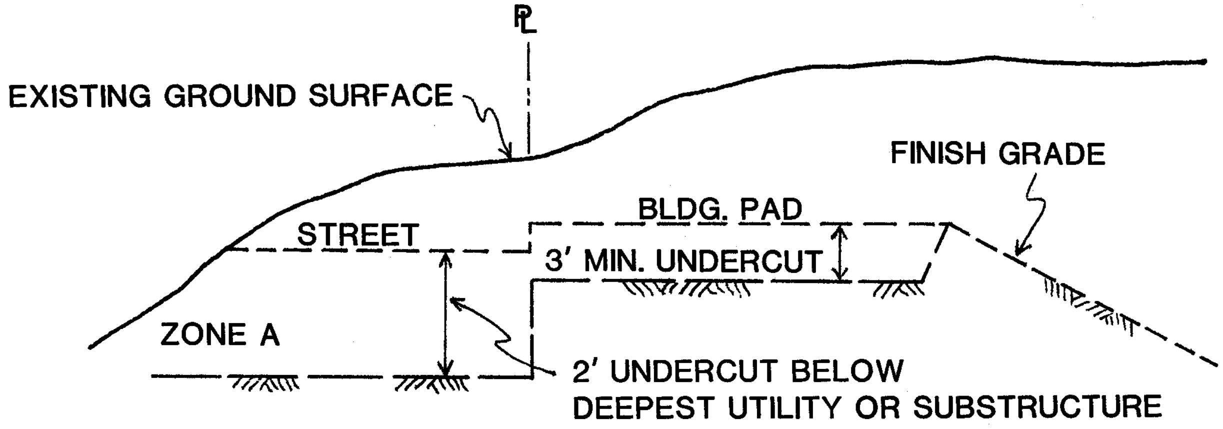
MINIMUM 4-INCH DIAMETER PVC SCH 40 OR ABS CLASS SDR 35 WITH A CRUSHING STRENGTH OF AT LEASE 1,000 POUNDS, WITH A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE. PROVIDE CAP AT UPSTREAM END OF PIPE. SLOPE AT 2 PERCENT TO OUTLET PIPE.

NOTES:

1. TRENCH FOR OUTLET PIPES TO BE BACKFILLED WITH ON-SITE SOIL.

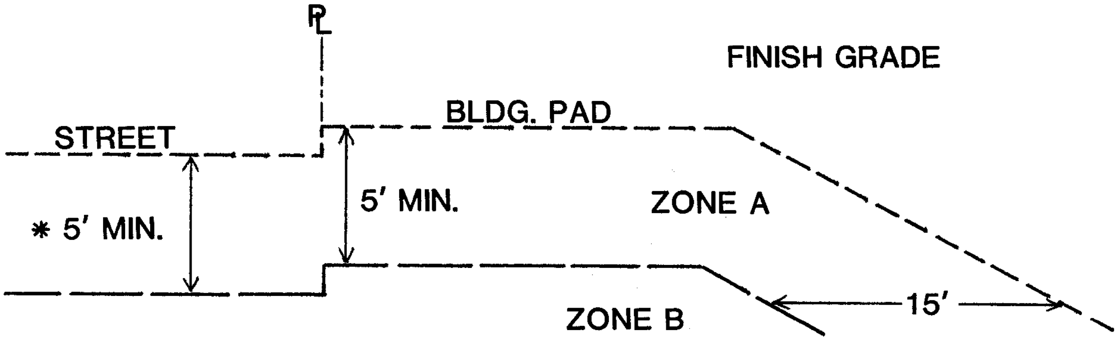
TYPICAL CUT AND FILL GRADING DETAILS

TYPICAL GRADING WITHIN PROPOSED DEEP BEDROCK CUT AREAS



NO SCALE

TYPICAL GRADING WITHIN PROPOSED FILL AREAS



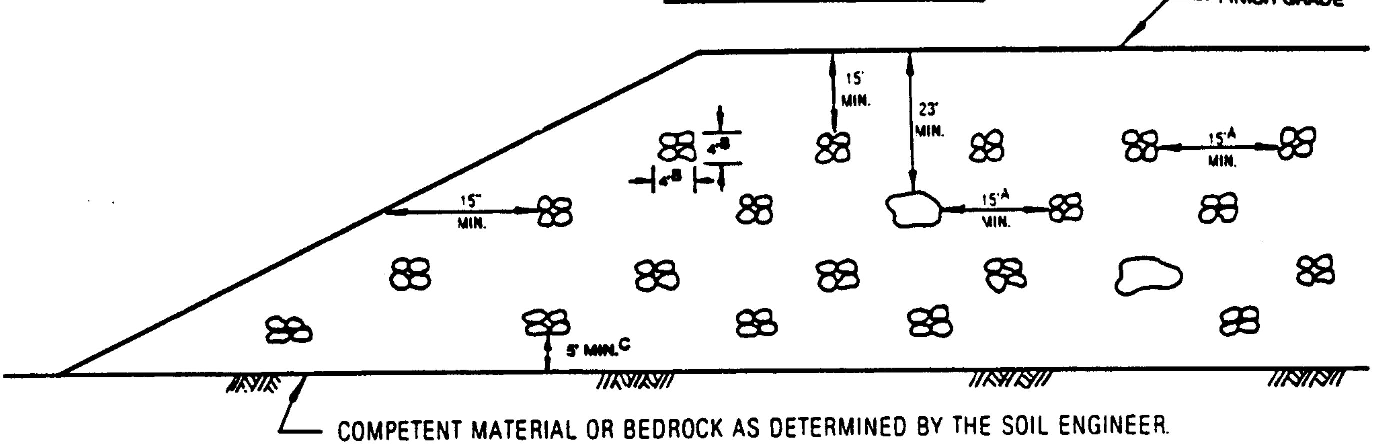
LEGEND

ZONE A ......"SOIL" FILL PLACED IN ACCORDANCE WITH THE RECOMMENDATIONS PRESENTED IN SECTION 11.2.3 OF THIS REPORT

ZONE B ......"SOIL-ROCK" AND/OR "ROCK" FILL PLACED IN ACCORDANCE WITH THE RECOMMENDATIONS PRESENTED IN SECTION 11.2.3 OF THIS REPORT

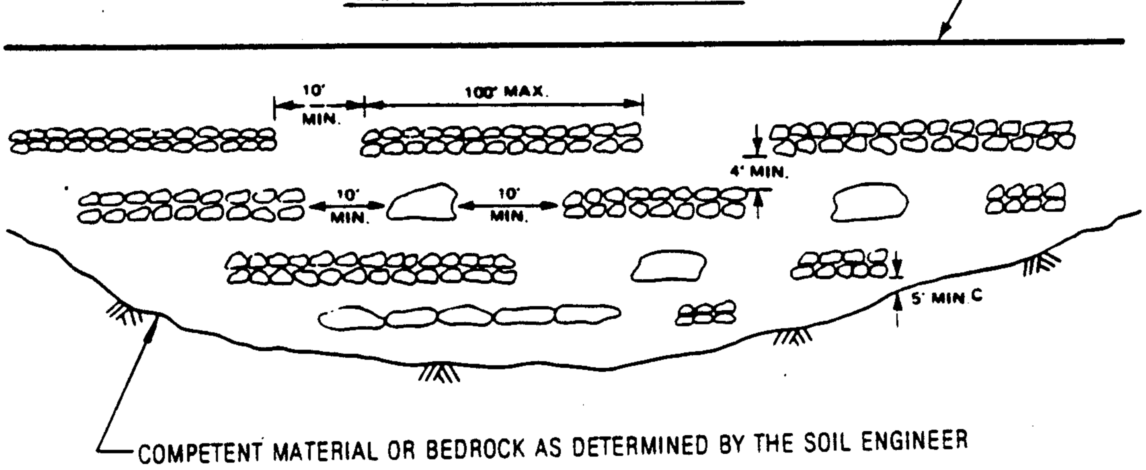
* 5' OR 1' BELOW DEEPEST UTILITY, WHICHEVER IS GREATER

TYPICAL OVERSIZE ROCK DISPOSAL – “SOIL-ROCK” FILL



VIEW NORMAL TO SLOPE FACE

NOTE:
ORIENTATION OF WINDROWS MAY VARY BUT SHALL BE AS RECOMMENDED BY SOIL ENGINEER.



VIEW PARALLEL TO SLOPE FACE

NOTES:

A. ONE EQUIPMENT WIDTH OR A MINIMUM OF 15 FEET.

B. HEIGHT AND WIDTH MAY VARY DEPENDING ON ROCK SIZE AND TYPE OF EQUIPMENT.

C. IF APPROVED BY THE SOIL ENGINEER, WINDROWS MAY BE PLACED DIRECTLY ON COMPETENT MATERIALS OR BEDROCK PROVIDING ADEQUATE SPACE IS AVAILABLE FOR COMPACTION.

D. VOIDS IN WINDROW TO BE FILLED BY FLOODING GRANULAR SOIL INTO PLACE. GRANULAR SOIL SHALL MEAN ANY SOIL WHICH HAS A UNIFIED SOIL CLASSIFICATION SYSTEM (UBC 29-1) DESIGNATION OF SM, SP, SW, GM, GP, OR GW.

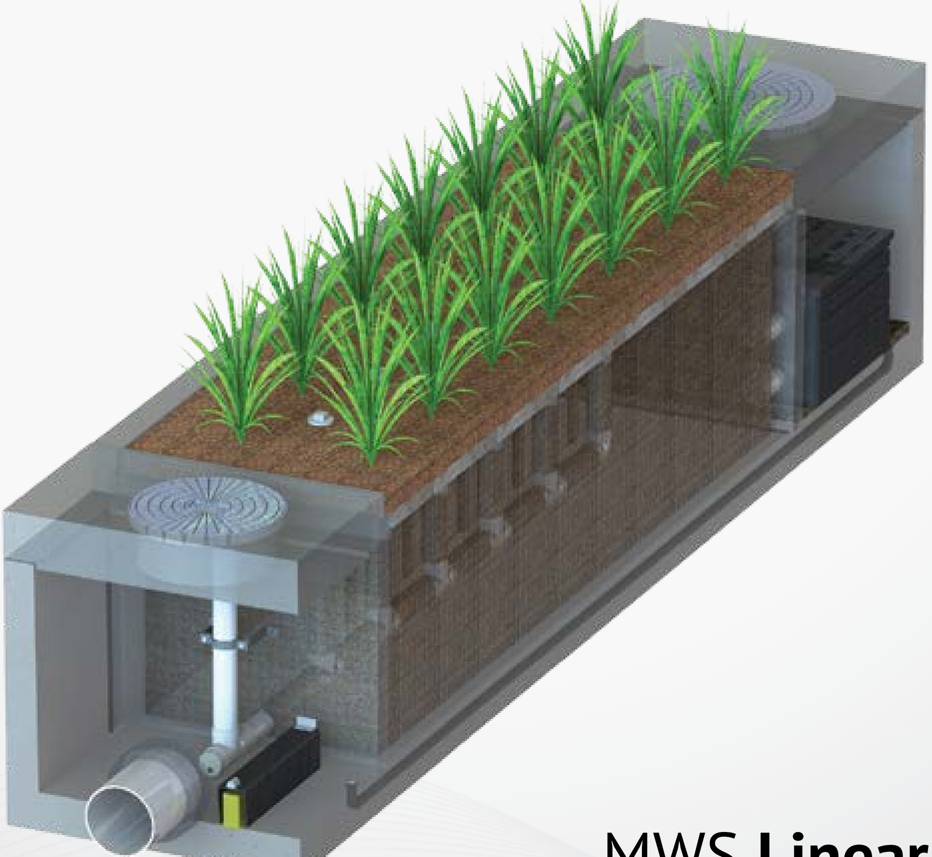
E. AFTER FILL BETWEEN WINDROWS IS PLACED AND COMPACTED WITH THE LIFT OF FILL COVERING WINDROW, WINDROW SHALL BE PROOF-ROLLED WITH D-9 DOZER OR EQUIVALENT.

F. OVERSIZED ROCK IS DEFINED AS LARGER THAN 12" IN SIZE.

Appendix D

MODULAR WETLANDS™

Advanced ***Stormwater*** *Biofiltration*



MWS **Linear**

Contents

The Urban Impact

For hundreds of years natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as our cities grow and develop, these natural wetlands have perished under countless roads, rooftops, and parking lots.

Plant A Wetland

Without natural wetlands our cities are deprived of water purification, flood control, and land stability. Modular Wetlands and the MWS Linear re-establish nature's presence and rejuvenate water ways in urban areas.

MWS **Linear**

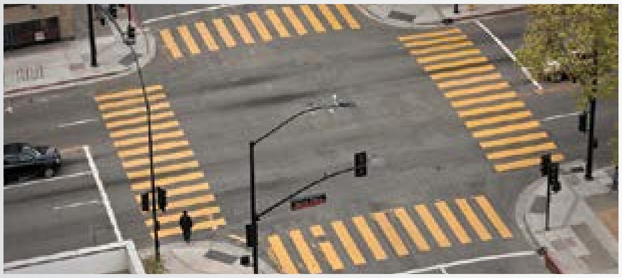
The Modular Wetland System Linear represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint and higher treatment capacity. While most biofilters use little or no pre-treatment, the MWS Linear incorporates an advanced pre-treatment chamber that includes separation and pre-filter cartridges. In this chamber sediment and hydrocarbons are removed from runoff before it enters the biofiltration chamber, in turn reducing maintenance costs and improving performance.

Applications

The MWS Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater and waste water applications - treating rooftops, streetscapes, parking lots, and industrial sites.

Industrial

Many states enforce strict regulations for discharges from industrial sites. The MWS Linear has helped various sites meet difficult EPA mandated effluent limits for dissolved metals and other pollutants.



Streets

Street applications can be challenging due to limited space. The MWS Linear is very adaptable, and offers the smallest footprint to work around the constraints of existing utilities on retrofit projects.

Commercial

Compared to bioretention systems, the MWS Linear can treat far more area in less space - meeting treatment and volume control requirements.

Residential

Low to high density developments can benefit from the versatile design of the MWS Linear. The system can be used in both decentralized LID design and cost-effective end-of-the-line configurations.

Parking Lots

Parking lots are designed to maximize space and the MWS Linear's 4 ft. standard planter width allows for easy integration into parking lot islands and other landscape medians.

Mixed Use

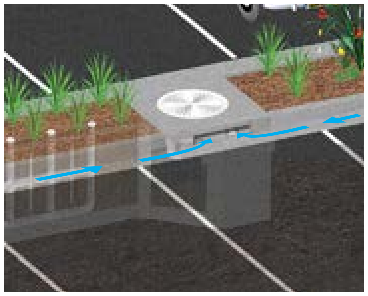
The MWS Linear can be installed as a raised planter to treat runoff from rooftops or patios, making it perfect for sustainable "live-work" spaces.

More applications are available on our website: www.ModularWetlands.com/Applications

- Agriculture
- Reuse
- Low Impact Development
- Waste Water

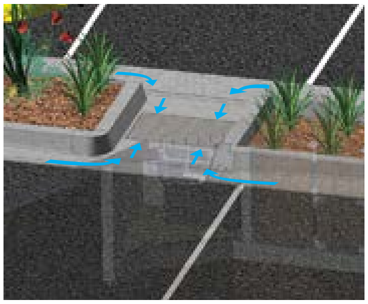
Configurations

The MWS Linear is the preferred biofiltration system of Civil Engineers across the country due to its versatile design. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your stormdrain design.



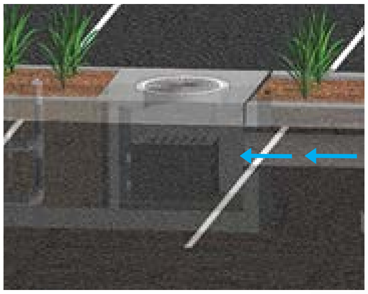
Curb Type

The *Curb Type* configuration accepts sheet flow through a curb opening and is commonly used along road ways and parking lots. It can be used in sump or flow by conditions. Length of curb opening varies based on model and size.



Grate Type

The *Grate Type* configuration offers the same features and benefits as the *Curb Type* but with a grated/drop inlet above the systems pre-treatment chamber. It has the added benefit of allowing for pedestrian access over the inlet. ADA compliant grates are available to assure easy and safe access. The *Grate Type* can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.



Vault Type

The system's patented horizontal flow biofilter is able to accept inflow pipes directly into the pre-treatment chamber, meaning the MWS Linear can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/bioretention systems. Another benefit of the "pipe in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.

Downspout Type

The *Downspout Type* is a variation of the *Vault Type* and is designed to accept a vertical downspout pipe from roof top and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

Advantages & Operation

The MWS Linear is the most efficient and versatile biofiltration system on the market, and the only system with horizontal flow which improves performance, reduces footprint, and minimizes maintenance. Figure-1 and Figure-2 illustrate the invaluable benefits of horizontal flow and the multiple treatment stages.

Featured Advantages

- Horizontal Flow Biofiltration
- Greater Filter Surface Area
- Pre-Treatment Chamber
- Patented Perimeter Void Area
- Flow Control
- No Depressed Planter Area

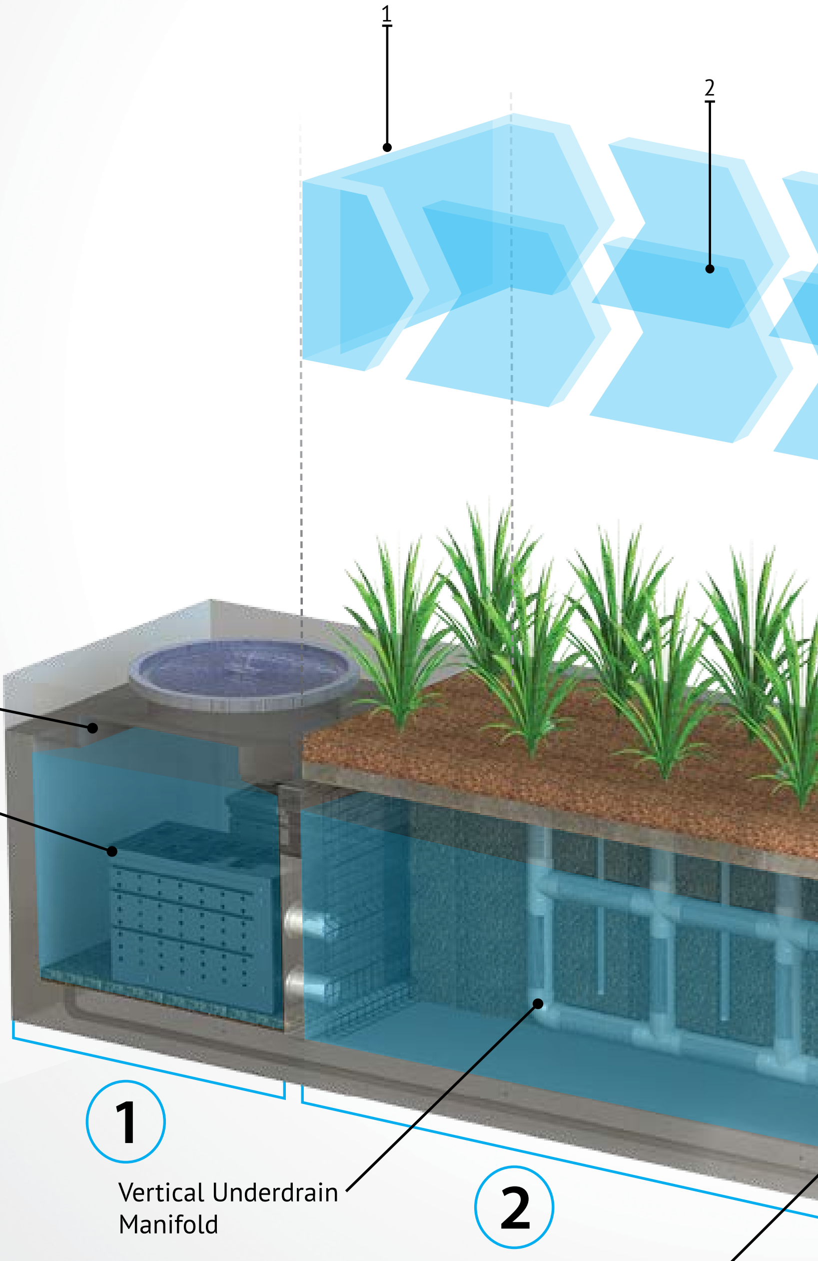
① Pre-Treatment

Separation

- Trash, sediment, and debris are separated before entering the pre-filter cartridges
- Designed for easy maintenance access

Pre-Filter Cartridges

- Over 25 ft^2 of surface area per cartridge
- Utilizes BioMediaGREEN filter material
- Removes over 80% of TSS & 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber



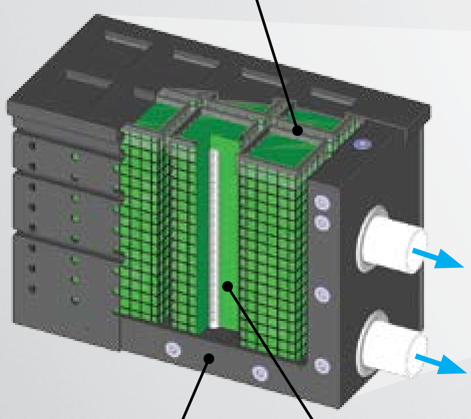


Fig. 2 - Top View

2x to 3x More Surface Area Than Traditional Downward Flow Bioretention Systems.

2 Biofiltration

Horizontal Flow

- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

Patented Perimeter Void Area

- Vertically extends void area between the walls and the WetlandMEDIA on all four sides.
- Maximizes surface area of the media for higher treatment capacity

WetlandMEDIA

- Contains no organics and removes phosphorus
- Greater surface area and 48% void space
- Maximum evapotranspiration
- High ion exchange capacity and light weight

3 Discharge

Flow Control

- Orifice plate controls flow of water through WetlandMEDIA to a level lower than the media's capacity.
- Extends the life of the media and improves performance

Drain-Down Filter

- The Drain-Down is an optional feature that completely drains the pre-treatment chamber
- Water that drains from the pre-treatment chamber between storm events will be treated

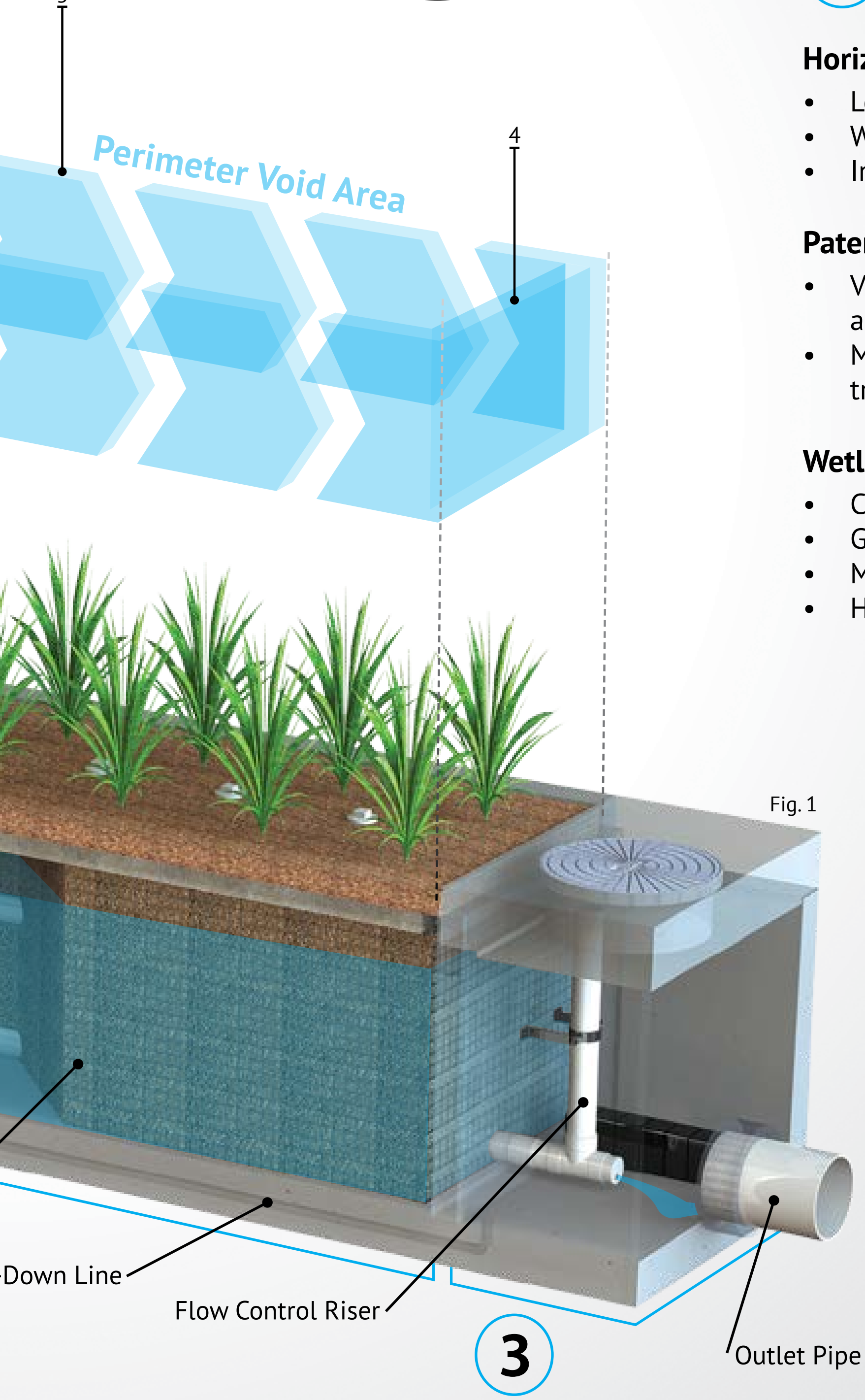


Fig. 1

Orientations

Side-By-Side

The *Side-By-Side* orientation places the pre-treatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side. This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk. This orientation also offers internal bypass options as discussed below.

End-To-End

The *End-To-End* orientation places the pre-treatment and discharge chambers on opposite ends of the biofiltration chamber therefore minimizing the width of the system to 5 ft (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation. One limitation of this orientation is bypass must be external.

Bypass

Internal Bypass Weir (Side-by-Side Only)

The *Side-By-Side* orientation places the pre-treatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system's treatment capacity, thus allowing bypass from the pre-treatment chamber directly to the discharge chamber.

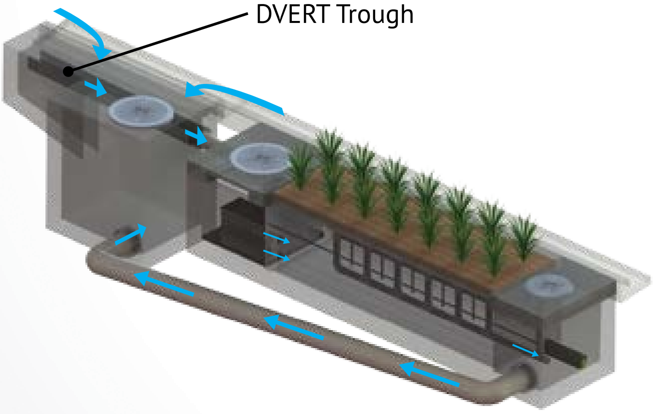
External Diversion Weir Structure

This traditional offline diversion method can be used with the MWS Linear in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir - to divert low flows over to the MWS Linear for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

Flow By Design

This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the MWS Linear and into the standard inlet downstream.

DVERT Low Flow Diversion



This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the MWS Linear via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels them over to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications that allows the MWS Linear to be installed anywhere space is available.

Performance

The MWS Linear continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons and bacteria. Since 2007 the MWS Linear has been field tested on numerous sites across the country. With it's advanced pre-treatment chamber and innovative horizontal flow biofilter, the system is able to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. With the same biological processes found in natural wetlands, the MWS Linear harnesses natures ability to process, transform, and remove even the most harmful pollutants.

Approvals

The MWS Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation, and perhaps the world.

State of Washington
TAPE
GULD
Basic
Enhanced/Metals
Phosphorus

Washington State TAPE Approved

The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft^2 loading rate. The highest performing BMP on the market for all main pollutant categories.

TSS	Total Phosphorus	Ortho Phosphorus	Nitrogen	Dissolved Zinc	Dissolved Copper	Total Zinc	Total Copper	Motor Oil
85%	64%	67%	45%	66%	38%	69%	50%	95%

VA

DEQ Assignment

The Virginia Department of Environmental Quality assigned the MWS Linear, the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) Technical Criteria.

MD

Maryland Department Of The Environment Approved

Granted ESD (Environmental Site Design) status for new construction, redevelopment and retrofitting when designed in accordance with the Design Manual.

MA

MASTEP Evaluation

The University of Massachusetts at Amherst – Water Resources Research Center, issued a technical evaluation report noting removal rates up to 84% TSS, 70% Total Phosphorus, 68.5% Total Zinc, and more.

RI

Rhode Island DEM Approved

Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% Pathogens, 30% Total Phosphorus, and 30% Total Nitrogen.

Flow Based Sizing

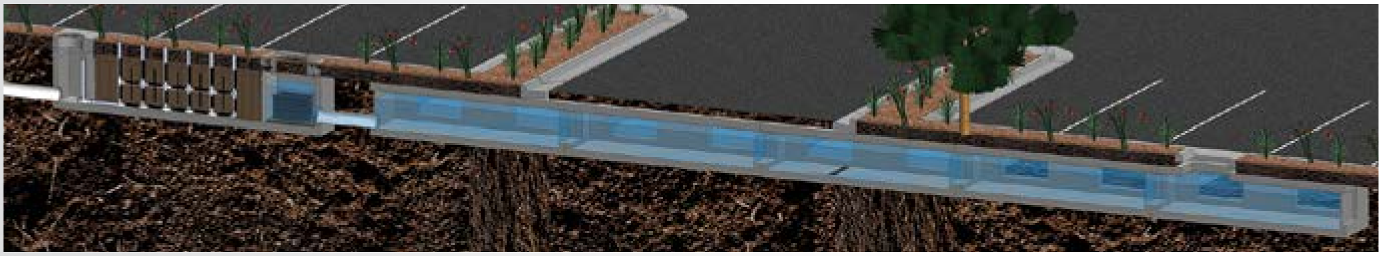
The MWS Linear can be used in stand alone applications to meet treatment flow requirements. Since the MWS Linear is the only biofiltration system that can accept inflow pipes several feet below the surface it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

Treatment Flow Sizing Table

Model #	Dimensions	WetlandMedia Surface Area	Treatment Flow Rate (cfs)
MWS-L-4-4	4’ x 4’	23 ft^2	0.052
MWS-L-4-6	4’ x 6’	32 ft^2	0.073
MWS-L-4-8	4’ x 8’	50 ft^2	0.115
MWS-L-4-13	4’ x 13’	63 ft^2	0.144
MWS-L-4-15	4’ x 15’	76 ft^2	0.175
MWS-L-4-17	4’ x 17’	90 ft^2	0.206
MWS-L-4-19	4’ x 19’	103 ft^2	0.237
MWS-L-4-21	4’ x 21’	117 ft^2	0.268
MWS-L-8-8	8’ x 8’	100 ft^2	0.230
MWS-L-8-12	8’ x 12’	151 ft^2	0.346
MWS-L-8-16	8’ x 16’	201 ft^2	0.462

Volume Based Sizing

Many states require treatment of a water quality volume and do not offer the option of flow based design. The MWS Linear and its unique horizontal flow makes it the only biofilter that can be used in volume based design installed downstream of ponds, detention basins, and underground storage systems.



Treatment Volume Sizing Table

Model #	Treatment Capacity (cu. ft.) @ 24-Hour Drain Down	Treatment Capacity (cu. ft.) @ 48-Hour Drain Down
MWS-L-4-4	1140	2280
MWS-L-4-6	1600	3200
MWS-L-4-8	2518	5036
MWS-L-4-13	3131	6261
MWS-L-4-15	3811	7623
MWS-L-4-17	4492	8984
MWS-L-4-19	5172	10345
MWS-L-4-21	5853	11706
MWS-L-8-8	5036	10072
MWS-L-8-12	7554	15109
MWS-L-8-16	10073	20145

Installation

The MWS Linear is simple, easy to install, and has a space efficient design that offers lower excavation and installation costs compared to traditional tree-box type systems. The structure of the system resembles pre-cast catch basin or utility vaults and is installed in a similar fashion.

The system is delivered fully assembled for quick installation. Generally, the structure can be unloaded and set in place in 15 minutes. Our experienced team of field technicians are available to supervise installations and provide technical support.

Maintenance

Reduce your maintenance costs, man hours, and materials with the MWS Linear. Unlike other biofiltration systems that provide no pre-treatment, the MWS Linear is a self-contained treatment train which incorporates simple and effective pre-treatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pre-treatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pre-treatment chamber that can be cleaned by hand or with a standard vac truck. Only periodic replacement of low-cost media in the pre-filter cartridges is required for long term operation and there is absolutely no need to replace expensive biofiltration media.

Plant Selection

Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the MWS Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade the stormwater runoff/flow is being subjected to nature's secret weapon: a dynamic physical, chemical, and biological process working to break down and remove non-point source pollutants. The flow rate is controlled in the MWS Linear, giving the plants more "contact time" so that pollutants are more successfully decomposed, volatilized and incorporated into the biomass of The MWS Linear's micro/macro flora and fauna.

A wide range of plants are suitable for use in the MWS Linear, but selections vary by location and climate. View suitable plants by selecting the list relative to your project location's hardy zone.

Please visit **www.ModularWetlands.com/Plants** for more information and various plant lists.

Section [________]

Modular Subsurface Flow Wetland System

PART 1 – GENERAL

01.01.00 Purpose

The purpose of this specification is to establish generally acceptable criteria for Modular Subsurface Flow Wetland Systems used for biofiltration of stormwater runoff including dry weather flows and other contaminated water sources. It is intended to serve as a guide to producers, distributors, architects, engineers, contractors, plumbers, installers, inspectors, agencies and users; to promote understanding regarding materials, manufacture and installation; and to provide for identification of devices complying with this specification.

01.02.00 Description

Modular Subsurface Flow Wetland Systems (MSFWS) are used for filtration of stormwater runoff including dry weather flows. The MSFWS is a pre-engineered biofiltration system composed of a pretreatment chamber containing filtration cartridges, a horizontal flow biofiltration chamber with a peripheral void area and a centralized and vertically extending underdrain, the biofiltration chamber containing a sorptive media mix which does not contain any organic material and a layer of plant establishment media, and a discharge chamber containing an orifice control structure . Treated water flows horizontally in series through the pretreatment chamber cartridges, biofiltration chamber and orifice control structure.

01.03.00 Manufacturer

The manufacturer of the MSFWS shall be one that is regularly engaged in the engineering design and production of systems developed for the treatment of stormwater runoff for at least (10) years, and which have a history of successful production, acceptable to the engineer of work. In accordance with the drawings, the MSFWS(s) shall be a filter device Manufactured by Bio Clean Environmental Services, Inc., or Modular Wetland Systems, Inc., or assigned distributors or licensees. Bio Clean Environmental Services Inc., and Modular Wetland Systems, Inc., can be reached at:

Corporate Headquarters:
Bio Clean Environmental Service, Inc.
2972 San Luis Rey Road
Oceanside, CA 92058
Phone: (760) 433-7640
Fax: (760) 433-3176
www.biocleanenvironmental.net

Corporate Headquarters:
Modular Wetland Systems, Inc.
P.O. Box 869
Oceanside, CA 92049
Phone: (760) 433-7650
www.modularwetlands.net

01.04.00 Submittals

01.04.01 Shop drawings are to be submitted with each order to the contractor and consulting engineer.

01.04.02 Shop drawings are to detail the MSFWS and all components required and the sequence for installation, including:

- System configuration with primary dimensions
- Interior components
- Any accessory equipment called out on shop drawings

01.04.03 Inspection and maintenance documentation submitted upon request.

01.05.00 Work Included

01.05.01 Specification requirements for installation of MSFWS.

01.05.02 Manufacturer to supply components of the MSFWS(s):

- Pretreatment chamber components (pre-assembled)
- Concrete Structure(s)
- Biofiltration chamber components (pre-assembled)
- Flow control discharge structure (pre-assembled)

01.06.00 Reference Standards

ASTM C 29	Standard Test Method for Unit Weight and Voids in Aggregate
ASTM C 88	C 88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C131	C 131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregates by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 330	C 330 Standard Specification for Lightweight Aggregate for Structural Concrete
ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft.-lbf/ft3 (600 kN-m/m3)
ASTM D 1621	10 Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
ASTM D 1777	ASTM D1777 - 96(2007) Standard Test Method for Thickness of Textile Materials
ASTM D 4716	Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
AASHTO T 99-01	Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in) Drop
AASHTO T 104	Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
AASHTO T 260	Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials.
AASHTO T 288	Standard Method of Test for Determining Minimum Laboratory Soil Resistivity
AASHTO T 289	Standard Method of Test for Determining ph of Soil for Use in Corrosion Testing
AASHTO T 291	Standard Method of Test for Determining Water Soluble Chloride Ion Content in Soil
AASHTO T 290	T 290 Standard Method of Test for Determining Water Soluble Sulfate Ion Content in Soil

PART 2 – COMPONENTS

The Modular Subsurface Flow Wetland Systems (MSFWS) and all of its components shall be self-contained within a concrete structure constructed of concrete with a minimum 28 day compressive strength of 5,000 psi, with reinforcing per ASTM A 615, Grade 60, and supports and H20 loading as indicated by AASHTO. Each Chamber shall have appropriate access hatches for easy maintenance and sized to allow removal of all internal components without disassembly. All water transfer system components shall conform with the following;

- Filter netting shall be 100% Polyester with a number 16 sieve size, and strength tested per ASTM D 3787.
- Drainage cells shall be manufactured of lightweight injection-molded plastic and have a minimum compressive strength test of 6,000 psi and a void area along the surface making contact with the filter media of 75% or greater. The cells shall be at least 2” in thickness and allow water to freely flow in all four directions.

02.01.00 Pretreatment Chamber Components

02.01.01 Filter Cartridges shall operate at a loading rate not to exceed 3 gallons per minute per square foot surface area.

02.01.02 Drain Down System shall include a pervious floor that allows water to drain into the underdrain pipe that is connected to the discharge chamber.

02.02.00 Biofiltration Chamber Components

02.02.01 Media shall consist of ceramic material produced by expanding and vitrifying select material in a rotary kiln. Media must be produced to meet the requirements of ASTM C330, ASTM C331, and AASHTO M195. Aggregates must have a minimum 24-hour water absorption of 10.5% mass. Media shall not contain any organic material. Flow through media shall be horizontal from the outer perimeter of the chamber toward the centralized and vertically extending underdrain. The retention time in the media shall be at least 3 minutes. Downward flow filters are not acceptable alternatives. The thickness of the media shall be at least 19” from influent end to effluent end. The loading rate on the media shall not exceed 1.1 gallons per minute per square foot surface area. Media must be contained within structure that spaces the surface of the media at least 2” from all vertically extending walls of the concrete structure.

02.02.02 Planting shall be native, drought tolerant species recommend by manufacturer and/or landscape architect.

02.02.03 Plant Support Media shall be made of a 3” thick moisture retention cell that is inert and contains no chemicals or fertilizers, is not made of organic material and has an internal void percentage of 80%.

02.03.00 Discharge Chamber

The discharge device shall house a flow control orifice plate that restricts flows greater than designed treatment flow rate. All piping components shall be made of a high-density polyethylene. The discharge chamber shall also contain a drain down filter if specified on the drawing.

PART 3 – PERFORMANCE

03.01.00 General

03.01.01 Function - The MSFWS has no moving internal components and functions based on gravity flow, unless otherwise specified. The MSFWS is composed of a pretreatment chamber, a biofiltration chamber and a discharge chamber. The pretreatment device houses cartridge media filters, which consist of filter media housed in a perforated enclosure. The untreated runoff flows into the system via subsurface piping and or surface inlet. Water entering the system is forced through the filter cartridge enclosures by gravity flow. Then the flow contacts the filter media. The flow through the media is horizontal toward the center of each individual media filter. In the center of the media shall be a round slotted PVC pipe of no greater than 1.5” in diameter. The slotted PVC pipe shall extend downward into the water transfer cavity of the cartridge. The slotted PVC pipe shall be threaded on the bottom to connect to the water transfer cavity. After pollutants have been removed by the filter media the water discharges the pretreatment chamber and flows into the water transfer system and is conveyed to the biofiltration chamber. Once runoff has been filtered by the biofiltration chamber it is collected by the vertical underdrain and conveyed to a discharge chamber equipped with a flow control orifice plate. Finally the treated flow exits the system.

03.01.02 Pollutants - The MSFWS will remove and retain debris, sediments, TSS, dissolved and particulate metals and nutrients including nitrogen and phosphorus species, bacteria, BOD, oxygen demanding substances, organic compounds and hydrocarbons entering the filter during frequent storm events and continuous dry weather flows.

03.01.03 Treatment Flow Rate and Bypass - The MSFWS operates in-line. The MSFWS will treat 100% of the required water quality treatment flow based on a minimum filtration capacities listed in section 03.02.00. The size of the system must match those provided on the drawing to ensure proper performance and hydraulic residence time.

Minimum Treatment Capabilities
- System must be capable of treating flows to the specified treatment flow rate on the drawings. The flow rate shall be controlled by an orifice plate.

PART 4 - EXECUTION

04.01.00 General

The installation of the MSFWS shall conform to all applicable national, state, state highway, municipal and local specifications.

04.02.00 Installation

The Contractor shall furnish all labor, equipment, materials and incidentals required to install the (MSFWS) device(s) and appurtenances in accordance with the drawings and these specifications.

04.02.01 Grading and Excavation site shall be properly surveyed by a registered professional surveyor, and clearly marked with excavation limits and elevations. After site is marked it is the responsibility of the contractor to contact local utility companies and/or DigAlert to check for underground utilities. All grading permits shall be approved by governing agencies before commencement of grading and excavation. Soil conditions shall be tested in accordance with the governing agencies requirements. All earth removed shall be transported, disposed, stored, and handled per governing agencies standards. It is the responsibility of the contractor to install and maintain proper erosion control measures during grading and excavation operations.

04.02.02 Compaction – All soil shall be compacted per registered professional soils engineer's recommendations prior to installation of MSFWS components.

04.02.03 Backfill shall be placed according to a registered professional soils engineer's recommendations, and with a minimum of 6" of gravel under all concrete structures.

04.02.04 Concrete Structures – After backfill has been inspected by the governing agency and approved the concrete structures shall be lifted and placed in proper position per plans.

04.02.05 Subsurface Flow Wetland Media shall be carefully loaded into area so not to damage the Wetland Liner or Water Transfer Systems. The entire wetland area shall be filled to a level 9 inches below finished surface.

04.02.06 Planting layer shall be installed per manufacturer's drawings and consist of a minimum 3" grow enhancement media that ensures greater than 95% plant survival rate, and 6" of wetland media. Planting shall consist of native plants recommended by manufacturer and/or landscape architect. Planting shall be drip irrigated for at least the first 3 months to insure long term plant growth. No chemical herbicides, pesticides, or fertilizers shall be used in the planting or care and maintenance of the planted area.

04.03.00 Shipping, Storage and Handling

04.03.01 Shipping – MSFWS shall be shipped to the contractor's address or job site, and is the responsibility of the contractor to offload the unit(s) and place in the exact site of installation.

04.03.02 Storage and Handling– The contractor shall exercise care in the storage and handling of the MSFWS and all components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be born by the contractor. The MSFWS(s) and all components shall always be stored indoors and transported inside the original shipping container until the unit(s) are ready to be installed. The MSFWS shall always be handled with care and lifted according to OSHA and NIOSA lifting recommendations and/or contractor's workplace safety professional recommendations.

04.04.00 Maintenance and Inspection

04.04.01 Inspection – After installation, the contractor shall demonstrate that the MSFWS has been properly installed at the correct location(s), elevations, and with appropriate components. All components associated with the MSFWS and its installation shall be subject to inspection by the engineer at the place of installation. In addition, the contractor shall demonstrate that the MSFWS has been installed per the manufacturer's specifications and recommendations. All components shall be inspected by a qualified person once a year and results of inspection shall be kept in an inspection log.

04.04.02 Maintenance – The manufacturer recommends cleaning and debris removal maintenance of once a year and replacement of the Cartridge Filters as needed. The maintenance shall be performed by someone qualified. A Maintenance Manual is available upon request from the manufacturer. The manual has detailed information regarding the maintenance of the MSFWS. A Maintenance/Inspection record shall be kept by the maintenance operator. The record shall include any maintenance activities preformed, amount and description of debris collected, and the condition of the filter.

04.04.03 Material Disposal - All debris, trash, organics, and sediments captured by the MSFWS shall be transported and disposed of at an approved facility for disposal in accordance with local and state requirements. Please refer to state and local regulations for the proper disposal of toxic and non-toxic material.

PART 5 – QUALITY ASSURNACE

05.01.00 Warranty

The Manufacturer shall guarantee the MSFWS against all manufacturing defects in materials and workmanship for a period of (5) years from the date of delivery to the ______. The manufacturer shall be notified of repair or replacement issues in writing within the warranty period. The MSFWS is limited to recommended application for which it was designed.

05.02.00 Performance Certification

The MSFWS manufacturer shall submit to the Engineer of Record a “Manufacturer’s Performance Certificate” certifying the MSFWS is capable of achieving the specified removal efficiency for suspended solids, phosphorous and dissolved metals.

Installation Guidelines for
Modular Wetland System

Delivery & Unloading/Lifting

1. Modular Wetland Systems, Inc. shall deliver the unit(s) to the site in coordination with the Contractor.

2. The Contractor will require spreader bars and chains/cables to safely and securely lift the main structure, risers a set of suitable lifting hooks, knuckles, shackles and eye bolts.

3. The main structure and lid can be lifted together or separately.

   Please see Modular Wetland Weights and Lifting Details. Contact Modular Wetlands for additional lifting details.

Inspection

1. Inspection of the Modular Wetland unit and all parts contained in or shipped outside of the unit shall be inspected at time of delivery by the site Engineer/Inspector and the Contractor. Any non-conformance to approved drawings or damage to any part of the system shall be documented on the Modular Wetland shipping ticket. Damage to the unit during and after unloading shall be corrected at the expense of the Contractor. Any necessary repairs to the Modular Wetland unit shall be made to the acceptance of the Engineer/Inspector.

Site Preparation

1. The Contractor is responsible for providing adequate and complete site/inlet protection when the Modular Wetland unit is installed prior to final site stabilization (full landscaping, grass cover, final paving, and street sweeping completed).

2. The Contractor shall adhere to all jurisdictional and/or OSHA safety rules in providing temporary shoring of the excavation.

3. The Contractor or Owner is responsible for appropriately barricading the Modular Wetland unit from traffic (in accordance with local codes).

Installation Guidelines for Modular Wetland System

Installation

1. Each unit shall be constructed at the locations and elevations according to the sizes shown on the approved drawings. Any modifications to the elevation or location shall be at the direction of and approved by the Engineer.

2. The unit shall be placed on the compacted sub-grade with a minimum 6-inch gravel base matching the final grade of the curb line in the area of the unit. The unit is to be placed such that the unit and top slab match the grade of the curb in the area of the unit. Compact undisturbed sub-grade materials to 95% of maximum density at +1% to 2% of the optimum moisture. Unsuitable material below sub-grade shall be replaced to site engineer's approval. Please see Modular Wetlands Weights and Lifting Details. Contact Modular Wetlands for guidance where slope exceeds 5%.

3. Once the unit is set, the internal wooden forms and protective silt fabric cover must be left intact (if WetlandMedia pre-installed). The top lid(s) should be sealed onto the box section before backfilling, using a non-shrink grout, butyl rubber or similar waterproof seal. The boards on the top of the lid and boards sealed in the unit's throat must NOT be removed. The Supplier will remove these sections at the time of activation.

4. Outlet connections shall be aligned and sealed to meet the approved drawings with modifications necessary to meet site conditions and local regulations. The correct outlet will be marked on the Modular Wetland unit.

5. Backfilling should be performed in a careful manner, bringing the appropriate fill material up in 6-inch lifts on all sides. Precast sections shall be set in a manner that will result in a watertight joint. In all instances, installation of the Modular Wetland unit shall conform to ASTM specification C891 "Standard Practice for Installation of Underground Precast Utility Structures" unless specified otherwise in contract documents.

6. It is the responsibility of the Contractor to provide curb and gutter and transition to the Modular Wetland unit for proper stormwater flow into the system through the throat, pipe or grate opening. A standard drawing of the throat and gutter detail is available in the following section; however the plans and contract documents supersede all standard drawings. Several variations of the standard design are available. Effective bypass for the Modular Wetland System is essential for correct operation (i.e. bypass to an overflow at lower elevation).

Installation Procedure

The contractor **MUST** provide all rigging And lifting apparatus, such as all cables, chains or straps and a set of lifting hooks, shackles, knuckles and eye bolts.

It is the contractor’s responsibility to provide suitable lifting equipment to off-load the Modular Wetland unit.

Modular Wetland units are designed to be off-loaded using the contractor’s spreader bar.

1. Apply Butyl Tape Seal

Apply butyl tape seal along the top of the box section. Butyl tape seal is provided with every unit.

Modular Wetland installed protective throat board and installed silt fabric must be left in place to protect the unit from construction sediment.

2. Unload and Set Box

Unload the Modular Wetland unit
the prepared hole with appropriate sub-grade.*

* Compacted sub-grade with a minimum
of six inches of gravel base which must match
the final grade of curb line the area of the unit.

3. Set Top On Box

Set the top slab on the box.

The Contractor is responsible for providing adequate and complete site/inlet protection when the Modular Wetland is installed prior to final site stabilization (full landscaping, grass cover, final paving, and street sweeping completed).

4. Connect Outfall Pipe

The correct outlet will be marked on the Modular Wetland.

Invert of outlet pipe **MUST** be even
with the floor of the system.

5. Install Curb & Gutter

It is the responsibility of the Contractor to provide curb and gutter and transition to the Modular Wetland for proper flow into the system through a 5”- 7” throat opening. A standard drawing of the throat and gutter detail in the following section. CONTRACTOR RESPONSIBLE FOR GROUTING IN ANY VISIBLE LIFTING POINTS.

6. Activation

Activation is performed **ONLY** by Modular Wetland personnel.

Activation can occur once the project site is fully stabilized (full landscaping, grass cover, final paving and street sweeping completed) and there is a 5” - 7” throat opening.

Call 760-433-7640 to schedule your activation.

NOTE: WetlandMedia Installation

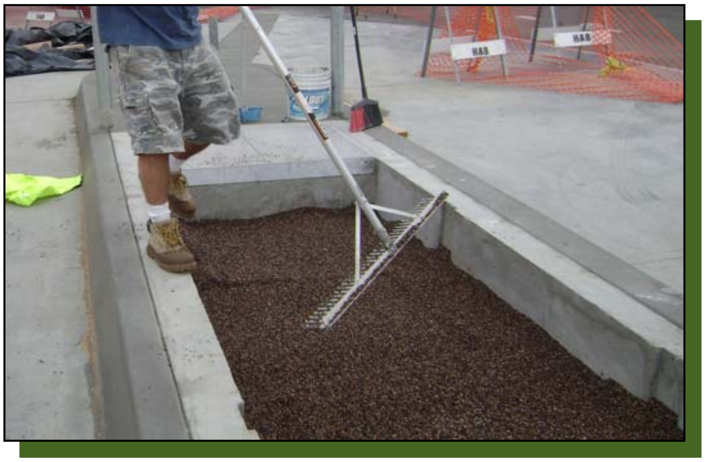
For Larger models (MWS-L-4-13 and above) the system will be delivered without WetlandMedia pre-installed to minimize pick weight and prevent contamination of the media during construction. For these models the WetlandMedia will be delivered in bulk or in super sacks. It will be responsibility of the contractor to fill the system with the WetlandMedia during the installation process. Installation of the WetlandMedia can be done after the unit is fully installed to avoid contamination. See following pages for details.

WetlandMedia Install (if applicable)

1. Fill WetlandMedia

Position super sack of WetlandMedia over wetland chamber. Bottom of sack should not be more than 2’ above top of system. Open sack and fill evenly*.

* One to several hundred cubic yards of WetlandMedia will be required based upon the model number and size of the system. For large scale jobs WetlandMedia will be delivered in bulk and will require a bobcat of similar to fill the system. All equipment is the responsibility of the contractor.



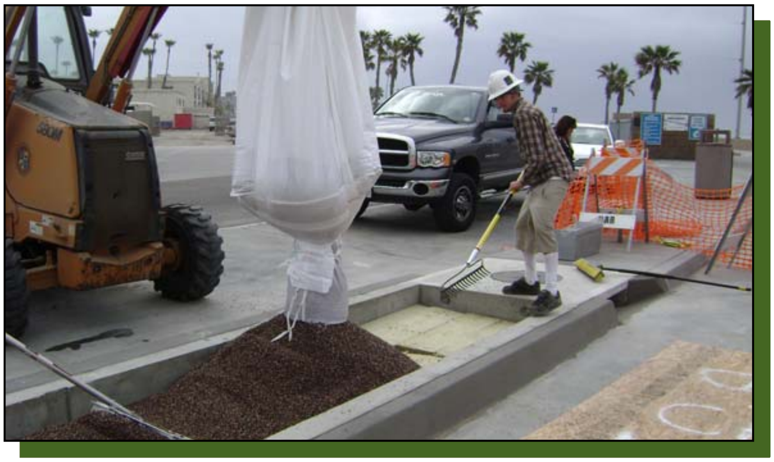
2. Install Plant Propagation Layer

Fill WetlandMedia up to 9” below the top of the wetland chamber. Level out the WetlandMedia as shown. Ensure that the level does not vary more than one inch or plant growth will be affected.

3. Install Plant Propagation Layer

Utilize plant propagation blocks provided by the manufacturer. Each block is approximately 40” by 6” by 3” thick. Blocks shall be placed side by side and end to end and cover the entire length and width of the wetland chamber unless specified.

4. Finish Filling WetlandMedia



After plant propagation blocks are installed repeat step 1 and fill the system to the top of the wetland chamber as shown. WetlandMedia must be filled within 2” of the top of the unit.

5. Planting

After system is filled with WetlandMedia planting of vegetation can begin. Utilizing 1 gallon plants dig down until The plant propagation blocks are reached. Remove plant and it’s root ball from the container. Set the bottom of the root ball on the tops of the blocks. Fill hole back in with WetlandMedia. After planting a thorough watering of the plants is necessary. The plant propagation blocks must be saturated to provide a water source for the plants during the establishment phase. It is recommended that hand watering is done three times a week for the first two months. Hand water can be supplemented with drip or spray irrigation after the second week. Please call the manufacturer for more details on plants, planting arrangement and irrigation options.

NOTE: planting is required on all units, including units delivered with WetlandMedia pre-installed.

Curb and Gutter Details

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P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

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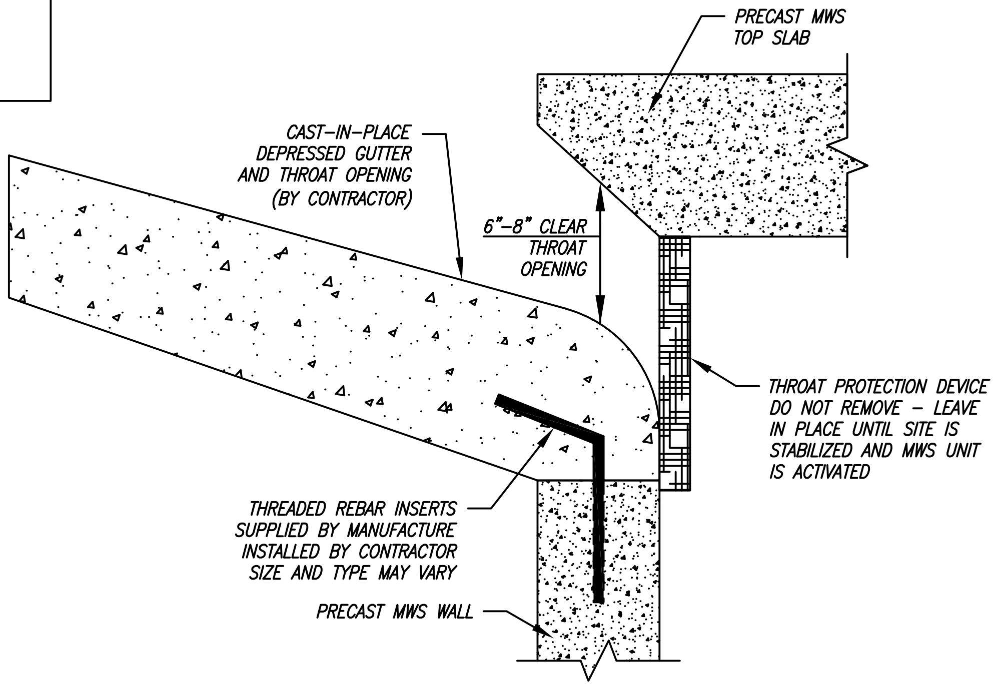
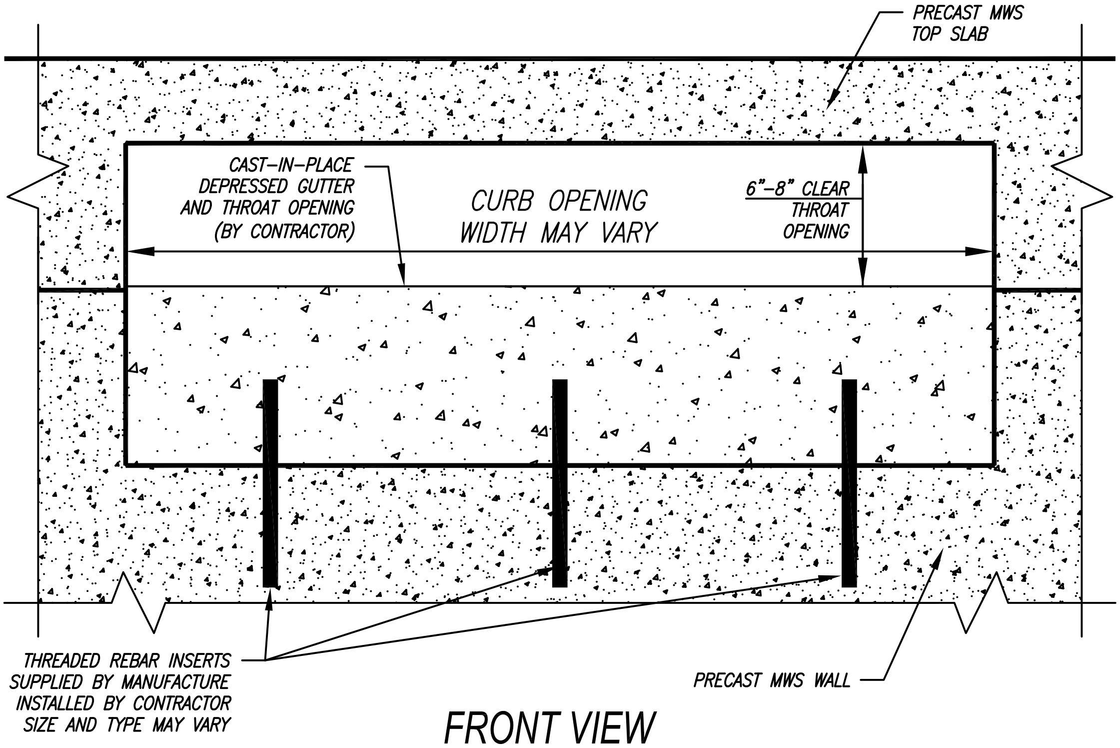


SECTION VIEW
STANDARD MODULAR WETLAND CURB OPENING



FRONT VIEW
STANDARD MODULAR WETLAND CURB OPENING

MODULAR WETLAND SYSTEMS INC.
P.O. BOX 869
OCEANSIDE, CA 92049
www.ModularWetlands.com

PROPRIETARY AND CONFIDENTIAL

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	NAME	DATE
DRAWN	John	5/3/13
EDITED		

COMMENTS:

TITLE: MWS LINEAR 2.0 CURB INLET DETAILS

SIZE
DWG. NO.
REV

SCALE NTS
UNITS = INCHES
SHEET 1 OF 1

Weights and Lifting Details

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F. 760-433-3176
E. Info@modularwetlands.com

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MWS-L 2.0 Max Pick Weights

Model #	Size (O.D)	Size (I.D)	Unit Weight (lbs)	Media Weight (lbs)	Total Weight (lbs)
MWS-L-4-4	5' x 5'	4' x 4'	7500.0	1607.7	9107.7
MWS-L-4-6 MWS-L-4-6.5	5' x 7' 5 x 7.5'	4' x 6' 4' x 6.5'	11,000 11,500	1798.9	12,619.2 13,119.2
MWS-L-4-8	5' x 9'	8' x 4'	12500	3966	16466
MWS-L-4-13	5' x 14'	13' x 4'	21200	5895	27095
MWS-L-4-15	5' x 16'	15' x 4'	23700	8039	31739
MWS-L-4-17	5' x 18'	17' x 4'	26500	10182	36682
MWS-L-4-19	5' x 20'	19' x 4'	28300	12326	40626
MWS-L-4-21	5' x 22'	21' x 4'	30000	14470	44470
MWS-L-6-8	7' x 9'	6' x 8'	24000	6109	30109
MWS-L-8-8	9' x 9'	8' x 8'	32000	8253	40253
MWS-L-8-12	9' x 13'	8' x 12'	44000	12540	56540
MWS-L-8-16	9' x 17'	8' x 16'	47000	16828	63828

Max Pick Weight if Shipped
Without Media Installed

Max Pick Weight if Shipped
With Media Installed

Note: All weights listed hereon are standard max pick weights, actual pick weights may vary based upon state and local regulations and variation in concerte and rebar standards. For project specific pick weights contact the manufacturer prior to shipping of the unit(s). Is is the contractors responsibility to off-load the unit with an adequate size crane. Units are shipped with WetlandMEDIA in superbags and installed by contractor.

When Available see project contract terms, if lifting points are on the inside of the unit due to custom designs or installations requiring pionts to be on the inside the media will be shipped in bags and the contractor will be reponsibile to install after the unit is installed. For example, units places against a wall.

For Questions or Comments Please Call 888-566-3938 or email: info@modularwetlands.com

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Connection Details

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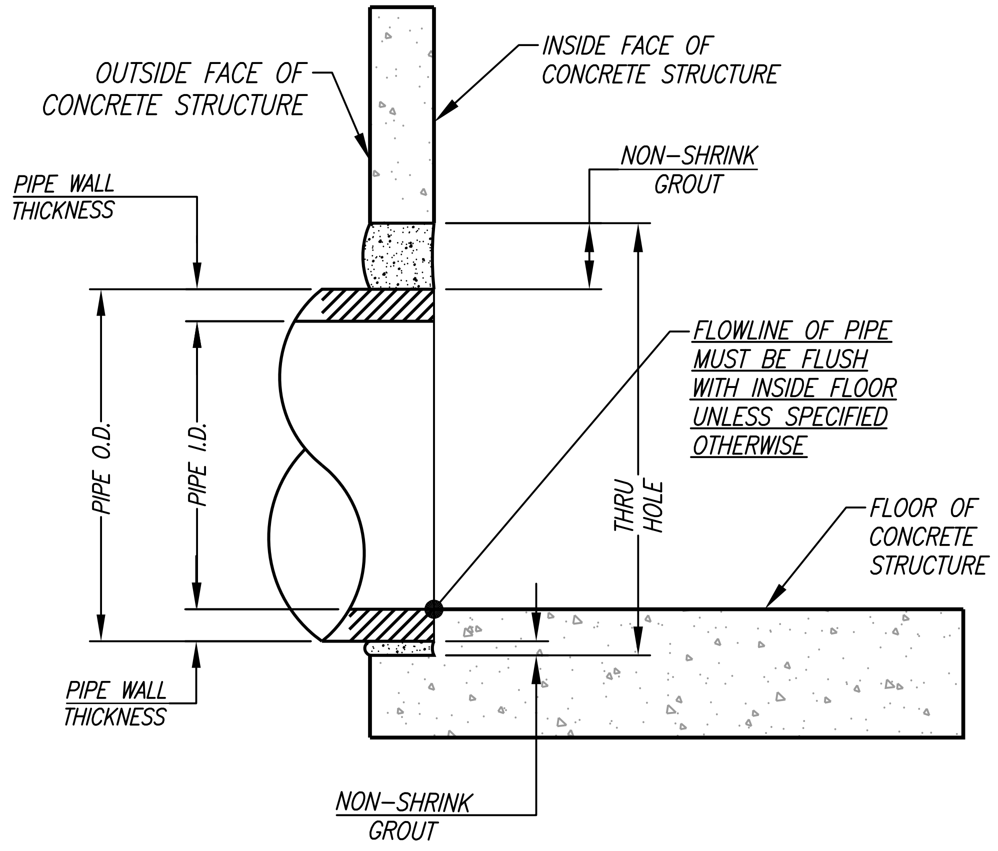
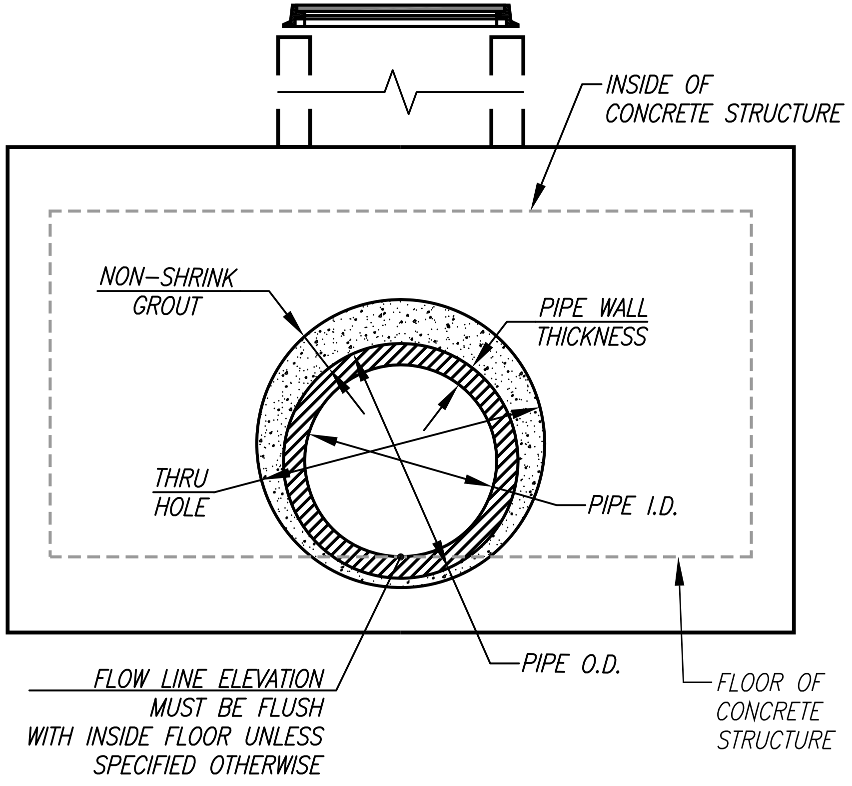


ELEVATION VIEW



END VIEW

INSTALLATION NOTES

1. ALL CONNECTION PIPES SUPPLIED AND INSTALLED BY CONTRACTOR. MODULAR WETLAND UNIT WILL BE DELIVERED WITH A THRU HOLE AND ITS THE CONTRACTORS RESPONSIBILITY TO SUPPLY PIPE, AND ALL LABOR AND MATERIAL TO CONNECT PIPE AND SEAL UNIT WATER TIGHT INCLUDING BUT NOT LIMITED TO GROUT, CONCRETE LUG, REBAR, PLUG, ANCHORS, COUPLER, FITTINGS AND/OR ALL SUPPORT AND CONNECTING HARDWARE.
2. ALL CONNECTIONS ARE TO BE FLUSH WITH THE INSIDE SURFACE OF THE CONCRETE STRUCTURE. (CAN NOT INTRUDE BEYOND FLUSH) ALL PIPE FLOWLINES SHALL BE FLUSH WITH INSIDE FLOOR UNLESS SPECIFIED OTHERWISE.
3. ALL GROUT AND/OR CONCRETE SHALL BE NON-SHRINK AND MEET OR EXCEED LOCAL PIPE CONNECTION STANDARDS.
4. REFER TO AGENCY SPECIFICATIONS WHERE APPLICABLE.

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

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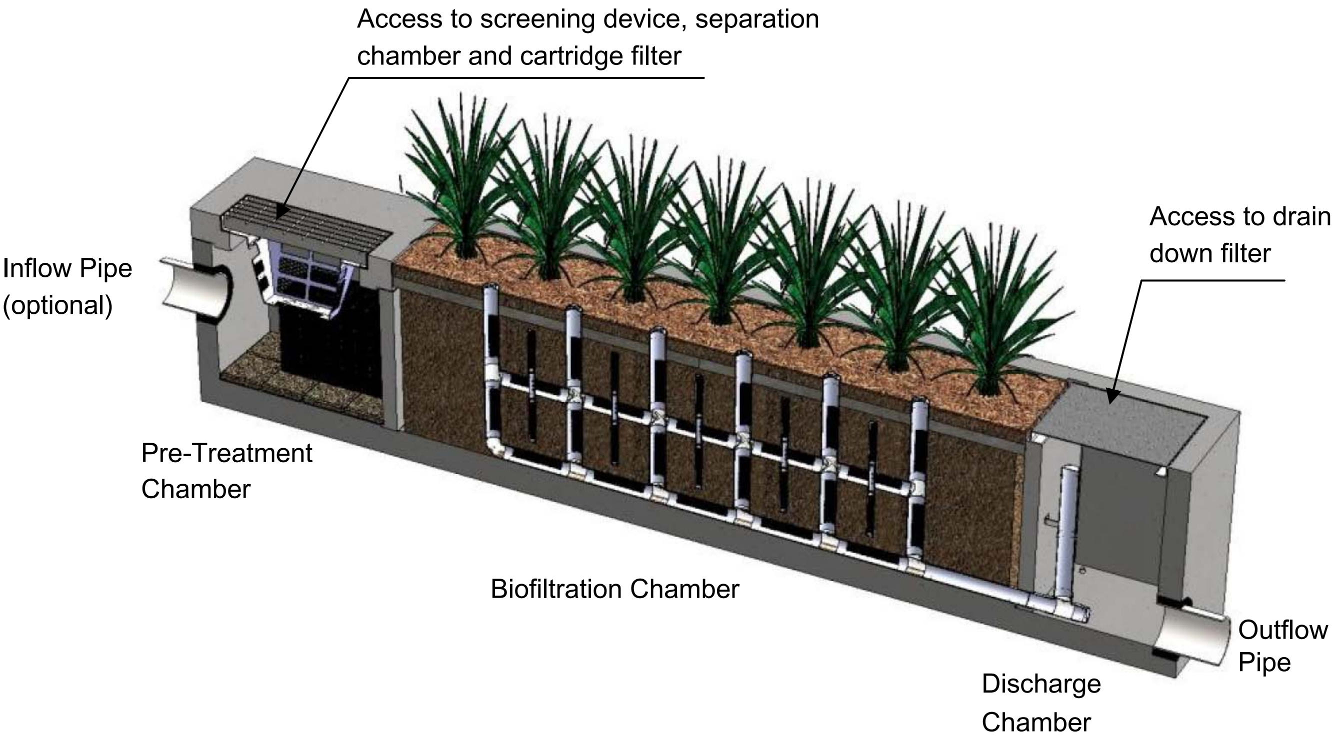
PIPE CONNECTION
STANDARD DETAIL

Maintenance Guidelines for Modular Wetland System - Linear

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
  - (*5 minute average service time*).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
  - (*10 minute average service time*).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
  - (*10-15 minute per cartridge average service time*).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
  - (*5 minute average service time*).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre-Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screening device.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.

2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.

3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

4. Entry into chambers may require confined space training based on state and local regulations.

5. No fertilizer shall be used in the Biofiltration Chamber.

6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

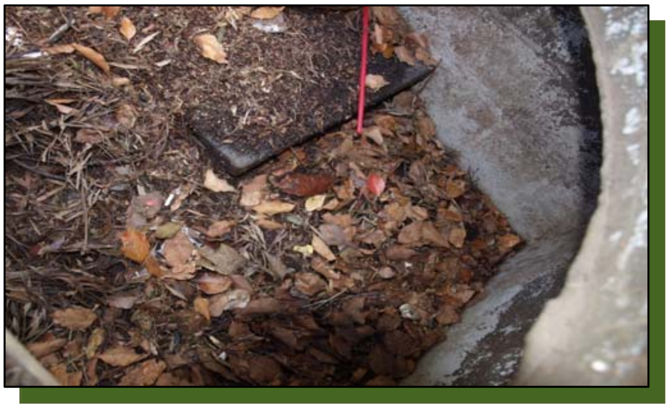
Maintenance Procedure Illustration

Screening Device

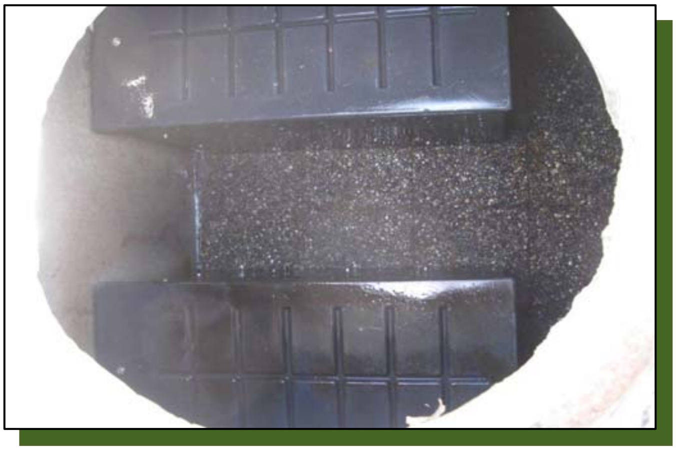
The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.

Separation Chamber

The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.



Cartridge Filters



The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.

Drain Down Filter

The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.

Trim Vegetation

Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.

Inspection Form

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

BIO CLEAN ENVIRONMENTAL SERVICES, INC.

Inspection Report
Modular Wetlands System

MODULAR WETLANDS

Project Name ____________________

Project Address ____________________
(city) (Zip Code)

Owner / Management Company ____________________

Contact ____________________ Phone ( ) –

Inspector Name ____________________ Date ___/___/_____ Time __________ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition ____________________ Additional Notes ____________________

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

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): __________ Size (22', 14' or etc.): __________

Structural Integrity:	**Yes**	**No**	**Comments**
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes, specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	**Yes**	**No**
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: ____________________

____

____

2972 San Luis Rey Road, Oceanside, CA 92058 P (760) 433-7640 F (760) 433-3176

Maintenance Report

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P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

BIO CLEAN ENVIRONMENTAL SERVICES, INC.

Cleaning and Maintenance Report
Modular Wetlands System

MODULAR WETLANDS

Project Name ______________________________

Project Address ______________________________ (city) (Zip Code)

Owner / Management Company ______________________________

Contact ______________________________ Phone (   )   –

Inspector Name ______________________________ Date ____/____/______ Time __________ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition ______________________________ Additional Notes ______________________________

For Office Use Only

(Reviewed By)

(Date)

Office personnel to complete section to the left.

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:

2972 San Luis Rey Road, Oceanside, CA 92058 P. 760.433.7640 F. 760.433.3176

Appendix E

PENDING CITY COVENANT AND AGREEMENT FORM

Appendix F

HYDROLOGY STUDY

TENTATIVE PARCEL MAP 2020-125

for

HILLTOP 3 DEVELOPMENT, LLC.

3875 Crest Drive
Yorba Linda, CA 92886
Robert Hoff

Prepared By:

KING CIVIL ENGINEERING CORP.
101 S Kraemer Blvd., Suite 232
Placentia, CA 92870
(714) 996-7010

8/18/2020

Thomas A. King *Date*
R.C.E. 16916 EXP. 06/30/21

REGISTERED PROFESSIONAL ENGINEER
THOMAS A. KING
No. 16916
Exp. 6/30/21
CIVIL
STATE OF CALIFORNIA

TABLE OF CONTENTS SECTION

Section I
Discussion

SECTION I

DISCUSSION

1) Site Location:

Tentative Parcel Map No. 2020-125 is located along the northern Yorba Linda City limits and westerly of Fairmont Boulevard.

2) Site Description:

The site is bordered on the east, south and west by single family homes. The northerly boundary is the City of Yorba Linda limits and State of California property.

3) Existing Conditions:

The site is presently vacant and consisting of rolling hills. The Yorba Linda Water District owns a 1.12 acre parcel within the site which contains an underground reservoir. There is a paved road to the reservoir site which enters the property off Little Canyon Lane. The entire site contains 42.6 acres which includes the Yorba Linda Water District property.

4) Proposed Development:

The proposed project consists of creating a three parcel parcel map and constructing a single family home on a 1.6 acre pad. The proposed home will be adjacent to the existing Yorba Linda Water District reservoir site. An access road is proposed to enter the property off of Fairmont Boulevard near Quail Circle. The home will be located on Parcel Number 1 and the two remaining parcels (A & 2) are proposed to remain vacant.

5) Design Criteria:

Hydrology studies were performed using the Orange County Local Drainage Manual and the O.C.E.M.A. Hydrology criterion. The Rational Method Hydrology Computer Program by Advanced Engineering software (AES) was utilized for these computations. The drainage area consists of S.C.S. Soil Group "C". Hydrology studies for 2 and 100 year event storm frequencies for developed and existing site conditions were performed.

6) Summary:

The project will consist of constructing a single family home which will be located on proposed Parcel 1 of Tentative Parcel Map No. 2020-125. Parcel No. 1 contains 15.2 acres which includes a 1.1 acre Yorba Linda Water District reservoir site. The home will be located on a 1.6 acre pad adjacent to the Yorba Linda Water District reservoir site. An access road to the home will enter off of Fairmont Boulevard near Quail Circle. Parcels "A" and "2" are proposed to remain vacant land.

Parcels "A" and "2" will drain in the their natural drainage patterns and continue offsite as the areas presently do. The home site will drain to Fairmont Boulevard with the runoff mitigated with water quality features.

Hydrology Node Point 13:

Storm runoff flows in the canyon towards the existing 27" RCP storm drain located on Lot 26 of Tract No. 11967. The proposed 100-year frequency runoff equals 81.01 cfs from 21.93 acres at the property line. The existing 100-year flow equals 74.33 cfs from 20.13 acres. This is an increase of 6.68 cfs and 1.80 acres. Sheet flow onto Lots 19 through 25 of Tract No. 11967 is eliminated by the proposed "V" ditch along the property line.

Hydrology Node Point 66

Storm runoff flow in the canyon towards the existing 24" RCP storm drain located on Lot 47 of Tract No. 11452. The proposed 100-year frequency runoff equals 15.77 cfs from 4.16 acres at the property line. The existing 100-year flow equals 35.87 cfs from 9.22 acres. This is a decrease of 20.10 cfs and 5.06 acres. Sheet flow onto Lots 46 through 52 of Tract No. 11452 is eliminated by the proposed "V" ditch along the property line.

Both existing storm drains join in a junction structure located in the Ravenswood Drive cul-de-sac. This results in a decrease runoff of 13.42 cfs.

Hydrology Node Point 111:

The remaining 100-year frequency storm runoff flowing toward Tract No. 11452 is intercepted by the proposed "V" ditch and exits into Fairmont Boulevard via a parkway culvert. The flow equals 6.42 cfs from 1.69 acres.

Hydrology Node Point 74:

A parkway culvert located at the proposed driveway has a 100-year frequency storm flow of 16.98 cfs from 4.22 acres. This parkway culvert also exists onto Fairmont Boulevard.

Hydrology Node Point 91:

A 0.14 acre slope along Fairmont Boulevard is tributary to Hydrology Node Point 91. The flow at Node Point 91 is 0.75 cfs for a 100-year frequency storm.

Hydrology Node Points 74, 91 and 111:

The total project storm runoff to Fairmont Boulevard consists of flow from Node Points 74, 91 and 111. The total 100-year frequency flow equals 24.15 cfs from 6.05 acres.

7) Conclusion:

The 100-year frequency storm flow exiting the project in the canyon shown at Hydrology Node Point 13 has an increase of 6.68 cfs and 1.80 acres.

The100-year frequency storm flow exiting the project in the canyon shown at Hydrology Node Point 66 has a decrease of 20.10 cfs and 5.06 acres.

The remaining 100-year frequency storm flow exits the project onto Fairmont Boulevard via parkway culverts. There is an increase of 1.81 cfs and 0.56 acres. This total runoff is from Hydrology Node Points 74, 91 and 111.

The point of the total 100-year runoff from Hydrology Node Points 74, 91 and 111 is calculated to run in the westerly curb at the southwesterly property line and Fairmont Boulevard. The existing curb face is 6" high and has a rate of grade of 9.80%. The depth of flow in the curb is 0.44 feet. The following calculations show this flow to be contained below the existing top of curb.

The proposed project "V" ditch along the property line northerly of Tract No. 11967 and Tract No. 11452 helps to protect all the lots abutting the project from storm runoff.

```
****************************************************************************
                 HYDRAULIC ELEMENTS - I  PROGRAM PACKAGE
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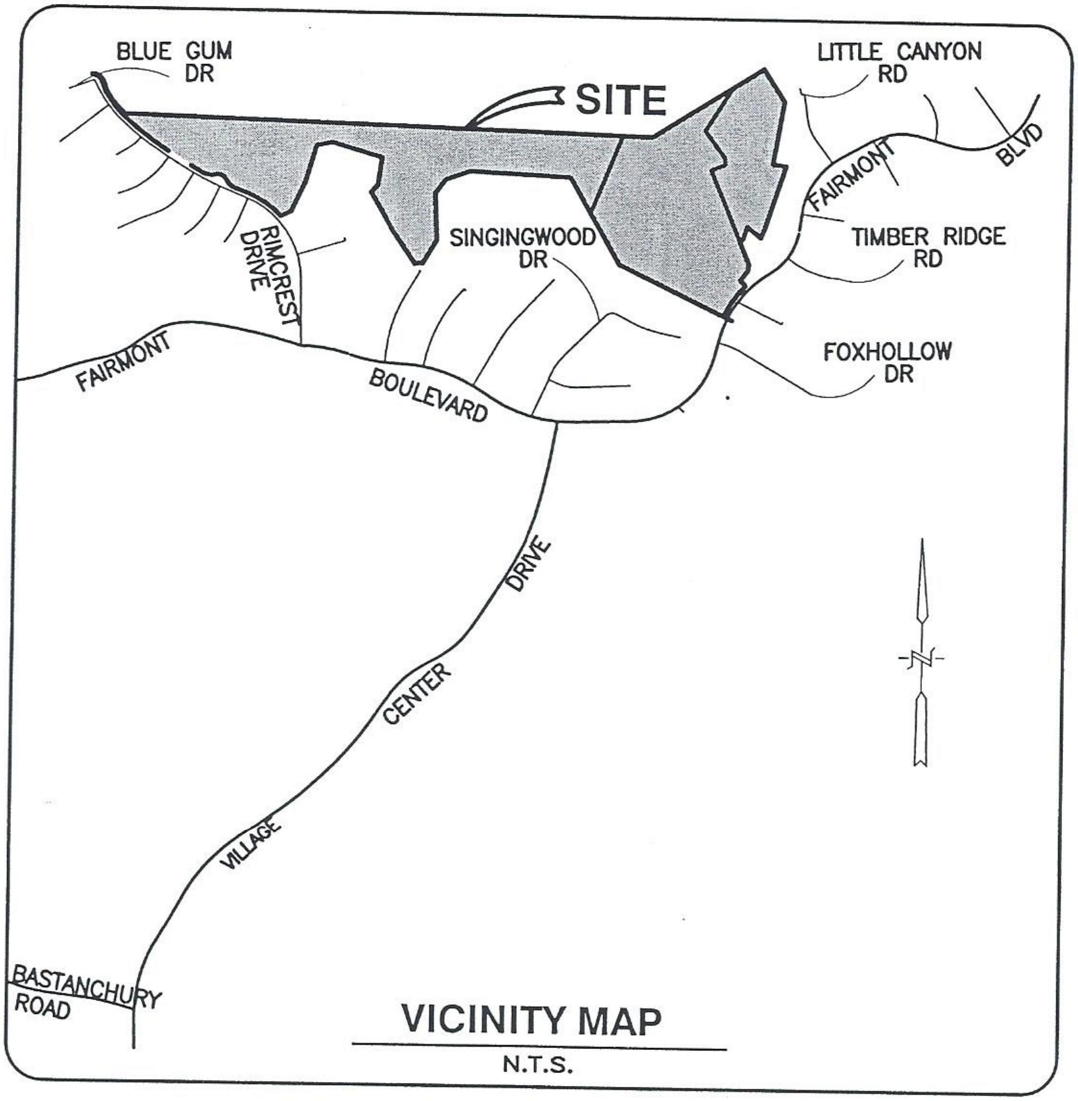
             Ver. 9.0  Release Date: 01/01/2003  License ID 1247

                          Analysis prepared by:

                       KING CIVIL ENGINEERING CORP.
                     101 S. KRAEMER BLVD. , SUITE ~~225~~ 232
                           PLACENTIA, CA. 92870
                   PHONE: 714-996-7010, FAX: 714-996-0322

----------------------------------------------------------------------------
  TIME/DATE OF STUDY: 11:30 08/17/2020
============================================================================
 Problem Descriptions:
  TENTATIVE  PARCEL MAP NO. 2020-125
  TOTAL 100 YEAR RUNOFF FROM NODE POINTS 74, 91 AND 111
  Q= 24.15 CFS, STREET SLOPE=0.098, DEPTH OF FLOW=0.44', EX. TC=0.50'
****************************************************************************
>>>>STREETFLOW MODEL INPUT INFORMATION<<<<
----------------------------------------------------------------------------
    CONSTANT STREET GRADE(FEET/FEET) = 0.098000
    CONSTANT STREET FLOW(CFS) =   24.15
    AVERAGE STREETFLOW FRICTION FACTOR(MANNING) = 0.015000
    CONSTANT SYMMETRICAL STREET HALF-WIDTH(FEET) =   20.00
    DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   15.00
    INTERIOR STREET CROSSFALL(DECIMAL) = 0.020000
    OUTSIDE  STREET CROSSFALL(DECIMAL) = 0.020000
    CONSTANT SYMMETRICAL CURB HEIGHT(FEET) =   0.50
    CONSTANT SYMMETRICAL GUTTER-WIDTH(FEET) =   1.50
    CONSTANT SYMMETRICAL GUTTER-LIP(FEET) =  0.03125
    CONSTANT SYMMETRICAL GUTTER-HIKE(FEET) =  0.12500
    FLOW ASSUMED TO FILL STREET ON ONE SIDE, AND THEN SPLITS
============================================================================
    STREET FLOW MODEL RESULTS:
----------------------------------------------------------------------------
    STREET FLOW DEPTH(FEET) =  0.44
    HALFSTREET FLOOD WIDTH(FEET) =   15.66
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    9.39
    PRODUCT OF DEPTH&VELOCITY =    4.13
============================================================================
```

Section II
Vicinity Map

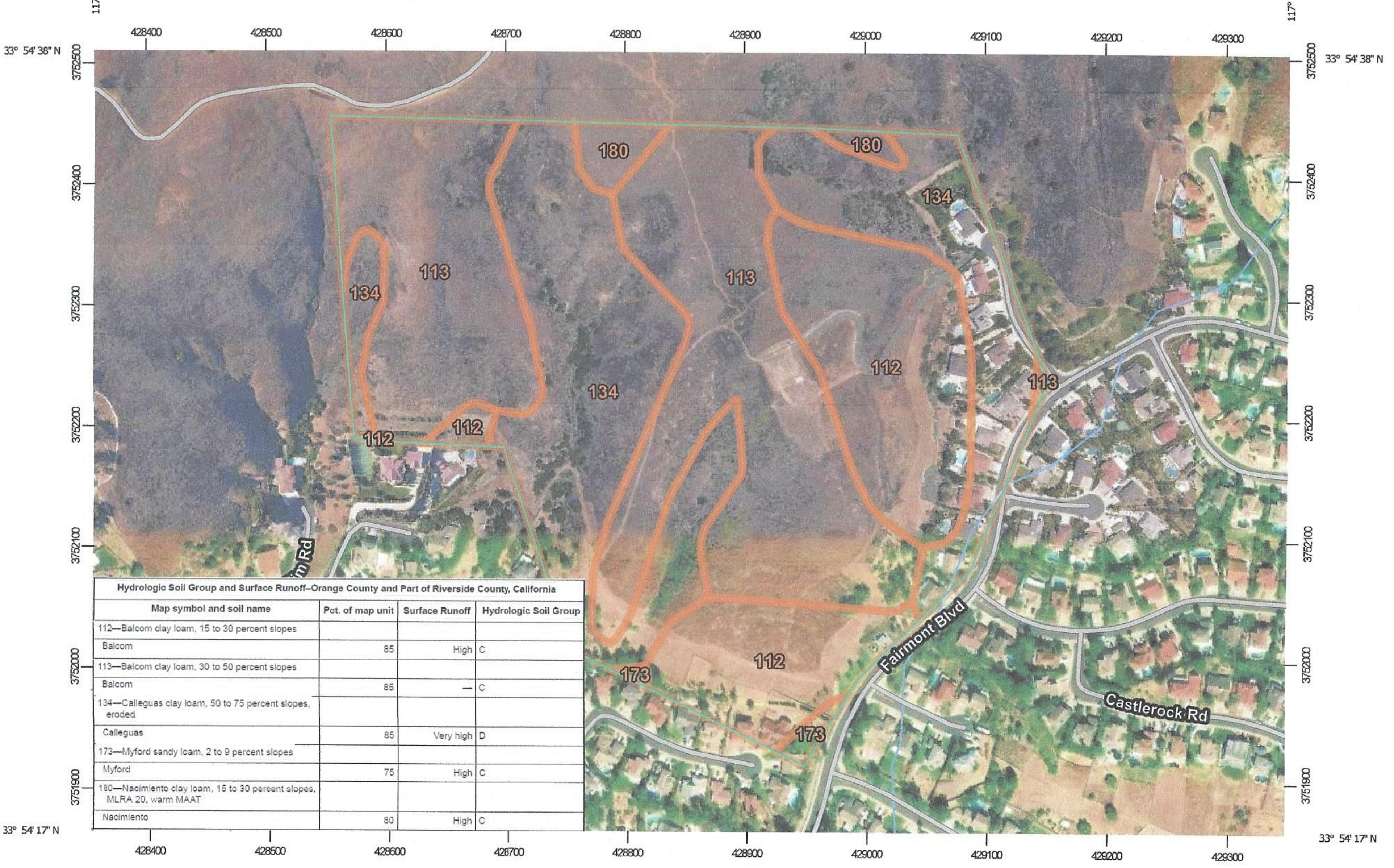


VICINITY MAP

N.T.S.

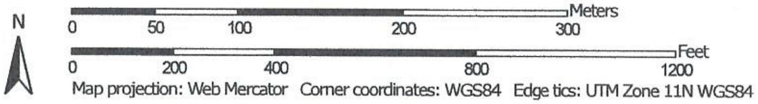
Section III
Hydrologic Soils Classification Map

Soil Map—Orange County and Part of Riverside County, California



Hydrologic Soil Group and Surface Runoff–Orange County and Part of Riverside County, California			
Map symbol and soil name	Pct. of map unit	Surface Runoff	Hydrologic Soil Group
112—Balcom clay loam, 15 to 30 percent slopes			
Balcom	85	High	C
113—Balcom clay loam, 30 to 50 percent slopes			
Balcom	85	—	C
134—Calleguas clay loam, 50 to 75 percent slopes, eroded			
Calleguas	85	Very high	D
173—Myford sandy loam, 2 to 9 percent slopes			
Myford	75	High	C
180—Nacimiento clay loam, 15 to 30 percent slopes, MLRA 20, warm MAAT			
Nacimiento	80	High	C

Map Scale: 1:4,550 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

Section IV
2-Year Event Hydrology Study
Existing Condition

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____________________________________________________________________________
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              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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                          Analysis prepared by:

                       KING CIVIL ENGINEERING CORP.
                     101 S. KRAEMER BLVD. , SUITE 225
                           PLACENTIA, CA. 92870
                  PHONE: 714-996-7010, FAX: 714-996-0322

  ************************** DESCRIPTION OF STUDY
**************************
 * TENTATIVE PARCEL MAP 2020-125
*
 * 2 YEAR HYDROLOGY
*
 * EXISTING CONDITIONS                                  2579E2.RES
*

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*

   FILE NAME: 2579E.2
   TIME/DATE OF STUDY: 08:21 04/15/2020

============================================================================
===
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

============================================================================
===
                    --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =    2.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =   3.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE =
0.95
   *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
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```
 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


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   FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  21
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----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

==========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
   ELEVATION DATA: UPSTREAM(FEET) =   1150.00  DOWNSTREAM(FEET) =
1095.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =     7.217
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.834
   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 POOR COVER
   "BARREN"                   C        2.66      0.25       1.00    80
7.22
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      3.79
   TOTAL AREA(ACRES) =      2.66   PEAK FLOW RATE(CFS) =      3.79


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***
   FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  52
 -------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<
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==========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =   1095.00  DOWNSTREAM(FEET) =
867.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   760.00   CHANNEL SLOPE =  0.3000
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =       3.79
   FLOW VELOCITY(FEET/SEC) =   6.26 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   2.02   Tc(MIN.) =   9.24
   LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =  1060.00
FEET.

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***
   FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =  81
 -------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

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===
   MAINLINE Tc(MIN) =   9.24
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.591
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C       12.84      0.25      1.00    80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =   12.84      SUBAREA RUNOFF(CFS) =   15.50
   EFFECTIVE AREA(ACRES) =     15.50   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =     15.50      PEAK FLOW RATE(CFS) =     18.71

**************************************************************************
***
   FLOW PROCESS FROM NODE     12.00 TO NODE     13.00 IS CODE =  52
 -------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

==========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    867.00  DOWNSTREAM(FEET) =
804.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   450.00   CHANNEL SLOPE =  0.1400
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =     18.71
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   FLOW VELOCITY(FEET/SEC) =   9.31 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   0.81   Tc(MIN.) =  10.05
   LONGEST FLOWPATH FROM NODE      10.00 TO NODE      13.00 =  1510.00
FEET.


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***
   FLOW PROCESS FROM NODE      13.00 TO NODE      13.00 IS CODE =  81
 ---------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

============================================================================
===
   MAINLINE Tc(MIN) =  10.05
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.517
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp         Ap      SCS
        LAND USE              GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                     C        4.63      0.25       1.00    80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =     4.63      SUBAREA RUNOFF(CFS) =     5.28
   EFFECTIVE AREA(ACRES) =      20.13   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      20.13       PEAK FLOW RATE(CFS) =      22.95

 +--------------------------------------------------------------------------
---+
 | CANYON FLOW AT PROPERTY LINE
|
 | Q=22.95 CFS, A=20.13 ACRES, Tc=10.0 MIN.
|
 |
|
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****************************************************************************
***
   FLOW PROCESS FROM NODE      20.00 TO NODE      21.00 IS CODE =  21
 ---------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

============================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   380.00
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   ELEVATION DATA: UPSTREAM(FEET) =   1190.00  DOWNSTREAM(FEET) =
1140.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.477
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.672
   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 POOR COVER
   "BARREN"                  C        2.15      0.25       1.00    80
8.48
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      2.75
   TOTAL AREA(ACRES) =      2.15   PEAK FLOW RATE(CFS) =      2.75


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***
   FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  52
 ------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

=========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =   1140.00  DOWNSTREAM(FEET) =
927.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   570.00   CHANNEL SLOPE =  0.3737
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =      2.75
   FLOW VELOCITY(FEET/SEC) =   5.83 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.63   Tc(MIN.) =  10.11
   LONGEST FLOWPATH FROM NODE     20.00 TO NODE     22.00 =   950.00
FEET.


*************************************************************************
***
   FLOW PROCESS FROM NODE     22.00 TO NODE     22.00 IS CODE =  81
 ------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=========================================================================
===
   MAINLINE Tc(MIN) =  10.11
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.511
   SUBAREA LOSS RATE DATA(AMC  I ):
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```
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                    C        3.63      0.25       1.00     80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =     3.63       SUBAREA RUNOFF(CFS) =    4.12
   EFFECTIVE AREA(ACRES) =       5.78   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =       5.78       PEAK FLOW RATE(CFS) =       6.56

 +-----------------------------------------------------------------------
---+
 | FLOW TO PORPERTY LINE
|
 | Q=6.56 CFS, A=5.78 ACRES, Tc=10.1 MIN.
|
 |
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***
   FLOW PROCESS FROM NODE     30.00 TO NODE     31.00 IS CODE =  21
 -----------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   280.00
   ELEVATION DATA: UPSTREAM(FEET) =   1108.00  DOWNSTREAM(FEET) =
1040.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.637
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.924
   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 POOR COVER
   "BARREN"                    C        0.42      0.25       1.00     80
6.64
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      0.63
   TOTAL AREA(ACRES) =      0.42   PEAK FLOW RATE(CFS) =      0.63
```

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***
   FLOW PROCESS FROM NODE     31.00 TO NODE     32.00 IS CODE =  52
 ---------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

======================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =   1040.00  DOWNSTREAM(FEET) =
867.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   640.00   CHANNEL SLOPE =  0.2703
   NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =       0.63
   FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   2.25   Tc(MIN.) =   8.89
   LONGEST FLOWPATH FROM NODE     30.00 TO NODE     32.00 =   920.00
FEET.


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***
   FLOW PROCESS FROM NODE     32.00 TO NODE     32.00 IS CODE =  81
 ---------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

======================================================================
===
   MAINLINE Tc(MIN) =   8.89
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.627
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        5.29      0.25       1.00    80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    5.29      SUBAREA RUNOFF(CFS) =    6.56
   EFFECTIVE AREA(ACRES) =      5.71   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      5.71       PEAK FLOW RATE(CFS) =      7.08

 +--------------------------------------------------------------------
---+
 | FLOW TO PROPERTY LINE
|
 | Q=7.08 CFS, A=5.71 ACRES, Tc=8.9 MIN.
|
```

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   |
  |
  +-----------------------------------------------------------------------
---+


**************************************************************************
***
   FLOW PROCESS FROM NODE      40.00 TO NODE      41.00 IS CODE =  21
 -------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

==========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
   ELEVATION DATA: UPSTREAM(FEET) =    1125.00  DOWNSTREAM(FEET) =
1034.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.526
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.943
   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 POOR COVER
   "BARREN"                   C         1.15       0.25       1.00    80
6.53
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      1.75
   TOTAL AREA(ACRES) =      1.15   PEAK FLOW RATE(CFS) =      1.75


**************************************************************************
***
   FLOW PROCESS FROM NODE      41.00 TO NODE      42.00 IS CODE =  52
 -------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

==========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    1034.00  DOWNSTREAM(FEET) =
826.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =    690.00   CHANNEL SLOPE =  0.3014
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =      1.75
   FLOW VELOCITY(FEET/SEC) =   5.30 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
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   TRAVEL TIME(MIN.) =   2.17   Tc(MIN.) =   8.70
   LONGEST FLOWPATH FROM NODE     40.00 TO NODE     42.00 =   990.00
FEET.


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***
   FLOW PROCESS FROM NODE     42.00 TO NODE     42.00 IS CODE =  81
 ------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=========================================================================
===
   MAINLINE Tc(MIN) =   8.70
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.647
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp        Ap     SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C       3.49      0.25      1.00    80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =     3.49      SUBAREA RUNOFF(CFS) =    4.39
   EFFECTIVE AREA(ACRES) =      4.64   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      4.64       PEAK FLOW RATE(CFS) =       5.84


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***
   FLOW PROCESS FROM NODE     42.00 TO NODE     42.00 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.) =   8.70
   RAINFALL INTENSITY(INCH/HR) =   1.65
   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25
   AREA-AVERAGED Ap =  1.00
   EFFECTIVE STREAM AREA(ACRES) =      4.64
   TOTAL STREAM AREA(ACRES) =      4.64
   PEAK FLOW RATE(CFS) AT CONFLUENCE =       5.84


*************************************************************************
***
   FLOW PROCESS FROM NODE     50.00 TO NODE     51.00 IS CODE =  21
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 ----------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

============================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =    300.00
   ELEVATION DATA: UPSTREAM(FEET) =   1028.00  DOWNSTREAM(FEET) =
965.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.024
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.863
   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 POOR COVER
   "BARREN"                   C        1.32      0.25       1.00    80
7.02
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      1.92
   TOTAL AREA(ACRES) =      1.32   PEAK FLOW RATE(CFS) =      1.92

****************************************************************************
***
   FLOW PROCESS FROM NODE     51.00 TO NODE     52.00 IS CODE =  52
 ----------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

============================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    965.00  DOWNSTREAM(FEET) =
826.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   350.00   CHANNEL SLOPE =  0.3971
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =      1.92
   FLOW VELOCITY(FEET/SEC) =   5.39 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.08   Tc(MIN.) =   8.11
   LONGEST FLOWPATH FROM NODE     50.00 TO NODE     52.00 =   650.00
FEET.

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***
   FLOW PROCESS FROM NODE     52.00 TO NODE     52.00 IS CODE =  81
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----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

======================================================================
===
   MAINLINE Tc(MIN) =   8.11
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.716
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        1.28      0.25       1.00    80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    1.28      SUBAREA RUNOFF(CFS) =    1.69
   EFFECTIVE AREA(ACRES) =      2.60   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      2.60       PEAK FLOW RATE(CFS) =       3.43


**********************************************************************
***
   FLOW PROCESS FROM NODE     52.00 TO NODE     52.00 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.) =   8.11
   RAINFALL INTENSITY(INCH/HR) =   1.72
   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25
   AREA-AVERAGED Ap =  1.00
   EFFECTIVE STREAM AREA(ACRES) =      2.60
   TOTAL STREAM AREA(ACRES) =      2.60
   PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.43

   ** CONFLUENCE DATA **
    STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
    NUMBER    (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
       1       5.84   8.70     1.647  0.25( 0.25) 1.00      4.6        40.00
       2       3.43   8.11     1.716  0.25( 0.25) 1.00      2.6        50.00

   RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
   CONFLUENCE FORMULA USED FOR  2 STREAMS.

   ** PEAK FLOW RATE TABLE **
    STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
    NUMBER    (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
```

```
      1      9.13    8.11     1.716  0.25( 0.25) 1.00     6.9       50.00
      2      9.11    8.70     1.647  0.25( 0.25) 1.00     7.2       40.00

   COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
   PEAK FLOW RATE(CFS) =       9.13    Tc(MIN.) =     8.11
   EFFECTIVE AREA(ACRES) =      6.92   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =       7.24
   LONGEST FLOWPATH FROM NODE     40.00 TO NODE     52.00 =   990.00
FEET.


**************************************************************************
***
   FLOW PROCESS FROM NODE     52.00 TO NODE     53.00 IS CODE =  52
 -------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

==========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    826.00  DOWNSTREAM(FEET) =
797.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   260.00   CHANNEL SLOPE =  0.1115
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =       9.13
   FLOW VELOCITY(FEET/SEC) =   7.72 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   0.56   Tc(MIN.) =   8.67
   LONGEST FLOWPATH FROM NODE     40.00 TO NODE     53.00 =  1250.00
FEET.


**************************************************************************
***
   FLOW PROCESS FROM NODE     53.00 TO NODE     53.00 IS CODE =  81
 -------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

==========================================================================
===
   MAINLINE Tc(MIN) =   8.67
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.651
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp           Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)   CN
   NATURAL POOR COVER
   "BARREN"                    C         1.98      0.25       1.00     80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    1.98       SUBAREA RUNOFF(CFS) =    2.50
   EFFECTIVE AREA(ACRES) =      8.90   AREA-AVERAGED Fm(INCH/HR) =  0.25
```

```
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      9.22       PEAK FLOW RATE(CFS) =      11.23

 +-------------------------------------------------------------------------
---+
 | OFFSITE FLOW TO PROPERTY LINE
|
 | Q=11.23 CFS, A=9.22 ACRES, Tc=8.7 MIN.
|
 |
|
 +-------------------------------------------------------------------------
---+


**************************************************************************
***
   FLOW PROCESS FROM NODE     60.00 TO NODE     61.00 IS CODE =  21
 -------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

==========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   290.00
   ELEVATION DATA: UPSTREAM(FEET) =    983.00  DOWNSTREAM(FEET) =
907.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.629
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.925
   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 POOR COVER
   "BARREN"                   C        0.70      0.25       1.00    80
6.63
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      1.06
   TOTAL AREA(ACRES) =      0.70   PEAK FLOW RATE(CFS) =      1.06


**************************************************************************
***
   FLOW PROCESS FROM NODE     61.00 TO NODE     62.00 IS CODE =  52
 -------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<
```

```
==========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    907.00  DOWNSTREAM(FEET) =
810.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   350.00   CHANNEL SLOPE =  0.2771
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =       1.06
   FLOW VELOCITY(FEET/SEC) =   4.79 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.22   Tc(MIN.) =   7.85
   LONGEST FLOWPATH FROM NODE     60.00 TO NODE     62.00 =   640.00
FEET.


**************************************************************************
***
   FLOW PROCESS FROM NODE     62.00 TO NODE     62.00 IS CODE =  81
 -------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

==========================================================================
===
   MAINLINE Tc(MIN) =   7.85
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.748
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        1.62      0.25       1.00    80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    1.62       SUBAREA RUNOFF(CFS) =    2.18
   EFFECTIVE AREA(ACRES) =      2.32   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      2.32       PEAK FLOW RATE(CFS) =      3.13

 +------------------------------------------------------------------------
---+
 | OFFSITE FLOW AT PROPERTY LINE
|
 | Q=3.13 CFS, A=2.32 ACRES, Tc=7.8 MIN.
|
 |
|
 +------------------------------------------------------------------------
---+


**************************************************************************
***
   FLOW PROCESS FROM NODE     70.00 TO NODE     71.00 IS CODE =  21
```

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

==========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =    320.00
   ELEVATION DATA: UPSTREAM(FEET) =    986.00  DOWNSTREAM(FEET) =
905.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.943
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.875
   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 POOR COVER
   "BARREN"                   C        0.62      0.25       1.00    80
6.94
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      0.91
   TOTAL AREA(ACRES) =      0.62   PEAK FLOW RATE(CFS) =      0.91


**************************************************************************
***
   FLOW PROCESS FROM NODE     71.00 TO NODE     72.00 IS CODE =  52
 ------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

==========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    905.00  DOWNSTREAM(FEET) =
789.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =    440.00   CHANNEL SLOPE =  0.2636
   NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =       0.91
   FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.55   Tc(MIN.) =   8.49
   LONGEST FLOWPATH FROM NODE     70.00 TO NODE     72.00 =   760.00
FEET.


**************************************************************************
***
   FLOW PROCESS FROM NODE     72.00 TO NODE     72.00 IS CODE =  81
```

```
 ------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

==========================================================================
===
   MAINLINE Tc(MIN) =    8.49
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.671
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA       Fp          Ap      SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                  C        2.24      0.25       1.00     80
   NATURAL POOR COVER
   "BARREN"                  D        0.31      0.20       1.00     83
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.24
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    2.55      SUBAREA RUNOFF(CFS) =    3.27
   EFFECTIVE AREA(ACRES) =      3.17   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      3.17       PEAK FLOW RATE(CFS) =       4.07

 +-----------------------------------------------------------------------
---+
 | OFFSITE FLOW AT PROPERTY LINE
|
 | Q=4.07 CFS, A=3.17 ACRES, Tc=8.5 MIN.
|
 |
|
 +-----------------------------------------------------------------------
---+


**************************************************************************
***
   FLOW PROCESS FROM NODE     80.00 TO NODE     81.00 IS CODE =  21
 ------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

==========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   350.00
   ELEVATION DATA: UPSTREAM(FEET) =    986.00  DOWNSTREAM(FEET) =
866.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.773
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.902
   SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA       Fp          Ap      SCS
Tc
```

16

```
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                    C        1.95      0.25      1.00    80
6.77
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      2.90
   TOTAL AREA(ACRES) =       1.95   PEAK FLOW RATE(CFS) =      2.90

 +--------------------------------------------------------------------------
---+
 | OFFSITE FLOW AT PROPERTY LINE
|
 | Q=2.90 CFS, A=1.95 ACRES, Tc=6.8 MIN.
|
 |
|
 +--------------------------------------------------------------------------
---+


****************************************************************************
***
   FLOW PROCESS FROM NODE     90.00 TO NODE     91.00 IS CODE =  21
 ---------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

============================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   460.00
   ELEVATION DATA: UPSTREAM(FEET) =   1040.00  DOWNSTREAM(FEET) =
877.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.505
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.793
   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 POOR COVER
   "BARREN"                    C        2.34      0.25      1.00    80
7.51
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      3.25
   TOTAL AREA(ACRES) =       2.34   PEAK FLOW RATE(CFS) =      3.25

 +--------------------------------------------------------------------------
---+
```

```
 | OFFSITE FLOW AT PROPERTY LINE
|
 | Q=3.25 CFS, A=2.34 ACRES, Tc=7.5 MIN.
|
 |
|
 +-----------------------------------------------------------------------
---+


***********************************************************************
***
   FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
 ----------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=======================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
   ELEVATION DATA: UPSTREAM(FEET) =   1090.00  DOWNSTREAM(FEET) =
1015.00

   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.)
   NATURAL POOR COVER
   "BARREN"                  C         2.93      0.25       1.00    80
6.78
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      4.35
   TOTAL AREA(ACRES) =      2.93   PEAK FLOW RATE(CFS) =      4.35


***********************************************************************
***
   FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  52
 ----------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

=======================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =   1015.00  DOWNSTREAM(FEET) =
837.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   640.00   CHANNEL SLOPE =  0.2781
```

```
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =       4.35
   FLOW VELOCITY(FEET/SEC) =   6.46 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.65   Tc(MIN.) =   8.43
   LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =   940.00
FEET.


**********************************************************************
***
   FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
 ---------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

======================================================================
===
   MAINLINE Tc(MIN) =   8.43
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.677
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        8.27      0.25       1.00    80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    8.27       SUBAREA RUNOFF(CFS) =   10.62
   EFFECTIVE AREA(ACRES) =     11.20   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =     11.20       PEAK FLOW RATE(CFS) =      14.38

 +--------------------------------------------------------------------
---+
 | OFFSITE FLOW AT PROPERTY LINE
|
 | Q=14.38 CFS, A=11.20 ACRES, Tc=8.4 MIN.
|
 |
|
 +--------------------------------------------------------------------
---+

======================================================================
===
   END OF STUDY SUMMARY:
   TOTAL AREA(ACRES)       =     11.20  TC(MIN.) =      8.43
   EFFECTIVE AREA(ACRES) =      11.20  AREA-AVERAGED Fm(INCH/HR)=  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   PEAK FLOW RATE(CFS)    =     14.38

======================================================================
===
```

Section V
100-Year Event Hydrology Study
Existing Condition

```
____________________________________________________________________________
___

**************************************************************************
***
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
          (c) Copyright 1983-2003 Advanced Engineering Software (aes)
              Ver. 8.0  Release Date: 01/01/2003  License ID 1247

                           Analysis prepared by:

                         KING CIVIL ENGINEERING CORP.
                       101 S. KRAEMER BLVD. , SUITE 225
                            PLACENTIA, CA. 92870
                     PHONE: 714-996-7010, FAX: 714-996-0322

  ************************* DESCRIPTION OF STUDY
**************************
 * TENTATIVE PARCEL MAP 2020-125
*
 * 100 YEAR HYDROLOGY
*
 * EXISTING CONDITIONS       2579E100.RES
*

**************************************************************************
*

   FILE NAME: 2579E.100
   TIME/DATE OF STUDY: 14:44 04/13/2020
==========================================================================
===
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
===
                       --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =  100.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =   3.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE =
0.95
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW
MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:
MANNING
      WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE
FACTOR
```

```
 NO.   (FT)      (FT)     SIDE / SIDE/ WAY    (FT)     (FT)  (FT)  (FT)
(n)
 ===  =====  =========  ================  ======  ===== ====== =====
=======
   1  20.0      10.0    0.010/0.010/ ---    0.50     1.50 0.0313 0.020
0.0150

   GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
     1. Relative Flow-Depth =  0.50 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     10.00 TO NODE     11.00 IS CODE =  21
 ---------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

============================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
   ELEVATION DATA: UPSTREAM(FEET) =   1150.00  DOWNSTREAM(FEET) =
1095.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.217
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.014
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                   C        2.66      0.25      1.00    98
7.22
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =     11.40
   TOTAL AREA(ACRES) =      2.66   PEAK FLOW RATE(CFS) =     11.40


****************************************************************************
***
   FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  52
 ---------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<
```

```
======================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    1095.00  DOWNSTREAM(FEET) =
867.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =    760.00   CHANNEL SLOPE =  0.3000
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =      11.40
   FLOW VELOCITY(FEET/SEC) =   8.17 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.55   Tc(MIN.) =   8.77
   LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =  1060.00
FEET.


**********************************************************************
***
   FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =  81
 ---------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

======================================================================
===
   MAINLINE Tc(MIN) =   8.77
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.525
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C       12.84      0.25      1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =   12.84     SUBAREA RUNOFF(CFS) =   49.40
   EFFECTIVE AREA(ACRES) =     15.50   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =     15.50       PEAK FLOW RATE(CFS) =      59.64


**********************************************************************
***
   FLOW PROCESS FROM NODE     12.00 TO NODE     13.00 IS CODE =  52
 ---------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

======================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =     867.00  DOWNSTREAM(FEET) =
804.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   450.00   CHANNEL SLOPE =  0.1400
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =      59.64
```

```
   FLOW VELOCITY(FEET/SEC) =  12.88 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   0.58   Tc(MIN.) =   9.35
   LONGEST FLOWPATH FROM NODE     10.00 TO NODE     13.00 =  1510.00
FEET.


**************************************************************************
***
   FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =  81
 -------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

==========================================================================
===
   MAINLINE Tc(MIN) =   9.35
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.353
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        4.63      0.25       1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    4.63      SUBAREA RUNOFF(CFS) =   17.10
   EFFECTIVE AREA(ACRES) =     20.13   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =     20.13       PEAK FLOW RATE(CFS) =      74.33

 +------------------------------------------------------------------------
---+
 | CANYON FLOW AT PROPERTY LINE
|
 | Q=74.33 CFS, A=20.13 ACRES, Tc=9.4 MIN.
|
 |
|
 +------------------------------------------------------------------------
---+


**************************************************************************
***
   FLOW PROCESS FROM NODE     20.00 TO NODE     21.00 IS CODE =  21
 -------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

==========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   380.00
```

```
   ELEVATION DATA: UPSTREAM(FEET) =   1190.00  DOWNSTREAM(FEET) =
1140.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.477
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.611
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
Tc
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                  C        2.15      0.25      1.00    98
8.48
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      8.44
   TOTAL AREA(ACRES) =      2.15   PEAK FLOW RATE(CFS) =      8.44


*************************************************************************
***
   FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  52
 ------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

=========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =   1140.00  DOWNSTREAM(FEET) =
927.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   570.00   CHANNEL SLOPE =  0.3737
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =      8.44
   FLOW VELOCITY(FEET/SEC) =    7.57  (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.25    Tc(MIN.) =    9.73
   LONGEST FLOWPATH FROM NODE     20.00 TO NODE     22.00 =   950.00
FEET.


*************************************************************************
***
   FLOW PROCESS FROM NODE     22.00 TO NODE     22.00 IS CODE =  81
 ------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=========================================================================
===
   MAINLINE Tc(MIN) =   9.73
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.240
   SUBAREA LOSS RATE DATA(AMC III):
```

```
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        3.63      0.25       1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    3.63      SUBAREA RUNOFF(CFS) =   13.03
   EFFECTIVE AREA(ACRES) =      5.78   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      5.78       PEAK FLOW RATE(CFS) =      20.75

 +-----------------------------------------------------------------------
---+
 | FLOW TO PROPERTY LINE
|
 | Q=20.75 CFS, A=5.78 ACRES, Tc=9.7 MIN.
|
 |
|
 +-----------------------------------------------------------------------
---+


************************************************************************
***
   FLOW PROCESS FROM NODE     30.00 TO NODE     31.00 IS CODE =  21
 -----------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   280.00
   ELEVATION DATA: UPSTREAM(FEET) =   1108.00  DOWNSTREAM(FEET) =
1040.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.637
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.345
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
Tc
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                   C        0.42      0.25       1.00    98
6.64
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      1.93
   TOTAL AREA(ACRES) =      0.42   PEAK FLOW RATE(CFS) =      1.93
```

```
************************************************************************
***
   FLOW PROCESS FROM NODE     31.00 TO NODE     32.00 IS CODE =  52
 ----------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =   1040.00  DOWNSTREAM(FEET) =
867.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   640.00   CHANNEL SLOPE =  0.2703
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =      1.93
   FLOW VELOCITY(FEET/SEC) =   5.40 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.98   Tc(MIN.) =   8.61
   LONGEST FLOWPATH FROM NODE     30.00 TO NODE     32.00 =   920.00
FEET.


************************************************************************
***
   FLOW PROCESS FROM NODE     32.00 TO NODE     32.00 IS CODE =  81
 ----------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

========================================================================
===
   MAINLINE Tc(MIN) =   8.61
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.571
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
        LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                  C        5.29      0.25      1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.00
   SUBAREA AREA(ACRES) =     5.29      SUBAREA RUNOFF(CFS) =   20.57
   EFFECTIVE AREA(ACRES) =      5.71   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      5.71       PEAK FLOW RATE(CFS) =      22.20

 +----------------------------------------------------------------------
---+
 | FLOW TO PROPERTY LINE
|
 | Q=22.20 CFS, A=5.71 ACRES, Tc=8.6 MIN.
|
  |
|
```

```
 +--------------------------------------------------------------------------
---+


****************************************************************************
***
   FLOW PROCESS FROM NODE     40.00 TO NODE     41.00 IS CODE =  21
 ---------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

============================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
   ELEVATION DATA: UPSTREAM(FEET) =   1125.00  DOWNSTREAM(FEET) =
1034.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.526
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.403
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
Tc
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                    C        1.15      0.25      1.00    98
6.53
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      5.33
   TOTAL AREA(ACRES) =      1.15   PEAK FLOW RATE(CFS) =      5.33


****************************************************************************
***
   FLOW PROCESS FROM NODE     41.00 TO NODE     42.00 IS CODE =  52
 ---------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

============================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =   1034.00  DOWNSTREAM(FEET) =
826.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   690.00   CHANNEL SLOPE =  0.3014
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =      5.33
   FLOW VELOCITY(FEET/SEC) =   6.77 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.70   Tc(MIN.) =   8.22
```

```
   LONGEST FLOWPATH FROM NODE     40.00 TO NODE     42.00 =    990.00
FEET.


*************************************************************************
***
   FLOW PROCESS FROM NODE     42.00 TO NODE     42.00 IS CODE =  81
 ------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=========================================================================
===
   MAINLINE Tc(MIN) =   8.22
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.686
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        3.49      0.25      1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    3.49      SUBAREA RUNOFF(CFS) =   13.93
   EFFECTIVE AREA(ACRES) =       4.64   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =       4.64       PEAK FLOW RATE(CFS) =      18.52


*************************************************************************
***
   FLOW PROCESS FROM NODE     42.00 TO NODE     42.00 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.) =    8.22
   RAINFALL INTENSITY(INCH/HR) =    4.69
   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25
   AREA-AVERAGED Ap =  1.00
   EFFECTIVE STREAM AREA(ACRES) =      4.64
   TOTAL STREAM AREA(ACRES) =      4.64
   PEAK FLOW RATE(CFS) AT CONFLUENCE =      18.52


*************************************************************************
***
   FLOW PROCESS FROM NODE     50.00 TO NODE     51.00 IS CODE =  21
 ------------------------------------------------------------------------
----
```

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

==========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =    300.00
   ELEVATION DATA: UPSTREAM(FEET) =    1028.00  DOWNSTREAM(FEET) =
965.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =     7.024
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.146
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
Tc
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)   CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                    C        1.32      0.25       1.00     98
7.02
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =       5.82
   TOTAL AREA(ACRES) =       1.32   PEAK FLOW RATE(CFS) =       5.82


**************************************************************************
***
   FLOW PROCESS FROM NODE     51.00 TO NODE     52.00 IS CODE =  52
 -------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

==========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =     965.00  DOWNSTREAM(FEET) =
826.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =    350.00   CHANNEL SLOPE =  0.3971
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =      5.82
   FLOW VELOCITY(FEET/SEC) =    6.92 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   0.84   Tc(MIN.) =   7.87
   LONGEST FLOWPATH FROM NODE     50.00 TO NODE     52.00 =   650.00
FEET.


**************************************************************************
***
   FLOW PROCESS FROM NODE     52.00 TO NODE     52.00 IS CODE =  81
 -------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

```
==========================================================================
===
   MAINLINE Tc(MIN) =    7.87
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.791
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER                  1.92
   "BARREN"                    C        1.28      0.25       1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =     1.28       SUBAREA RUNOFF(CFS) =    5.23
   EFFECTIVE AREA(ACRES) =       2.60   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =       2.60       PEAK FLOW RATE(CFS) =      10.63


**************************************************************************
***
   FLOW PROCESS FROM NODE     52.00 TO NODE     52.00 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.) =    7.87
   RAINFALL INTENSITY(INCH/HR) =    4.79
   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25
   AREA-AVERAGED Ap =  1.00
   EFFECTIVE STREAM AREA(ACRES) =      2.60
   TOTAL STREAM AREA(ACRES) =      2.60
   PEAK FLOW RATE(CFS) AT CONFLUENCE =      10.63

   ** CONFLUENCE DATA **
    STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
    NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)        (ACRES)    NODE
       1      18.52   8.22    4.686   0.25( 0.25) 1.00      4.6       40.00
       2      10.63   7.87    4.791   0.25( 0.25) 1.00      2.6       50.00

   RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
   CONFLUENCE FORMULA USED FOR  2 STREAMS.

   ** PEAK FLOW RATE TABLE **
    STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
    NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)        (ACRES)    NODE
       1      28.77   7.87    4.791   0.25( 0.25) 1.00      7.0       50.00
       2      28.90   8.22    4.686   0.25( 0.25) 1.00      7.2       40.00
```

//

```
   COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
   PEAK FLOW RATE(CFS) =      28.90    Tc(MIN.) =      8.22
   EFFECTIVE AREA(ACRES) =      7.24   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      7.24
   LONGEST FLOWPATH FROM NODE      40.00 TO NODE      52.00 =   990.00
FEET.


**************************************************************************
***
   FLOW PROCESS FROM NODE      52.00 TO NODE      53.00 IS CODE =  52
 -------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

==========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    826.00  DOWNSTREAM(FEET) =
797.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   260.00   CHANNEL SLOPE =  0.1115
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =      28.90
   FLOW VELOCITY(FEET/SEC) =  10.48 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   0.41   Tc(MIN.) =   8.64
   LONGEST FLOWPATH FROM NODE      40.00 TO NODE      53.00 =  1250.00
FEET.


**************************************************************************
***
   FLOW PROCESS FROM NODE      53.00 TO NODE      53.00 IS CODE =  81
 -------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

==========================================================================
===
   MAINLINE Tc(MIN) =   8.64
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.564
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                    C        1.98      0.25       1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =     1.98      SUBAREA RUNOFF(CFS) =     7.69
   EFFECTIVE AREA(ACRES) =      9.22   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      9.22       PEAK FLOW RATE(CFS) =      35.79
```

```
   ** PEAK FLOW RATE TABLE **
    STREAM     Q      Tc    Intensity   Fp(Fm)     Ap   Ae      HEADWATER
    NUMBER   (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)        (ACRES)    NODE
       1      35.87   8.28     4.669  0.25( 0.25) 1.00      9.0       50.00
       2      35.79   8.64     4.564  0.25( 0.25) 1.00      9.2       40.00
   NEW PEAK FLOW DATA ARE:
   PEAK FLOW RATE(CFS) =      35.87  Tc(MIN.) =    8.28
   AREA-AVERAGED Fm(INCH/HR) =  0.25  AREA-AVERAGED Fp(INCH/HR) =  0.25
   AREA-AVERAGED Ap =  1.00  EFFECTIVE AREA(ACRES) =       9.02

 +--------------------------------------------------------------------------
---+
 | OFFSITE FLOW TO PROPERTY LINE
|
 | Q=35.87 CFS, A=9.22 ACRES, Tc=8.3 MIN.
|
 |
|
 +--------------------------------------------------------------------------
---+


****************************************************************************
***
   FLOW PROCESS FROM NODE     60.00 TO NODE     61.00 IS CODE =  21
 ---------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

============================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   290.00
   ELEVATION DATA: UPSTREAM(FEET) =    983.00  DOWNSTREAM(FEET) =
907.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.629
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.350
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
Tc
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)   CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                   C        0.70      0.25       1.00     98
6.63
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      3.21
   TOTAL AREA(ACRES) =      0.70  PEAK FLOW RATE(CFS) =      3.21
```

```
*************************************************************************
***
   FLOW PROCESS FROM NODE     61.00 TO NODE     62.00 IS CODE =  52
 ------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

=========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    907.00  DOWNSTREAM(FEET) =
810.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   350.00   CHANNEL SLOPE =  0.2771
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =       3.21
   FLOW VELOCITY(FEET/SEC) =   6.03 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   0.97   Tc(MIN.) =    7.60
   LONGEST FLOWPATH FROM NODE     60.00 TO NODE     62.00 =   640.00
FEET.


*************************************************************************
***
   FLOW PROCESS FROM NODE     62.00 TO NODE     62.00 IS CODE =  81
 ------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=========================================================================
===
   MAINLINE Tc(MIN) =   7.60
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.871
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        1.62      0.25       1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =     1.62      SUBAREA RUNOFF(CFS) =    6.74
   EFFECTIVE AREA(ACRES) =      2.32   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      2.32       PEAK FLOW RATE(CFS) =        9.65

 +-----------------------------------------------------------------------
---+
 | OFFSITE FLOW AT PROPERTY LINE
|
 | Q=9.65 CFS, A=2.32 ACRES, Tc=7.6 MIN.
|
 |
|
```

```
 +-----------------------------------------------------------------------
---+


************************************************************************
***
   FLOW PROCESS FROM NODE      70.00 TO NODE      71.00 IS CODE =  21
 -----------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =    320.00
   ELEVATION DATA: UPSTREAM(FEET) =     986.00  DOWNSTREAM(FEET) =
905.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =     6.943
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.187
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
Tc
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                   C        0.62      0.25       1.00    98
6.94
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =       2.76
   TOTAL AREA(ACRES) =       0.62   PEAK FLOW RATE(CFS) =      2.76


************************************************************************
***
   FLOW PROCESS FROM NODE      71.00 TO NODE      72.00 IS CODE =  52
 -----------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =     905.00  DOWNSTREAM(FEET) =
789.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =    440.00   CHANNEL SLOPE =  0.2636
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =       2.76
   FLOW VELOCITY(FEET/SEC) =   5.83 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.26   Tc(MIN.) =   8.20
```

```
   LONGEST FLOWPATH FROM NODE      70.00 TO NODE      72.00 =   760.00
FEET.


****************************************************************************
***
   FLOW PROCESS FROM NODE      72.00 TO NODE      72.00 IS CODE =  81
 ---------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

============================================================================
===
   MAINLINE Tc(MIN) =    8.20
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.692
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                    C        2.24      0.25       1.00     98
   NATURAL POOR COVER
   "BARREN"                    D        0.31      0.20       1.00     98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.24
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =     2.55       SUBAREA RUNOFF(CFS) =    10.21
   EFFECTIVE AREA(ACRES) =       3.17   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =       3.17       PEAK FLOW RATE(CFS) =      12.69

 +--------------------------------------------------------------------------
---+
 | OFFSITE FLOW AT PROPERTY LINE
|
 | Q=12.69 CFS, A=3.17 ACRES, Tc=8.2 MIN.
|
 |
|
 +--------------------------------------------------------------------------
---+


****************************************************************************
***
   FLOW PROCESS FROM NODE      80.00 TO NODE      81.00 IS CODE =  21
 ---------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

============================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   350.00
   ELEVATION DATA: UPSTREAM(FEET) =    986.00  DOWNSTREAM(FEET) =
866.00
```

```
   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.773
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.275
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
Tc
        LAND USE            GROUP    (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                   C         1.95      0.25       1.00    98
6.77
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      8.82
   TOTAL AREA(ACRES) =      1.95   PEAK FLOW RATE(CFS) =      8.82

 +-----------------------------------------------------------------------
---+
 | OFFSITE FLOW AT PROPERTY LINE
|
 | Q=8.82 CFS, A=1.95 ACRES, Tc=6.8 MIN.
|
 |
|
 +-----------------------------------------------------------------------
---+


************************************************************************
***
   FLOW PROCESS FROM NODE     90.00 TO NODE     91.00 IS CODE =  21
 -----------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   460.00
   ELEVATION DATA: UPSTREAM(FEET) =   1040.00  DOWNSTREAM(FEET) =
877.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.505
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.898
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
Tc
        LAND USE            GROUP    (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                   C         2.34      0.25       1.00    98
7.51
```

```
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =       9.79
   TOTAL AREA(ACRES) =       2.34   PEAK FLOW RATE(CFS) =       9.79

 +-----------------------------------------------------------------------
---+
 | OFFSITE FLOW AT PROPERTY LINE
|
 | Q=9.79 CFS, A=2.34 ACRES, Tc=7.5 MIN.
|
 |
|
 +-----------------------------------------------------------------------
---+


************************************************************************
***
   FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
 -----------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
   ELEVATION DATA: UPSTREAM(FEET) =   1090.00  DOWNSTREAM(FEET) =
1015.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =     6.783
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.270
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
Tc
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                   C        2.93      0.25       1.00    98
6.78
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      13.24
   TOTAL AREA(ACRES) =       2.93   PEAK FLOW RATE(CFS) =      13.24


************************************************************************
***
   FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  52
 -----------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
```

```
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

==========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =   1015.00  DOWNSTREAM(FEET) =
837.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   640.00   CHANNEL SLOPE =  0.2781
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =     13.24
   FLOW VELOCITY(FEET/SEC) =   8.49 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.26    Tc(MIN.) =   8.04
   LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =   940.00
FEET.


**************************************************************************
***
   FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
 -------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

==========================================================================
===
   MAINLINE Tc(MIN) =   8.04
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.741
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        8.27      0.25       1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    8.27       SUBAREA RUNOFF(CFS) =   33.42
   EFFECTIVE AREA(ACRES) =     11.20   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =     11.20       PEAK FLOW RATE(CFS) =      45.26

 +------------------------------------------------------------------------
---+
 | OFFSITE FLOW AT PROPERTY LINE
|
 | Q=45.26 CFS, A=11.20 ACRES, Tc=8.0 MIN.
|
 |
|
 +------------------------------------------------------------------------
---+

==========================================================================
===
   END OF STUDY SUMMARY:
   TOTAL AREA(ACRES)      =     11.20  TC(MIN.) =      8.04
```

```
   EFFECTIVE AREA(ACRES) =      11.20  AREA-AVERAGED Fm(INCH/HR)=  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   PEAK FLOW RATE(CFS)    =     45.26

============================================================================
===

============================================================================
===
   END OF RATIONAL METHOD ANALYSIS
```

Section VI
2-Year Event Hydrology Study
Developed Condition

```
___________________________________________________________________________
___

**************************************************************************
***
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
          (c) Copyright 1983-2003 Advanced Engineering Software (aes)
              Ver. 8.0  Release Date: 01/01/2003  License ID 1247

                           Analysis prepared by:

                        KING CIVIL ENGINEERING CORP.
                      101 S. KRAEMER BLVD. , SUITE 225
                            PLACENTIA, CA. 92870
                   PHONE: 714-996-7010, FAX: 714-996-0322

  ************************** DESCRIPTION OF STUDY
**************************
 * TENTATIVE PARCEL MAP 2020-125
*
 * 2 YEAR HYDROLOGY
*
 * NEW HOUSE CONDITION                             2579N2.RES
*

**************************************************************************
*

   FILE NAME: 2579N.2
   TIME/DATE OF STUDY: 10:24 07/15/2020

==========================================================================
===
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

==========================================================================
===
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =     2.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =    3.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE =
0.95
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW
MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:
MANNING
      WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE
FACTOR
```

```
 NO.   (FT)      (FT)     SIDE / SIDE/ WAY    (FT)     (FT)  (FT)  (FT)
(n)
 ===  =====   =========  ================  ======   ===== ====== =====
=======
  1   20.0      10.0     0.010/0.010/ ---    0.50     1.50 0.0313 0.020
0.0150

   GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
     1. Relative Flow-Depth =  0.50 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     10.00 TO NODE     11.00 IS CODE =  21
 -------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

==========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
   ELEVATION DATA: UPSTREAM(FEET) =   1150.00  DOWNSTREAM(FEET) =
1095.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.217
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.834
   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 POOR COVER
   "BARREN"                   C        2.70      0.25       1.00    80
7.22
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      3.85
   TOTAL AREA(ACRES) =      2.70   PEAK FLOW RATE(CFS) =      3.85


**************************************************************************
***
   FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  52
 -------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<
```

```
========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =   1095.00  DOWNSTREAM(FEET) =
870.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   760.00   CHANNEL SLOPE =  0.2961
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =      3.85
   FLOW VELOCITY(FEET/SEC) =   6.28 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   2.02   Tc(MIN.) =   9.23
   LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =  1060.00
FEET.


************************************************************************
***
   FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =  81
 -----------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

========================================================================
===
   MAINLINE Tc(MIN) =   9.23
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.592
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C       12.74      0.25       1.00    80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =   12.74       SUBAREA RUNOFF(CFS) =   15.38
   EFFECTIVE AREA(ACRES) =     15.44   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =     15.44        PEAK FLOW RATE(CFS) =      18.65


************************************************************************
***
   FLOW PROCESS FROM NODE     12.00 TO NODE     13.00 IS CODE =  52
 -----------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    870.00  DOWNSTREAM(FEET) =
804.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   450.00   CHANNEL SLOPE =  0.1467
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =     18.65
```

```
   FLOW VELOCITY(FEET/SEC) =   9.30 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   0.81   Tc(MIN.) =  10.04
   LONGEST FLOWPATH FROM NODE     10.00 TO NODE     13.00 =  1510.00
FEET.


**************************************************************************
***
   FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =  81
 -------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

==========================================================================
===
   MAINLINE Tc(MIN) =  10.04
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.517
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        1.37      0.25       1.00    80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    1.37      SUBAREA RUNOFF(CFS) =    1.56
   EFFECTIVE AREA(ACRES) =     16.81   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =    16.81       PEAK FLOW RATE(CFS) =     19.17


**************************************************************************
***
   FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 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.) =  10.04
   RAINFALL INTENSITY(INCH/HR) =   1.52
   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25
   AREA-AVERAGED Ap =  1.00
   EFFECTIVE STREAM AREA(ACRES) =    16.81
   TOTAL STREAM AREA(ACRES) =    16.81
   PEAK FLOW RATE(CFS) AT CONFLUENCE =     19.17


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

```
  FLOW PROCESS FROM NODE     20.00 TO NODE     21.00 IS CODE =  21
 ----------------------------------------------------------------------
----
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=========================================================================
===
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   420.00
  ELEVATION DATA: UPSTREAM(FEET) =   1125.00  DOWNSTREAM(FEET) =
1013.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.661
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.772
  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 POOR COVER
  "BARREN"                   C        1.37      0.25       1.00    80
7.66
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA RUNOFF(CFS) =      1.88
  TOTAL AREA(ACRES) =      1.37   PEAK FLOW RATE(CFS) =      1.88


*************************************************************************
***
  FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  52
 ----------------------------------------------------------------------
----
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<

=========================================================================
===
  ELEVATION DATA: UPSTREAM(FEET) =   1013.00  DOWNSTREAM(FEET) =
826.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   460.00   CHANNEL SLOPE =  0.4065
  NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =      1.88
  FLOW VELOCITY(FEET/SEC) =   5.37 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
  TRAVEL TIME(MIN.) =   1.43   Tc(MIN.) =   9.09
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     22.00 =   880.00
FEET.


*************************************************************************
***
  FLOW PROCESS FROM NODE     22.00 TO NODE     22.00 IS CODE =  81
```

```
 ----------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

======================================================================
===
   MAINLINE Tc(MIN) =   9.09
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.606
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                  C        2.89      0.25       1.00    80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    2.89       SUBAREA RUNOFF(CFS) =    3.53
   EFFECTIVE AREA(ACRES) =      4.26   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      4.26       PEAK FLOW RATE(CFS) =       5.20


**********************************************************************
***
   FLOW PROCESS FROM NODE     22.00 TO NODE     13.00 IS CODE =  52
 ----------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

======================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    826.00  DOWNSTREAM(FEET) =
804.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   120.00   CHANNEL SLOPE =  0.1833
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =      5.20
   FLOW VELOCITY(FEET/SEC) =   6.73 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   0.30   Tc(MIN.) =   9.39
   LONGEST FLOWPATH FROM NODE     20.00 TO NODE     13.00 =  1000.00
FEET.


**********************************************************************
***
   FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 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.) =    9.39
   RAINFALL INTENSITY(INCH/HR) =   1.58
   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25
   AREA-AVERAGED Ap =  1.00
   EFFECTIVE STREAM AREA(ACRES) =     4.26
   TOTAL STREAM AREA(ACRES) =     4.26
   PEAK FLOW RATE(CFS) AT CONFLUENCE =       5.20

   ** CONFLUENCE DATA **
    STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
    NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
       1      19.17  10.04     1.517  0.25( 0.25) 1.00     16.8       10.00
       2       5.20   9.39     1.577  0.25( 0.25) 1.00      4.3       20.00

   RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
   CONFLUENCE FORMULA USED FOR  2 STREAMS.

   ** PEAK FLOW RATE TABLE **
    STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
    NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
       1      23.97   9.39     1.577  0.25( 0.25) 1.00     20.0       20.00
       2      24.14  10.04     1.517  0.25( 0.25) 1.00     21.1       10.00

   COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
   PEAK FLOW RATE(CFS) =      24.14    Tc(MIN.) =     10.04
   EFFECTIVE AREA(ACRES) =     21.07   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =     21.07
   LONGEST FLOWPATH FROM NODE      10.00 TO NODE      13.00 =  1510.00
FEET.


*************************************************************************
***
   FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =  81
 ------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=========================================================================
===
   MAINLINE Tc(MIN) =  10.04
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.517
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap       SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)   CN
   NATURAL POOR COVER
   "BARREN"                   C         0.86      0.25       1.00     80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    0.86     SUBAREA RUNOFF(CFS) =     0.98
   EFFECTIVE AREA(ACRES) =     21.93   AREA-AVERAGED Fm(INCH/HR) =  0.25
```

```
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =     21.93       PEAK FLOW RATE(CFS) =      25.01

 +----------------------------------------------------------------------
---+
 | TOTAL FLOW TO CANYON AT PROPERTY LINE ABOVE EX. 27" RCP SD
|
 | Q=25.01 CFS, A=21.93 ACRES, TC=10.0 MIN.
|
 |
|
 +----------------------------------------------------------------------
---+


************************************************************************
***
  FLOW PROCESS FROM NODE     30.00 TO NODE     31.00 IS CODE =  21
 -----------------------------------------------------------------------
----
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

========================================================================
===
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   380.00
  ELEVATION DATA: UPSTREAM(FEET) =   1190.00  DOWNSTREAM(FEET) =
1140.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.477
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.672
  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 POOR COVER
  "BARREN"                   C        2.15      0.25       1.00    80
8.48
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA RUNOFF(CFS) =      2.75
  TOTAL AREA(ACRES) =      2.15   PEAK FLOW RATE(CFS) =      2.75


************************************************************************
***
  FLOW PROCESS FROM NODE     31.00 TO NODE     32.00 IS CODE =  52
 -----------------------------------------------------------------------
----
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
```

```
==========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =   1140.00  DOWNSTREAM(FEET) =
908.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   420.00   CHANNEL SLOPE =  0.5524
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =      2.75
   FLOW VELOCITY(FEET/SEC) =   5.83 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.20   Tc(MIN.) =   9.68
   LONGEST FLOWPATH FROM NODE     30.00 TO NODE     32.00 =   800.00
FEET.


**************************************************************************
***
   FLOW PROCESS FROM NODE     32.00 TO NODE     32.00 IS CODE =  81
 -------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

==========================================================================
===
   MAINLINE Tc(MIN) =   9.68
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.549
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap       SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)   CN
   NATURAL POOR COVER
   "BARREN"                   C        4.09      0.25       1.00     80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    4.09      SUBAREA RUNOFF(CFS) =    4.78
   EFFECTIVE AREA(ACRES) =       6.24   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =       6.24       PEAK FLOW RATE(CFS) =       7.30

  +-----------------------------------------------------------------------
---+
  | OFFSITE FLOW TO NORTHWEST PROPERTY LINE
|
  | Q=7.30 CFS, A=6.24 ACRES, Tc=9.7 MIN.
|
  |
|
  +-----------------------------------------------------------------------
---+


**************************************************************************
***
   FLOW PROCESS FROM NODE     40.00 TO NODE     41.00 IS CODE =  21
```

```
 ------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   390.00
   ELEVATION DATA: UPSTREAM(FEET) =   1110.00  DOWNSTREAM(FEET) =
1005.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.423
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.804
   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 POOR COVER
   "BARREN"                   C        0.59      0.25       1.00    80
7.42
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      0.83
   TOTAL AREA(ACRES) =      0.59   PEAK FLOW RATE(CFS) =      0.83


**************************************************************************
***
   FLOW PROCESS FROM NODE     41.00 TO NODE     42.00 IS CODE =  52
 ------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<
==========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =   1005.00  DOWNSTREAM(FEET) =
900.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   410.00   CHANNEL SLOPE =  0.2561
   NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =      0.83
   FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.44   Tc(MIN.) =   8.86
   LONGEST FLOWPATH FROM NODE     40.00 TO NODE     42.00 =   800.00
FEET.


**************************************************************************
***
   FLOW PROCESS FROM NODE     42.00 TO NODE     42.00 IS CODE =  81
```

```
 ----------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

============================================================================
===
   MAINLINE Tc(MIN) =   8.86
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.630
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        4.46      0.25       1.00    80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    4.46      SUBAREA RUNOFF(CFS) =    5.54
   EFFECTIVE AREA(ACRES) =      5.05   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      5.05       PEAK FLOW RATE(CFS) =       6.27

 +--------------------------------------------------------------------------
---+
 | FLOW TO PROPERTY LINE
|
 | Q=6.27 CFS, A=5.05 ACRES, Tc=8.9 MIN.
|
 |
|
 +--------------------------------------------------------------------------
---+


****************************************************************************
***
   FLOW PROCESS FROM NODE     50.00 TO NODE     51.00 IS CODE =  21
 ----------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

============================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   400.00
   ELEVATION DATA: UPSTREAM(FEET) =    987.00  DOWNSTREAM(FEET) =
866.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.326
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.818
   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.)
```

11

```
   NATURAL POOR COVER
   "BARREN"                 C        2.39      0.25       1.00     80
 7.33
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      3.37
   TOTAL AREA(ACRES) =      2.39   PEAK FLOW RATE(CFS) =       3.37

  +--------------------------------------------------------------------------
 ---+
  | EXISTING SLOPE FLOW TO PROPERTY LINE
 |
  | Q=3.37 CFS, A=2.39 ACRES, Tc=7.3 MIN.
 |
  |
 |
  +--------------------------------------------------------------------------
 ---+


 ****************************************************************************
 ***
   FLOW PROCESS FROM NODE     60.00 TO NODE     61.00 IS CODE =  21
  ---------------------------------------------------------------------------
 ----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

 ============================================================================
 ===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   280.00
   ELEVATION DATA: UPSTREAM(FEET) =   1045.00  DOWNSTREAM(FEET) =
 1005.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.380
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.810
   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 POOR COVER
   "BARREN"                 C        0.80      0.25       1.00     80
 7.38
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      1.12
   TOTAL AREA(ACRES) =      0.80   PEAK FLOW RATE(CFS) =       1.12


 ****************************************************************************
 ***
   FLOW PROCESS FROM NODE     61.00 TO NODE     62.00 IS CODE =  52
```

```
   NATURAL POOR COVER
   "BARREN"                  C        2.39      0.25       1.00    80
7.33
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      3.37
   TOTAL AREA(ACRES) =      2.39   PEAK FLOW RATE(CFS) =      3.37

 +-----------------------------------------------------------------------
---+
 | EXISTING SLOPE FLOW TO PROPERTY LINE
|
 | Q=3.37 CFS, A=2.39 ACRES, Tc=7.3 MIN.
|
 |
|
 +-----------------------------------------------------------------------
---+


*************************************************************************
***
   FLOW PROCESS FROM NODE     60.00 TO NODE     61.00 IS CODE =  21
 ------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   280.00
   ELEVATION DATA: UPSTREAM(FEET) =   1045.00  DOWNSTREAM(FEET) =
1005.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.380
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.810
   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 POOR COVER
   "BARREN"                  C        0.80      0.25       1.00    80
7.38
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      1.12
   TOTAL AREA(ACRES) =      0.80   PEAK FLOW RATE(CFS) =      1.12


*************************************************************************
***
   FLOW PROCESS FROM NODE     61.00 TO NODE     62.00 IS CODE =  52
```

```
 ----------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

=======================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =   1005.00  DOWNSTREAM(FEET) =
965.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   215.00   CHANNEL SLOPE =  0.1860
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =      1.12
   FLOW VELOCITY(FEET/SEC) =   4.85 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   0.74   Tc(MIN.) =   8.12
   LONGEST FLOWPATH FROM NODE     60.00 TO NODE     62.00 =   495.00
FEET.


***********************************************************************
***
   FLOW PROCESS FROM NODE     62.00 TO NODE     62.00 IS CODE =  81
 ----------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=======================================================================
===
   MAINLINE Tc(MIN) =   8.12
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.714
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        0.83      0.25      1.00     80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    0.83       SUBAREA RUNOFF(CFS) =    1.09
   EFFECTIVE AREA(ACRES) =      1.63   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      1.63       PEAK FLOW RATE(CFS) =       2.15


***********************************************************************
***
   FLOW PROCESS FROM NODE     62.00 TO NODE     62.00 IS CODE =  81
 ----------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=======================================================================
===
   MAINLINE Tc(MIN) =   8.12
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.714
```

```
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.40     0.25       0.10    50
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.40      SUBAREA RUNOFF(CFS) =    2.13
  EFFECTIVE AREA(ACRES) =       3.03   AREA-AVERAGED Fm(INCH/HR) =  0.15
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.58
  TOTAL AREA(ACRES) =       3.03       PEAK FLOW RATE(CFS) =       4.28


****************************************************************************
***
  FLOW PROCESS FROM NODE     62.00 TO NODE     63.00 IS CODE =  51
 ---------------------------------------------------------------------------
----
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

============================================================================
===
  ELEVATION DATA: UPSTREAM(FEET) =    965.00  DOWNSTREAM(FEET) =
855.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   700.00   CHANNEL SLOPE =  0.1571
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   1.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.50
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.619
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C        0.50     0.25       1.00    80
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.58
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  13.77
  AVERAGE FLOW DEPTH(FEET) =   0.58   TRAVEL TIME(MIN.) =   0.85
  Tc(MIN.) =   8.97
  SUBAREA AREA(ACRES) =     0.50      SUBAREA RUNOFF(CFS) =    0.62
  EFFECTIVE AREA(ACRES) =      3.53    AREA-AVERAGED Fm(INCH/HR) =
0.16
  AREA-AVERAGED Fp(INCH/HR) =   0.25  AREA-AVERAGED Ap =   0.64
  TOTAL AREA(ACRES) =      3.53       PEAK FLOW RATE(CFS) =       4.63

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.58   FLOW VELOCITY(FEET/SEC.) =  13.64
  LONGEST FLOWPATH FROM NODE     60.00 TO NODE     63.00 =  1195.00
FEET.


****************************************************************************
***
  FLOW PROCESS FROM NODE     63.00 TO NODE     64.00 IS CODE =  51
```

```
 --------------------------------------------------------------------------
----
   >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =     855.00  DOWNSTREAM(FEET) =
835.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =     40.00   CHANNEL SLOPE =  0.5000
   CHANNEL BASE(FEET) =     0.00    "Z" FACTOR =   1.000
   MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =    1.50
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.616
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp         Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C         0.54       0.25       1.00    80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =         4.96
   TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  21.75
   AVERAGE FLOW DEPTH(FEET) =    0.48    TRAVEL TIME(MIN.) =   0.03
   Tc(MIN.) =   9.00
   SUBAREA AREA(ACRES) =      0.54       SUBAREA RUNOFF(CFS) =    0.66
   EFFECTIVE AREA(ACRES) =       4.07     AREA-AVERAGED Fm(INCH/HR) =
 0.17
   AREA-AVERAGED Fp(INCH/HR) =    0.25  AREA-AVERAGED Ap =   0.69
   TOTAL AREA(ACRES) =       4.07         PEAK FLOW RATE(CFS) =        5.29

   END OF SUBAREA CHANNEL FLOW HYDRAULICS:
   DEPTH(FEET) =  0.49   FLOW VELOCITY(FEET/SEC.) =  21.92
   LONGEST FLOWPATH FROM NODE      60.00 TO NODE      64.00 =  1235.00
 FEET.

 **************************************************************************
 ***
   FLOW PROCESS FROM NODE      64.00 TO NODE      64.00 IS CODE =  81
  ------------------------------------------------------------------------
 ----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
 =========================================================================
 ===
   MAINLINE Tc(MIN) =   9.00
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.616
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp         Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C         0.29       0.25       1.00    80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
```

```
   SUBAREA AREA(ACRES) =     0.29      SUBAREA RUNOFF(CFS) =     0.36
   EFFECTIVE AREA(ACRES) =       4.36   AREA-AVERAGED Fm(INCH/HR) =  0.18
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.71
   TOTAL AREA(ACRES) =       4.36       PEAK FLOW RATE(CFS) =       5.64

**************************************************************************
***
   FLOW PROCESS FROM NODE     64.00 TO NODE     65.00 IS CODE =  51
 -------------------------------------------------------------------------
----
   >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

==========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =     835.00  DOWNSTREAM(FEET) =
816.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =    165.00   CHANNEL SLOPE =  0.1152
   CHANNEL BASE(FEET) =     0.00   "Z" FACTOR =   1.000
   MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =    1.50
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.594
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        0.68      0.25       1.00    80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.05
   TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  13.02
   AVERAGE FLOW DEPTH(FEET) =   0.68   TRAVEL TIME(MIN.) =   0.21
   Tc(MIN.) =   9.21
   SUBAREA AREA(ACRES) =     0.68      SUBAREA RUNOFF(CFS) =     0.82
   EFFECTIVE AREA(ACRES) =       5.04     AREA-AVERAGED Fm(INCH/HR) =
0.19
   AREA-AVERAGED Fp(INCH/HR) =   0.25  AREA-AVERAGED Ap =   0.75
   TOTAL AREA(ACRES) =       5.04        PEAK FLOW RATE(CFS) =         6.38

   END OF SUBAREA CHANNEL FLOW HYDRAULICS:
   DEPTH(FEET) =  0.70   FLOW VELOCITY(FEET/SEC.) =  13.13
   LONGEST FLOWPATH FROM NODE     60.00 TO NODE     65.00 =  1400.00
FEET.


**************************************************************************
***
   FLOW PROCESS FROM NODE     65.00 TO NODE     66.00 IS CODE =  51
 -------------------------------------------------------------------------
----
   >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
=======================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    816.00  DOWNSTREAM(FEET) =
796.60
   CHANNEL LENGTH THRU SUBAREA(FEET) =    75.00   CHANNEL SLOPE =  0.2587
   CHANNEL BASE(FEET) =    0.00    "Z" FACTOR =   1.000
   MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.50
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.588
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        0.52      0.25       1.00    80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      6.69
   TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  18.14
   AVERAGE FLOW DEPTH(FEET) =   0.61   TRAVEL TIME(MIN.) =   0.07
   Tc(MIN.) =   9.28
   SUBAREA AREA(ACRES) =     0.52       SUBAREA RUNOFF(CFS) =    0.63
   EFFECTIVE AREA(ACRES) =      5.56     AREA-AVERAGED Fm(INCH/HR) =
0.19
   AREA-AVERAGED Fp(INCH/HR) =   0.25  AREA-AVERAGED Ap =   0.77
   TOTAL AREA(ACRES) =      5.56         PEAK FLOW RATE(CFS) =        6.98

   END OF SUBAREA CHANNEL FLOW HYDRAULICS:
   DEPTH(FEET) =  0.62   FLOW VELOCITY(FEET/SEC.) =  18.44
   LONGEST FLOWPATH FROM NODE     60.00 TO NODE     66.00 =  1475.00
FEET.

 +---------------------------------------------------------------------
---+
 | FLOW TO CANYON ABOVE EX. 24' RCP SD AT PROPERTY LINE  NODE 66
|
 | Q=6.98 CFS, A=5.56 ACRES, TC=9.3 MIN.
|
 |
|
 +---------------------------------------------------------------------
---+


***********************************************************************
***
   FLOW PROCESS FROM NODE     70.00 TO NODE     71.00 IS CODE =  21
 ----------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=======================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   380.00
```

```
   ELEVATION DATA: UPSTREAM(FEET) =    965.00  DOWNSTREAM(FEET) =
891.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.838
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.749
   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 POOR COVER
   "BARREN"                   C        0.76      0.25       1.00    80
7.84
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      1.03
   TOTAL AREA(ACRES) =      0.76   PEAK FLOW RATE(CFS) =      1.03

**********************************************************************
***
   FLOW PROCESS FROM NODE     71.00 TO NODE     71.00 IS CODE =  81
 ---------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

======================================================================
===
   MAINLINE Tc(MIN) =   7.84
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.749
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        0.58      0.25       1.00    80
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    0.58      SUBAREA RUNOFF(CFS) =    0.78
   EFFECTIVE AREA(ACRES) =      1.34   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      1.34       PEAK FLOW RATE(CFS) =      1.81

**********************************************************************
***
   FLOW PROCESS FROM NODE     71.00 TO NODE     72.00 IS CODE =  51
 ---------------------------------------------------------------------
----
   >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

======================================================================
===
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    891.00  DOWNSTREAM(FEET) =
845.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =    95.00   CHANNEL SLOPE =  0.4842
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   1.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.50
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.738
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C         0.93      0.25       1.00     80
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      2.43
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  17.84
  AVERAGE FLOW DEPTH(FEET) =   0.37   TRAVEL TIME(MIN.) =   0.09
  Tc(MIN.) =   7.93
  SUBAREA AREA(ACRES) =     0.93       SUBAREA RUNOFF(CFS) =    1.25
  EFFECTIVE AREA(ACRES) =      2.27     AREA-AVERAGED Fm(INCH/HR) =
0.25
  AREA-AVERAGED Fp(INCH/HR) =   0.25  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =      2.27         PEAK FLOW RATE(CFS) =       3.04

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.40   FLOW VELOCITY(FEET/SEC.) =  18.85
  LONGEST FLOWPATH FROM NODE     70.00 TO NODE     72.00 =   475.00
FEET.

*************************************************************************
***
  FLOW PROCESS FROM NODE     72.00 TO NODE     73.00 IS CODE =  51
 ------------------------------------------------------------------------
----
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=========================================================================
===
  ELEVATION DATA: UPSTREAM(FEET) =    845.00  DOWNSTREAM(FEET) =
817.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.1400
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   1.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.50
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.704
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C         0.35      0.25       1.00     80
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.27
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  12.01
```

```
   AVERAGE FLOW DEPTH(FEET) =    0.52   TRAVEL TIME(MIN.) =    0.28
   Tc(MIN.) =    8.20
   SUBAREA AREA(ACRES) =       0.35       SUBAREA RUNOFF(CFS) =    0.46
   EFFECTIVE AREA(ACRES) =       2.62     AREA-AVERAGED Fm(INCH/HR) =
0.25
   AREA-AVERAGED Fp(INCH/HR) =   0.25  AREA-AVERAGED Ap =   1.00
   TOTAL AREA(ACRES) =       2.62        PEAK FLOW RATE(CFS) =       3.43

   END OF SUBAREA CHANNEL FLOW HYDRAULICS:
   DEPTH(FEET) =  0.53   FLOW VELOCITY(FEET/SEC.) =  12.15
   LONGEST FLOWPATH FROM NODE      70.00 TO NODE      73.00 =   675.00
FEET.


****************************************************************************
***
   FLOW PROCESS FROM NODE      73.00 TO NODE      73.00 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.) =    8.20
   RAINFALL INTENSITY(INCH/HR) =    1.70
   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25
   AREA-AVERAGED Ap =  1.00
   EFFECTIVE STREAM AREA(ACRES) =      2.62
   TOTAL STREAM AREA(ACRES) =      2.62
   PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.43


****************************************************************************
***
   FLOW PROCESS FROM NODE      80.00 TO NODE      81.00 IS CODE =  21
 ----------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

============================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =    140.00
   ELEVATION DATA: UPSTREAM(FEET) =     900.00  DOWNSTREAM(FEET) =
840.00

   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.)
   NATURAL POOR COVER
   "BARREN"                  C        0.41      0.25       1.00     80
5.00
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      0.74
   TOTAL AREA(ACRES) =      0.41   PEAK FLOW RATE(CFS) =      0.74


*************************************************************************
***
   FLOW PROCESS FROM NODE     81.00 TO NODE     73.00 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.) =    5.00
   RAINFALL INTENSITY(INCH/HR) =   2.26
   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25
   AREA-AVERAGED Ap =  1.00
   EFFECTIVE STREAM AREA(ACRES) =     0.41
   TOTAL STREAM AREA(ACRES) =     0.41
   PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.74

   ** CONFLUENCE DATA **
    STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae     HEADWATER
    NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
       1      3.43   8.20     1.704  0.25( 0.25) 1.00     2.6      70.00
       2      0.74   5.00     2.264  0.25( 0.25) 1.00     0.4      80.00

   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      3.64   5.00     2.264  0.25( 0.25) 1.00     2.0      80.00
       2      3.96   8.20     1.704  0.25( 0.25) 1.00     3.0      70.00

   COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
   PEAK FLOW RATE(CFS) =      3.96    Tc(MIN.) =      8.20
   EFFECTIVE AREA(ACRES) =      3.03   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25   AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      3.03
```

```
  LONGEST FLOWPATH FROM NODE     70.00 TO NODE     73.00 =   675.00
FEET.


****************************************************************************
***
  FLOW PROCESS FROM NODE     73.00 TO NODE     74.00 IS CODE =  51
 ---------------------------------------------------------------------------
----
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

============================================================================
===
  ELEVATION DATA: UPSTREAM(FEET) =    817.00  DOWNSTREAM(FEET) =
806.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   120.00   CHANNEL SLOPE =  0.0917
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   1.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.50
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.682
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C        0.35      0.25       1.00    80
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =        4.19
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  10.87
  AVERAGE FLOW DEPTH(FEET) =   0.62   TRAVEL TIME(MIN.) =   0.18
  Tc(MIN.) =    8.39
  SUBAREA AREA(ACRES) =      0.35       SUBAREA RUNOFF(CFS) =     0.45
  EFFECTIVE AREA(ACRES) =       3.38     AREA-AVERAGED Fm(INCH/HR) =
 0.25
  AREA-AVERAGED Fp(INCH/HR) =   0.25  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =       3.38        PEAK FLOW RATE(CFS) =        4.36

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.63   FLOW VELOCITY(FEET/SEC.) =  11.03
  LONGEST FLOWPATH FROM NODE     70.00 TO NODE     74.00 =   795.00
FEET.

  +-------------------------------------------------------------------------
 ---+
  | PARTIAL FLOW TO FAIRMONT BLVD. PARKWAY CULVERT AT DRIVEWAY
 |
  | Q=6.48 CFS, A=4.78 ACRES, Tc=8.3 MIN.
 |
  |
 |
  +-------------------------------------------------------------------------
 ---+
```

```
*************************************************************************
***
   FLOW PROCESS FROM NODE      74.00 TO NODE      74.00 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.) =    8.39
   RAINFALL INTENSITY(INCH/HR) =    1.68
   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25
   AREA-AVERAGED Ap =  1.00
   EFFECTIVE STREAM AREA(ACRES) =      3.38
   TOTAL STREAM AREA(ACRES) =      3.38
   PEAK FLOW RATE(CFS) AT CONFLUENCE =       4.36


*************************************************************************
***
   FLOW PROCESS FROM NODE     100.00 TO NODE     101.00 IS CODE =  21
 ------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =    300.00
   ELEVATION DATA: UPSTREAM(FEET) =     965.00  DOWNSTREAM(FEET) =
924.00

   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                 C        0.41       0.25       0.10    50
5.00
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
   SUBAREA RUNOFF(CFS) =       0.83
   TOTAL AREA(ACRES) =       0.41   PEAK FLOW RATE(CFS) =       0.83


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

```
   FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  62
 ----------------------------------------------------------------------
----
   >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
   >>>>>(STREET TABLE SECTION #  1 USED)<<<<<

======================================================================
===
   UPSTREAM ELEVATION(FEET) =  924.00  DOWNSTREAM ELEVATION(FEET) =
806.00
   STREET LENGTH(FEET) =   855.00   CURB HEIGHT(INCHES) =  6.0
   STREET HALFWIDTH(FEET) = 20.00

   DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
   INSIDE STREET CROSSFALL(DECIMAL) =  0.010
   OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.010

   SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
   Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =
0.0150

     **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.15
     STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
     STREET FLOW DEPTH(FEET) =  0.10
     HALFSTREET FLOOD WIDTH(FEET) =    6.63
     AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.25
     PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.44
   STREET FLOW TRAVEL TIME(MIN.) =   3.35   Tc(MIN.) =   8.35
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.686
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   COMMERCIAL                 C        0.43      0.25       0.10    50
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
   SUBAREA AREA(ACRES) =    0.43      SUBAREA RUNOFF(CFS) =    0.64
   EFFECTIVE AREA(ACRES) =       0.84    AREA-AVERAGED Fm(INCH/HR) =  0.02
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.10
   TOTAL AREA(ACRES) =       0.84        PEAK FLOW RATE(CFS) =      1.26

   END OF SUBAREA STREET FLOW HYDRAULICS:
   DEPTH(FEET) = 0.11   HALFSTREET FLOOD WIDTH(FEET) =   6.92
   FLOW VELOCITY(FEET/SEC.) =  4.33   DEPTH*VELOCITY(FT*FT/SEC.) =   0.46
   LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =  1155.00
FEET.

**********************************************************************
***
   FLOW PROCESS FROM NODE    102.00 TO NODE     74.00 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.) =    8.35
   RAINFALL INTENSITY(INCH/HR) =   1.69
   AREA-AVERAGED Fm(INCH/HR) =  0.02
   AREA-AVERAGED Fp(INCH/HR) =  0.25
   AREA-AVERAGED Ap =  0.10
   EFFECTIVE STREAM AREA(ACRES) =      0.84
   TOTAL STREAM AREA(ACRES) =      0.84
   PEAK FLOW RATE(CFS) AT CONFLUENCE =        1.26

   ** CONFLUENCE DATA **
    STREAM     Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
    NUMBER   (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)        (ACRES)     NODE
       1      4.17    5.19     2.217   0.25( 0.25) 1.00      2.4       80.00
       1      4.36    8.39     1.682   0.25( 0.25) 1.00      3.4       70.00
       2      1.26    8.35     1.686   0.25( 0.02) 0.10      0.8      100.00

   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      5.20    5.19     2.217   0.25( 0.21) 0.84      2.9       80.00
       2      5.61    8.35     1.686   0.25( 0.21) 0.82      4.2      100.00
       3      5.61    8.39     1.682   0.25( 0.21) 0.82      4.2       70.00

   COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
   PEAK FLOW RATE(CFS) =        5.61     Tc(MIN.) =     8.35
   EFFECTIVE AREA(ACRES) =      4.21    AREA-AVERAGED Fm(INCH/HR) =  0.21
   AREA-AVERAGED Fp(INCH/HR) =  0.25    AREA-AVERAGED Ap =  0.82
   TOTAL AREA(ACRES) =        4.22
   LONGEST FLOWPATH FROM NODE     100.00 TO NODE     74.00 =  1155.00
FEET.

 +--------------------------------------------------------------------------
---+
 | TOTAL FLOW DRIVEWAY AND V DITCH AT FAIRMONT BLVD. CULVERT
|
 | Q=5.61 CFS, A= 4.22 ACRES, TC= 8.3 MIN.
|
 | NODE 74
|
 +--------------------------------------------------------------------------
---+


****************************************************************************
***
   FLOW PROCESS FROM NODE     90.00 TO NODE     91.00 IS CODE =  22
```

```
 -----------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>>>>USE SPECIFIED Tc VALUE FOR INITIAL SUBAREA<<<

========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   855.00
   USER SPECIFIED Tc(MIN.) =    5.000
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
   SUBAREA LOSS RATE DATA(AMC  I ):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   D        0.14      0.20       1.00    83
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      0.26
   TOTAL AREA(ACRES) =      0.14   PEAK FLOW RATE(CFS) =      0.26

 +----------------------------------------------------------------------
---+
 | SLOPE FLOW TO FAIRMONT BLVD.
|
 | Q=0.26 CFS, A=0.14 ACRES, Tc=5.0 MIN.
|
 |
|
 +----------------------------------------------------------------------
---+


************************************************************************
***
   FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  21
 -----------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   430.00
   ELEVATION DATA: UPSTREAM(FEET) =    845.00  DOWNSTREAM(FEET) =
790.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.957
   *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.620
   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 POOR COVER
   "BARREN"                   C        1.69      0.25      1.00    80
8.96
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =       2.08
   TOTAL AREA(ACRES) =       1.69   PEAK FLOW RATE(CFS) =       2.08

 +--------------------------------------------------------------------------
---+
 | FLOW TO SOUTHERLY FAIRMONT BLVD. CULVERT
|
 | Q=2.08 CFS, A=1.69 ACRES, Tc=9.0 MIN.
|
 |
|
 +--------------------------------------------------------------------------
---+

============================================================================
===
   END OF STUDY SUMMARY:
   TOTAL AREA(ACRES)      =       1.69  TC(MIN.) =       8.96
   EFFECTIVE AREA(ACRES) =       1.69  AREA-AVERAGED Fm(INCH/HR)=  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   PEAK FLOW RATE(CFS)    =       2.08

============================================================================
===

============================================================================
===
   END OF RATIONAL METHOD ANALYSIS
```

Section VII
100-Year Event Hydrology Study
Developed Condition

```
____________________________________________________________________________
___

************************************************************************
***
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
          (c) Copyright 1983-2003 Advanced Engineering Software (aes)
              Ver. 8.0  Release Date: 01/01/2003  License ID 1247

                           Analysis prepared by:

                         KING CIVIL ENGINEERING CORP.
                     101 S. KRAEMER BLVD. , SUITE 225
                           PLACENTIA, CA. 92870
                  PHONE: 714-996-7010, FAX: 714-996-0322

  ************************** DESCRIPTION OF STUDY
**************************
 * TENTATIVE PARCEL MAP 2020-125
*
 * 100 YEAR HYDROLOGY STUDY
*
 * NEW HOUSE CONDITION                        2579N100.RES
*

************************************************************************
*

   FILE NAME: 2579N.100
   TIME/DATE OF STUDY: 14:50 07/15/2020

========================================================================
===
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

========================================================================
===
                      --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =  100.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =    3.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE =
0.95
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW
MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:
MANNING
      WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE
FACTOR
```

```
 NO.   (FT)      (FT)    SIDE / SIDE/ WAY    (FT)     (FT)  (FT)  (FT)
(n)
 ===  =====  =========  ================  ======  ===== ====== =====
=======
   1   20.0     10.0    0.010/0.010/ ---    0.50    1.50 0.0313 0.020
0.0150
   2   20.0     10.0    0.010/0.010/ ---    0.50    1.50 0.0313 0.020
0.0150

   GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
     1. Relative Flow-Depth =  0.50 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     10.00 TO NODE     11.00 IS CODE =  21
 ------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
   ELEVATION DATA: UPSTREAM(FEET) =   1150.00  DOWNSTREAM(FEET) =
1095.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.217
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.014
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                  C        2.70      0.25       1.00    98
7.22
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =     11.58
   TOTAL AREA(ACRES) =      2.70   PEAK FLOW RATE(CFS) =     11.58


*************************************************************************
***
   FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  52
 ------------------------------------------------------------------------
----
```

```
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

=========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =   1095.00  DOWNSTREAM(FEET) =
870.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   760.00   CHANNEL SLOPE =  0.2961
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =     11.58
   FLOW VELOCITY(FEET/SEC) =   8.20 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.54   Tc(MIN.) =   8.76
   LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =  1060.00
FEET.


*************************************************************************
***
   FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =  81
 ------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=========================================================================
===
   MAINLINE Tc(MIN) =   8.76
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.527
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                  C       12.74      0.25      1.00     98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =   12.74      SUBAREA RUNOFF(CFS) =   49.04
   EFFECTIVE AREA(ACRES) =     15.44   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =     15.44      PEAK FLOW RATE(CFS) =     59.43


*************************************************************************
***
   FLOW PROCESS FROM NODE     12.00 TO NODE     13.00 IS CODE =  52
 ------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

=========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    870.00  DOWNSTREAM(FEET) =
804.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   450.00   CHANNEL SLOPE =  0.1467
```

```
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =      59.43
   FLOW VELOCITY(FEET/SEC) =  12.87 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   0.58    Tc(MIN.) =   9.34
   LONGEST FLOWPATH FROM NODE      10.00 TO NODE      13.00 =  1510.00
FEET.


************************************************************************
***
   FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =  81
 -----------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

========================================================================
===
   MAINLINE Tc(MIN) =   9.34
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.354
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                    C        1.37      0.25       1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =     1.37      SUBAREA RUNOFF(CFS) =     5.06
   EFFECTIVE AREA(ACRES) =     16.81   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =     16.81        PEAK FLOW RATE(CFS) =     62.09


************************************************************************
***
   FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 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.) =    9.34
   RAINFALL INTENSITY(INCH/HR) =    4.35
   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25
   AREA-AVERAGED Ap =  1.00
   EFFECTIVE STREAM AREA(ACRES) =     16.81
   TOTAL STREAM AREA(ACRES) =     16.81
   PEAK FLOW RATE(CFS) AT CONFLUENCE =     62.09
```

```
****************************************************************************
***
   FLOW PROCESS FROM NODE     20.00 TO NODE     21.00 IS CODE =  21
 ----------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

============================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   420.00
   ELEVATION DATA: UPSTREAM(FEET) =   1125.00  DOWNSTREAM(FEET) =
1013.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.661
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.852
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL  AREA      Fp         Ap     SCS
Tc
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                   C        1.37      0.25       1.00    98
7.66
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      5.67
   TOTAL AREA(ACRES) =       1.37  PEAK FLOW RATE(CFS) =       5.67


****************************************************************************
***
   FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  52
 ----------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

============================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =   1013.00  DOWNSTREAM(FEET) =
826.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   460.00   CHANNEL SLOPE =  0.4065
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =       5.67
   FLOW VELOCITY(FEET/SEC) =   6.87 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.12   Tc(MIN.) =   8.78
   LONGEST FLOWPATH FROM NODE     20.00 TO NODE     22.00 =   880.00
FEET.
```

```
************************************************************************
***
   FLOW PROCESS FROM NODE     22.00 TO NODE     22.00 IS CODE =  81
 -----------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

========================================================================
===
   MAINLINE Tc(MIN) =   8.78
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.522
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        2.89      0.25       1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    2.89       SUBAREA RUNOFF(CFS) =   11.11
   EFFECTIVE AREA(ACRES) =      4.26   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      4.26       PEAK FLOW RATE(CFS) =      16.38


************************************************************************
***
   FLOW PROCESS FROM NODE     22.00 TO NODE     13.00 IS CODE =  52
 -----------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    826.00  DOWNSTREAM(FEET) =
804.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   120.00   CHANNEL SLOPE =  0.1833
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =     16.38
   FLOW VELOCITY(FEET/SEC) =   8.98 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   0.22   Tc(MIN.) =    9.00
   LONGEST FLOWPATH FROM NODE     20.00 TO NODE     13.00 =  1000.00
FEET.


************************************************************************
***
   FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 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.) =    9.00
   RAINFALL INTENSITY(INCH/HR) =    4.46
   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25
   AREA-AVERAGED Ap =  1.00
   EFFECTIVE STREAM AREA(ACRES) =      4.26
   TOTAL STREAM AREA(ACRES) =      4.26
   PEAK FLOW RATE(CFS) AT CONFLUENCE =      16.38

   ** CONFLUENCE DATA **
    STREAM      Q      Tc    Intensity   Fp(Fm)       Ap    Ae      HEADWATER
    NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
       1      62.09    9.34     4.354  0.25( 0.25) 1.00     16.8       10.00
       2      16.38    9.00     4.456  0.25( 0.25) 1.00      4.3       20.00

   RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
   CONFLUENCE FORMULA USED FOR  2 STREAMS.

   ** PEAK FLOW RATE TABLE **
    STREAM      Q      Tc    Intensity   Fp(Fm)       Ap    Ae      HEADWATER
    NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
       1      77.67    9.00     4.456  0.25( 0.25) 1.00     20.4       20.00
       2      78.08    9.34     4.354  0.25( 0.25) 1.00     21.1       10.00

   COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
   PEAK FLOW RATE(CFS) =      78.08     Tc(MIN.) =      9.34
   EFFECTIVE AREA(ACRES) =     21.07   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25   AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      21.07
   LONGEST FLOWPATH FROM NODE      10.00 TO NODE      13.00 =  1510.00
FEET.

************************************************************************
***
   FLOW PROCESS FROM NODE      13.00 TO NODE      13.00 IS CODE =  81
 -----------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

========================================================================
===
   MAINLINE Tc(MIN) =    9.34
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.354
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C         0.86       0.25        1.00     98
```

```
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =     0.86      SUBAREA RUNOFF(CFS) =    3.18
   EFFECTIVE AREA(ACRES) =      21.93   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      21.93       PEAK FLOW RATE(CFS) =      81.01

 +----------------------------------------------------------------------
---+
 | TOTAL FLOW TO CANYON AT PROPERTY LINE ABOVE EX. 27" RCP SD
|
 | Q=81.01 CFS, A=21.93 ACRES, Tc=9.3 MIN.
|
 |
|
 +----------------------------------------------------------------------
---+


**************************************************************************
***
   FLOW PROCESS FROM NODE     30.00 TO NODE     31.00 IS CODE =  21
 ----------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

==========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   380.00
   ELEVATION DATA: UPSTREAM(FEET) =   1190.00  DOWNSTREAM(FEET) =
1140.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.477
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.611
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                   C        2.15      0.25       1.00    98
8.48
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      8.44
   TOTAL AREA(ACRES) =       2.15   PEAK FLOW RATE(CFS) =      8.44


**************************************************************************
***
   FLOW PROCESS FROM NODE     31.00 TO NODE     32.00 IS CODE =  52
```

```
 ----------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

============================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =   1140.00  DOWNSTREAM(FEET) =
908.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   420.00   CHANNEL SLOPE =  0.5524
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =       8.44
   FLOW VELOCITY(FEET/SEC) =   7.57 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   0.92   Tc(MIN.) =   9.40
   LONGEST FLOWPATH FROM NODE     30.00 TO NODE     32.00 =   800.00
FEET.


****************************************************************************
***
   FLOW PROCESS FROM NODE     32.00 TO NODE     32.00 IS CODE =  81
 ----------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

============================================================================
===
   MAINLINE Tc(MIN) =   9.40
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.337
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        4.09      0.25       1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =     4.09      SUBAREA RUNOFF(CFS) =    15.05
   EFFECTIVE AREA(ACRES) =      6.24   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      6.24       PEAK FLOW RATE(CFS) =      22.95

 +---------------------------------------------------------------------------
---+
 | OFFSITE FLOW TO NORTHWEST PROPERTY LINE
|
 | Q=22.95 CFS, A=6.24 ACRES, TC=9.4 MIN.
|
 |
|
 +---------------------------------------------------------------------------
---+
```

```
***************************************************************************
***
   FLOW PROCESS FROM NODE     40.00 TO NODE     41.00 IS CODE =  21
 --------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

===========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   390.00
   ELEVATION DATA: UPSTREAM(FEET) =   1110.00  DOWNSTREAM(FEET) =
1005.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.423
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.940
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
Tc
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                  C        0.59      0.25       1.00    98
7.42
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      2.49
   TOTAL AREA(ACRES) =      0.59   PEAK FLOW RATE(CFS) =       2.49


***************************************************************************
***
   FLOW PROCESS FROM NODE     41.00 TO NODE     42.00 IS CODE =  52
 --------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

===========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =   1005.00  DOWNSTREAM(FEET) =
900.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   410.00   CHANNEL SLOPE =  0.2561
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =      2.49
   FLOW VELOCITY(FEET/SEC) =   5.70 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.20   Tc(MIN.) =   8.62
   LONGEST FLOWPATH FROM NODE     40.00 TO NODE     42.00 =   800.00
FEET.
```

```
*************************************************************************
***
   FLOW PROCESS FROM NODE     42.00 TO NODE     42.00 IS CODE =  81
 ------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=========================================================================
===
   MAINLINE Tc(MIN) =   8.62
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.568
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)   (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        4.46      0.25        1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    4.46      SUBAREA RUNOFF(CFS) =   17.33
   EFFECTIVE AREA(ACRES) =       5.05   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      5.05       PEAK FLOW RATE(CFS) =      19.63

 +-----------------------------------------------------------------------
---+
 | FLOW TO PROPERTY LINE
|
 | Q=19.63 CFS, A=5.05 ACRES, TC=8.6 MIN.
|
 |
|
 +-----------------------------------------------------------------------
---+


*************************************************************************
***
   FLOW PROCESS FROM NODE     50.00 TO NODE     51.00 IS CODE =  21
 ------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   400.00
   ELEVATION DATA: UPSTREAM(FEET) =    987.00  DOWNSTREAM(FEET) =
866.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.326
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.990
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
```

```
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                  C         2.39      0.25       1.00    98
7.33
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =     10.20
   TOTAL AREA(ACRES) =       2.39   PEAK FLOW RATE(CFS) =      10.20

 +--------------------------------------------------------------------------
---+
 | EXISTING SLOPE FLOW TO PROPERTY LINE
|
 | Q=10.20 CFS, A=2.39 ACRES, TC=7.3 MIN.
|
 |
|
 +--------------------------------------------------------------------------
---+


****************************************************************************
***
   FLOW PROCESS FROM NODE     60.00 TO NODE     61.00 IS CODE =  21
 ---------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

============================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   280.00
   ELEVATION DATA: UPSTREAM(FEET) =   1045.00  DOWNSTREAM(FEET) =
1005.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.380
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.962
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                  C         0.80      0.25       1.00    98
7.38
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      3.39
   TOTAL AREA(ACRES) =       0.80   PEAK FLOW RATE(CFS) =       3.39
```

```
**********************************************************************
***
   FLOW PROCESS FROM NODE      61.00 TO NODE      62.00 IS CODE =  52
 ---------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

======================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    1005.00  DOWNSTREAM(FEET) =
965.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =    215.00   CHANNEL SLOPE =  0.1860
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =         3.39
   FLOW VELOCITY(FEET/SEC) =    6.10 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   0.59   Tc(MIN.) =    7.97
   LONGEST FLOWPATH FROM NODE      60.00 TO NODE      62.00 =   495.00
FEET.


**********************************************************************
***
   FLOW PROCESS FROM NODE      62.00 TO NODE      62.00 IS CODE =  81
 ---------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

======================================================================
===
   MAINLINE Tc(MIN) =    7.97
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.762
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                    C        0.83       0.25       1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =     0.83      SUBAREA RUNOFF(CFS) =     3.37
   EFFECTIVE AREA(ACRES) =       1.63   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =       1.63       PEAK FLOW RATE(CFS) =        6.62


**********************************************************************
***
   FLOW PROCESS FROM NODE      62.00 TO NODE      62.00 IS CODE =  81
 ---------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

```
==========================================================================
===
   MAINLINE Tc(MIN) =   7.97
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.762
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   COMMERCIAL                  C        1.40      0.25       0.10    86
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
   SUBAREA AREA(ACRES) =    1.40      SUBAREA RUNOFF(CFS) =    5.97
   EFFECTIVE AREA(ACRES) =       3.03   AREA-AVERAGED Fm(INCH/HR) =  0.15
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.58
   TOTAL AREA(ACRES) =       3.03       PEAK FLOW RATE(CFS) =      12.59


*************************************************************************
***
   FLOW PROCESS FROM NODE     62.00 TO NODE     63.00 IS CODE =  51
 ------------------------------------------------------------------------
----
   >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

==========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    965.00  DOWNSTREAM(FEET) =
855.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   700.00   CHANNEL SLOPE =  0.1571
   CHANNEL BASE(FEET) =     0.00    "Z" FACTOR =    1.000
   MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =    1.50
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.568
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                    C        0.50      0.25       1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      13.56
   TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  17.81
   AVERAGE FLOW DEPTH(FEET) =   0.87   TRAVEL TIME(MIN.) =   0.66
   Tc(MIN.) =   8.62
   SUBAREA AREA(ACRES) =      0.50       SUBAREA RUNOFF(CFS) =    1.94
   EFFECTIVE AREA(ACRES) =       3.53     AREA-AVERAGED Fm(INCH/HR) =
0.16
   AREA-AVERAGED Fp(INCH/HR) =   0.25  AREA-AVERAGED Ap =   0.64
   TOTAL AREA(ACRES) =       3.53        PEAK FLOW RATE(CFS) =      14.00

   END OF SUBAREA CHANNEL FLOW HYDRAULICS:
   DEPTH(FEET) =  0.88   FLOW VELOCITY(FEET/SEC.) =  18.07
   LONGEST FLOWPATH FROM NODE     60.00 TO NODE     63.00 =  1195.00
FEET.
```

```
************************************************************************
***
   FLOW PROCESS FROM NODE     63.00 TO NODE     64.00 IS CODE =  51
 -----------------------------------------------------------------------
----
   >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    855.00  DOWNSTREAM(FEET) =
835.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =    40.00   CHANNEL SLOPE =  0.5000
   CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   1.000
   MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.50
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.561
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        0.54      0.25       1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     15.05
   TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  28.42
   AVERAGE FLOW DEPTH(FEET) =   0.73   TRAVEL TIME(MIN.) =   0.02
   Tc(MIN.) =   8.65
   SUBAREA AREA(ACRES) =     0.54       SUBAREA RUNOFF(CFS) =    2.10
   EFFECTIVE AREA(ACRES) =      4.07     AREA-AVERAGED Fm(INCH/HR) =
0.17
   AREA-AVERAGED Fp(INCH/HR) =   0.25  AREA-AVERAGED Ap =   0.69
   TOTAL AREA(ACRES) =      4.07          PEAK FLOW RATE(CFS) =      16.07

   END OF SUBAREA CHANNEL FLOW HYDRAULICS:
   DEPTH(FEET) =  0.74   FLOW VELOCITY(FEET/SEC.) =  28.98
   LONGEST FLOWPATH FROM NODE     60.00 TO NODE     64.00 =  1235.00
FEET.


************************************************************************
***
   FLOW PROCESS FROM NODE     64.00 TO NODE     64.00 IS CODE =  81
 -----------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

========================================================================
===
   MAINLINE Tc(MIN) =   8.65
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.561
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
```

```
      LAND USE              GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        0.29      0.25      1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =     0.29     SUBAREA RUNOFF(CFS) =    1.13
   EFFECTIVE AREA(ACRES) =       4.36   AREA-AVERAGED Fm(INCH/HR) =  0.18
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.71
   TOTAL AREA(ACRES) =       4.36       PEAK FLOW RATE(CFS) =      17.20


*************************************************************************
***
   FLOW PROCESS FROM NODE     64.00 TO NODE     65.00 IS CODE =  51
 ------------------------------------------------------------------------
----
   >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    835.00  DOWNSTREAM(FEET) =
816.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   165.00   CHANNEL SLOPE =  0.1152
   CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   1.000
   MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =    1.50
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.514
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C        0.68      0.25      1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      18.50
   TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  17.28
   AVERAGE FLOW DEPTH(FEET) =   1.03   TRAVEL TIME(MIN.) =   0.16
   Tc(MIN.) =   8.80
   SUBAREA AREA(ACRES) =     0.68       SUBAREA RUNOFF(CFS) =    2.61
   EFFECTIVE AREA(ACRES) =      5.04     AREA-AVERAGED Fm(INCH/HR) =
0.19
   AREA-AVERAGED Fp(INCH/HR) =   0.25  AREA-AVERAGED Ap =   0.75
   TOTAL AREA(ACRES) =       5.04        PEAK FLOW RATE(CFS) =      19.62

   END OF SUBAREA CHANNEL FLOW HYDRAULICS:
   DEPTH(FEET) =  1.06   FLOW VELOCITY(FEET/SEC.) =  17.54
   LONGEST FLOWPATH FROM NODE     60.00 TO NODE     65.00 =  1400.00
FEET.


*************************************************************************
***
   FLOW PROCESS FROM NODE     65.00 TO NODE     66.00 IS CODE =  51
```

```
 -----------------------------------------------------------------------
----
   >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    816.00  DOWNSTREAM(FEET) =
796.60
   CHANNEL LENGTH THRU SUBAREA(FEET) =     75.00   CHANNEL SLOPE =  0.2587
   CHANNEL BASE(FEET) =     0.00    "Z" FACTOR =   1.000
   MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.50
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.498
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                    C        0.52      0.25       1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     20.62
   TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  23.95
   AVERAGE FLOW DEPTH(FEET) =   0.93   TRAVEL TIME(MIN.) =   0.05
   Tc(MIN.) =   8.86
   SUBAREA AREA(ACRES) =     0.52      SUBAREA RUNOFF(CFS) =    1.99
   EFFECTIVE AREA(ACRES) =      5.56     AREA-AVERAGED Fm(INCH/HR) =
0.19
   AREA-AVERAGED Fp(INCH/HR) =   0.25  AREA-AVERAGED Ap =   0.77
   TOTAL AREA(ACRES) =      5.56         PEAK FLOW RATE(CFS) =      21.54

   END OF SUBAREA CHANNEL FLOW HYDRAULICS:
   DEPTH(FEET) =  0.94   FLOW VELOCITY(FEET/SEC.) =  24.22
   LONGEST FLOWPATH FROM NODE     60.00 TO NODE     66.00 =  1475.00
FEET.

 +----------------------------------------------------------------------
---+
 | FLOW TO CANYON ABOVE EX. 24" RCP SD AT PROPERTY LINE  NODE 66
|
 | Q=21.54 CFS, A=5.56 ACRES, Tc=8.9 MIN.
|
 |
|
 +----------------------------------------------------------------------
---+


************************************************************************
***
  FLOW PROCESS FROM NODE     70.00 TO NODE     71.00 IS CODE =  21
 -----------------------------------------------------------------------
----
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
```

```
==========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   380.00
   ELEVATION DATA: UPSTREAM(FEET) =    965.00  DOWNSTREAM(FEET) =
891.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.838
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.800
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
Tc
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                   C         0.76      0.25       1.00    98
7.84
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      3.11
   TOTAL AREA(ACRES) =      0.76   PEAK FLOW RATE(CFS) =      3.11

**************************************************************************
***
   FLOW PROCESS FROM NODE     71.00 TO NODE     71.00 IS CODE =  81
 -------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

==========================================================================
===
   MAINLINE Tc(MIN) =   7.84
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.800
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   C         0.58      0.25       1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA AREA(ACRES) =    0.58     SUBAREA RUNOFF(CFS) =    2.38
   EFFECTIVE AREA(ACRES) =       1.34   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      1.34        PEAK FLOW RATE(CFS) =       5.49

**************************************************************************
***
   FLOW PROCESS FROM NODE     71.00 TO NODE     72.00 IS CODE =  51
 -------------------------------------------------------------------------
----
   >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
```

```
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=========================================================================
===
  ELEVATION DATA: UPSTREAM(FEET) =    891.00  DOWNSTREAM(FEET) =
845.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =    95.00  CHANNEL SLOPE =  0.4842
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   1.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.50
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.780
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C        0.93      0.25       1.00    98
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.38
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  23.40
  AVERAGE FLOW DEPTH(FEET) =   0.56   TRAVEL TIME(MIN.) =   0.07
  Tc(MIN.) =   7.91
  SUBAREA AREA(ACRES) =      0.93        SUBAREA RUNOFF(CFS) =    3.79
  EFFECTIVE AREA(ACRES) =       2.27     AREA-AVERAGED Fm(INCH/HR) =
0.25
  AREA-AVERAGED Fp(INCH/HR) =   0.25  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =       2.27          PEAK FLOW RATE(CFS) =       9.25

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.61   FLOW VELOCITY(FEET/SEC.) =  24.61
  LONGEST FLOWPATH FROM NODE      70.00 TO NODE      72.00 =   475.00
FEET.


*************************************************************************
***
  FLOW PROCESS FROM NODE      72.00 TO NODE      73.00 IS CODE =  51
 ------------------------------------------------------------------------
----
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=========================================================================
===
  ELEVATION DATA: UPSTREAM(FEET) =    845.00  DOWNSTREAM(FEET) =
817.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.1400
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   1.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.50
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.718
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C        0.35      0.25       1.00    98
```

```
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.96
   TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  15.93
   AVERAGE FLOW DEPTH(FEET) =   0.79   TRAVEL TIME(MIN.) =   0.21
   Tc(MIN.) =   8.11
   SUBAREA AREA(ACRES) =     0.35      SUBAREA RUNOFF(CFS) =    1.41
   EFFECTIVE AREA(ACRES) =      2.62     AREA-AVERAGED Fm(INCH/HR) =
0.25
   AREA-AVERAGED Fp(INCH/HR) =   0.25  AREA-AVERAGED Ap =   1.00
   TOTAL AREA(ACRES) =      2.62          PEAK FLOW RATE(CFS) =      10.54

   END OF SUBAREA CHANNEL FLOW HYDRAULICS:
   DEPTH(FEET) =  0.81   FLOW VELOCITY(FEET/SEC.) =  16.00
   LONGEST FLOWPATH FROM NODE     70.00 TO NODE     73.00 =   675.00
FEET.

*************************************************************************
***
   FLOW PROCESS FROM NODE     73.00 TO NODE     73.00 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.) =   8.11
   RAINFALL INTENSITY(INCH/HR) =   4.72
   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25
   AREA-AVERAGED Ap =  1.00
   EFFECTIVE STREAM AREA(ACRES) =     2.62
   TOTAL STREAM AREA(ACRES) =     2.62
   PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.54


*************************************************************************
***
   FLOW PROCESS FROM NODE     80.00 TO NODE     81.00 IS CODE =  21
 ------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   140.00
   ELEVATION DATA: UPSTREAM(FEET) =    900.00  DOWNSTREAM(FEET) =
840.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
```

```
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  6.190
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
Tc
        LAND USE            GROUP    (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                  C         0.41      0.25       1.00    98
5.00
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      2.19
   TOTAL AREA(ACRES) =      0.41   PEAK FLOW RATE(CFS) =      2.19


*************************************************************************
***
   FLOW PROCESS FROM NODE     81.00 TO NODE     73.00 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.) =   5.00
   RAINFALL INTENSITY(INCH/HR) =   6.19
   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25
   AREA-AVERAGED Ap =  1.00
   EFFECTIVE STREAM AREA(ACRES) =     0.41
   TOTAL STREAM AREA(ACRES) =     0.41
   PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.19

   ** CONFLUENCE DATA **
    STREAM      Q      Tc    Intensity   Fp(Fm)      Ap   Ae      HEADWATER
    NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)        (ACRES)    NODE
       1      10.54   8.11     4.718   0.25( 0.25) 1.00     2.6       70.00
       2       2.19   5.00     6.190   0.25( 0.25) 1.00     0.4       80.00

   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      10.82   5.00     6.190   0.25( 0.25) 1.00     2.0       80.00
       2      12.18   8.11     4.718   0.25( 0.25) 1.00     3.0       70.00

   COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
   PEAK FLOW RATE(CFS) =      12.18    Tc(MIN.) =     8.11
```

```
   EFFECTIVE AREA(ACRES) =      3.03   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =      3.03
   LONGEST FLOWPATH FROM NODE      70.00 TO NODE      73.00 =   675.00
FEET.


************************************************************************
***
   FLOW PROCESS FROM NODE      73.00 TO NODE      74.00 IS CODE =  51
 -----------------------------------------------------------------------
----
   >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

========================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    817.00  DOWNSTREAM(FEET) =
806.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   120.00   CHANNEL SLOPE =  0.0917
   CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   1.000
   MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.50
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.677
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                    C        0.35      0.25       1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      12.88
   TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  14.48
   AVERAGE FLOW DEPTH(FEET) =   0.94   TRAVEL TIME(MIN.) =   0.14
   Tc(MIN.) =   8.25
   SUBAREA AREA(ACRES) =      0.35       SUBAREA RUNOFF(CFS) =    1.39
   EFFECTIVE AREA(ACRES) =       3.38     AREA-AVERAGED Fm(INCH/HR) =
0.25
   AREA-AVERAGED Fp(INCH/HR) =   0.25  AREA-AVERAGED Ap =   1.00
   TOTAL AREA(ACRES) =      3.38         PEAK FLOW RATE(CFS) =      13.47

   END OF SUBAREA CHANNEL FLOW HYDRAULICS:
   DEPTH(FEET) =  0.96   FLOW VELOCITY(FEET/SEC.) =  14.66
   LONGEST FLOWPATH FROM NODE      70.00 TO NODE      74.00 =   795.00
FEET.

 +----------------------------------------------------------------------
---+
 | PARTIAL FLOW TO FAIRMONT BLVD. PARKWAY CULVERT AT DRIVEWAY
|
 | Q=19.39 CFS, A=4.78 ACRES, Tc=8.2 MIN.
|
 |
|
```

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 +----------------------------------------------------------------------
---+


**********************************************************************
***
   FLOW PROCESS FROM NODE     74.00 TO NODE     74.00 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.) =    8.25
   RAINFALL INTENSITY(INCH/HR) =   4.68
   AREA-AVERAGED Fm(INCH/HR) =  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25
   AREA-AVERAGED Ap =  1.00
   EFFECTIVE STREAM AREA(ACRES) =      3.38
   TOTAL STREAM AREA(ACRES) =      3.38
   PEAK FLOW RATE(CFS) AT CONFLUENCE =      13.47


**********************************************************************
***
   FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
 ---------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

======================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =    300.00
   ELEVATION DATA: UPSTREAM(FEET) =     965.00  DOWNSTREAM(FEET) =
924.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =     5.000
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  6.190
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
Tc
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   COMMERCIAL                 C        0.41       0.25       0.10    86
5.00
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
   SUBAREA RUNOFF(CFS) =       2.27
   TOTAL AREA(ACRES) =       0.41   PEAK FLOW RATE(CFS) =       2.27
```

```
**********************************************************************
***
   FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  62
 ---------------------------------------------------------------------
----
   >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
   >>>>>(STREET TABLE SECTION #  1 USED)<<<<<

======================================================================
===
   UPSTREAM ELEVATION(FEET) =  924.00  DOWNSTREAM ELEVATION(FEET) =
806.00
   STREET LENGTH(FEET) =   855.00   CURB HEIGHT(INCHES) =  6.0
   STREET HALFWIDTH(FEET) = 20.00

   DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
   INSIDE STREET CROSSFALL(DECIMAL) =  0.010
   OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.010

   SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
   Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =
0.0150

     **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.21
     STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
     STREET FLOW DEPTH(FEET) =  0.14
     HALFSTREET FLOOD WIDTH(FEET) =   10.39
     AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.44
     PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.76
   STREET FLOW TRAVEL TIME(MIN.) =   2.62   Tc(MIN.) =   7.62
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.865
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
        LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   COMMERCIAL                C        0.43      0.25      0.10    86
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
   SUBAREA AREA(ACRES) =    0.43      SUBAREA RUNOFF(CFS) =    1.87
   EFFECTIVE AREA(ACRES) =      0.84    AREA-AVERAGED Fm(INCH/HR) =  0.02
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.10
   TOTAL AREA(ACRES) =      0.84        PEAK FLOW RATE(CFS) =       3.66

   END OF SUBAREA STREET FLOW HYDRAULICS:
   DEPTH(FEET) = 0.15   HALFSTREET FLOOD WIDTH(FEET) =  10.97
   FLOW VELOCITY(FEET/SEC.) =  5.61   DEPTH*VELOCITY(FT*FT/SEC.) =   0.82
   LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =  1155.00
FEET.


**********************************************************************
***
   FLOW PROCESS FROM NODE    102.00 TO NODE     74.00 IS CODE =   1
```

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 ----------------------------------------------------------------------------
----
   >>>>>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.) =    7.62
   RAINFALL INTENSITY(INCH/HR) =   4.86
   AREA-AVERAGED Fm(INCH/HR) =  0.02
   AREA-AVERAGED Fp(INCH/HR) =  0.25
   AREA-AVERAGED Ap =  0.10
   EFFECTIVE STREAM AREA(ACRES) =      0.84
   TOTAL STREAM AREA(ACRES) =      0.84
   PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.66

   ** CONFLUENCE DATA **
    STREAM      Q      Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
    NUMBER    (CFS) (MIN.) (INCH/HR) (INCH/HR)       (ACRES)    NODE
       1      12.54   5.14    6.117  0.25( 0.25) 1.00      2.4      80.00
       1      13.47   8.25    4.677  0.25( 0.25) 1.00      3.4      70.00
       2       3.66   7.62    4.865  0.25( 0.02) 0.10      0.8     100.00

   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      15.65   5.14    6.117  0.25( 0.21) 0.83      2.9      80.00
       2      16.94   7.62    4.865  0.25( 0.20) 0.81      4.0     100.00
       3      16.98   8.25    4.677  0.25( 0.21) 0.82      4.2      70.00

   COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
   PEAK FLOW RATE(CFS) =      16.98    Tc(MIN.) =     8.25
   EFFECTIVE AREA(ACRES) =     4.22   AREA-AVERAGED Fm(INCH/HR) =  0.21
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.82
   TOTAL AREA(ACRES) =      4.22
   LONGEST FLOWPATH FROM NODE    100.00 TO NODE     74.00 =  1155.00
FEET.

 +---------------------------------------------------------------------------
---+
 | TOTAL FLOW DRIVEWAY AND V DITCH AT FAIRMONT BLVD, PARKWAY CULVERT
|
 | Q= 16.98 CFS, A= 4.22 ACES, Tc=8.2 MIN.
|
 | NODE 74
|
 +---------------------------------------------------------------------------
---+
```

```
************************************************************************
***
   FLOW PROCESS FROM NODE     90.00 TO NODE     91.00 IS CODE =  22
 ----------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>>>>USE SPECIFIED Tc VALUE FOR INITIAL SUBAREA<<<

========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
   USER SPECIFIED Tc(MIN.) =    5.000
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  6.190
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   NATURAL POOR COVER
   "BARREN"                   D        0.14      0.20       1.00    98
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      0.75
   TOTAL AREA(ACRES) =      0.14   PEAK FLOW RATE(CFS) =      0.75

 +---------------------------------------------------------------------
---+
 | SLOPE FLOW TO FAIRMONT BLVD.
|
 | Q=0.75 CFS, A=0.14 ACRES, TC=5.0 MIN.
|
 |
|
 +---------------------------------------------------------------------
---+


************************************************************************
***
   FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  21
 ----------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

========================================================================
===
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   430.00
   ELEVATION DATA: UPSTREAM(FEET) =    845.00  DOWNSTREAM(FEET) =
790.00

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.957
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.469
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
```

```
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
Tc
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
(MIN.)
   NATURAL POOR COVER
   "BARREN"                   C        1.69      0.25       1.00    98
8.96
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
   SUBAREA RUNOFF(CFS) =      6.42
   TOTAL AREA(ACRES) =       1.69   PEAK FLOW RATE(CFS) =      6.42

 +--------------------------------------------------------------------------
---+
 | FLOW TO SOUTHERLY FAIRMONT BLVD. PARKWAY CULVERT
|
 | Q=6.42 CFS, A=1.69 ACRES, Tc=9.0 MIN.
|
 |
|
 +--------------------------------------------------------------------------
---+

============================================================================
===
   END OF STUDY SUMMARY:
   TOTAL AREA(ACRES)       =      1.69  TC(MIN.) =      8.96
   EFFECTIVE AREA(ACRES) =      1.69  AREA-AVERAGED Fm(INCH/HR)=  0.25
   AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
   PEAK FLOW RATE(CFS)     =      6.42

============================================================================
===

============================================================================
===
   END OF RATIONAL METHOD ANALYSIS
```

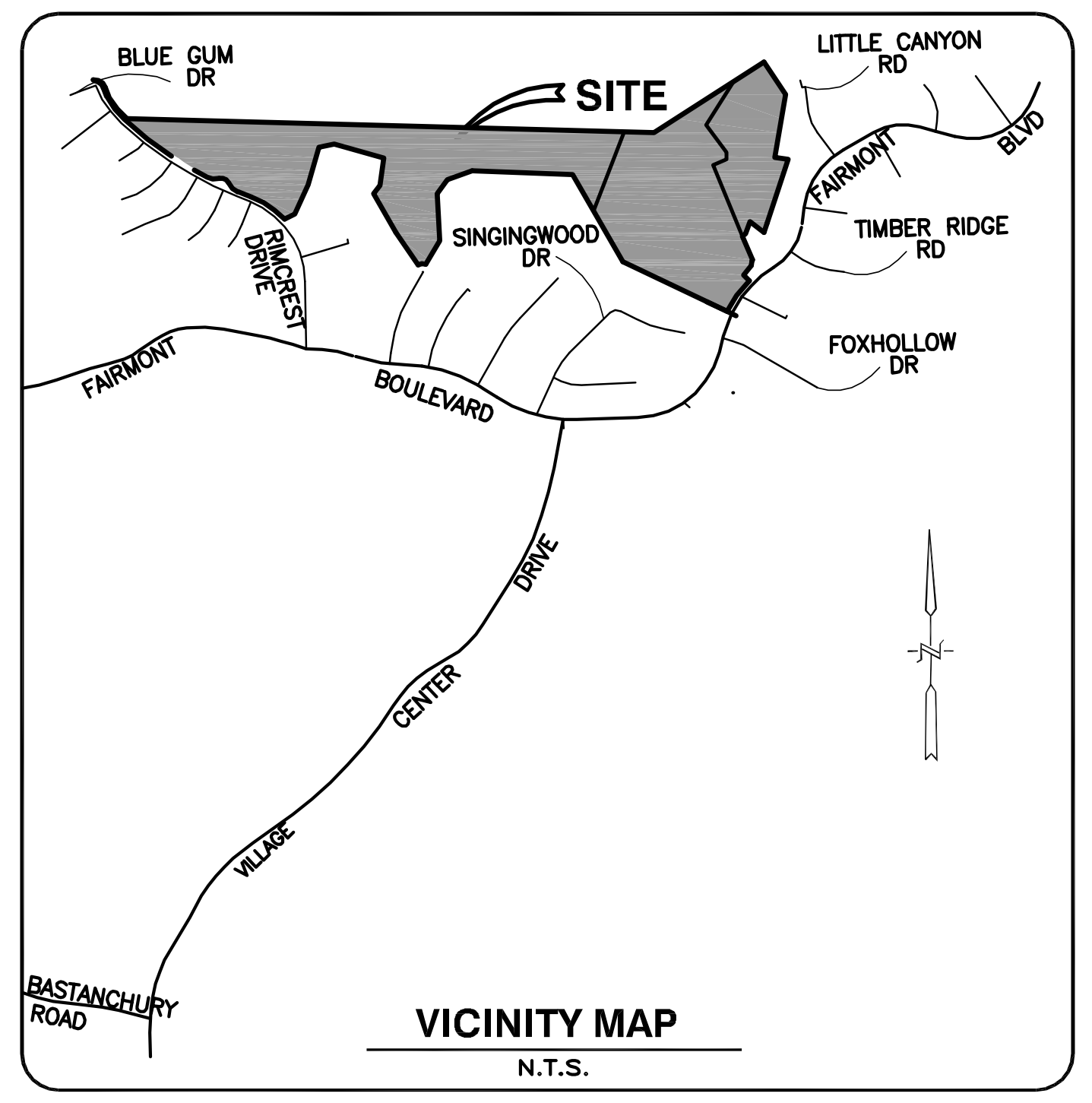
HYDROLOGY MAP
EXISTING CONDITION

TENTATIVE PARCEL MAP
NO. 2020-125

LEGEND

— —	TRIBUTARY SUBAREA BOUNDARY
(50)	HYDROLOGY NODE POINT
(2.52 AC.)	DRAINAGE AREA (ACRES)
L=300'	DRAINAGE SUBAREA TRAVEL LENGTH
ELEV.= 453.8	HYDROLOGY NODE POINT ELEVATION
Q= 2.50 CFS / A= 2.67 AC.	TRIBUTARY DRAINAGE AREA SUMMATIONS
←	DRAINAGE RUNOFF FLOW PATTERN
100%	PERCENT PERVIOUS
⬠ C	SOIL TYPE

SCALE: 1"= 100'
0 100' 200'



VICINITY MAP
N.T.S.

OWNER:

HILLTOP 3 DEVELOPMENT, LLC
3875 CREST DRIVE
YORBA LINDA, CA. 92886
CONTACT: ROBERT HOFF
714-742-7965
rhoff73776@aol.com

PREPARED BY:

KING CIVIL ENGINEERING CORP.
101 S. KRAEMER BLVD., SUITE 232
PLACENTIA, CALIF. 92870
TEL. (714) 996-7010 FAX (714) 996-0322
kingcivil@earthlink.net
CONTACT: TOM KING

THOMAS A. KING R.C.E. NO. 16916

No. 16916
Exp. 6/30/2021

SHEET 1 OF 1

PLAN DATE: APRIL 20, 2020

NODE 13 Q_{100}
DEVELOPED
Q_{100}=81.01 CFS, A=21.93 ACRES
EXISTING
Q_{100}=74.33 CFS, A=20.13 ACRES
INCREASE Q_{100}=6.68 CFS

NODE 32 Q_{100}
DEVELOPED
Q=22.95 CFS, A=6.24 ACRES
EXISTING
Q=20.75 CFS, A=5.78 ACRES

NODE 42 Q_{100}
DEVELOPED
Q=19.63 CFS, A=5.05 ACRES
EXISTING
Q=22.20 CFS, A=5.71 ACRES

NODE 51 Q_{100}
DEVELOPED
Q_{100}=10.20 CFS, A=2.39 ACRES
EXISTING
Q_{100}=8.82 CFS, A=1.95 ACRES

NODE 13 + NODE 66 Q_{100}
TOTAL FLOW WHERE TWO EX. SD'S JOIN
DEVELOPED
Q_{100}=96.78 CFS, A=26.09 ACRES
EXISTING
Q_{100}=110.20 CFS, A=29.35 ACRES
DECREASE Q_{100}=13.42 CFS

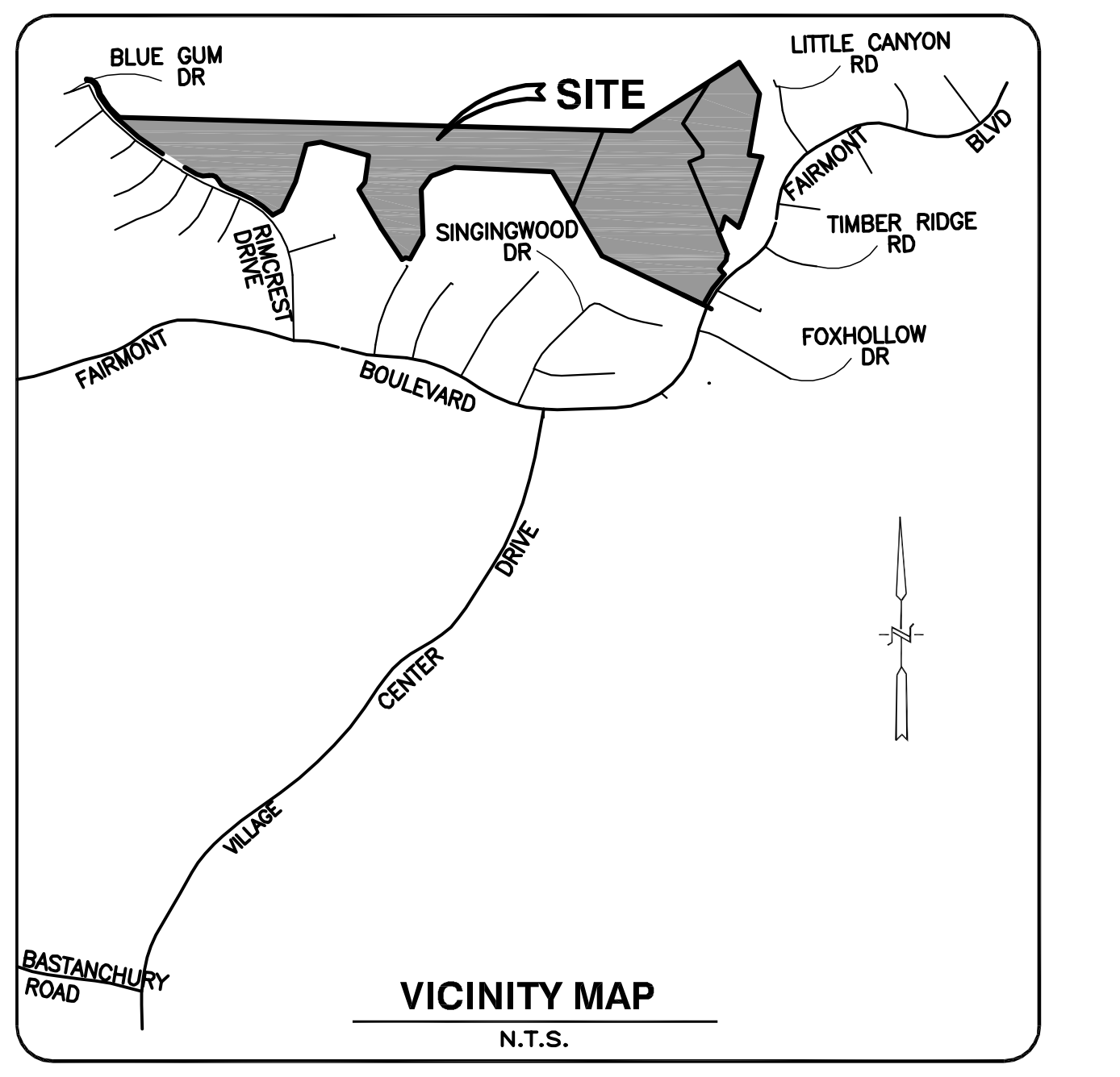
NODE 66 Q_{100}
DEVELOPED
Q_{100}=15.77 CFS, A=4.16 ACRES
EXISTING
Q_{100}=35.87 CFS, A=9.22 ACRES
DECREASE Q_{100}=20.10 CFS

TOTAL FAIRMONT BLVD.
NODE 74, 91 AND 111 Q_{100}
DEVELOPED
Q_{100}=24.15 CFS, A=6.05 ACRES
EXISTING
Q_{100}=22.34 CFS, A=5.49 ACRES
INCREASE Q_{100}=1.81 CFS

NODE 111 Q_{100}
DEVELOPED
Q_{100}=6.42 CFS, A=1.69 ACRES
EXISTING
Q_{100}=22.34 CFS, A=5.49 ACRES

LEGEND

— —	TRIBUTARY SUBAREA BOUNDARY
(50)	HYDROLOGY NODE POINT
(2.52 AC.)	DRAINAGE AREA (ACRES)
L=300'	DRAINAGE SUBAREA TRAVEL LENGTH
ELEV.= 453.8	HYDROLOGY NODE POINT ELEVATION
Q= 2.50 CFS / A= 2.67 AC.	TRIBUTARY DRAINAGE AREA SUMMATIONS
←	DRAINAGE RUNOFF FLOW PATTERN
100%	PERCENT PERVIOUS
⬠ C	SOIL TYPE



VICINITY MAP
N.T.S.

HYDROLOGY DEVELOPED CONDITION
TENTATIVE PARCEL MAP NO. 2020-125

APN 326-021-50
APN 350-331-06

OWNER:
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YORBA LINDA, CA. 92886
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rhoff73776@aol.com

PREPARED BY:
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PLACENTIA, CALIF. 92870
TEL. (714) 996-7010 FAX (714) 996-0322
kingcivil@earthlink.net
CONTACT: TOM KING

THOMAS A. KING R.C.E. NO. 16916

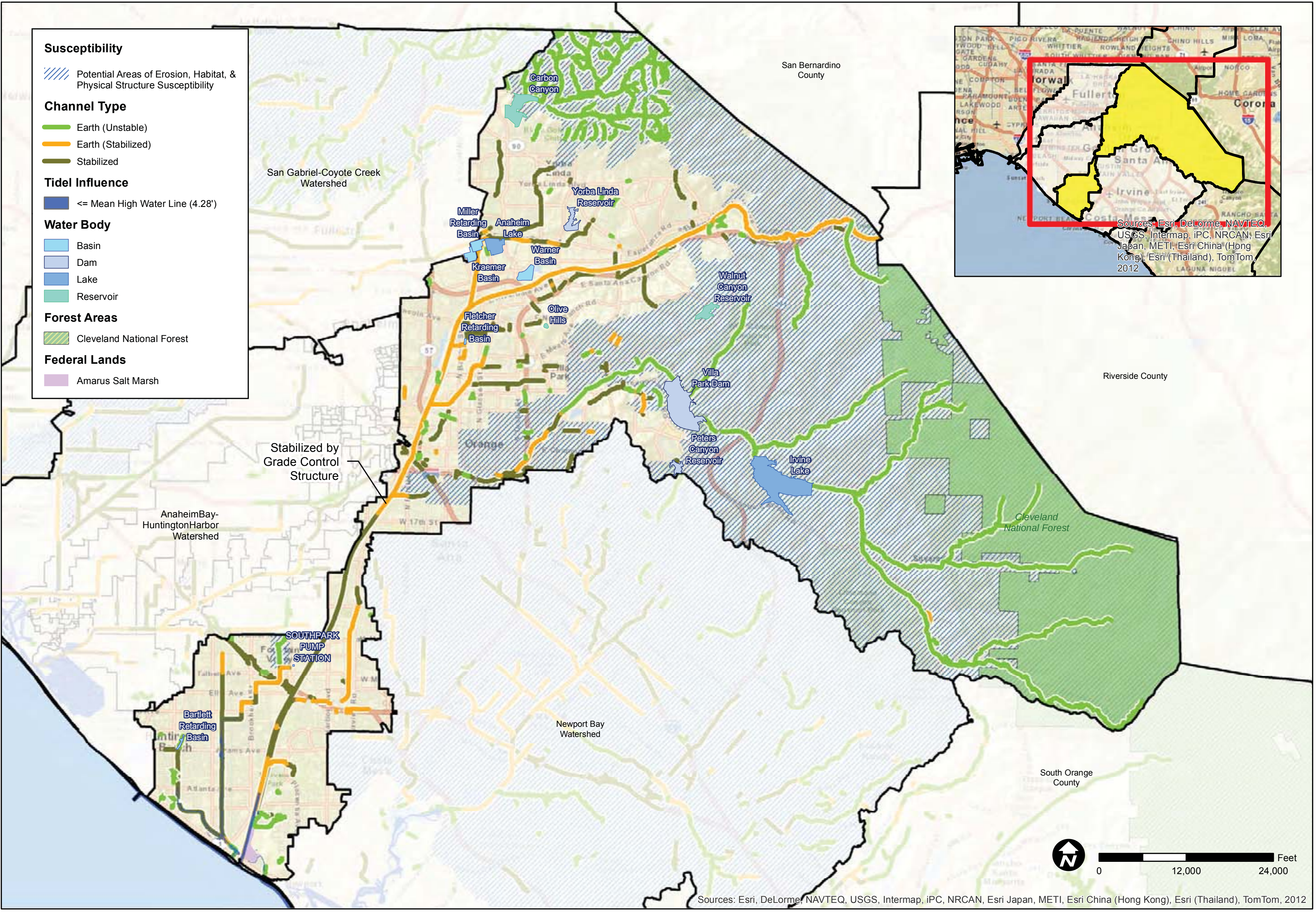
No. 16916
Exp. 6/30/2021

PLAN DATE: AUGUST 17, 2020

SHEET 1 OF 1

Appendix G

SUSCEPTIBILITY MAP UPATE (FEB 2013)



Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2012

TITLE
SUSCEPTIBILITY ANALYIS
SANTA ANA RIVER

JOB
ORANGE COUNTY
WATERSHED
MASTER PLANNING
ORANGE CO. CA

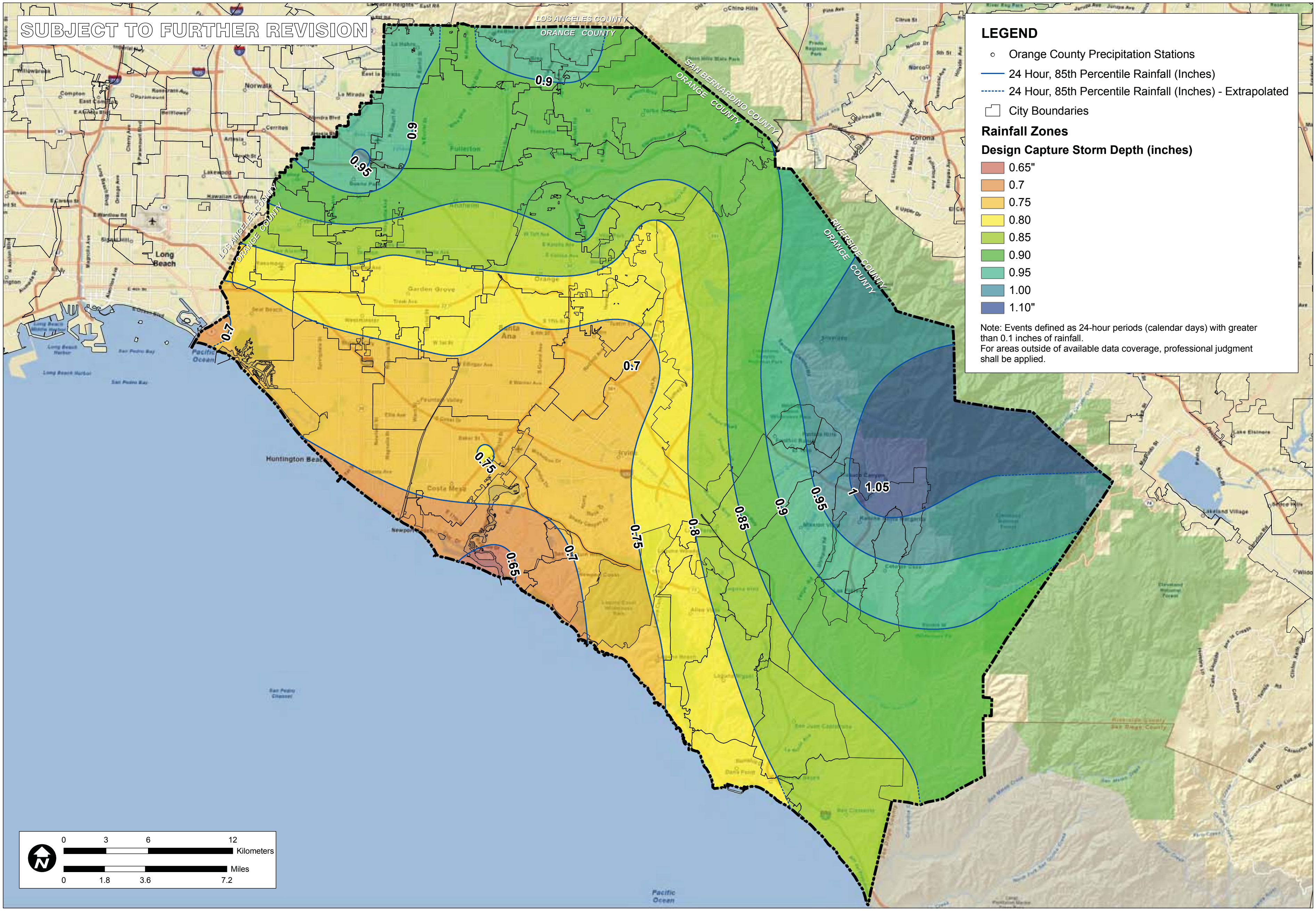
SCALE 1" = 12000'
DESIGNED TH
DRAWING TH
CHECKED BMP
DATE 04/30/10
JOB NO. 9526-E

PACE
Advanced Water Engineering

FIGURE
3

P:\9526E\6-GIS\Mxds\SusceptibilityMaps_20100505\9526E_SantaAnaRiverSusceptibility_20100430.mxd

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



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.

TITLE

RAINFALL ZONES

JOB

ORANGE COUNTY TECHNICAL GUIDANCE DOCUMENT

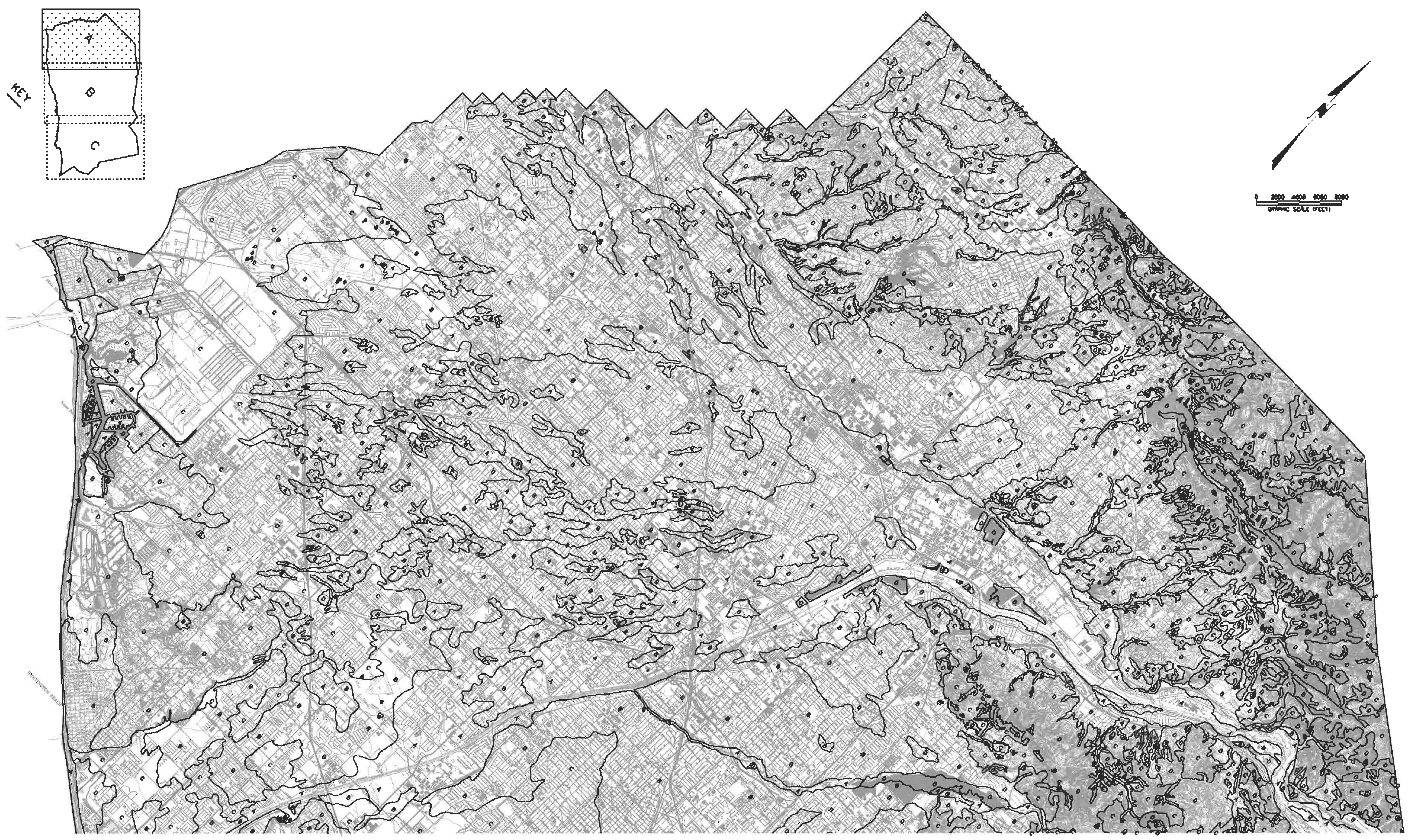
ORANGE CO. CA

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



LEGEND

A B C D	HYDROLOGIC SOIL GROUPS
—	HYDROLOGIC SOIL GROUP BOUNDARY

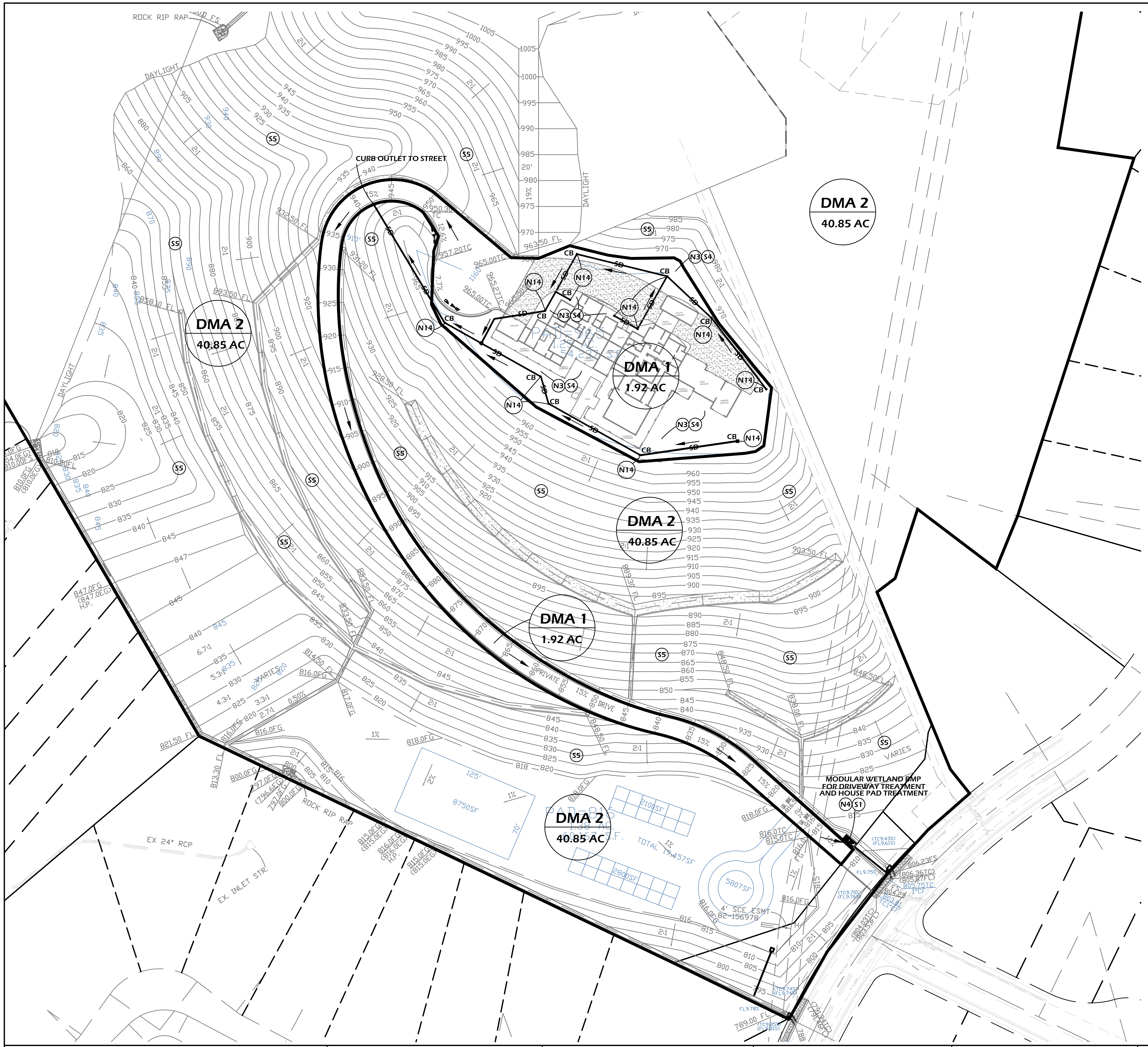
SOURCES:

BASE MAP	- ORANGE COUNTY/RESOURCES & DEVELOPMENT MANAGEMENT DEPT GEOMATICS AND LAND INFORMATION SYSTEMS DIVISION
SOIL GROUPS	- SOIL SURVEY OF ORANGE COUNTY AND WESTERN PART OF RIVERSIDE COUNTY, CALIFORNIA, USDA, SOIL CONSERVATION SERVICE, 1978.

ORANGE COUNTY
HYDROLOGY MANUAL

HYDROLOGIC CLASSIFICATION OF SOILS
ORANGE COUNTY, CALIFORNIA
PLATE A

Appendix H



HILLTOP 3 DEVELOPMENT, LLC
WQMP EXHIBIT

11-17-20

NOTES:

DMA 1 - 1.92 ACRES
96% IMPERVIOUS 4% PERVIOUS

DMA 2 - 40.85 ACRES
0% IMPERVIOUS 100% PERVIOUS

PREDEVELOPMENT:
TOTAL AREA = 42.64 ACRES
IMPERVIOUS AREA = 0 ACRES
PERVIOUS AREA = 42.64 ACRES

POST DEVELOPMENT:
TOTAL AREA = 42.64 ACRES
IMPERVIOUS AREA = 1.79 ACRES
PERVIOUS AREA = 40.85 ACRES

LEGEND

DMA #	DRAINAGE MANAGEMENT AREA
N3	COMMON AREA LANDSCAPE MANAGEMENT
N4	BMP MAINTENANCE
N14	COMMON AREA CATCH BASIN INSPECTION
S1	CATCHBASIN STENCIL "NO DUMPING DRAINS TO OCEAN"
S4	EFFICIENT IRRIGATION AND LANDSCAPE DESIGN
S5	PROTECT SLOPES AND CHANNELS PROVIDE ENERGY DISSIPATION
CB	CATCH BASIN

W.Q.M.P. EXHIBIT
FOR
HILLTOP 3 DEVELOPMENT, LLC
APN 350-331-06, 326-021-50
YORBA LINDA, CA

REVISIONS

NUMBER	BY	DESCRIPTION	DATE	ACCEPTED
1				

OWNER

HILLTOP 3 DEVELOPMENT, LLC
3875 CREST DRIVE
YORBA LINDA, CA 92886
(714) 742-7965

ENGINEER

PREPARED UNDER THE SUPERVISION

GILBERT
ENGINEERING & ASSOCIATES, INC.
CIVIL ENGINEERING, SURVEYING AND LAND DEVELOPMENT SERVICES
2 MERRIWEATHER PLACE LADERA RANCH, CA 92694
PH. (949) 218-8075
www.gilbert-engineering.com

JOB NO.:
552.000

R. WILLIAM GILBERT
NO. C-053251
Exp. 06/30/21

WQMP EXHIBIT

HILLTOP 3 DEVELOPMENT, LLC
APN 350-331-06, 326-021-50
YORBA LINDA, CA 92886

CITY OF YORBA LINDA

SHEET 1 OF 2

HILLTOP 3 DEVELOPMENT, LLC
WQMP EXHBIT

11-17-20

SITE SPECIFIC DATA

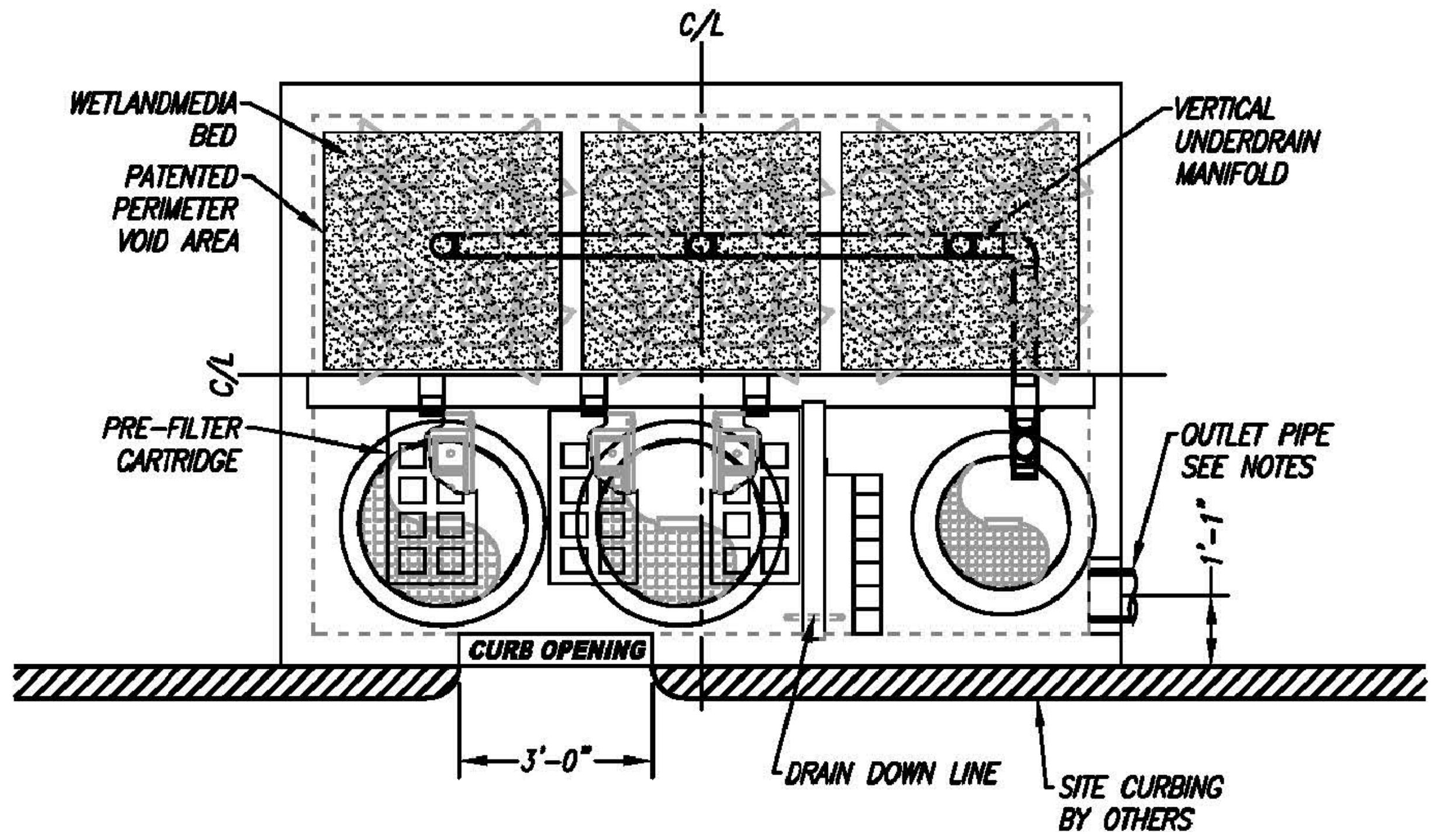
PROJECT NUMBER			
ORDER NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	PEDESTRIAN
FRAME & COVER	2EA ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			TBD
ORIFICE SIZE (DIA. INCHES)			TBD
NOTES: PRELIMINARY NOT FOR CONSTRUCTION.			

INSTALLATION NOTES

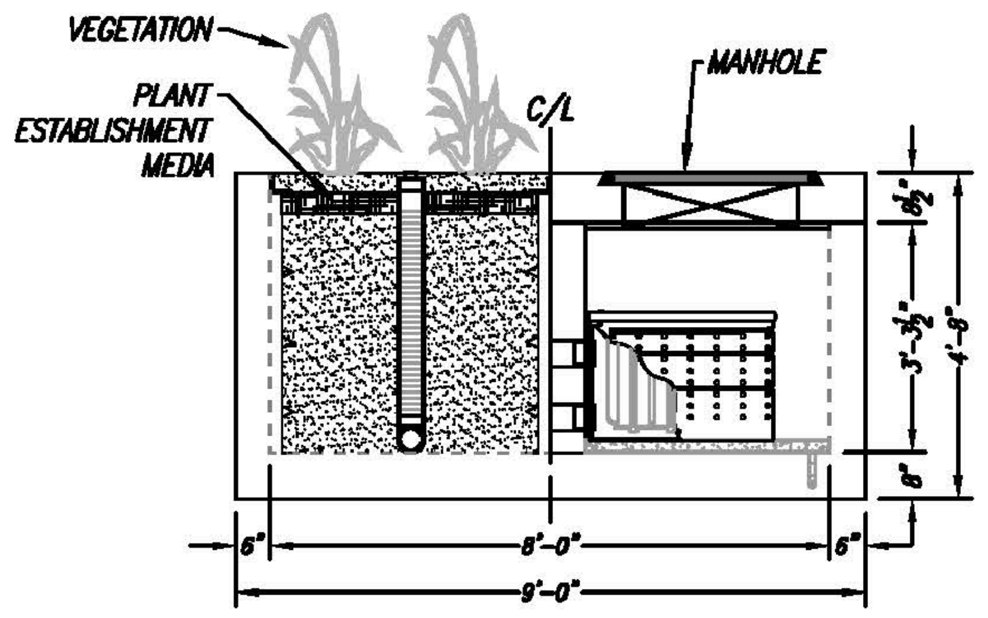
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER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

GENERAL NOTES

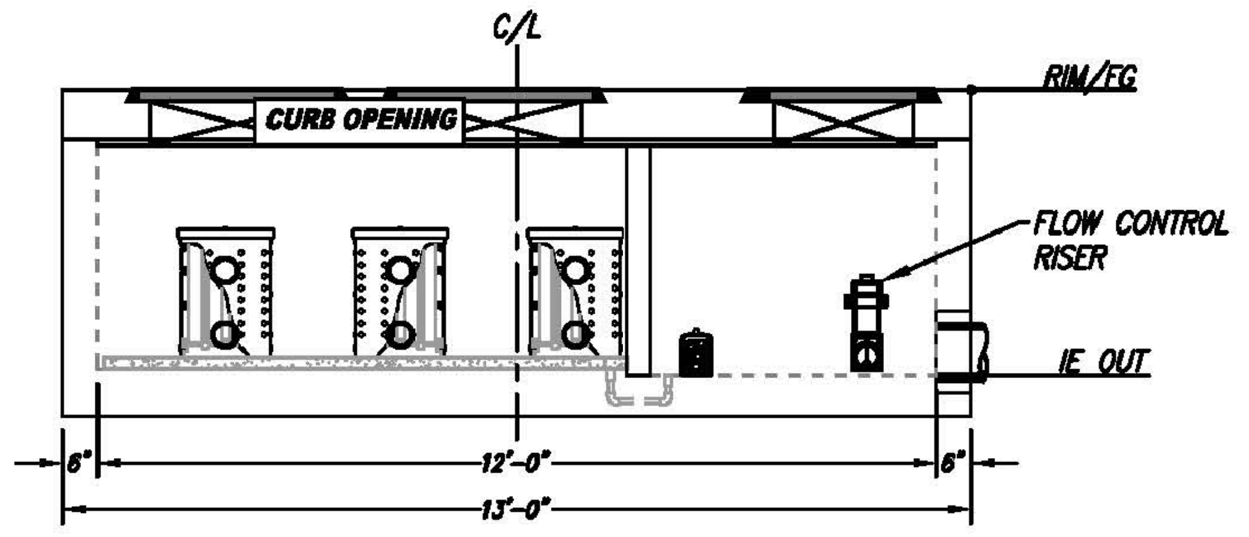
1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT BIO CLEAN.



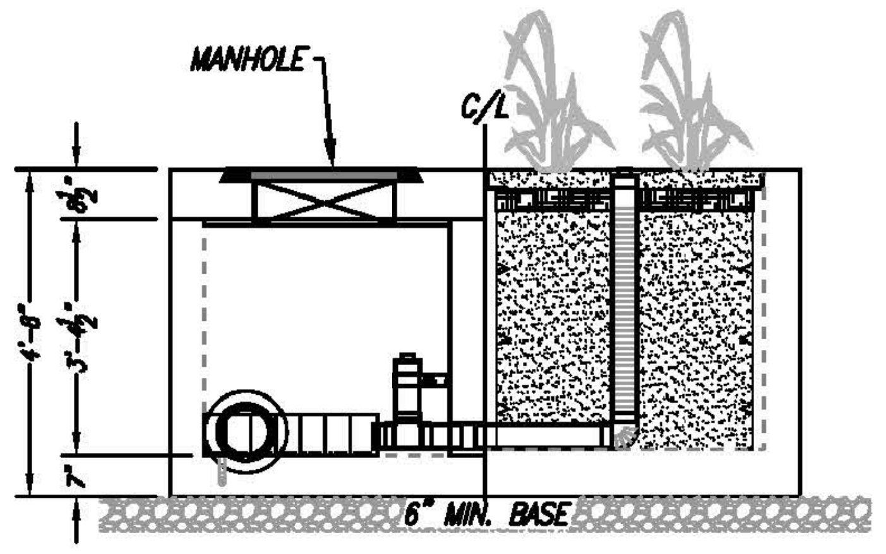
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.346
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MODULAR WETLANDS

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

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Bio Clean
A Forterra Company

MWS-L-8-12-C
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

REVISIONS

NUMBER	BY	DESCRIPTION	DATE	ACCEPTED
1				

OWNER

HILLTOP 3 DEVELOPMENT, LLC
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YORBA LINDA, CA 92886
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CITY OF YORBA LINDA

SHEET 2 OF 2