(P19-00009)

CITY OF OCEANSIDE
ENGINEERING DIVISION

PRIORITY DEVELOPMENT PROJECT

STORM WATER QUALITY MANAGEMENT PLAN

FOR

OCEAN KAMP

T19-00004, D19-00016, CUP 19-00021, P19-00009

ENGINEER OF WORK

PREPARED FOR:

ZEPHYR OCEANSIDE, LLC

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How to Use This Template

This template, assembled by GHD Inc. on behalf of the City of Oceanside, is for the development of Storm Water Quality Management Plans (SWQMPs) for Priority Development Projects (PDPs) proposed within Oceanside, CA. It is based on requirements set forth in the Regional Water Quality Control Board's National Pollutant Discharge Elimination System MS4 Permit that covers the San Diego Region (Order No. R9-2013-0001).

All references within the template refer to the City of Oceanside BMP Design Manual dated February 2016 (Manual). Use of this template in conjunction with the Manual is intended to help a project applicant develop a SWQMP compliant with City of Oceanside and MS4 Permit requirements.

Template Date: February 16, 2016

Assembled By:

Quick Reference Guide

Item	Project Information
Project Name	Ocean Kamp (Zephyr Oceanside)
Application Number(s)	P19-00009
Project Address	3480 MISSION AVE OCEANSIDE, CA 92054
Total Parcel Area	92 ac
Project Description	The project proposes to mass grade and develope the Oceanside Swap Meet (formerly a drive-in movie complex) into a resort community including: hotel, spa, conference buildings, wave pool, beach club, commercial buildings, residences, and 2 graded lots for future development.
Proposed Disturbed Area	74 ac
Created or Replaced Impervious	44 ac
Project Hydrologic Unit Watershed	☐ Santa Maria ☒ San Luis Rey ☐ Carlsbad
Required to implement HMP	☐ Yes ☒ No

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CERTIFICATION PAGE

Project Name: Zephyr Oceanside
Permit Application Number: P19-00009

I hereby declare that I am the Engineer in Responsible Charge of design of storm water BMPs for this project, and that I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the requirements of the City of Oceanside BMP Design Manual, which is based on the requirements of San Diego Regional Water Quality Control Board Order No. R9-2013-0001 (MS4 Permit).

I have read and understand that the City has adopted minimum requirements for managing urban runoff, including storm water, from land development activities, as described in the BMP Design Manual. I certify that this SWQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable source control and site design BMPs proposed to minimize the potentially negative impacts of this project's land development activities on water quality. I understand and acknowledge that the plan check review of this SWQMP by City staff is confined to a review and does not relieve me, as the Engineer in Responsible Charge of design of storm water BMPs for this project, of my responsibilities for project design.

As Engineer of Work, I agree to indemnify, defend, and hold harmless the City of Oceanside, its officers, agents, and employees from any and all liability, claims, damages, or injuries to any person or property which might arise from the negligent acts, errors, or omissions of the Engineer of Work, my employees, agents or consultants.

_____

Engineer of Work's Signature, PE Number & Expiration Date

Tory R. Walker, President

Print Name

Tory R. Walker Engineering, Inc.

Company

_____

Date

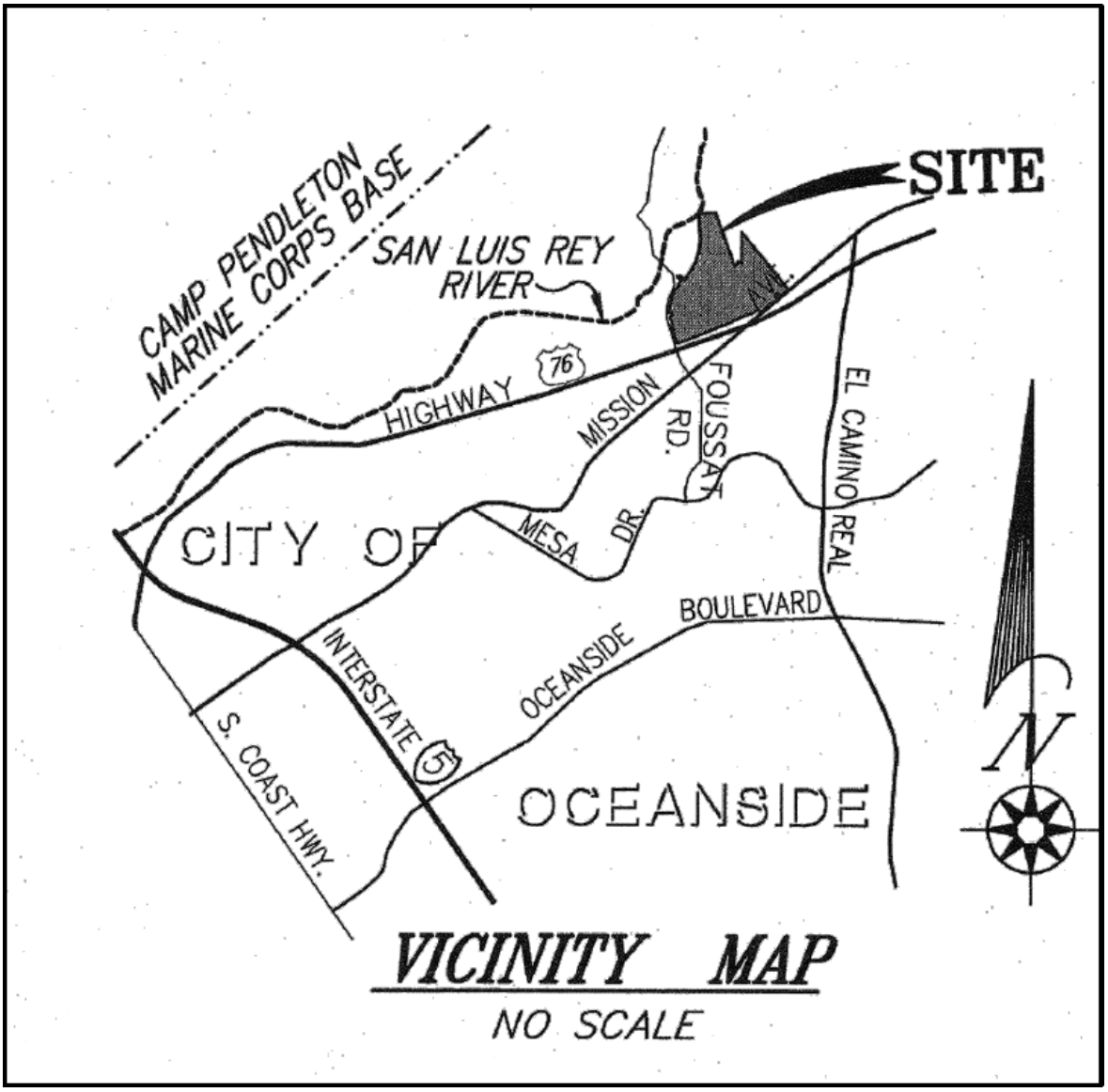
Engineer's Seal:

SUBMITTAL RECORD

Use this Table to keep a record of submittals of this SWQMP. Each time the SWQMP is re-submitted, provide the date and status of the project. In last column indicate changes that have been made or indicate if response to plancheck comments is included. When applicable, insert response to plancheck comments behind this page.

Submittal Number	Date	Project Status	Changes
1	12/20/19	☒ Preliminary Design/ Planning/ CEQA ☐ Final Design	Initial Submittal
2	03/12/2020	☒ Preliminary Design/ Planning/ CEQA ☐ Final Design	Updated per City Engineering Review comments (01/15/2020)
3	[MM/DD/YY]	☐ Preliminary Design/ Planning/ CEQA ☐ Final Design	Click here to enter text.
4	[MM/DD/YY]	☐ Preliminary Design/ Planning/ CEQA ☐ Final Design	Click here to enter text.

Project Vicinity Map



Applicability of Permanent, Post-Construction Storm Water BMP Requirements (Storm Water Intake Form for all Development Permit Applications)	Form I-1

Project Identification

Project Name: Zephyr Oceanside	
Permit Application Number: P19-00009	Date: 11/2019

Determination of Requirements

The purpose of this form is to identify permanent, post-construction requirements that apply to the project. This form serves as a short summary of applicable requirements, in some cases referencing separate forms that will serve as the backup for the determination of requirements.

Answer each step below, starting with Step 1 and progressing through each step until reaching "Stop".
Refer to the manual sections and/or separate forms referenced in each step below.

Step	Answer	Progression
Step 1: Is the project a "development project"? See Section 1.3 of the manual for guidance.	☒Yes	Go to Step 2.
	☐No	Stop. Permanent BMP requirements do not apply. No SWQMP will be required. Provide discussion below.
Discussion / justification if the project is not a "development project" (e.g., the project includes *only* interior remodels within an existing building):		
Step 2: Is the project a Standard Project, PDP, or exception to PDP definitions? To answer this item, see Section 1.4 of the manual *in its entirety* for guidance, AND complete Form I-2, Project Type Determination.	☐Standard Project	Stop. Standard Project requirements apply, including Standard Project SWQMP.
	☒PDP	PDP requirements apply, including PDP SWQMP. Go to Step 3.
	☐ Exception to PDP definitions	Stop. Standard Project requirements apply. Provide discussion and list any additional requirements below. Prepare Standard Project SWQMP.
Discussion / justification, and additional requirements for exceptions to PDP definitions, if applicable:		

Form I-1 Page 2 of 2		
Step	**Answer**	**Progression**
Step 3. Is the project subject to earlier PDP requirements due to a prior lawful approval? See Section 1.10 of the manual for guidance.	☐Yes	Consult the [City Engineer] to determine requirements. Provide discussion and identify requirements below. Go to Step 4.
	☒No	BMP Design Manual PDP requirements apply. Go to Step 4.
Discussion / justification of prior lawful approval, and identify requirements (*not required if prior lawful approval does not apply*): 3		
Step 4. Do hydromodification control requirements apply? See Section 1.6 of the manual for guidance.	☐Yes	PDP structural BMPs required for pollutant control (Chapter 5) and hydromodification control (Chapter 6). Go to Step 5.
	☒No	Stop. PDP structural BMPs required for pollutant control (Chapter 5) only. Provide brief discussion of exemption to hydromodification control below.
Discussion / justification if hydromodification control requirements do <u>not</u> apply: Per the City of Oceanside BMP Design Manual (BMPDM), the San Luis Rey River from upstream river limit of Basin Plan subwatershed 903.1 (upstream of Bonsall and near Interstate 15) to the Pacific Ocean is exempt from hydromodification management requirements.		
Step 5. Does protection of critical coarse sediment yield areas apply? See Section 6.2 of the manual for guidance.	☐Yes	Management measures required for protection of critical coarse sediment yield areas (Chapter 6.2). Stop.
	☒No	Management measures not required for protection of critical coarse sediment yield areas. Provide brief discussion below. Stop.
Discussion / justification if protection of critical coarse sediment yield areas does <u>not</u> apply: There are no Potential Critical Coarse Sediment Yield Areas (PCCSYAs) located onsite.		

Project Type Determination Checklist			Form I-2
Project Information			
Project Name: Zephyr Oceanside			
Permit Application Number: P19-00009			
Project Type Determination: Standard Project or PDP			
The project is (select one): ☐ New Development ☒ Redevelopment			
The total proposed newly created or replaced impervious area is: 1,912,751 ft² (43.91) acres			
Is the project in any of the following categories, (a) through (f)?			
Yes ☐	No ☒	(a)	New development projects that create 10,000 square feet or more of impervious surfaces (collectively over the entire project site). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
Yes ☒	No ☐	(b)	Redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site on an existing site of 10,000 square feet or more of impervious surfaces). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
Yes ☒	No ☐	(c)	New and redevelopment projects that create 5,000 square feet or more of impervious surface (collectively over the entire project site), and support one or more of the following uses: (i) Restaurants. This category is defined as a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption SIC code 5812). (ii) Hillside development projects. This category includes development on any natural slope that is twenty-five percent or greater. (iii) Parking lots. This category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce. (iv) Streets, roads, highways, freeways, and driveways. This category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles.

Form I-2 Page 2 of 2			
Yes ☐	No ☒	(d)	New or redevelopment projects that create or replace 2,500 square feet or more of impervious surface (collectively over the entire project site), and discharging directly to an Environmentally Sensitive Area (ESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands). Note: ESAs are areas that include but are not limited to all Clean Water Act Section 303(d) impaired water bodies; areas designated as Areas of Special Biological Significance by the State Water Board and SDRWQCB; State Water Quality Protected Areas; water bodies designated with the RARE beneficial use by the State Water Board and SDRWQCB; and any other equivalent environmentally sensitive areas which have been identified by the Copermittees. See manual Section 1.4.2 for additional guidance.
Yes ☐	No ☒	(e)	New development projects that support one or more of the following uses: (i) Automotive repair shops. This category is defined as a facility that is categorized in any one of the following SIC codes: 5013, 5014, 5541, 7532-7534, or 7536-7539. (ii) Retail gasoline outlets. This category includes retail gasoline outlets that meet the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic of 100 or more vehicles per day.
Yes ☒	No ☐	(f)	New or redevelopment projects that result in the disturbance of one or more acres of land and are expected to generate pollutants post construction. *Note: See manual Section 1.4.2 for additional guidance.*

Does the project meet the definition of one or more of the PDP categories (a) through (f) listed above?

☐ No – the project is not a PDP (Standard Project).

☒ Yes – the project is a PDP.

The following is for redevelopment PDPs only:

The area of existing (pre-project) impervious area at the project site is: 1,371,552 ft² (A)
The total proposed newly created or replaced impervious area is: 1,912,751 ft² (B)
Percent impervious surface created or replaced (B/A)*100: 139%
The percent impervious surface created or replaced is (select one based on the above calculation):

☐ less than or equal to fifty percent (50%) – only new impervious areas are considered PDP

OR

☒ greater than fifty percent (50%) – the entire project site is a PDP

Site Information Checklist For PDPs	Form I-3B (PDPs)
Project Summary Information	
Project Name	Zephyr Oceanside
Project Address	3480 MISSION AVE., OCEANSIDE, CA 92054
Assessor's Parcel Number(s)	160-270-31, 82, 79, & 160-280-14, 48-51, 53-55, & 160-290-58, 60, 63 160-270-77
Permit Application Number	P19-00009
Project Watershed (Hydrologic Unit)	Select One: ☐Santa Margarita 902 ☒San Luis Rey 903 ☐Carlsbad 904
Parcel Area (total area of Assessor's Parcel(s) associated with the project)	92 Acres
Area to be disturbed by the project (Project Area)	74 Acres
Project Proposed Impervious Area (subset of Project Area)	44 Acres
Project Proposed Pervious Area (subset of Project Area)	30 Acres
Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Parcel Area.	

Hydrologic Unit	Hydrologic Area	Hydrologic Sub-Area
Santa Margarita 902.00	☐ Ysidora 902.10	☐ Lower Ysidora 902.11
San Luis Rey 903.00	☒ Lower San Luis 903.10	☒ Mission 903.11
		☐ Bonsall 903.12
Carlsbad 904.00	☐ Loma Alta 904.10	Not Applicable
	☐ Buena Vista Creek 904.20	☐ El Salto 904.21
		☐ Vista 904.22
	☐ Agua Hedionda 4.30	☐ Los Monos 904.31

Description of Existing Site Condition and Drainage Patterns

Current Status of the Site (select all that apply):

☒Existing development

☐Previously graded but not built out

☐Agricultural or other non-impervious use

☒Vacant, undeveloped/natural

Description / Additional Information:

The existing site is currently used as a weekend swap meet venue (formerly a drive-in movie complex) featuring permanent and temporary structures, vehicle parking, and vacant undeveloped land.

Existing Land Cover Includes (select all that apply):

☒Vegetative Cover

☒Non-Vegetated Pervious Areas

☒Impervious Areas

Description / Additional Information:

The existing site cover is characterized by paved and unpaved parking areas, shipping containers, temporary canopies, and sparsely vegetated vacant land.

Underlying Soil belongs to Hydrologic Soil Group (select all that apply):

☒NRCS Type A

☒NRCS Type B

☐NRCS Type C

☐NRCS Type D

Approximate Depth to Groundwater:

☐Groundwater Depth < 5 feet

☒5 feet < Groundwater Depth < 10 feet

☒10 feet < Groundwater Depth < 20 feet

☒Groundwater Depth > 20 feet

Description of Existing Site Topography and Drainage [How is storm water runoff conveyed from the site? At a minimum, this description should answer (1) whether existing drainage conveyance is natural or urban; (2) describe existing constructed storm water conveyance systems, if applicable; and (3) is runoff from offsite conveyed through the site? If so, describe]:

The existing 92-acre site is bounded by the San Luis Rey River Channel and Levee to the northwest, Park Pond and Fireside Channel and Master Drainage Facility AD box culvert to the northeast and east, the State Route 76 Expressway to the south, and Foussat Road and Middle Pond to the west. The middle third of the site currently has pavement remaining at the old drive-in theater. These paved areas are currently used for weekend swap meets and have been for many years. The Park and Middle Ponds were constructed with the San Luis Rey Levee and Channel project in the late 1980s and are designed for flood attenuation for the San Luis Rey River. A utility/powerline corridor bisects the easterly third of the property, with a portion of the corridor draining south and west ending up at the 48" storm drain crossing the levee. The southerly portion drains overland southerly to the 76 Expressway. From there runoff flows westerly in a swale/channel on along the north edge of the expressway, then is collected into a headwall/60-inch storm drain which drains west along the expressway, outletting into the Middle Pond (just west of Foussat Road). The westerly quarter of the site (between Foussat and old Foussat) currently drains overland southwesterly to a low point in Foussat, where a 24-inch storm drain conveys runoff south to the 60-inch storm drain. The remaining middle portion of the property, both paved former drive-in areas and the areas east of the pavement, drain overland westerly and northerly to the existing headwall and 48" storm drain just east of the Foussat Road bridge. The 48" storm drain conveys concentrated runoff through the levee into the San Luis Rey River. In summary, the two project discharge points are at the southwest corner 60" outfall (just west of Foussat), and the 48" outfall into San Luis Rey River.

Description of Proposed Site Development and Drainage Patterns

Project Description / Proposed Land Use and/or Activities:

The project proposes to mass grade and develop the Oceanside Swap Meet (formerly a drive-in movie complex) into a resort community including: hotel, spa, conference buildings, wave pool, beach club, commercial buildings, residences, 2 graded lots for future development, and natural open space areas.

List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features):

Hotel, spa, conference buildings, beach club, commercial buildings, residences, parking lots, driveways, and hardscape.

List/describe proposed pervious features of the project (e.g., landscape areas):

Natural landscape areas with native vegetation.

Does the project include grading and changes to site topography?

☒Yes

☐No

Description / Additional Information:

Please refer to the proposed site drainage description provided below.

Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)?

☒Yes

☐No

Description / Additional Information:

The project proposes to raise site grades by placing fill to create pad areas for the Ocean Kamp development. The fill areas change site drainage as shown on the DMA Exhibit and in the project's drainage study. New onsite and offsite storm drain systems are proposed.

Form I-3B Page 5 of 10

Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply):

☒Onsite storm drain inlets

☐Interior floor drains and elevator shaft sump pumps

☐Interior parking garages

☒Need for future indoor & structural pest control

☒Landscape/outdoor pesticide use

☒Pools, spas, ponds, decorative fountains, and other water features

☒Food service

☒Refuse areas

☐Industrial processes

☒Outdoor storage of equipment or materials

☐Vehicle and equipment cleaning

☐Vehicle/equipment repair and maintenance

☐Fuel dispensing areas

☐Loading docks

☒Fire sprinkler test water

☒Miscellaneous drain or wash water

☒Plazas, sidewalks, and parking lots

Form I-3B Page 6 of 10		
Identification of Receiving Water Pollutants of Concern		
Describe path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable): The project site will discharge to the San Luis Rey River (as described on Form I-3B Page 5), then flow westerly to the Pacific Ocean Shoreline.		
List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs for the impaired water bodies:		
303(d) Impaired Water Body	**Pollutant(s)/Stressor(s)**	**TMDLs**
San Luis Rey River, Lower	Benthic Community Effects Bifenthrin Chloride Indicator Bacteria Nitrogen Phosphorus Total Dissolved Solids Toxicity	N/A
Pacific Ocean Shoreline at San Luis Rey River Mouth	N/A	Indicator Bacteria

Form I-3B Page 7 of 10			
Identification of Project Site Pollutants* ***Identification of project site pollutants is only required if flow-thru treatment BMPs are implemented onsite in lieu of retention or biofiltration BMPs (note the project must also participate in an alternative compliance program unless prior lawful approval to meet earlier PDP requirements is demonstrated)**			
Identify pollutants expected from the project site based on all proposed use(s) of the site (see manual Appendix B.6):			
Pollutant	**Not Applicable to the Project Site**	**Expected from the Project Site**	**Also a Receiving Water Pollutant of Concern**
Sediment			
Nutrients			
Heavy Metals			
Organic Compounds			
Trash & Debris			
Oxygen Demanding Substances			
Oil & Grease			
Bacteria & Viruses			
Pesticides			

Note: Indicator Bacteria shall be addressed as a Pollutant of Concern (POC) for projects located in the Lower San Luis Hydrologic Area and for projects that discharge to the Pacific Ocean Shoreline within the boundaries of the City of Oceanside.

Note: Nutrients shall be addressed as a Pollutant of Concern (POC) for projects located in the Loma Alta Hydrologic Area.

Form I-3B Page 8 of 10
Hydromodification Management Requirements
Do hydromodification management requirements apply (see Section 1.6 of the manual)? ☐Yes, hydromodification management flow control structural BMPs required. ☐No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☒No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides. Description / Additional Information (to be provided if a 'No' answer has been selected above): Per the BMPDM, the San Luis Rey River from upstream river limit of Basin Plan subwatershed 903.1 (upstream of Bonsall and near Interstate 15) to the Pacific Ocean is exempt from hydromodification management requirements. The existing direct discharge outfalls serve as the project's ultimate discharge points and feature properly sized energy dissipation and have inverts elevated below the 100-year floodplain elevation.
Critical Coarse Sediment Yield Areas* ***This Section only required if hydromodification management requirements apply**

Based on the maps provided within the WMAA, do potential critical coarse sediment yield areas exist within the project drainage boundaries?

☐Yes

☒No, no critical coarse sediment yield areas to be protected based on WMAA maps

If yes, have any of the optional analyses presented in Section 6.2 of the manual been performed?

☐6.2.1 Verification of GLUs Onsite

☐6.2.2 Downstream Systems Sensitivity to Coarse Sediment

☐6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite

☐No optional analyses performed, the project will avoid critical coarse sediment yield areas identified based on WMAA maps

If optional analyses were performed, what is the final result?

☐No critical coarse sediment yield areas to be protected based on verification of GLUs onsite.

☐Critical coarse sediment yield areas exist but additional analysis has determined that protection is not required. Documentation attached in Attachment 8 of the SWQMP.

☐Critical coarse sediment yield areas exist and require protection. The project will implement management measures described in Sections 6.2.4 and 6.2.5 as applicable, and the areas are identified on the SWQMP Exhibit.

Discussion / Additional Information:

Form I-3B Page 9 of 10

Flow Control for Post-Project Runoff*

***This Section only required if hydromodification management requirements apply**

List and describe point(s) of compliance (POCs) for flow control for hydromodification management (see Section 6.3.1). For each POC, provide a POC identification name or number correlating to the project's HMP Exhibit and a receiving channel identification name or number correlating to the project's HMP Exhibit.

N/A

Has a geomorphic assessment been performed for the receiving channel(s)?

☐No, the low flow threshold is 0.1Q2 (default low flow threshold)

☐Yes, the result is the low flow threshold is 0.1Q2

☐Yes, the result is the low flow threshold is 0.3Q2

☐Yes, the result is the low flow threshold is 0.5Q2

If a geomorphic assessment has been performed, provide title, date, and preparer:

Discussion / Additional Information: (optional)

Other Site Requirements and Constraints

When applicable, list other site requirements or constraints that will influence storm water management design, such as zoning requirements including setbacks and open space, or local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements.

The project site contains many existing and proposed utility lines and utility easements. Some of these easements and utility lines impact the drainage system design, BMP locations, and site design.

Optional Additional Information or Continuation of Previous Sections As Needed

This space provided for additional information or continuation of information from previous sections as needed.

Source Control BMP Checklist for All Development Projects (Standard Projects and PDPs)	Form I-4

Project Identification

Project Name

Permit Application Number

Source Control BMPs

All development projects must implement source control BMPs SC-1 through SC-6 where applicable and feasible. See Chapter 4 and Appendix E of the manual for information to implement source control BMPs shown in this checklist.

Answer each category below pursuant to the following.

- "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E of the manual. Discussion / justification is not required.
- "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.
- "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion / justification may be provided.

Source Control Requirement	Implemented?		
SC-1 Prevention of Illicit Discharges into the MS4	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-1 not implemented:			
SC-2 Storm Drain Stenciling or Signage	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-2 not implemented:			
SC-3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-3 not implemented:			

Form I-4 Page 2 of 3			
Source Control Requirement	**Implemented?**		
SC-4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Discussion / justification if SC-4 not implemented:			
SC-5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-5 not implemented:			

Form I-4 Page 3 of 3			
SC-6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below)	**Implemented?**		
Onsite storm drain inlets	☒ Yes	☐ No	☐ N/A
Interior floor drains and elevator shaft sump pumps	☐ Yes	☐ No	☒ N/A
Interior parking garages	☐ Yes	☐ No	☒ N/A
Need for future indoor & structural pest control	☒ Yes	☐ No	☐ N/A
Landscape/outdoor pesticide use	☒ Yes	☐ No	☐ N/A
Pools, spas, ponds, decorative fountains, and other water features	☒ Yes	☐ No	☐ N/A
Food service	☒ Yes	☐ No	☐ N/A
Refuse area	☒ Yes	☐ No	☐ N/A
Industrial processes	☐ Yes	☐ No	☒ N/A
Outdoor storage of equipment or materials	☒ Yes	☐ No	☐ N/A
Vehicle and equipment cleaning	☐ Yes	☐ No	☒ N/A
Vehicle/equipment repair and maintenance	☐ Yes	☐ No	☒ N/A
Fuel dispensing areas	☐ Yes	☐ No	☒ N/A
Loading docks	☐ Yes	☐ No	☒ N/A
Fire sprinkler test water	☒ Yes	☐ No	☐ N/A
Miscellaneous drain or wash water	☒ Yes	☐ No	☐ N/A
Plazas, sidewalks, and parking lots	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for <u>all</u> "No" answers shown above.			

Site Design BMP Checklist for All Development Projects (Standard Projects and PDPs)	Form I-5

Project Identification

Project Name: Zephyr Oceanside

Permit Application Number: P19-00009

Site Design BMPs

All development projects must implement site design BMPs SD-1 through SD-8 where applicable and feasible. See Chapter 4 and Appendix E of the manual for information to implement site design BMPs shown in this checklist.

Answer each category below pursuant to the following.

- "Yes" means the project will implement the site design BMP as described in Chapter 4 and/or Appendix E of the manual. Discussion / justification is not required.
- "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.
- "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project site has no existing natural areas to conserve). Discussion / justification may be provided.

Site Design Requirement	Applied?		
SD-1 Maintain Natural Drainage Pathways and Hydrologic Features	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-1 not implemented:			
SD-2 Conserve Natural Areas, Soils, and Vegetation	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-2 not implemented:			
SD-3 Minimize Impervious Area	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-3 not implemented:			
SD-4 Minimize Soil Compaction	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-4 not implemented:			

Form I-5 Page 2 of 2			
Site Design Requirement	**Applied?**		
SD-5 Impervious Area Dispersion	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-5 not implemented:			
SD-6 Runoff Collection	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-6 not implemented:			
SD-7 Landscaping with Native or Drought Tolerant Species	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-7 not implemented:			
SD-8 Harvesting and Using Precipitation	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-8 not implemented:			

Summary of PDP Structural BMPs	Form I-6 (PDPs)
Project Identification	
Project Name: Zephyr Oceanside	
Permit Application Number: P19-00009	
PDP Structural BMPs	
All PDPs must implement structural BMPs for storm water pollutant control (see Chapter 5 of the manual). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in Chapter 5. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see Chapter 6 of the manual). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s). PDP structural BMPs must be verified by the local jurisdiction at the completion of construction. This may include requiring the project owner or project owner's representative to certify construction of the structural BMPs (see Section 1.12 of the manual). PDP structural BMPs must be maintained into perpetuity, and the local jurisdiction must confirm the maintenance (see Section 7 of the manual). Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page 3 of this form) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).	
Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate. Each DMA will drain to a biofiltration basin for pollutant control and flow control (100-year detention only, project is HMP exempt) as shown on the DMA Exhibit and in the project's drainage study. The biofilitration basins will be lined with an impermeable liner because the project's geotechnical engineer recommends no infiltration (see geotechnical study provided in Attachment 6). (Continue on page 2 as necessary.)	

Form I-6 Page 2 of 4
(Page reserved for continuation of description of general strategy for structural BMP implementation at the site)
(Continued from page 1)

Form I-6 Page 3 of X (Copy as many as needed)	
Structural BMP Summary Information **(Copy this page as needed to provide information for each individual proposed structural BMP)**	
Structural BMP ID No. 1A	
Construction Plan Sheet No.	
Type of structural BMP: ☐Retention by harvest and use (HU-1) ☐Retention by infiltration basin (INF-1) ☐Retention by bioretention (INF-2) ☐Retention by permeable pavement (INF-3) ☐Partial retention by biofiltration with partial retention (PR-1) ☒Biofiltration (BF-1) ☐Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☒Detention pond or vault for hydromodification management ☐Other (describe in discussion section below)	
Purpose: ☒Pollutant control only ☐Hydromodification control only ☐Combined pollutant control and hydromodification control ☐Pre-treatment/forebay for another structural BMP ☒Other (describe in discussion section below) 100-year Detention	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the manual)	Tory R. Walker Engineering, Inc.
Who will be the final owner of this BMP?	Zephyr Oceanside, LLC
Who will maintain this BMP into perpetuity?	Zephyr Oceanside, LLC
What is the funding mechanism for maintenance?	Zephyr Oceanside, LLC

Form I-6 Page 3 of X (Copy as many as needed)	
Structural BMP Summary Information **(Copy this page as needed to provide information for each individual proposed structural BMP)**	
Structural BMP ID No. 1B	
Construction Plan Sheet No.	
Type of structural BMP: ☐Retention by harvest and use (HU-1) ☐Retention by infiltration basin (INF-1) ☐Retention by bioretention (INF-2) ☐Retention by permeable pavement (INF-3) ☐Partial retention by biofiltration with partial retention (PR-1) ☒Biofiltration (BF-1) ☐Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☒Detention pond or vault for hydromodification management ☐Other (describe in discussion section below)	
Purpose: ☒Pollutant control only ☐Hydromodification control only ☐Combined pollutant control and hydromodification control ☐Pre-treatment/forebay for another structural BMP ☒Other (describe in discussion section below) 100-year Detention	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the manual)	Tory R. Walker Engineering, Inc.
Who will be the final owner of this BMP?	Zephyr Oceanside, LLC
Who will maintain this BMP into perpetuity?	Zephyr Oceanside, LLC
What is the funding mechanism for maintenance?	Zephyr Oceanside, LLC

Form I-6 Page 3 of X (Copy as many as needed)	
Structural BMP Summary Information **(Copy this page as needed to provide information for each individual proposed structural BMP)**	
Structural BMP ID No. 2	
Construction Plan Sheet No.	
Type of structural BMP: ☐Retention by harvest and use (HU-1) ☐Retention by infiltration basin (INF-1) ☐Retention by bioretention (INF-2) ☐Retention by permeable pavement (INF-3) ☐Partial retention by biofiltration with partial retention (PR-1) ☒Biofiltration (BF-1) ☐Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☒Detention pond or vault for hydromodification management ☐Other (describe in discussion section below)	
Purpose: ☒Pollutant control only ☐Hydromodification control only ☐Combined pollutant control and hydromodification control ☐Pre-treatment/forebay for another structural BMP ☒Other (describe in discussion section below) 100-year Detention	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the manual)	Tory R. Walker Engineering, Inc.
Who will be the final owner of this BMP?	Zephyr Oceanside, LLC
Who will maintain this BMP into perpetuity?	Zephyr Oceanside, LLC
What is the funding mechanism for maintenance?	Zephyr Oceanside, LLC

Form I-6 Page 3 of X (Copy as many as needed)	
Structural BMP Summary Information **(Copy this page as needed to provide information for each individual proposed structural BMP)**	
Structural BMP ID No. 3	
Construction Plan Sheet No.	
Type of structural BMP: ☐Retention by harvest and use (HU-1) ☐Retention by infiltration basin (INF-1) ☐Retention by bioretention (INF-2) ☐Retention by permeable pavement (INF-3) ☐Partial retention by biofiltration with partial retention (PR-1) ☒Biofiltration (BF-1) ☐Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☒Detention pond or vault for hydromodification management ☐Other (describe in discussion section below)	
Purpose: ☒Pollutant control only ☐Hydromodification control only ☐Combined pollutant control and hydromodification control ☐Pre-treatment/forebay for another structural BMP ☒Other (describe in discussion section below) 100-year Detention	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the manual)	Tory R. Walker Engineering, Inc.
Who will be the final owner of this BMP?	Zephyr Oceanside, LLC
Who will maintain this BMP into perpetuity?	Zephyr Oceanside, LLC
What is the funding mechanism for maintenance?	Zephyr Oceanside, LLC

Form I-6 Page 3 of X (Copy as many as needed)	
Structural BMP Summary Information **(Copy this page as needed to provide information for each individual proposed structural BMP)**	
Structural BMP ID No. 4	
Construction Plan Sheet No.	
Type of structural BMP: ☐Retention by harvest and use (HU-1) ☐Retention by infiltration basin (INF-1) ☐Retention by bioretention (INF-2) ☐Retention by permeable pavement (INF-3) ☐Partial retention by biofiltration with partial retention (PR-1) ☒Biofiltration (BF-1) ☐Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☒Detention pond or vault for hydromodification management ☐Other (describe in discussion section below)	
Purpose: ☒Pollutant control only ☐Hydromodification control only ☐Combined pollutant control and hydromodification control ☐Pre-treatment/forebay for another structural BMP ☒Other (describe in discussion section below) 100-year Detention	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the manual)	Tory R. Walker Engineering, Inc.
Who will be the final owner of this BMP?	Zephyr Oceanside, LLC
Who will maintain this BMP into perpetuity?	Zephyr Oceanside, LLC
What is the funding mechanism for maintenance?	Zephyr Oceanside, LLC

Form I-6 Page 4 of X (Copy as many needed)
Structural BMP Summary Information **(Copy this page as needed to provide information for each individual proposed structural BMP)**
Discussion (as needed):

	City of Oceanside 300 N Coast Highway Oceanside, CA 92054	**Permanent BMP Construction** **Self Certification Form**	February 2016

Date Prepared: Click here to enter text.	Project No.: Click here to enter text.
Project Applicant: Click here to enter text.	Phone: Click here to enter text.
Project Address: Click here to enter text.	
Project Engineer: Click here to enter text.	Phone: Click here to enter text.

The purpose of this form is to verify that the site improvements for the project, identified above, have been constructed in conformance with the approved Storm Water Quality Management Plan (SWQMP) documents and drawings.

This form must be completed by the engineer and installing contractor and submitted prior to final inspection of the construction permit. Completion and submittal of this form is required for all new development and redevelopment projects in order to comply with the City's Storm Water ordinances and NDPES Permit Order No. R9-2013-0001. Final inspection for occupancy and/or release of grading or public improvement bonds may be delayed if this form is not submitted and approved by the City of Oceanside.

ENGINEER'S CERTIFICATION:

As the professional in responsible charge for the design of the above project, I certify that I have inspected all constructed Low Impact Development (LID) site design, source control and treatment control BMP's required per the approved SWQMP and Construction Permit No. Click here to enter text.; and that said BMP's have been constructed in compliance with the approved plans and all applicable specifications, permits, ordinances and Order No. R9-2013-0001 of the San Diego Regional Water Quality Control Board.

I understand that this BMP certification statement does not constitute an operation and maintenance verification.

Signature: _____

Date of Signature: _ Click here to enter text._

Printed Name: _ Click here to enter text._

Title: _ Click here to enter text._

Phone No. _ Click here to enter text. _____

Engineer's Stamp

CONTRACTOR'S CERTIFICATION:

As the professional in responsible charge for construction of the above project, I certify that all constructed Low Impact Development (LID) site design, source control and treatment control BMP's required per the approved SWQMP and Construction Permit No. Click here to enter text.; have been constructed in compliance with the approved plans and all applicable specifications, permits, and ordinances.

I understand that this BMP certification statement does not constitute an operation and maintenance verification.

Signature: _____

Date of Signature: _ Click here to enter text._

Printed Name: _ Click here to enter text._

Title: _ Click here to enter text._

Phone No. _ Click here to enter text. _____

ATTACHMENT 1

BACKUP FOR PDP POLLUTANT CONTROL BMPS

This is the cover sheet for Attachment 1.

Indicate which Items are Included:

Attachment Sequence	Contents	Checklist
Attachment 1a	DMA Exhibit (Required) See DMA Exhibit Checklist.	☒Included
Attachment 1b	Tabular Summary of DMAs Showing DMA ID matching DMA Exhibit, DMA Area, and DMA Type (Required)* *Provide table in this Attachment OR on DMA Exhibit in Attachment 1a	☒Included on DMA Exhibit in Attachment 1a ☐Included as Attachment 1b, separate from DMA Exhibit
Attachment 1c	Design Capture Volume Worksheet	☒Included
Attachment 1d	Form I-7, Harvest and Use Feasibility Screening Checklist (Required unless the entire project will use infiltration BMPs) Refer to Appendix B.3-1 of the BMP Design Manual to complete Form I-7.	☒Included ☐Not included because the entire project will use infiltration BMPs
Attachment 1e	Form I-8, Categorization of Infiltration Feasibility Condition (Required unless the project will use harvest and use BMPs) Refer to Appendices C and D of the BMP Design Manual to complete Form I-8.	☒Included ☐Not included because the entire project will use harvest and use BMPs
Attachment 1f	Pollutant Control BMP Design Worksheets / Calculations (Required) Refer to Appendices B and E of the BMP Design Manual for structural pollutant control BMP design guidelines	☒Included

Use this checklist to ensure the required information has been included on the DMA Exhibit:

The DMA Exhibit must identify:

☒Underlying hydrologic soil group
☒Approximate depth to groundwater
☒Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
☒Critical coarse sediment yield areas to be protected
☒Existing topography and impervious areas
☒Existing and proposed site drainage network and connections to drainage offsite
☒Proposed grading
☒Proposed impervious features
☒Proposed design features and surface treatments used to minimize imperviousness
☒Drainage management area (DMA) boundaries, DMA ID numbers, and DMA areas (square footage or acreage), and DMA type (i.e., drains to BMP, self-retaining, or self-mitigating)
☒Potential pollutant source areas and corresponding required source controls (see Chapter 4, Appendix E.1, and Form I-3B)
☒Structural BMPs (identify location, type of BMP, and size/detail)

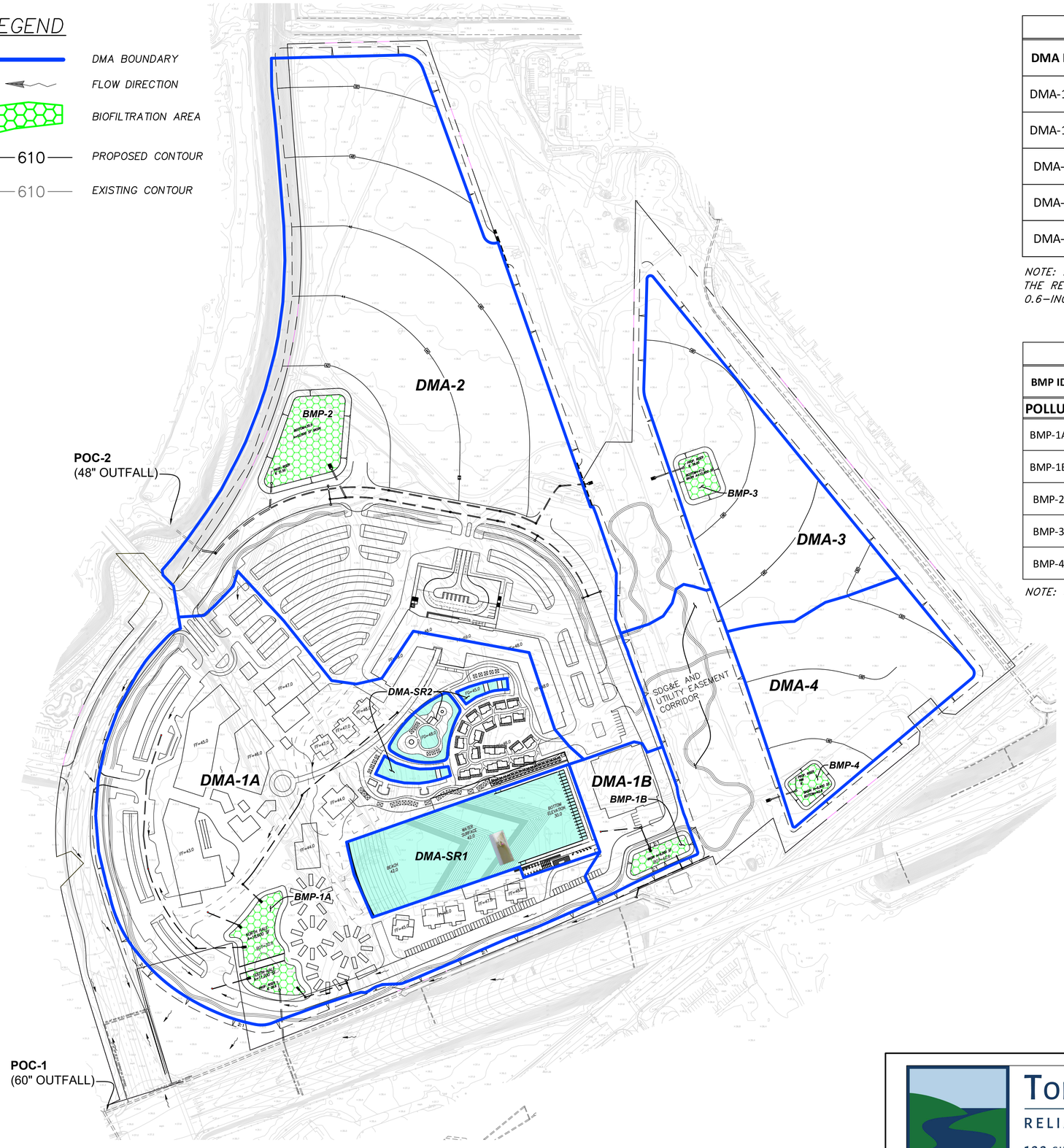
Placeholder – **Tabular Summary of DMAs (if separate from DMA Exhibit)**

Leave placeholder intact if not applicable.

☒Not Applicable – Tabular Summary included on DMA Exhibit

LEGEND

- DMA BOUNDARY
- FLOW DIRECTION
- BIOFILTRATION AREA
- 610 — PROPOSED CONTOUR
- 610 — EXISTING CONTOUR



DMA SUMMARY

DMA ID	DMA SURFACE TYPE & AREA (SF)		DMA AREA (SF)	DMA TYPE	PROPOSED STRUCT BMP TYPE	STRUCT BMP ID	POC
DMA-1A	IMPERVIOUS	557,660	1,075,932	DRAINS TO BMP	BIOFILTRATION (BF-1)	BMP-1A	POC-1
	PERVIOUS	518,272					
DMA-1B	IMPERVIOUS	53,850	104,544	DRAINS TO BMP	BIOFILTRATION (BF-1)	BMP-1B	POC-1
	PERVIOUS	50,694					
DMA-2	IMPERVIOUS	879,811	1,441,836	DRAINS TO BMP	BIOFILTRATION (BF-1)	BMP-2	POC-2
	PERVIOUS	562,025					
DMA-3	IMPERVIOUS	166,319	326,116	DRAINS TO BMP	BIOFILTRATION (BF-1)	BMP-3	POC-2
	PERVIOUS	159,797					
DMA-4	IMPERVIOUS	176,067	270,872	DRAINS TO BMP	BIOFILTRATION (BF-1)	BMP-4	POC-1
	PERVIOUS	94,805					

NOTE: DMAs SR1 & SR2 ARE SELF RETAINING POOL AREAS. THE POOL AREAS ARE HYDRAULICALLY DISCONNECTED FROM THE REST OF THE SITE AND HAVE SUFFICIENT FREEBOARD TO RETAIN THE 85TH PERCENTILE STORM EVENT DEPTH (P85 = 0.6–INCH < 3–INCH MINIMUM POOL FREEBOARD).

BMP TABLE

BMP ID	BMP TYPE	SYMBOL	MIN REQ'D (SF)	PROVIDED (SF)	DRAWING NO.	SHEET NO.(S)	INSPECTION FREQUENCY	MAINTENANCE FREQUENCY
POLLUTANT CONTROL								
BMP-1A	BIOFILTRATION BASIN (BF-1)	SEE LEGEND	16,612	29,800	N/A	N/A	QUARTERLY	SEMI-ANNUALLY
BMP-1B	BIOFILTRATION BASIN (BF-1)	SEE LEGEND	1,606	9,000	N/A	N/A	QUARTERLY	SEMI-ANNUALLY
BMP-2	BIOFILTRATION BASIN (BF-1)	SEE LEGEND	25,441	42,600	N/A	N/A	QUARTERLY	SEMI-ANNUALLY
BMP-3	BIOFILTRATION BASIN (BF-1)	SEE LEGEND	4,970	10,800	N/A	N/A	QUARTERLY	SEMI-ANNUALLY
BMP-4	BIOFILTRATION BASIN (BF-1)	SEE LEGEND	5,038	8,800	N/A	N/A	QUARTERLY	SEMI-ANNUALLY

NOTE: SEE SHEET 2 FOR BMP SECTION DETAILS

LID SITE DEISGN BMPS

1. *MAINTAIN NATURAL DRAINAGE PATHWAYS AND HYDROLOGIC FEATURES (SD–1)*
2. *CONSERVE NATURAL AREAS, SOILS, AND VEGETATION (SD–2)*
3. *MINIMIZE IMPERVIOUS AREAS (SD–3)*
4. *MINIMIZE SOIL COMPACTION (SD–4)*
5. *LANDSCAPE WITH NATIVE OR DROUGHT TOLERANT SPECIES (SD–7)*

SOURCE CONTROL BMPS

1. *PREVENTION OF ILLICIT DISCHARGES INTO THE MS4 (SC–1)*
2. *STORM DRAIN STENCILING OF SIGNAGE (SC–2)*
3. *PROTECT TRASH STORAGE AREAS FROM RAINFALL, RUN–ON, RUN–OFF, AND WIND DISPERSAL (SC–5)*
4. *ADDITIONAL BMPs BASED ON POTENTIAL SOURCES OF RUN–OFF POLLUTANTS (SC–6):*
   - *ON–SITE STORM DRAIN INLETS*
   - *N/A*
   - *NEED FOR FUTURE INDOOR & STRUCTURAL PEST CONTROL*
   - *LANDSCAPE/OUTDOOR PESTICIDE USE*
   - *N/A*
   - *REFUSE/TRASH AREAS TO BE COVERED*
   - *N/A*
   - *N/A*
   - *PLAZAS, SIDEWALKS, AND DRIVEWAYS*

PROJECT SITE INFO

1. *UNDERLYING HYDROLOGIC SOILS:* *TYPE A & TYPE B*
2. *APPROXIMATE GROUNDWATER DEPTH:* *N/A*
3. *EXISTING NATURAL HYDROLOGIC FEATURES:* *NATURAL DRAINAGE CHANNEL ALONG WESTERN PROPERTY BOUNDARY*
4. *CRITICAL COURSE SEDIMENT YIELD AREAS TO BE PROTECTED:* *NONE*

N
W E
S

0 150 300 FEET

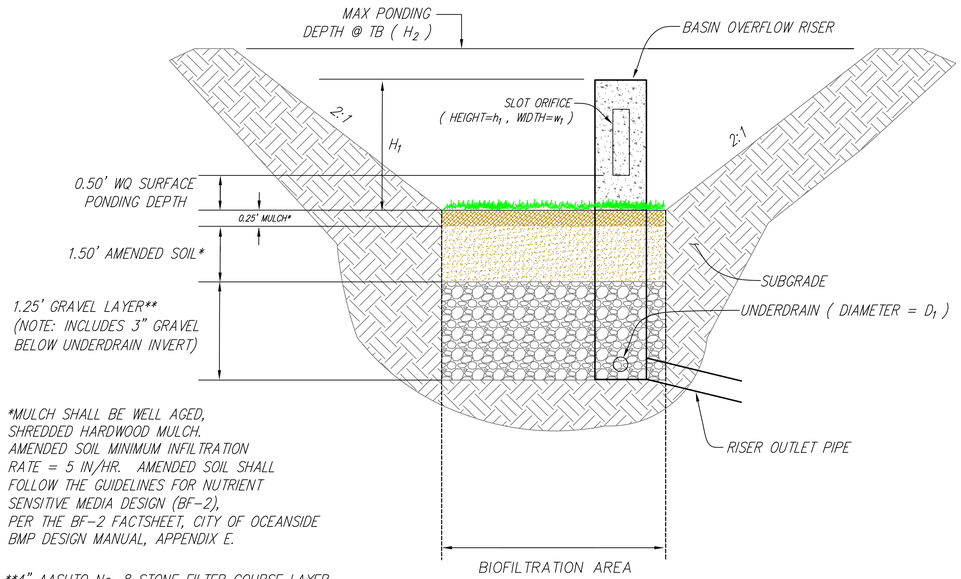
SCALE: 1" = 150'

TORY R. WALKER ENGINEERING
RELIABLE SOLUTIONS IN WATER RESOURCES
122 CIVIC CENTER DR, STE 206, VISTA, CA 92084 · 760-414-9212

OCEAN KAMP

P19–00009

DMA EXHIBIT



*MULCH SHALL BE WELL AGED, SHREDDED HARDWOOD MULCH. AMENDED SOIL MINIMUM INFILTRATION RATE = 5 IN/HR. AMENDED SOIL SHALL FOLLOW THE GUIDELINES FOR NUTRIENT SENSITIVE MEDIA DESIGN (BF-2), PER THE BF-2 FACTSHEET, CITY OF OCEANSIDE BMP DESIGN MANUAL, APPENDIX E.

**4" AASHTO No. 8 STONE FILTER COURSE LAYER OVER 8" AASHTO No. 57 STONE LAYER

(SEE QUANTITY PROVIDED IN BMP TABLE ON SHEET 1)

BMP CROSS SECTION (TYPICAL)

NOT TO SCALE

BMP ID	H_1 (FT)	H_2 (FT)	SLOT ORIFICE		UNDERDRAIN DIAMETER
			h_1 (FT)	w_1 (FT)	D_1 (IN)
1A	8	9	7	0.33	10
1B	0.5	6	N/A	N/A	6
2	5	6	4	1.5	12
3	4	5	3	0.5	6
4	2.5	3	1.5	1	6

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OCEAN KAMP

DMA EXHIBIT

BMP SECTION DETAILS

Harvest and Use Feasibility Checklist	Form I-7

1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season?

■ Toilet and urinal flushing
■ Landscape irrigation
☐ Other:_____

2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2.

SEE COUNTY OF SAN DIEGO BMPDM WORKSHEET B.3-1 PROVIDED IN ATTACHMENT 1

3. Calculate the DCV using worksheet B-2.1.

DCV = *92,328* (cubic feet)

3a. Is the 36 hour demand greater than or equal to the DCV?	3b. Is the 36 hour demand greater than 0.25DCV but less than the full DCV?	3c. Is the 36 hour demand less than 0.25DCV?
☐ Yes / ☒ No ⇨ ⇩	☐ Yes / ☒ No ⇨ ⇩	☒ Yes ⇩
Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.	Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.	**Harvest and use is considered to be infeasible.**

Is harvest and use feasible based on further evaluation?

☐ Yes, refer to Appendix E to select and size harvest and use BMPs.

☒ No, select alternate BMPs.

Automated Worksheet B.3-1: Project-Scale BMP Feasibility Analysis (V1.3)

Category	#	Description	Value	Units
Capture & Use Inputs	0	Design Capture Volume for Entire Project Site	92,328	cubic-feet
	1	Proposed Development Type	Retail	unitless
	2	Number of Residents or Employees at Proposed Development	2,110	#
	3	Total Planted Area within Development	649,457	sq-ft
	4	Water Use Category for Proposed Planted Areas	Moderate	unitless
Infiltration Inputs	5	Is Average Site Design Infiltration Rate ≤0.500 Inches per Hour?	No	yes/no
	6	Is Average Site Design Infiltration Rate ≤0.010 Inches per Hour?	No	yes/no
	7	Is Infiltration of the Full DCV Anticipated to Produce Negative Impacts?	Yes	yes/no
	8	Is Infiltration of Any Volume Anticipated to Produce Negative Impacts?	Yes	yes/no
Calculations	9	36-Hour Toilet Use Per Resident or Employee	1.40	cubic-feet
	10	Subtotal: Anticipated 36 Hour Toilet Use	2,962	cubic-feet
	11	Anticipated 1 Acre Landscape Use Over 36 Hours	196.52	cubic-feet
	12	Subtotal: Anticipated Landscape Use Over 36 Hours	2,930	cubic-feet
	13	Total Anticipated Use Over 36 Hours	5,892	cubic-feet
	14	Total Anticipated Use / Design Capture Volume	0.06	cubic-feet
	15	Are Full Capture and Use Techniques Feasible for this Project?	No	unitless
	16	Is Full Retention Feasible for this Project?	No	yes/no
	17	Is Partial Retention Feasible for this Project?	No	yes/no
Result	18	Feasibility Category	5	1, 2, 3, 4, 5

Worksheet B.3-1 General Notes:

A. Applicants may use this worksheet to determine the types of structural BMPs that are acceptable for implementation at their project site (as required in Section 5 of the BMPDM). User input should be provided for yellow shaded cells, values for all other cells will be automatically generated. Projects demonstrating feasibility or potential feasibility via this worksheet are encouraged to incorporate capture and use features in their project.

B. Negative impacts associated with retention may include geotechnical, groundwater, water balance, or other issues identified by a geotechnical engineer and substantiated through completion of Form I-8.

C. Feasibility Category 1: Applicant must implement capture & use, retention, and/or infiltration elements for the entire DCV.

D. Feasibility Category 2: Applicant must implement capture & use elements for the entire DCV.

E. Feasibility Category 3: Applicant must implement retention and/or infiltration elements for all DMAs with Design Infiltration Rates greater than 0.50 in/hr.

F. Feasibility Category 4: Applicant must implement standard unlined biofiltration BMPs sized at ≥3% of the effective impervious tributary area for all DMAs with Design Infiltration Rates of 0.011 to 0.50 in/hr. Applicants may be permitted to implement lined BMPs, reduced size BMPs, and/or specialized biofiltration BMPs provided additional criteria identified in "Supplemental Retention Criteria for Non-Standard Biofiltration BMPs" are satisfied.

G. Feasibility Category 5: Applicant must implement standard lined biofiltration BMPs sized at ≥3% of the effective impervious tributary area for all DMAs with Design Infiltration Rates of 0.010 in/hr or less. Applicants may also be permitted to implement reduced size and/or specialized biofiltration BMPs provided additional criteria identified in "Supplemental Retention Criteria for Non-Standard Biofiltration BMPs" are satisfied.

H. PDPs participating in an offsite alternative compliance program are not held to the feasibility categories presented herein.

Categorization of Infiltration Feasibility Condition	Form I-8

Part 1 - Full Infiltration Feasibility Screening Criteria

Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
1	**Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.	☒	☐

Provide basis:

The tested infiltration rate is greater than 0.5 in/hr (see geotechnical study in Attachment 6).

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

2	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.	☐	☒

Provide basis:

The project's geotechnical engineer recommends no infiltration based on increased risk of geotechnical hazards (see geotechnical study provided in Attachment 6).

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

Form I-8 Page 2 of 4			
Criteria	Screening Question	**Yes**	**No**
3	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	☐	☐
Provide basis: *N/A because answer to Criteria 2 is No.* Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	☐	☐
Provide basis: *N/A because answer to Criteria 2 is No.* Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Part 1 Result *	If all answers to rows 1 - 4 are "**Yes**" a full infiltration design is potentially feasible. The feasibility screening category is **Full Infiltration** If any answer from row 1-4 is "**No**", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2	☐Full Infiltration ☒No	

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by Agency/Jurisdictions to substantiate findings

Form I-8 Page 3 of 4

Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria

Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
5	**Do soil and geologic conditions allow for infiltration in any appreciable rate or volume?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.	☒	☐

Provide basis:

Onsite infiltration is possible, but at low rates (see geotechnical study in Attachment 6).

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

6	**Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level**? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.	☐	☒

Provide basis:

The project's geotechnical engineer recommends no infiltration based on increased risk of geotechnical hazards (see geotechnical study provided in Attachment 6).

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

Form I-8 Page 4 of 4			
Criteria	Screening Question	**Yes**	**No**
7	**Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	☐	☒
Provide basis: *The geotechnical engineer anticipates a shallow groundwater table (see geotechnical study provided in Attachment 6).* Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
8	**Can infiltration be allowed without violating downstream water rights**? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	☐	☐
Provide basis: *N/A because answer to Criteria 6 is No.* Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
Part 2 Result*	If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is **Partial Infiltration.** If any answer from row 5-8 is no, then infiltration of any volume is considered to be **infeasible** within the drainage area. The feasibility screening category is **No Infiltration.**	☐Partial Infiltration ☒No Infiltration	

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by Agency/Jurisdictions to substantiate findings

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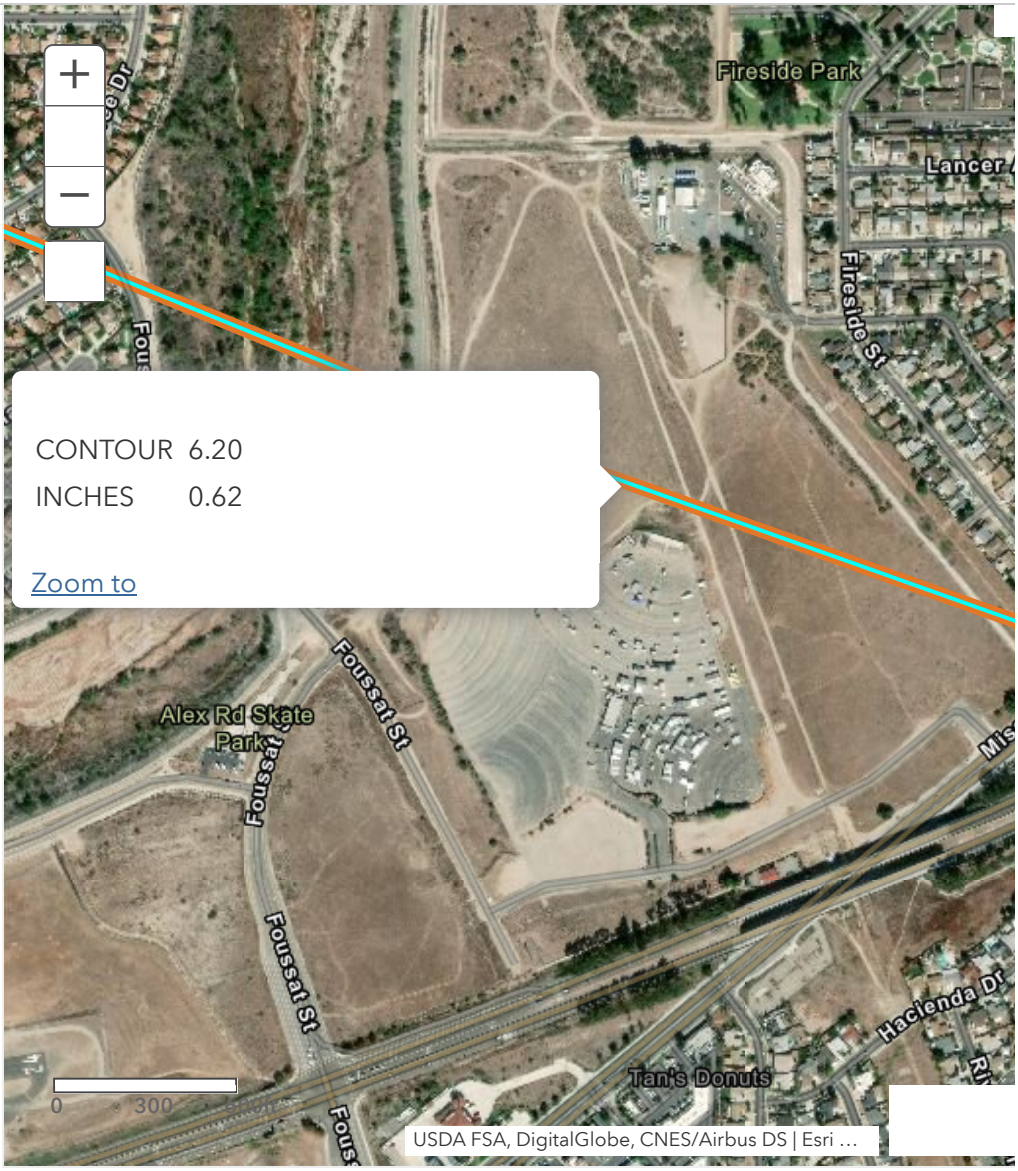

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Automated Worksheet B.1: Calculation of Design Capture Volume (V2.0)

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
Standard Drainage Basin Inputs	1	Drainage Basin ID or Name	DMA-1A	DMA-1B	DMA-2	DMA-3	DMA-4						unitless
	2	85th Percentile 24-hr Storm Depth	0.62	0.62	0.62	0.62	0.62						inches
	3	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	557,660	53,850	879,811	166,319	176,067						sq-ft
	4	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)											sq-ft
	5	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)	518,272	50,694	562,025	159,797	94,805						sq-ft
	6	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)											sq-ft
	7	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)											sq-ft
	8	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)											sq-ft
	9	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)											sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	10	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	No	No	No	No	No	No	No	No	No	No	yes/no
	11	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)											sq-ft
	12	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	13	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	14	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	15	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)											sq-ft
	16	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)											sq-ft
	17	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	18	Number of Tree Wells Proposed per SD-A											#
	19	Average Mature Tree Canopy Diameter											ft
	20	Number of Rain Barrels Proposed per SD-E											#
	21	Average Rain Barrel Size											gal
Initial Runoff Factor Calculation	22	Total Tributary Area	1,075,932	104,544	1,441,836	326,116	270,872	0	0	0	0	0	sq-ft
	23	Initial Runoff Factor for Standard Drainage Areas	0.51	0.51	0.59	0.51	0.62	0.00	0.00	0.00	0.00	0.00	unitless
	24	Initial Runoff Factor for Dispersed & Dispersion Areas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	25	Initial Weighted Runoff Factor	0.51	0.51	0.59	0.51	0.62	0.00	0.00	0.00	0.00	0.00	unitless
	26	Initial Design Capture Volume	28,351	2,755	43,952	8,593	8,677	0	0	0	0	0	cubic-feet
Dispersion Area Adjustments	27	Total Impervious Area Dispersed to Pervious Surface	0	0	0	0	0	0	0	0	0	0	sq-ft
	28	Total Pervious Dispersion Area	0	0	0	0	0	0	0	0	0	0	sq-ft
	29	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	ratio
	30	Adjustment Factor for Dispersed & Dispersion Areas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	ratio
	31	Runoff Factor After Dispersion Techniques	0.51	0.51	0.59	0.51	0.62	n/a	n/a	n/a	n/a	n/a	unitless
	32	Design Capture Volume After Dispersion Techniques	28,351	2,755	43,952	8,593	8,677	0	0	0	0	0	cubic-feet
Tree & Barrel Adjustments	33	Total Tree Well Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
	34	Total Rain Barrel Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
Results	35	Final Adjusted Runoff Factor	0.51	0.51	0.59	0.51	0.62	0.00	0.00	0.00	0.00	0.00	unitless
	36	Final Effective Tributary Area	548,725	53,317	850,683	166,319	167,941	0	0	0	0	0	sq-ft
	37	Initial Design Capture Volume Retained by Site Design Elements	0	0	0	0	0	0	0	0	0	0	cubic-feet
	38	Final Design Capture Volume Tributary to BMP	28,351	2,755	43,952	8,593	8,677	0	0	0	0	0	cubic-feet

No Warning Messages

Automated Worksheet B.3: BMP Performance (V2.0)

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
BMP Inputs	1	Drainage Basin ID or Name	DMA-1A	DMA-1B	DMA-2	DMA-3	DMA-4	-	-	-	-	-	sq-ft
	2	Design Infiltration Rate Recommended	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	in/hr
	3	Design Capture Volume Tributary to BMP	28,351	2,755	43,952	8,593	8,677	-	-	-	-	-	cubic-feet
	4	Is BMP Vegetated or Unvegetated?	Vegetated	Vegetated	Vegetated	Vegetated	Vegetated						unitless
	5	Is BMP Impermeably Lined or Unlined?	Lined	Lined	Lined	Lined	Lined						unitless
	6	Does BMP Have an Underdrain?	Underdrain	Underdrain	Underdrain	Underdrain	Underdrain						unitless
	7	Does BMP Utilize Standard or Specialized Media?	Standard	Standard	Standard	Standard	Standard						unitless
	8	Provided Surface Area	29,800	9,000	42,600	10,800	8,800						sq-ft
	9	Provided Surface Ponding Depth	6	6	6	6	6						inches
	10	Provided Soil Media Thickness	21	21	21	21	21						inches
	11	Provided Gravel Thickness (Total Thickness)	15	15	15	15	15						inches
	12	Underdrain Offset	3	3	3	3	3						inches
	13	Diameter of Underdrain or Hydromod Orifice (Select Smallest)	10.00	6.00	12.00	6.00	6.00						inches
	14	Specialized Soil Media Filtration Rate											in/hr
	15	Specialized Soil Media Pore Space for Retention											unitless
	16	Specialized Soil Media Pore Space for Biofiltration											unitless
	17	Specialized Gravel Media Pore Space											unitless
Retention Calculations	18	Volume Infiltrated Over 6 Hour Storm	0	0	0	0	0	0	0	0	0	0	cubic-feet
	19	Ponding Pore Space Available for Retention	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	unitless
	20	Soil Media Pore Space Available for Retention	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	unitless
	21	Gravel Pore Space Available for Retention (Above Underdrain)	0.00	0.00	0.00	0.00	0.00	0.40	0.40	0.40	0.40	0.40	unitless
	22	Gravel Pore Space Available for Retention (Below Underdrain)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	23	Effective Retention Depth	2.25	2.25	2.25	2.25	2.25	0.00	0.00	0.00	0.00	0.00	inches
	24	Fraction of DCV Retained (Independent of Drawdown Time)	0.20	0.61	0.18	0.24	0.19	0.00	0.00	0.00	0.00	0.00	ratio
	25	Calculated Retention Storage Drawdown Time	120	120	120	120	120	0	0	0	0	0	hours
	26	Efficacy of Retention Processes	0.22	0.54	0.20	0.26	0.21	0.00	0.00	0.00	0.00	0.00	ratio
	27	Volume Retained by BMP (Considering Drawdown Time)	6,268	1,487	8,835	2,193	1,831	0	0	0	0	0	cubic-feet
	28	Design Capture Volume Remaining for Biofiltration	22,083	1,268	35,117	6,400	6,846	0	0	0	0	0	cubic-feet
Biofiltration Calculations	29	Max Hydromod Flow Rate through Underdrain	4.4205	1.6375	6.2712	1.6375	1.6375	0.0000	0.0000	0.0000	0.0000	0.0000	cfs
	30	Max Soil Filtration Rate Allowed by Underdrain Orifice	6.41	7.86	6.36	6.55	8.04	0.00	0.00	0.00	0.00	0.00	in/hr
	31	Soil Media Filtration Rate per Specifications	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	in/hr
	32	Soil Media Filtration Rate to be used for Sizing	5.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.00	0.00	in/hr
	33	Depth Biofiltered Over 6 Hour Storm	30.00	30.00	30.00	30.00	30.00	0.00	0.00	0.00	0.00	0.00	inches
	34	Ponding Pore Space Available for Biofiltration	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	unitless
	35	Soil Media Pore Space Available for Biofiltration	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	unitless
	36	Gravel Pore Space Available for Biofiltration (Above Underdrain)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	37	Effective Depth of Biofiltration Storage	15.00	15.00	15.00	15.00	15.00	0.00	0.00	0.00	0.00	0.00	inches
	38	Drawdown Time for Surface Ponding	1	1	1	1	1	0	0	0	0	0	hours
	39	Drawdown Time for Effective Biofiltration Depth	3	3	3	3	3	0	0	0	0	0	hours
	40	Total Depth Biofiltered	45.00	45.00	45.00	45.00	45.00	0.00	0.00	0.00	0.00	0.00	inches
	41	Option 1 - Biofilter 1.50 DCV: Target Volume	33,125	1,902	52,675	9,599	10,269	0	0	0	0	0	cubic-feet
	42	Option 1 - Provided Biofiltration Volume	33,125	1,902	52,675	9,599	10,269	0	0	0	0	0	cubic-feet
	43	Option 2 - Store 0.75 DCV: Target Volume	16,563	951	26,338	4,800	5,134	0	0	0	0	0	cubic-feet
	44	Option 2 - Provided Storage Volume	16,563	951	26,338	4,800	5,134	0	0	0	0	0	cubic-feet
	45	Portion of Biofiltration Performance Standard Satisfied	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	ratio
Result	46	Do Site Design Elements and BMPs Satisfy Annual Retention Requirements?	Yes	Yes	Yes	Yes	Yes	-	-	-	-	-	yes/no
	47	Overall Portion of Performance Standard Satisfied (BMP Efficacy Factor)	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	ratio
	48	**Deficit of Effectively Treated Stormwater**	**0**	**0**	**0**	**0**	**0**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	cubic-feet

No Warning Messages

ATTACHMENT 2
BACKUP FOR PDP HYDROMODIFICATION CONTROL MEASURES

This is the cover sheet for Attachment 2.

☒Mark this box if this attachment is empty because the project is exempt from PDP hydromodification management requirements.

Indicate which Items are Included:

Attachment Sequence	Contents	Checklist
Attachment 2a	1. Hydromodification Management Exhibit (Required)	☐Included See Hydromodification Management Exhibit Checklist.
Attachment 2b	Management of Critical Coarse Sediment Yield Areas (WMAA Exhibit is required, additional analyses are optional) See Section 6.2 of the BMP Design Manual.	☐Exhibit showing project drainage boundaries marked on WMAA Critical Coarse Sediment Yield Area Map (Required) Optional analyses for Critical Coarse Sediment Yield Area Determination ☐6.2.1 Verification of Geomorphic Landscape Units Onsite ☐6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite
Attachment 2c	Geomorphic Assessment of Receiving Channels (Optional) See Section 6.3.4 of the BMP Design Manual.	☐Not performed ☐Included ☐Submitted as separate stand-alone document
Attachment 2d	Flow Control Facility Design and Structural BMP Drawdown Calculations (Required) Overflow Design Summary for each structural BMP See Chapter 6 and Appendix G of the BMP Design Manual	☐Included ☐Submitted as separate stand-alone document
Attachment 2e	Vector Control Plan (Required when structural BMPs will not drain in 96 hours)	☐Included ☐Not required because BMPs will drain in less than 96 hours

Use this checklist to ensure the required information has been included on the Hydromodification Management Exhibit:

The Hydromodification Management Exhibit must identify:

☐Underlying hydrologic soil group
☐Approximate depth to groundwater
☐Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
☐Critical coarse sediment yield areas to be protected
☐Existing topography
☐Existing and proposed site drainage network and connections to drainage offsite
☐Proposed grading
☐Proposed impervious features
☐Proposed design features and surface treatments used to minimize imperviousness
☐Point(s) of Compliance (POC) for Hydromodification Management
☐Existing and proposed drainage boundary and drainage area to each POC (when necessary, create separate exhibits for pre-development and post-project conditions)
☐Structural BMPs for hydromodification management (identify location, type of BMP, and size/detail)

Please provide the Exhibit in 24”x36” format with map pocket, wet date, and stamp.

Placeholder – **Hydromodification Management Exhibit**

Replace placeholder with required exhibit.

Placeholder – **WMAA Exhibit**

Replace placeholder with required exhibit.

Placeholder – **6.2.1 Verification of GLUs Onsite** (if applicable)

Replace placeholder with required calculations/documentation.

Leave placeholder intact if not applicable.

☐Not Applicable

Downstream Systems Sensitivity to Course Sediment		Form I-10	
When it has been determined that potential critical coarse sediment yield areas exist within the project site, the next step is to determine whether downstream systems would be sensitive to reduction of coarse sediment yield from the project site. Use this form to document the evaluation of downstream systems requirements for preservation of coarse sediment supply.			
Project Name:			
Project Tracking Number / Permit Application Number:			
1	Will the project discharge runoff to a hardened MS4 system (pipe or lined channel) or an un-lined channel?	☐ Hardened MS4 system	Go to 2
		☐ Un-lined channel	Go to 4
2	Will the hardened MS4 system convey sediment (e.g., a concrete-lined channel with steep slope and cleansing velocity) or sink sediment (e.g., flat slopes, constrictions, treatment BMPs, or ponds with restricted outlets within the system will trap sediment and not allow conveyance of coarse sediment from the project site to an un-lined system).	☐ Convey	Go to 3
		☐ Sink	Go to 7
3	What kind of receiving water will the hardened MS4 system convey the sediment to?	☐ Un-lined channel	Go to 4
		☐ Lake ☐ Reservoir ☐ Bay	Go to 7
		☐ Lagoon ☐ Ocean	Go to 6
4	Is the un-lined channel impacted by deposition of sediment? This condition must be documented by the local agency.	☐ Yes	Go to 7
		☐ No	Go to 5

Form I-10 Page 2 of 2	
5	End – Preserve coarse sediment supply to protect un-lined channels from accelerated erosion due to reduction of coarse sediment yield from the project site unless further investigation determines the sediment is not critical to the receiving stream. Sediment that is critical to receiving streams is the sediment that is a significant source of bed material to the receiving stream (bed sediment supply) (see Section 6.2.3 and Appendix H.2 of the manual).
6	End – Provide management measures for preservation of coarse sediment supply (protect beach sand supply).
7	End – Downstream system does not warrant preservation of coarse sediment supply, no measures for protection of critical coarse sediment yield areas onsite are necessary. Use the space below to describe the basis for this finding for the project.

Placeholder – **6.2.3 Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite** (Optional)

Replace placeholder with required calculations/documentation.

Leave placeholder intact if not applicable.

Not Applicable

Placeholder – **6.3.4 Geomorphic Assessment of Receiving Channels** (Optional)

Replace placeholder with required calculations/documentation.

Leave placeholder intact if not applicable.

Not Applicable

Placeholder - **Flow Control Facility Design and Structural BMP Drawdown Calculations**

Replace placeholder with required calculations/documentation.

See Chapter 6 and Appendix G of the BMP Design Manual

NOTE: DRAWDOWN CALCULATIONS ARE PROVIDED IN ATTACHMENT 1 WORKSHEET B.3 LINES 38 AND 39.

Placeholder – **Vector Control Plan** (required when structural BMPs will drain in 96 hours)

Replace placeholder with required documentation.

Leave placeholder intact if not applicable.

Not Applicable

ATTACHMENT 3
STRUCTURAL BMP MAINTENANCE INFORMATION

This is the cover sheet for Attachment 3.

Indicate which Items are Included:

Attachment Sequence	Contents	Checklist
Attachment 3a	Structural BMP Maintenance Thresholds and Actions (Required)	☒Included See Structural BMP Maintenance Information Checklist.
Attachment 3b	Draft Maintenance Agreement (when applicable)	☐Included ☒Not Applicable

Use this checklist to ensure the required information has been included in the Structural BMP Maintenance Information Attachment:

Preliminary Design / Planning / CEQA level submittal:

- Attachment 3a must identify:

☒Typical maintenance indicators and actions for proposed structural BMP(s) based on Section 7.7 of the BMP Design Manual

- Attachment 3b is not required for preliminary design / planning / CEQA level submittal.

Final Design level submittal:

Attachment 3a must identify:

☐Specific maintenance indicators and actions for proposed structural BMP(s). This shall be based on Section 7.7 of the BMP Design Manual and enhanced to reflect actual proposed components of the structural BMP(s)
☐How to access the structural BMP(s) to inspect and perform maintenance
☐Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
☐Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
☐Maintenance thresholds specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
☐Recommended equipment to perform maintenance
☐When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management
Attachment 3b: For private entity operation and maintenance, Attachment 3b shall include a draft maintenance agreement in the local jurisdiction's standard format (PDP applicant to contact the City Engineer to obtain the current maintenance agreement forms).

ATTACHMENT 3A

MAINTENANCE INDICATORS AND ACTIONS

Biofiltration BMP (BMPs 1A, 1B, 2, 3, & 4)

Typical Maintenance Indicator(s) for Vegetated BMPs	Maintenance Actions
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials, without damage to the vegetation.
Poor vegetation establishment	Re-seed, re-plant, or re-establish vegetation per original plans.
Overgrown vegetation	Mow or trim as appropriate, but not less than the design height of the vegetation per original plans when applicable (e.g. a vegetated swale may require a minimum vegetation height).
Erosion due to concentrated irrigation flow	Repair/re-seed/re-plant eroded areas and adjust the irrigation system.
Erosion due to concentrated storm water runoff flow	Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, The County must be contacted prior to any additional repairs or reconstruction.
Standing water in vegetated swales	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, loosening or replacing top soil to allow for better infiltration, or minor re-grading for proper drainage. If the issue is not corrected by restoring the BMP to the original plan and grade, County staff in the Watershed Protection Program must be contacted prior to any additional repairs or reconstruction.
Standing water in bioretention, biofiltration with partial retention, or biofiltration areas, or flow-through planter boxes for longer than 96 hours following a storm event*	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains (where applicable), or repairing/replacing clogged or compacted soils.
Obstructed inlet or outlet structure	Clear obstructions.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable.
*These BMPs typically include a surface ponding layer as part of their function which may take 96 hours to drain following a storm event.	

BMP ACCESS – Maintenance access to the biofiltration BMP is readily available as it is a surface treatment facility. The outlet riser structures will be easily accessible via a removable grate.

INSPECTION FEATURES – Inspection features include a removable grate at the top of the outlet riser structure and cleanouts for the underdrain pipe. A removable orifice plate on the inner outlet riser wall will facilitate maintenance and inspection of the underdrain pipe.

RECOMMENDED EQUIPMENT – Typical landscape equipment should be all that is required to maintain the BMPs.

TRAINING – Training requirements will be established in final engineering.

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BMP MAINTENANCE FACT SHEET
FOR
STRUCTURAL BMP BF-1 BIOFILTRATION

Biofiltration facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to discharge via underdrain or overflow to the downstream conveyance system. Biofiltration facilities have limited or no infiltration. They are typically designed to provide enough hydraulic head to move flows through the underdrain connection to the storm drain system. Typical biofiltration components include:

- Inflow distribution mechanisms (e.g., perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side slope and basin bottom vegetation selected based on climate and ponding depth
- Non-floating mulch layer
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer consisting of aggregate to prevent the migration of fines into uncompacted native soils or the aggregate storage layer
- Aggregate storage layer with underdrain(s)
- Impermeable liner or uncompacted native soils at the bottom of the facility
- Overflow structure

Normal Expected Maintenance

Biofiltration requires routine maintenance to: remove accumulated materials such as sediment, trash or debris; maintain vegetation health; maintain infiltration capacity of the media layer; replenish mulch; and maintain integrity of side slopes, inlets, energy dissipators, and outlets. A summary table of standard inspection and maintenance indicators is provided within this Fact Sheet.

Non-Standard Maintenance or BMP Failure

If any of the following scenarios are observed, the BMP is not performing as intended to protect downstream waterways from pollution and/or erosion. Corrective maintenance, increased inspection and maintenance, BMP replacement, or a different BMP type will be required.

- The BMP is not drained between storm events. Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health, and surface ponding longer than approximately 96 hours following a storm event poses a risk of vector (mosquito) breeding. Poor drainage can result from clogging of the media layer, filter course, aggregate storage layer, underdrain, or outlet structure. The specific cause of the drainage issue must be determined and corrected.
- Sediment, trash, or debris accumulation greater than 25% of the surface ponding volume within one month. This means the load from the tributary drainage area is too high, reducing BMP function or clogging the BMP. This would require pretreatment measures within the tributary area draining to the BMP to intercept the materials. Pretreatment components, especially for sediment, will extend the life of components that are more expensive to replace such as media, filter course, and aggregate layers.
- Erosion due to concentrated storm water runoff flow that is not readily corrected by adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.

Other Special Considerations

Biofiltration is a vegetated structural BMP. Vegetated structural BMPs that are constructed in the vicinity of, or connected to, an existing jurisdictional water or wetland could inadvertently result in creation of expanded waters or wetlands. As such, vegetated structural BMPs have the potential to come under the jurisdiction of the United States Army Corps of Engineers, SDRWQCB, California Department of Fish and Wildlife, or the United States Fish and Wildlife Service. This could result in the need for specific resource agency permits and costly mitigation to perform maintenance of the structural BMP. Along with proper placement of a structural BMP, **routine maintenance is key to preventing this scenario**.

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SUMMARY OF STANDARD INSPECTION AND MAINTENANCE FOR BF-1 BIOFILTRATION		
The property owner is responsible to ensure inspection, operation and maintenance of permanent BMPs on their property unless responsibility has been formally transferred to an agency, community facilities district, homeowners association, property owners association, or other special district. Maintenance frequencies listed in this table are average/typical frequencies. Actual maintenance needs are site-specific, and maintenance may be required more frequently. Maintenance must be performed whenever needed, based on maintenance indicators presented in this table. The BMP owner is responsible for conducting regular inspections to see when maintenance is needed based on the maintenance indicators. During the first year of operation of a structural BMP, inspection is recommended at least once prior to August 31 and then monthly from September through May. Inspection during a storm event is also recommended. After the initial period of frequent inspections, the minimum inspection and maintenance frequency can be determined based on the results of the first year inspections.		
Threshold/Indicator	**Maintenance Action**	**Typical Maintenance Frequency**
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials, without damage to the vegetation or compaction of the media layer.	• Inspect monthly. If the BMP is 25% full* or more in one month, increase inspection frequency to monthly plus after every 0.1-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Obstructed inlet or outlet structure	Clear blockage.	• Inspect monthly and after every 0.5-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable	• Inspect annually. • Maintenance when needed.
Poor vegetation establishment	Re-seed, re-plant, or re-establish vegetation per original plans.	• Inspect monthly. • Maintenance when needed.
Dead or diseased vegetation	Remove dead or diseased vegetation, re-seed, re-plant, or re-establish vegetation per original plans.	• Inspect monthly. • Maintenance when needed.
Overgrown vegetation	Mow or trim as appropriate.	• Inspect monthly. • Maintenance when needed.
2/3 of mulch has decomposed, or mulch has been removed	Remove decomposed fraction and top off with fresh mulch to a total depth of 3 inches.	• Inspect monthly. • Replenish mulch annually, or more frequently when needed based on inspection.

*"25% full" is defined as ¼ of the depth from the design bottom elevation to the crest of the outflow structure (e.g., if the height to the outflow opening is 12 inches from the bottom elevation, then the materials must be removed when there is 3 inches of accumulation – this should be marked on the outflow structure).

SUMMARY OF STANDARD INSPECTION AND MAINTENANCE FOR BF-1 BIOFILTRATION (Continued from previous page)		
Threshold/Indicator	**Maintenance Action**	**Typical Maintenance Frequency**
Erosion due to concentrated irrigation flow	Repair/re-seed/re-plant eroded areas and adjust the irrigation system.	• Inspect monthly. • Maintenance when needed.
Erosion due to concentrated storm water runoff flow	Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.	• Inspect after every 0.5-inch or larger storm event. If erosion due to storm water flow has been observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.
Standing water in BMP for longer than 24 hours following a storm event Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains, or repairing/replacing clogged or compacted soils.	• Inspect monthly and after every 0.5-inch or larger storm event. If standing water is observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed.
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology	If mosquitos/larvae are observed: first, immediately remove any standing water by dispersing to nearby landscaping; second, make corrective measures as applicable to restore BMP drainage to prevent standing water. If mosquitos persist following corrective measures to remove standing water, or if the BMP design does not meet the 96-hour drawdown criteria due to release rates controlled by an orifice installed on the underdrain, the [City Engineer] shall be contacted to determine a solution. A different BMP type, or a Vector Management Plan prepared with concurrence from the County of San Diego Department of Environmental Health, may be required.	• Inspect monthly and after every 0.5-inch or larger storm event. If mosquitos are observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed.
Underdrain clogged	Clear blockage.	• Inspect if standing water is observed for longer than 24-96 hours following a storm event. • Maintenance when needed.

References

American Mosquito Control Association.
http://www.mosquito.org/
California Storm Water Quality Association (CASQA). 2003. Municipal BMP Handbook.
https://www.casqa.org/resources/bmp-handbooks/municipal-bmp-handbook
County of San Diego. 2014. Low Impact Development Handbook.
http://www.sandiegocounty.gov/content/sdc/dpw/watersheds/susmp/lid.html
San Diego County Copermittees. 2016. Model BMP Design Manual, Appendix E, Fact Sheet BF-1.
http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=250&Itemid=220

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Biofiltration

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	
Property / Development Name:	Responsible Party Name and Phone Number:	
Property Address of BMP:	Responsible Party Address:	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 1 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Accumulation of sediment, litter, or debris Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove and properly dispose of accumulated materials, without damage to the vegetation ☐ If sediment, litter, or debris accumulation exceeds 25% of the surface ponding volume within one month (25% full*), add a forebay or other pre-treatment measures within the tributary area draining to the BMP to intercept the materials. ☐ Other / Comments:		
Poor vegetation establishment Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Re-seed, re-plant, or re-establish vegetation per original plans ☐ Other / Comments:		

*"25% full" is defined as ¼ of the depth from the design bottom elevation to the crest of the outflow structure (e.g., if the height to the outflow opening is 12 inches from the bottom elevation, then the materials must be removed when there is 3 inches of accumulation – this should be marked on the outflow structure).

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 2 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Dead or diseased vegetation Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove dead or diseased vegetation, re-seed, re-plant, or re-establish vegetation per original plans ☐ Other / Comments:		
Overgrown vegetation Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Mow or trim as appropriate ☐ Other / Comments:		
2/3 of mulch has decomposed, or mulch has been removed Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove decomposed fraction and top off with fresh mulch to a total depth of 3 inches ☐ Other / Comments:		

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 3 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Erosion due to concentrated irrigation flow Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair/re-seed/re-plant eroded areas and adjust the irrigation system ☐ Other / Comments:		
Erosion due to concentrated storm water runoff flow Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan ☐ If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction ☐ Other / Comments:		

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Biofiltration

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 4 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Obstructed inlet or outlet structure Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Clear blockage ☐ Other / Comments:		
Underdrain clogged (inspect underdrain if standing water is observed for longer than 24-96 hours following a storm event) Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Clear blockage ☐ Other / Comments:		
Damage to structural components such as weirs, inlet or outlet structures Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair or replace as applicable ☐ Other / Comments:		

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Biofiltration

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 5 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Standing water in BMP for longer than 24-96 hours following a storm event* Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains, or repairing/replacing clogged or compacted soils ☐ Other / Comments:		
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Apply corrective measures to remove standing water in BMP when standing water occurs for longer than 24-96 hours following a storm event.** ☐ Other / Comments:		

*Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health, and surface ponding longer than approximately 96 hours following a storm event poses a risk of vector (mosquito) breeding. Poor drainage can result from clogging of the media layer, filter course, aggregate storage layer, underdrain, or outlet structure. The specific cause of the drainage issue must be determined and corrected.

**If mosquitos persist following corrective measures to remove standing water, or if the BMP design does not meet the 96-hour drawdown criteria due to release rates controlled by an orifice installed on the underdrain, the [City Engineer] shall be contacted to determine a solution. A different BMP type, or a Vector Management Plan prepared with concurrence from the County of San Diego Department of Environmental Health, may be required.

ATTACHMENT 4
Copy of Plan Sheets Showing Permanent Storm Water BMPs

This is the cover sheet for Attachment 4.

Use this checklist to ensure the required information has been included on the plans:

The plans must identify:

☒Structural BMP(s) with ID numbers matching Form I-6 Summary of PDP Structural BMPs
☒The grading and drainage design shown on the plans must be consistent with the delineation of DMAs shown on the DMA exhibit
☒Details and specifications for construction of structural BMP(s)
☒Signage indicating the location and boundary of structural BMP(s) as required by the City Engineer
☒How to access the structural BMP(s) to inspect and perform maintenance
☒Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
☒Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
☒Maintenance thresholds specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
☒Recommended equipment to perform maintenance
☒When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management
☒Include landscaping plan sheets showing vegetation requirements for vegetated structural BMP(s)
☒All BMPs must be fully dimensioned on the plans
☒When propritery BMPs are used, site specific cross section with outflow, inflow and model number shall be provided. Broucher photocopies are not allowed.

Placeholder – **Stormwater BMP Plan Sheet(s)**

Replace placeholder with plan sheet(s).

ATTACHMENT 5
Drainage Report

This is the cover sheet for Attachment 5.

CEQA-Level Drainage Report

for

Ocean Kamp

T19-00004, D19-00016, CUP 19-00021, P19-00009

Oceanside, CA

Prepared for:

Zephyr Oceanside, LLC
700 Second Street
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Prepared on:

December 19, 2019

Revised: March 5, 2020

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TORY R. WALKER ENGINEERING
RELIABLE SOLUTIONS IN WATER RESOURCES

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3. **Hydrologic Methodology and Discussion** 3
4. **Detention Basin Routing** 4
5. **Retention Analysis and Hydraulics** 4
6. **Middle Pond & Park Pond** 4
7. **Conclusions** 5
8. **References** 5

Appendices

A. San Diego County Charts and Nomographs
B. Rational Method Calculations/AES Output
C. Detention Basin Routing
D. Retention Analysis and Hydraulics
E. Project Maps
   - Existing Condition Hydrology Map
   - Developed Condition Hydrology Map

1. Introduction and Purpose

The proposed Ocean Kamp project is a combined mixed-use/community resort project located near the Oceanside airport along the 76 Expressway in Oceanside, CA. This CEQA-level drainage report provides a basis for preliminary detention basin sizes and trunk storm drain design. Estimated flows from the project storm drain outfalls are quantified and assessed in relation to the adjacent San Luis River and regional flood control basins along the U.S. Army Corps of Engineers (USACOE) levee at the river. Supporting calculations, exhibits, and narrative for the project drainage designs are included in the Appendices of this report. A Storm Water Quality Management Plan (SWQMP) is provided separately with the project submittal.

2. Project Description

Location

The project is located at the former Oceanside Drive-in location at Foussat Road and Mission Road, and adjacent to the 76 Expressway in Oceanside, CA.

Proposed Project

The developers of the Ocean Kamp project are proposing a resort with wave pool on the southerly one-third of the site. Extensive planting, landscaping, and decorative hardscape features will accent the large wave pool/beach with smaller pools, lawn areas, cabanas, and bungalows proposed along the entire perimeter of the wave pool. Retail shops, hotel buildings, and a parking lot are proposed further out along the project loop road, north of the wave pool. Future residential areas are proposed north and east of the loop r–oad, with densities ranging from 11 to 25 dwelling units per acre. Those areas are currently mass-graded and development plans are pending. All calculations in this report account for the future developed conditions of these areas.

Existing (Pre-Developed) Conditions Drainage Patterns

The Existing (pre-developed) Condition Hydrology Map is the same as was used in the 2007 report that Tory R. Walker Engineering (TRWE) prepared for the Pavilion Project. That map is provided in Appendix E of this report. The 90-acre site is bounded by the San Luis Rey River channel and levee to the northwest, Park Pond and Fireside Channel and Master Drainage Facility AD box culvert to the northeast and east, the State Route 76 Expressway to the south, and Foussat Road and Middle Pond to the west. The middle third of the site was formerly paved for the old drive-in theater and swap meet. Park Pond and Middle Pond were both constructed with the San Luis Rey Levee and Channel Project in the late 1980s and are designed for local flood attenuation when the San Luis Rey River is at flood stage. A utility/powerline corridor bisects the easterly third of the property; the northerly portion of the corridor drains west, with an outfall at the 48-inch RCP storm drain crossing the levee (Node 29 on the existing conditions map). The southerly portion drains south to the 76 Expressway. From there, runoff flows westerly in an existing

concrete trapezoidal channel along the north edge of the expressway, and then into a headwall/60-inch RCP storm drain (Node 15). The storm drain continues west along the expressway, with an outfall into Middle Pond just west of Foussat Road. The westerly quarter of the site (between Foussat and Old Foussat) currently drains southwesterly to a low point in Foussat, where a 24-inch RCP storm drain conveys runoff south to the 60-inch RCP storm drain (Node 18). The remaining middle portion of the property drains west and north to the existing headwall and 48-inch RCP storm drain just east of the Foussat Road bridge (Node 29). The 48-inch storm drain conveys runoff through the levee into the San Luis Rey River. In summary, the two project discharge points are Node 19 (southwest corner 60-inch RCP outfall just west of Foussat), and Node 29 (48-inch outfall into the San Luis Rey River).

Developed Conditions Drainage Patterns and Designs

The proposed project drainage design is intended to generally match existing drainage patterns. Approximately 60% of the resort and retail areas drain southwest to the outfall at the existing 60-inch storm drain near Foussat Road. Runoff from the southerly portion of the SDGE easement and the proposed residential area to the east also contribute to the existing 60-inch storm drain. Within the resort area, approximately 25 acres drain to the large (30k square feet) combined stormwater treatment - detention basin (Basin 1A) at the southwest corner of the site. Flow attenuation is provided within this basin, and outflows are piped to join the existing 60-inch storm drain along the 76 Expressway. The combined total outflow at the 60-inch outlet into Middle Pond is summarized in the conclusions section of this report and compared with existing condition flows.

Portions of the areas north and east of the wave pool drain north into the project loop road and large treatment-detention basin (Basin 2) just north of the loop road. Runoff from the northerly future residential area is also treated and attenuated in this basin. From there, flows join the loop road trunk storm drain and continue to the San Luis Rey River through the aforementioned 48-inch storm drain outfall near the Foussat Bridge. Portions of the SDGE easement and easterly residential areas (treated at small basins within those areas) drain to the loop road trunk storm drain and also to the outfall at the existing 48-inch pipe. There are two separate trunk storm drains proposed in the loop road; one for untreated flows (leading to Basin 2), and one for treated flows (treated upstream).

Drainage at Easterly Edge of Project

The approximately 4-acre area at the easterly boundary will remain as open space; the northerly half of this area will drain north toward the Fireside Channel, and the southerly half will drain to the existing box culvert (Oceanside Master Facility AD). No runoff will flow to the adjacent residential tract along Fireside Drive.

Residential Areas North and East of Loop Road and SDGE Easement – Infrastructure

The residential area north of the loop road, and west of the SDGE easement, will be approximately 40% single family detached (11 DU/AC), and 60% multi-family attached, with a cul-de-sac street feeding several private driveways throughout. A large detention/treatment basin and a neighborhood park are planned on either side of the cul-de-sac. Drainage infrastructure for both residential areas will include roof downspouts to landscaped areas, private drainage pipes, catch basins at sumps, trunk private storm drains, and grass swales where there is available space. The cul-de-sac street will include a trunk public storm drain that will outlet into the detention basin and curb inlets.

Resort Area Infrastructure

The northerly parking lot area will drain to the loop road, with sheet flow, V-gutters where needed, and catch basins/private storm drains to be located and sized at the final engineering stage of the project. Buildings and parking areas east of the main parking lot will have downspouts, areas of sheet flow, V-gutters, catch basins and private storm drains again leading to the loop road.

The resort area includes grass areas, pools, hardscape walkways, and perimeter buildings/commercial areas. Roof downspouts will outlet onto grass and planter areas wherever feasible. A network of private catch basins and storm drains will convey runoff westerly to the large treatment/detention basin. Runoff in the parking areas west of the resort area will be captured in catch basins and trunk storm drains, discharging into the basin. Areas south of the wave pool area will drain to the southerly loop road, which slopes west toward the large basin.

3. Hydrologic Methodology and Discussion

Rational Method hydrologic calculations are provided for the developed conditions using San Diego County Hydrology Manual (SDCHM) methodology. Flows for three storm events, the 2, 10, and 100-year design storms were calculated using AES (Advanced Engineering Software) which routes and confluences flows in a nodal system. AES calculates runoff using the Rational Method based on estimated runoff coefficients and times-of-concentration (see Appendix B for output). The project runoff totals for existing and developed conditions are summarized in Table 1. The basis for the hydrology calculations is provided with the hydrology maps in Appendix E, with corresponding drainage boundaries, initial subareas, and discharge points illustrated. The project site consists of Soil Type D, with the proposed imported fill. The land cover consists of pavement, landscaped areas, buildings, pools, hardscape, seating lawns, etc. Runoff coefficients were assigned based on the combinations of land cover/imperviousness and proposed use. Peak flow rates from the Rational Method calculations were input into the detention basin routing calculations. Detained peak flow values were also reentered into the rational method calculations for post-detention basin flows.

4. Detention Basin Routing

Detention basin routing calculations for the 100-year, 6-hour storm event are provided for the project's several combined treatment-detention basins. We used a Modified-Puls routing of the BMP facilities in SWMM with the Rational Method Hydrograph procedure per the San Diego County Hydrology Manual (SDCHM). Peak flows were obtained using the Rational Method per the SDCHM. The design storm and runoff hydrographs (generated per the SDCHM) were routed through the BMPs in order to satisfy the drainage study Q_{100} criteria. Backup calculations are provided in Appendix C.

5. Retention Analysis and Hydraulics

As noted previously, the northern portion of the proposed project drains to the existing 48-inch storm drain under the levee, which incorporates a flap gate to prevent backwater flow from the San Luis Rey River. In order to satisfy City of Oceanside criteria, we determined the onsite storage volume required for full retention of the runoff volume from a 10-year, 24-hour storm event for the area tributary to the 48-inch pipe (assuming 100-year water surface elevation in the San Luis Rey River and the 48-inch flap gate is closed). We performed a HEC-HMS model hydrologic analysis of the subbasin and used the NRCS Unit Hydrograph method to calculate the 10-year, 24-hour runoff volume. We then prepared preliminary calculations demonstrating that the runoff volume can be temporarily retained within the onsite storm drain system, BMP-2 (basin), and the SDGE easement area. The ponded elevation within the SDGE easement area is 37.1 feet, just over one foot of ponding.

We performed a preliminary hydraulic analysis of the existing 48-inch storm drain and the loop road trunk storm drain and confirmed that the system has sufficient capacity to convey the onsite 100-year peak flow. The analysis assumes a 10-year water surface elevation in the San Luis Rey River per City of Oceanside criteria. The analysis continues upstream in the loop road to the SDGE easement (Node 604 on the Developed Conditions Hydrology Map).

6. Middle Pond & Park Pond

Park Pond

The project design currently routes no runoff north to Park Pond. Runoff for the northerly half of the site flows to the 48-inch storm drain outlet at the San Luis Rey River and is detained in Basin 2 as noted above in Sections 4 and 5.

Middle Pond

Project runoff from the resort area/southwest portion of the site, will be significantly attenuated in Basin 1A, the large basin west of the wave pool. After attenuation, flows combine with runoff from Route 76 and Foussat Road, and outlet into Middle Pond. The combined area is 51.5 acres, which is a slight increase from the existing condition contribution of 49 acres. Using the USACOE

General Design Memorandum (GDM) for the San Luis Rey River Levee Project as a reference, the total tributary area for Middle Pond is 3.3 square miles. The small increase in contributing area from the proposed Ocean Kamp project is therefore inconsequential in terms of flood risk, runoff rate, or storage volume. On-site attenuation and increased pervious cover and infiltration throughout the resort landscaping provides a net decrease from the site to Middle Pond for each of those measurables. As noted in the summary and the hydrology map, the developed condition 100-year flow is reduced with the project, due to extensive detention.

7. Conclusions

As proposed, the Ocean Kamp project will not substantially alter existing drainage patterns. At Discharge Point 2, the 100-year flows and tributary area that run into the 48-inch outfall at the Foussat bridge are both less than with existing conditions. In addition, retention storage volume will be available within project pipes and the adjacent SDGE easement, such that 10-year storm volumes will be retained in the 100-year flow condition in the adjacent San Luis Rey River. At Discharge Point 1, the project will result in reductions as noted in Section 6 above.

A summary of existing and developed conditions runoff is provided in Table 1 below.

Table 1: Project Outfall Flows and Tributary Areas

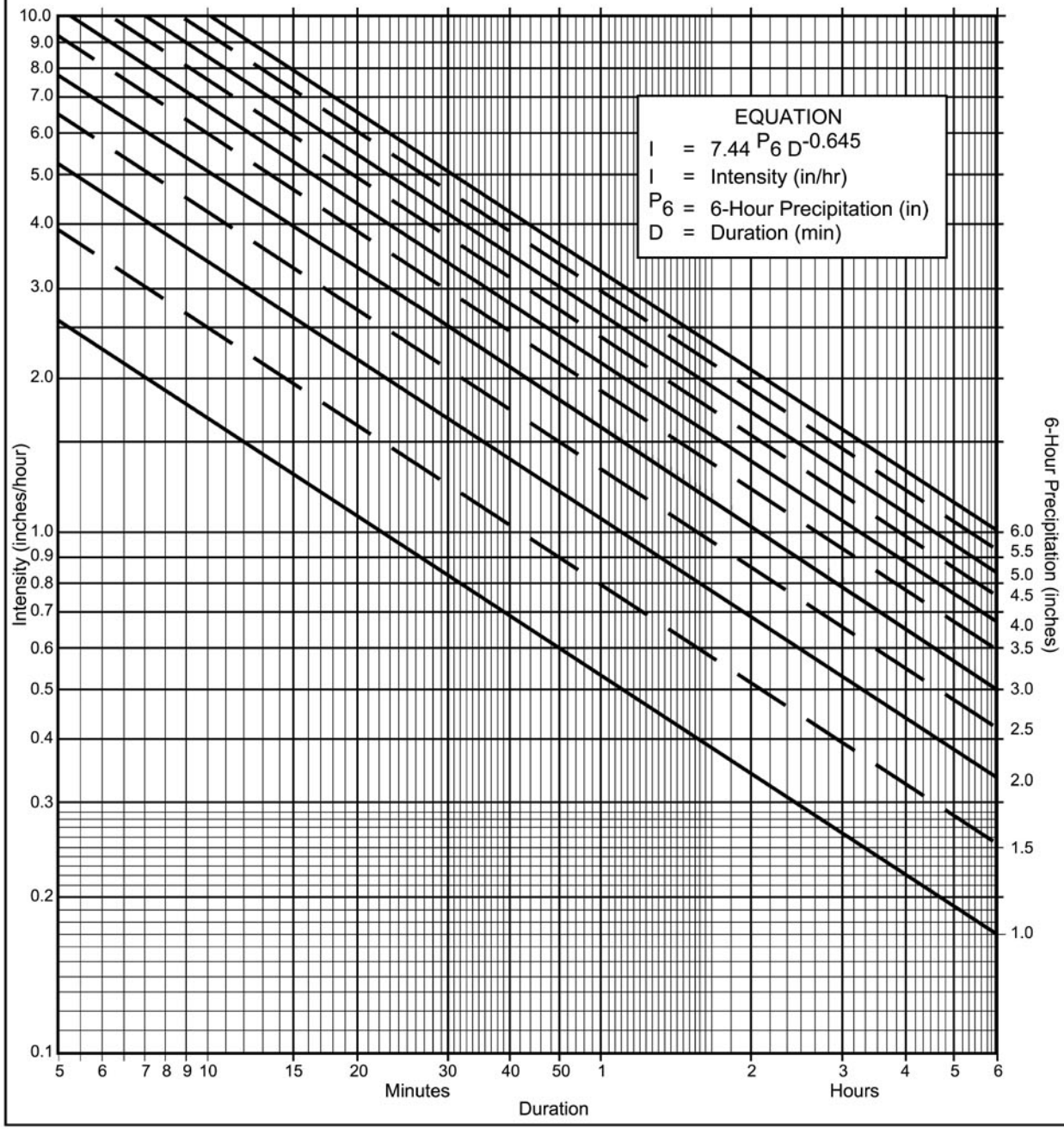
Location	Existing Conditions		Developed Conditions	
	Drainage Area (ac)	Q_{100} (cfs)	Drainage Area (ac)	Q_{100} (cfs)
Discharge Point 1 (60-inch RCP)	49.0	50.0	51.6	40.0
Discharge Point 2 (48-inch RCP)	64.1	68	48.1	24.8

REFERENCES

1. San Diego County, *Hydrology Manual,* June 2013.
2. Hydrology Report for The Pavilion at Oceanside, by TRWE, December 14, 2007 (on file with the City of Oceanside Engineering Dept)

APPENDIX A

San Diego County Charts and Nomographs



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency ___10-___ year

(b) P_6 = ___1.8___ in., P_{24} = ___3.3___, $\frac{P_6}{P_{24}}$ = ___55___ %(2)

(c) Adjusted P_6(2) = ___N/A___ in.

(d) t_x = _____ min.

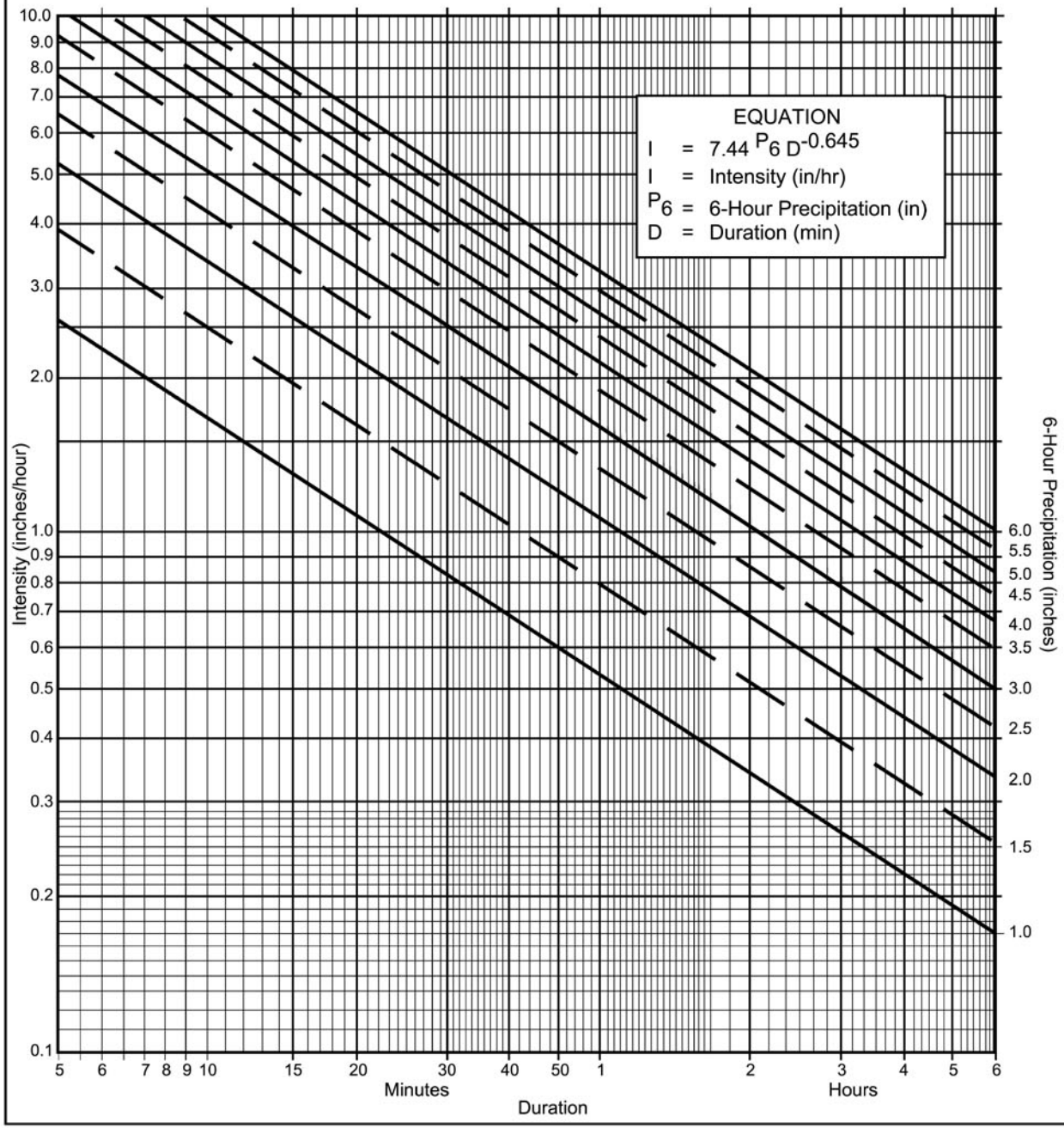
(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100- year

(b) P_6 = 2.7 in., P_{24} = 5.0 , $\frac{P_6}{P_{24}}$ = 54 %(2)

(c) Adjusted P_6(2) = N/A in.

(d) t_x = _____ min.

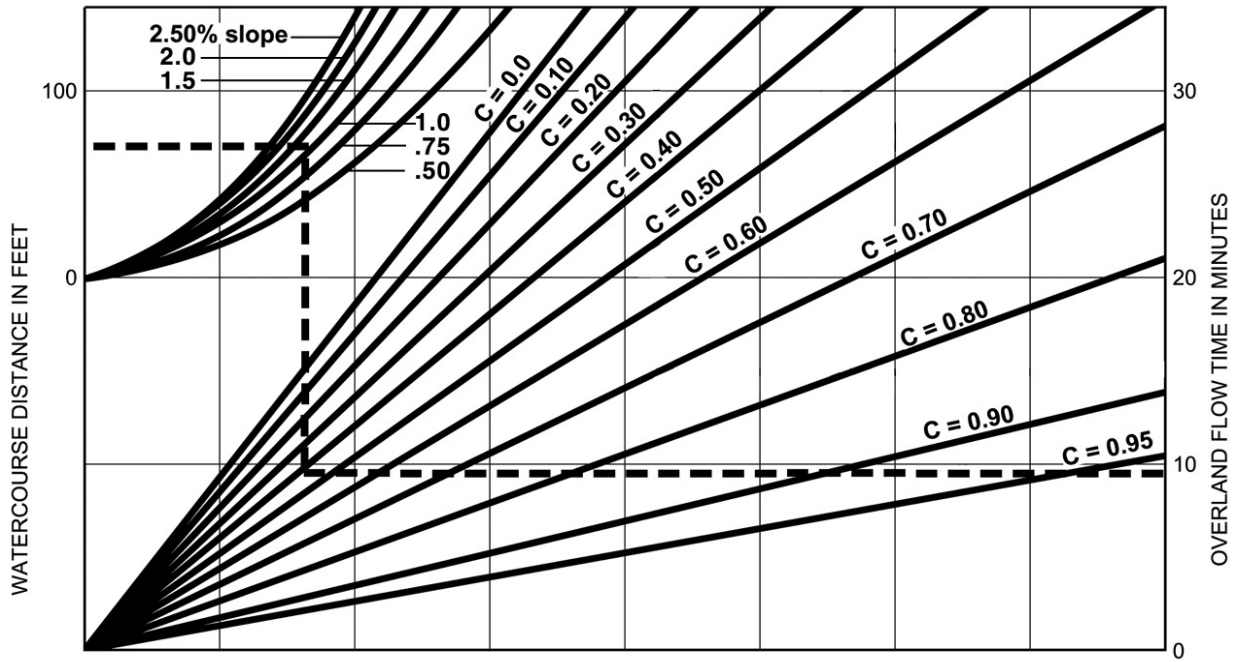
(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1



EXAMPLE:

Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE 3-3

Rational Formula - Overland Time of Flow Nomograph

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

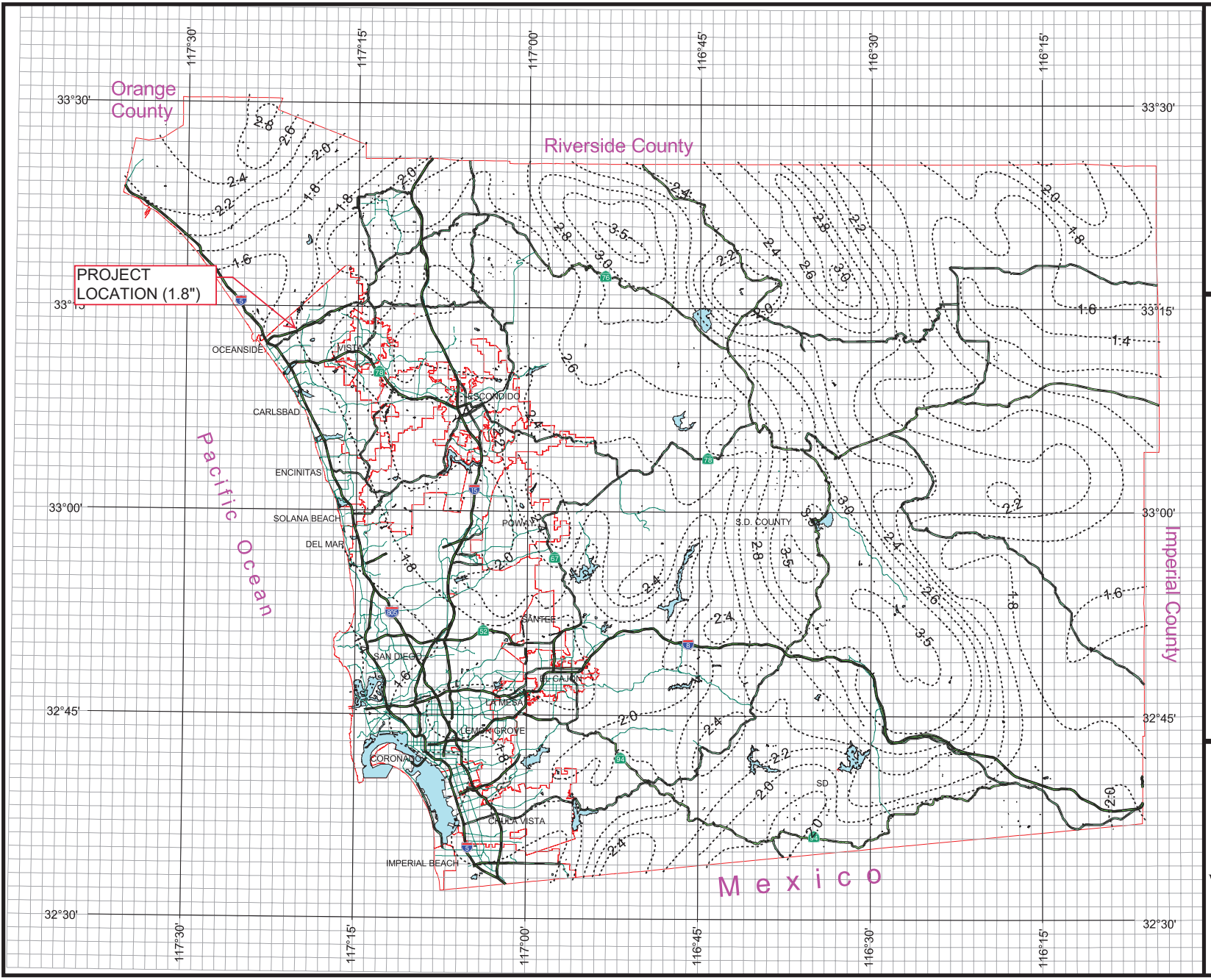
*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service

County of San Diego Hydrology Manual

Rainfall Isopluvials

10 Year Rainfall Event - 6 Hours

Isopluvial (inches)



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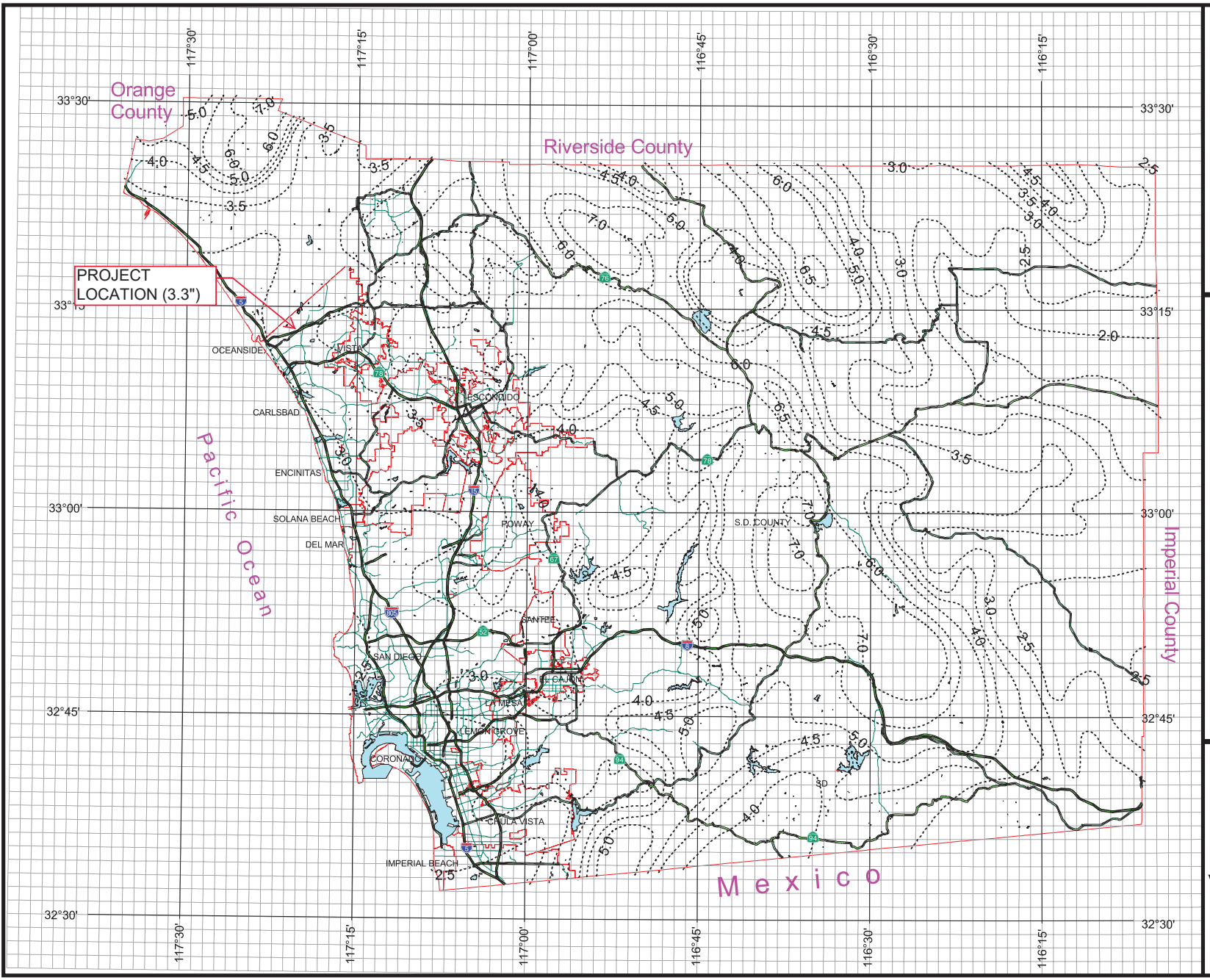
County of San Diego Hydrology Manual

Rainfall Isopluvials

10 Year Rainfall Event - 24 Hours

Isopluvial (inches)



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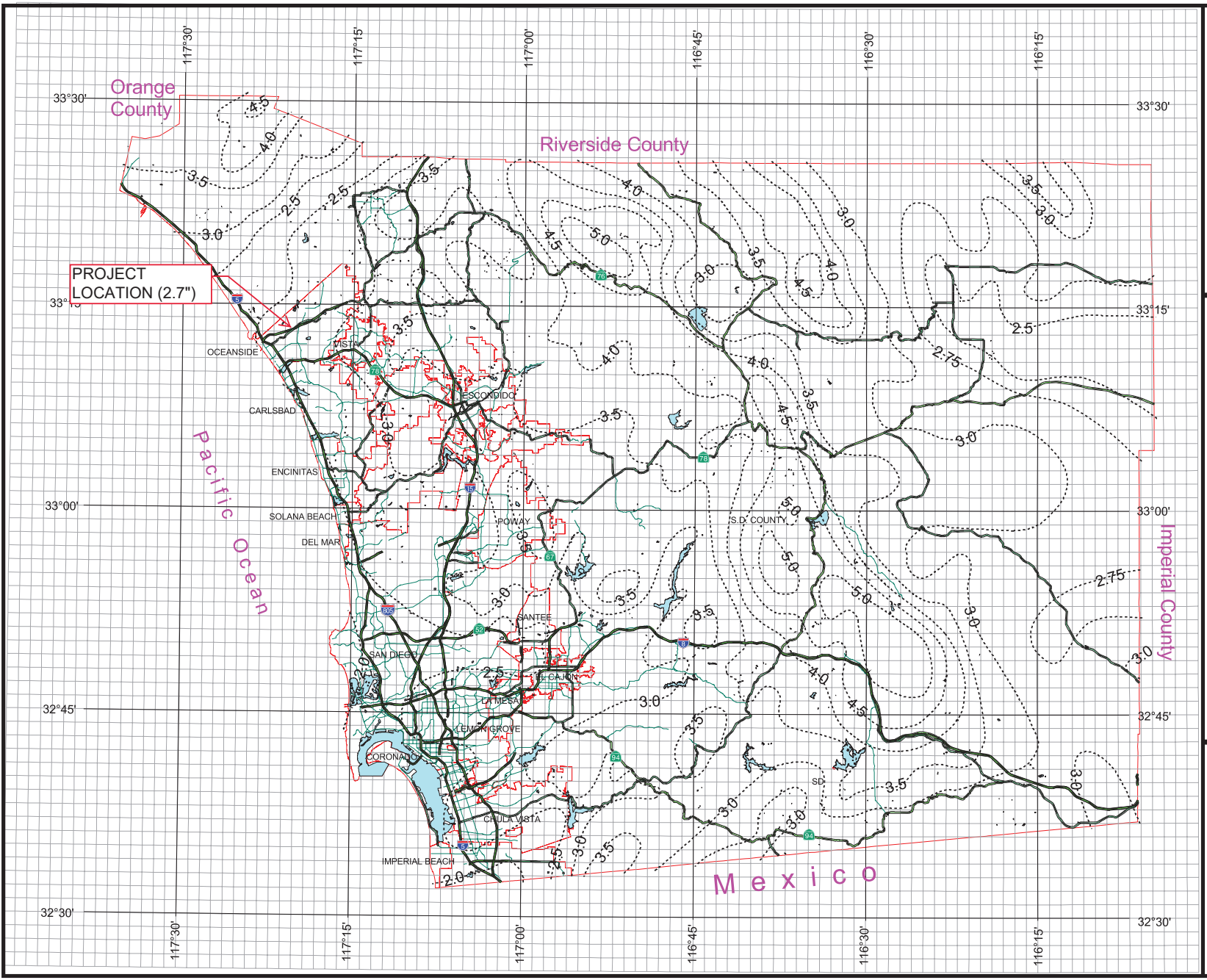
County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)



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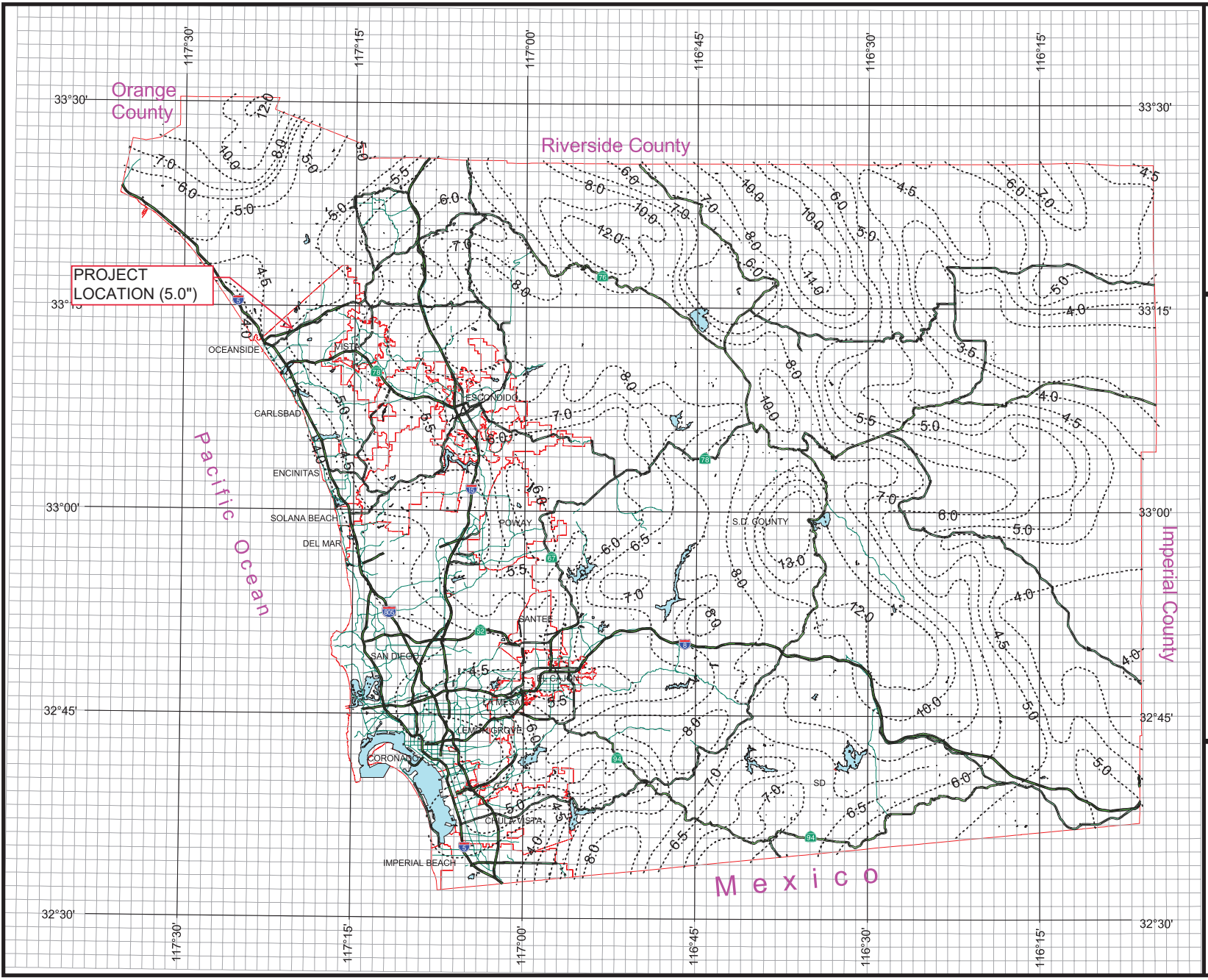
County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)



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APPENDIX B

Rational Method Calculations/AES Output

B. 100-Year Rational Method

1a-zsw100

1b-zne100

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2016 Advanced Engineering Software (aes)
              Ver. 23.0 Release Date: 07/01/2016  License ID 1532

                            Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* Ocean Kamp - Rational Method - SW Area                                 *
* December 16, 2019                                                      *
* 100-year analysis                                                      *
 ************************************************************************

  FILE NAME: ZSW100.DAT
  TIME/DATE OF STUDY: 07:25 12/19/2019
------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.700
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-   CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =     48.00
  DOWNSTREAM ELEVATION(FEET) =     47.50
  ELEVATION DIFFERENCE(FEET) =      0.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.216
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
```

```
          THE MAXIMUM OVERLAND FLOW LENGTH =    50.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.615
  SUBAREA RUNOFF(CFS) =      1.09
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      1.09

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     47.50  DOWNSTREAM(FEET) =     46.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   270.00   CHANNEL SLOPE =  0.0056
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.020   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.480
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.71
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.49
  AVERAGE FLOW DEPTH(FEET) =   0.16   TRAVEL TIME(MIN.) =   3.02
  Tc(MIN.) =   10.24
  SUBAREA AREA(ACRES) =     1.10       SUBAREA RUNOFF(CFS) =    3.20
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  TOTAL AREA(ACRES) =        1.4         PEAK FLOW RATE(CFS) =       4.08

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.20   FLOW VELOCITY(FEET/SEC.) =   1.69
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     390.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    42.00  DOWNSTREAM(FEET) =    38.00
  FLOW LENGTH(FEET) =   420.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.26
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.08
  PIPE TRAVEL TIME(MIN.) =   1.33    Tc(MIN.) =   11.57
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     810.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.10 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.140
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6167
  SUBAREA AREA(ACRES) =    2.80   SUBAREA RUNOFF(CFS) =    6.96
  TOTAL AREA(ACRES) =        4.2   TOTAL RUNOFF(CFS) =      10.72
  TC(MIN.) =   11.57
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    103.20 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.140
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6097
  SUBAREA AREA(ACRES) =    3.00   SUBAREA RUNOFF(CFS) =    7.45
  TOTAL AREA(ACRES) =        7.2   TOTAL RUNOFF(CFS) =      18.18
  TC(MIN.) =   11.57

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    38.00  DOWNSTREAM(FEET) =    32.60
  FLOW LENGTH(FEET) =   350.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.85
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      18.18
  PIPE TRAVEL TIME(MIN.) =   0.66    Tc(MIN.) =   12.23
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    1160.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.10 TO NODE    107.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.995
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5888
  SUBAREA AREA(ACRES) =    1.70   SUBAREA RUNOFF(CFS) =    3.40
  TOTAL AREA(ACRES) =        8.9   TOTAL RUNOFF(CFS) =      20.93
  TC(MIN.) =   12.23

****************************************************************************
  FLOW PROCESS FROM NODE    107.20 TO NODE    107.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.995
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6064
  SUBAREA AREA(ACRES) =    3.60   SUBAREA RUNOFF(CFS) =    9.35
  TOTAL AREA(ACRES) =       12.5   TOTAL RUNOFF(CFS) =      30.28
  TC(MIN.) =   12.23

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 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.) =   12.23
 RAINFALL INTENSITY(INCH/HR) =   4.00
 TOTAL STREAM AREA(ACRES) =    12.50
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     30.28

****************************************************************************
 FLOW PROCESS FROM NODE    108.00 TO NODE    109.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8000
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
 UPSTREAM ELEVATION(FEET) =     46.50
 DOWNSTREAM ELEVATION(FEET) =     45.50
 ELEVATION DIFFERENCE(FEET) =      1.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.320
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    56.67
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.114
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      1.71
 TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      1.71

****************************************************************************
 FLOW PROCESS FROM NODE    109.00 TO NODE    110.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     45.50  DOWNSTREAM(FEET) =     42.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   370.00   CHANNEL SLOPE =  0.0081
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   5.000
 MANNING'S FACTOR = 0.013   MAXIMUM DEPTH(FEET) =   2.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.548
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8000
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.32
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.51
 AVERAGE FLOW DEPTH(FEET) =   0.41   TRAVEL TIME(MIN.) =   1.37
 Tc(MIN.) =    5.69
 SUBAREA AREA(ACRES) =     2.90       SUBAREA RUNOFF(CFS) =   15.19
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.800
 TOTAL AREA(ACRES) =        3.2         PEAK FLOW RATE(CFS) =      16.76

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.55   FLOW VELOCITY(FEET/SEC.) =   5.27
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    110.00 =     490.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    38.00  DOWNSTREAM(FEET) =    36.00
 FLOW LENGTH(FEET) =   360.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.7 INCHES
```

```
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.07
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      16.76
 PIPE TRAVEL TIME(MIN.) =   0.99    Tc(MIN.) =    6.67
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    111.00 =     850.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    111.10 TO NODE    111.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.905
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .7000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.7508
 SUBAREA AREA(ACRES) =    3.10   SUBAREA RUNOFF(CFS) =   12.81
 TOTAL AREA(ACRES) =        6.3   TOTAL RUNOFF(CFS) =      27.93
 TC(MIN.) =    6.67

****************************************************************************
 FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    36.00  DOWNSTREAM(FEET) =    34.20
 FLOW LENGTH(FEET) =   265.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.36
 ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      27.93
 PIPE TRAVEL TIME(MIN.) =   0.60    Tc(MIN.) =    7.27
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    112.00 =    1115.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    112.10 TO NODE    112.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.586
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .7000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.7405
 SUBAREA AREA(ACRES) =    1.60   SUBAREA RUNOFF(CFS) =    6.26
 TOTAL AREA(ACRES) =        7.9   TOTAL RUNOFF(CFS) =      32.68
 TC(MIN.) =    7.27

****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    34.20  DOWNSTREAM(FEET) =    32.60
 FLOW LENGTH(FEET) =   130.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  30.0 INCH PIPE IS  19.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.67
 ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      32.68
 PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =    7.50
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    107.00 =    1245.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    107.00 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.) =    7.50
 RAINFALL INTENSITY(INCH/HR) =   5.48
 TOTAL STREAM AREA(ACRES) =     7.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     32.68

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       30.28    12.23        3.995         12.50
     2       32.68     7.50        5.478          7.90

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       51.24     7.50       5.478
     2       54.12    12.23       3.995

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      54.12   Tc(MIN.) =   12.23
 TOTAL AREA(ACRES) =       20.4
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    107.00 =    1245.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    107.00 TO NODE    123.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     32.80  DOWNSTREAM(FEET) =     32.30
 CHANNEL LENGTH THRU SUBAREA(FEET) =    50.00   CHANNEL SLOPE =  0.0100
 CHANNEL BASE(FEET) =   30.00   "Z" FACTOR =  20.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.931
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      54.87
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.70
 AVERAGE FLOW DEPTH(FEET) =   0.51   TRAVEL TIME(MIN.) =   0.31
 Tc(MIN.) =   12.54
 SUBAREA AREA(ACRES) =     1.10       SUBAREA RUNOFF(CFS) =    1.51
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.643
 TOTAL AREA(ACRES) =       21.5         PEAK FLOW RATE(CFS) =      54.31

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.50   FLOW VELOCITY(FEET/SEC.) =   2.71
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    123.00 =    1295.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    107.00 TO NODE    123.00 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.) =   12.54
  RAINFALL INTENSITY(INCH/HR) =   3.93
  TOTAL STREAM AREA(ACRES) =    21.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     54.31

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    121.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   150.00
  UPSTREAM ELEVATION(FEET) =     48.90
  DOWNSTREAM ELEVATION(FEET) =     47.80
  ELEVATION DIFFERENCE(FEET) =      1.10
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.641
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    54.67
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.924
  SUBAREA RUNOFF(CFS) =      1.93
  TOTAL AREA(ACRES) =      0.50   TOTAL RUNOFF(CFS) =      1.93

****************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   47.80  DOWNSTREAM ELEVATION(FEET) =   41.60
  STREET LENGTH(FEET) =   570.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

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

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.51
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.24
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.36
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.78
  STREET FLOW TRAVEL TIME(MIN.) =   4.02   Tc(MIN.) =   10.67
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.364
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.608
  SUBAREA AREA(ACRES) =    2.70      SUBAREA RUNOFF(CFS) =    7.07
  TOTAL AREA(ACRES) =        3.2        PEAK FLOW RATE(CFS) =       8.49
```

```
  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  2.64   DEPTH*VELOCITY(FT*FT/SEC.) =   0.98
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    122.00 =     720.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    123.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    34.70  DOWNSTREAM(FEET) =    32.60
  FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.46
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.49
  PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =   10.98
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    123.00 =     860.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    123.00 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.) =   10.98
  RAINFALL INTENSITY(INCH/HR) =   4.28
  TOTAL STREAM AREA(ACRES) =     3.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.49

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       54.31    12.54        3.931         21.50
      2        8.49    10.98        4.284          3.20

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       58.34    10.98       4.284
      2       62.10    12.54       3.931

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      62.10   Tc(MIN.) =   12.54
  TOTAL AREA(ACRES) =       24.7
  LONGEST FLOWPATH FROM NODE    108.00 TO NODE    123.00 =    1295.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    123.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  45.00   RAIN INTENSITY(INCH/HOUR) =  1.72
  TOTAL AREA(ACRES) =    24.70   TOTAL RUNOFF(CFS) =      6.20
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    306.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    28.60  DOWNSTREAM(FEET) =    25.60
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS   6.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.35
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.20
  PIPE TRAVEL TIME(MIN.) =   0.33    Tc(MIN.) =   45.33
  LONGEST FLOWPATH FROM NODE    108.00 TO NODE    306.00 =    1440.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    306.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =     51.00
  DOWNSTREAM ELEVATION(FEET) =     49.80
  ELEVATION DIFFERENCE(FEET) =      1.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.256
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.595
  SUBAREA RUNOFF(CFS) =      1.01
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      1.01

****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   49.30  DOWNSTREAM ELEVATION(FEET) =   46.30
  STREET LENGTH(FEET) =   300.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  13.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.49
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
```

```
    STREET FLOW DEPTH(FEET) =  0.36
    HALFSTREET FLOOD WIDTH(FEET) =   11.47
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.43
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.86
  STREET FLOW TRAVEL TIME(MIN.) =   2.06   Tc(MIN.) =    9.31
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.763
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.642
  SUBAREA AREA(ACRES) =    1.60      SUBAREA RUNOFF(CFS) =    4.95
  TOTAL AREA(ACRES) =        1.9        PEAK FLOW RATE(CFS) =       5.81

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.41   HALFSTREET FLOOD WIDTH(FEET) =  14.17
  FLOW VELOCITY(FEET/SEC.) =  2.73   DEPTH*VELOCITY(FT*FT/SEC.) =   1.12
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =     420.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    503.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    41.00  DOWNSTREAM(FEET) =    38.00
  FLOW LENGTH(FEET) =   300.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.85
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.81
  PIPE TRAVEL TIME(MIN.) =   0.85    Tc(MIN.) =   10.17
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    503.00 =     720.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    503.10 TO NODE    503.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.501
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6474
  SUBAREA AREA(ACRES) =    3.80   SUBAREA RUNOFF(CFS) =   11.12
  TOTAL AREA(ACRES) =        5.7   TOTAL RUNOFF(CFS) =      16.61
  TC(MIN.) =   10.17

****************************************************************************
  FLOW PROCESS FROM NODE    503.20 TO NODE    503.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.501
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6234
  SUBAREA AREA(ACRES) =    0.50   SUBAREA RUNOFF(CFS) =    0.79
  TOTAL AREA(ACRES) =        6.2   TOTAL RUNOFF(CFS) =      17.39
  TC(MIN.) =   10.17

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

```
 FLOW PROCESS FROM NODE    503.00 TO NODE    503.00 IS CODE =   7
----------------------------------------------------------------------------
 >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
 USER-SPECIFIED VALUES ARE AS FOLLOWS:
 TC(MIN) =  21.00   RAIN INTENSITY(INCH/HOUR) =  2.82
 TOTAL AREA(ACRES) =     6.20   TOTAL RUNOFF(CFS) =      4.00

****************************************************************************
 FLOW PROCESS FROM NODE    503.00 TO NODE    504.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    38.50  DOWNSTREAM(FEET) =    38.00
 FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.98
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       4.00
 PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =   21.20
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    504.00 =     780.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    504.00 TO NODE    505.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     38.00  DOWNSTREAM(FEET) =     36.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   280.00   CHANNEL SLOPE =  0.0054
 CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.689
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.05
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.35
 AVERAGE FLOW DEPTH(FEET) =   0.42   TRAVEL TIME(MIN.) =   1.39
 Tc(MIN.) =   22.59
 SUBAREA AREA(ACRES) =     0.10       SUBAREA RUNOFF(CFS) =    0.09
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.231
 TOTAL AREA(ACRES) =        6.3         PEAK FLOW RATE(CFS) =       4.00

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.42   FLOW VELOCITY(FEET/SEC.) =   3.31
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    505.00 =    1060.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    505.10 TO NODE    505.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.689
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.2841
 SUBAREA AREA(ACRES) =    5.10   SUBAREA RUNOFF(CFS) =    4.80
 TOTAL AREA(ACRES) =       11.4   TOTAL RUNOFF(CFS) =       8.71
 TC(MIN.) =   22.59
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    505.00 TO NODE    506.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    36.50  DOWNSTREAM(FEET) =    36.35
  FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.36
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.71
  PIPE TRAVEL TIME(MIN.) =   0.40    Tc(MIN.) =   22.99
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    506.00 =    1140.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    506.00 TO NODE    506.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   22.99
  RAINFALL INTENSITY(INCH/HR) =   2.66
  TOTAL STREAM AREA(ACRES) =    11.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.71

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =     49.00
  DOWNSTREAM ELEVATION(FEET) =      4.00
  ELEVATION DIFFERENCE(FEET) =     45.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.342
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.114
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      5.48
  TOTAL AREA(ACRES) =      1.10   TOTAL RUNOFF(CFS) =      5.48

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    44.00  DOWNSTREAM(FEET) =    42.60
  FLOW LENGTH(FEET) =   180.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.24
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.48
  PIPE TRAVEL TIME(MIN.) =   0.57    Tc(MIN.) =    3.91
```

```
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     300.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    302.10 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.114
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .4500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.5646
 SUBAREA AREA(ACRES) =    1.30   SUBAREA RUNOFF(CFS) =    4.16
 TOTAL AREA(ACRES) =        2.4   TOTAL RUNOFF(CFS) =       9.64
 TC(MIN.) =    3.91

****************************************************************************
 FLOW PROCESS FROM NODE    506.00 TO NODE    506.00 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.) =    3.91
 RAINFALL INTENSITY(INCH/HR) =   7.11
 TOTAL STREAM AREA(ACRES) =     2.40
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.64

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        8.71    22.99        2.659         11.40
     2        9.64     3.91        7.114          2.40

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       11.12     3.91       7.114
     2       12.31    22.99       2.659

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      12.31   Tc(MIN.) =   22.99
 TOTAL AREA(ACRES) =       13.8
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    506.00 =    1140.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    506.00 TO NODE    304.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    36.35  DOWNSTREAM(FEET) =    36.00
 FLOW LENGTH(FEET) =   160.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  19.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.91
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      12.31
 PIPE TRAVEL TIME(MIN.) =   0.68    Tc(MIN.) =   23.67
```

```
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    304.00 =    1300.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    304.10 TO NODE    304.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.609
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .5000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3399
 SUBAREA AREA(ACRES) =    0.60   SUBAREA RUNOFF(CFS) =    0.78
 TOTAL AREA(ACRES) =       14.4   TOTAL RUNOFF(CFS) =      12.77
 TC(MIN.) =   23.67

****************************************************************************
 FLOW PROCESS FROM NODE    304.00 TO NODE    305.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     36.00  DOWNSTREAM(FEET) =     33.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   720.00   CHANNEL SLOPE =  0.0042
 CHANNEL BASE(FEET) =    7.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.50
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.402
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6000
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      15.00
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.70
 AVERAGE FLOW DEPTH(FEET) =   0.51   TRAVEL TIME(MIN.) =   3.25
 Tc(MIN.) =   26.92
 SUBAREA AREA(ACRES) =     3.10       SUBAREA RUNOFF(CFS) =    4.47
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.386
 TOTAL AREA(ACRES) =       17.5         PEAK FLOW RATE(CFS) =      16.22

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.53   FLOW VELOCITY(FEET/SEC.) =   3.79
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    305.00 =    2020.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    305.00 TO NODE    306.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    29.30  DOWNSTREAM(FEET) =    27.80
 FLOW LENGTH(FEET) =   364.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  60.0 INCH PIPE IS  13.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.20
 GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      16.22
 PIPE TRAVEL TIME(MIN.) =   1.17    Tc(MIN.) =   28.09
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    306.00 =    2384.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    306.10 TO NODE    306.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.337
```

```
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.4387
 SUBAREA AREA(ACRES) =    2.00   SUBAREA RUNOFF(CFS) =    4.21
 TOTAL AREA(ACRES) =       19.5   TOTAL RUNOFF(CFS) =      19.99
 TC(MIN.) =   28.09

****************************************************************************
 FLOW PROCESS FROM NODE    306.00 TO NODE    306.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       19.99    28.09       2.337       19.50
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    306.00 =    2384.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        6.20    45.33       1.716       24.70
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    306.00 =    1440.00 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      23.83      28.09        2.337
     2      20.88      45.33        1.716

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      23.83   Tc(MIN.) =   28.09
 TOTAL AREA(ACRES) =       44.2

****************************************************************************
 FLOW PROCESS FROM NODE    306.00 TO NODE    307.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    27.80  DOWNSTREAM(FEET) =    26.60
 FLOW LENGTH(FEET) =   198.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  60.0 INCH PIPE IS  14.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.67
 GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      23.83
 PIPE TRAVEL TIME(MIN.) =   0.50    Tc(MIN.) =   28.58
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    307.00 =    2582.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    307.10 TO NODE    307.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.311
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.2927
 SUBAREA AREA(ACRES) =    1.30   SUBAREA RUNOFF(CFS) =    2.70
 TOTAL AREA(ACRES) =       45.5   TOTAL RUNOFF(CFS) =      30.78
```

```
 TC(MIN.) =   28.58

****************************************************************************
 FLOW PROCESS FROM NODE    307.00 TO NODE    127.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    26.60  DOWNSTREAM(FEET) =    25.50
 FLOW LENGTH(FEET) =   198.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  60.0 INCH PIPE IS  16.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.96
 GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      30.78
 PIPE TRAVEL TIME(MIN.) =   0.47    Tc(MIN.) =   29.06
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    127.00 =    2780.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    125.00 TO NODE    127.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.286
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.2954
 SUBAREA AREA(ACRES) =    2.20   SUBAREA RUNOFF(CFS) =    1.76
 TOTAL AREA(ACRES) =       47.7   TOTAL RUNOFF(CFS) =      32.21
 TC(MIN.) =   29.06

****************************************************************************
 FLOW PROCESS FROM NODE    125.10 TO NODE    127.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.286
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3300
 SUBAREA AREA(ACRES) =    2.90   SUBAREA RUNOFF(CFS) =    5.97
 TOTAL AREA(ACRES) =       50.6   TOTAL RUNOFF(CFS) =      38.18
 TC(MIN.) =   29.06

****************************************************************************
 FLOW PROCESS FROM NODE    126.00 TO NODE    127.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.286
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3400
 SUBAREA AREA(ACRES) =    0.90   SUBAREA RUNOFF(CFS) =    1.85
 TOTAL AREA(ACRES) =       51.5   TOTAL RUNOFF(CFS) =      40.03
 TC(MIN.) =   29.06

****************************************************************************
 FLOW PROCESS FROM NODE    127.00 TO NODE    128.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    25.50  DOWNSTREAM(FEET) =    25.32
  FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  60.0 INCH PIPE IS  24.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.40
  GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      40.03
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =   29.30
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    128.00 =    2860.00 FEET.
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       51.5  TC(MIN.) =     29.30
  PEAK FLOW RATE(CFS)   =      40.03
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2016 Advanced Engineering Software (aes)
              Ver. 23.0 Release Date: 07/01/2016  License ID 1532

                            Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* Ocean Kamp - Rational Method Northerly area nodes 600-700               *
* December 13, 2019                                                       *
* 100-year analysis                                                       *
 ************************************************************************

  FILE NAME: ZNE100.DAT
  TIME/DATE OF STUDY: 07:13 12/19/2019
------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.700
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-   CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

******************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    601.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6300
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =     51.00
  DOWNSTREAM ELEVATION(FEET) =     49.80
  ELEVATION DIFFERENCE(FEET) =      1.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.821
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
```

```
          THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.823
 SUBAREA RUNOFF(CFS) =      1.10
 TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      1.10

****************************************************************************
 FLOW PROCESS FROM NODE    601.00 TO NODE    602.00 IS CODE =  61
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   49.80  DOWNSTREAM ELEVATION(FEET) =   44.80
 STREET LENGTH(FEET) =   600.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 16.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.90
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.40
   HALFSTREET FLOOD WIDTH(FEET) =   13.77
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.46
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.99
 STREET FLOW TRAVEL TIME(MIN.) =   4.07   Tc(MIN.) =   10.89
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.305
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.601
 SUBAREA AREA(ACRES) =    6.70      SUBAREA RUNOFF(CFS) =   17.31
 TOTAL AREA(ACRES) =        7.0        PEAK FLOW RATE(CFS) =      18.12

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.47   HALFSTREET FLOOD WIDTH(FEET) =  16.00
 FLOW VELOCITY(FEET/SEC.) =  2.94   DEPTH*VELOCITY(FT*FT/SEC.) =   1.39
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    602.00 =     720.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    602.00 TO NODE    603.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.305
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.5845
 SUBAREA AREA(ACRES) =    0.50   SUBAREA RUNOFF(CFS) =    0.75
 TOTAL AREA(ACRES) =        7.5   TOTAL RUNOFF(CFS) =      18.87
 TC(MIN.) =   10.89

****************************************************************************
 FLOW PROCESS FROM NODE    602.00 TO NODE    603.00 IS CODE =   7
----------------------------------------------------------------------------
```

```
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  51.00   RAIN INTENSITY(INCH/HOUR) =  1.59
  TOTAL AREA(ACRES) =     7.50   TOTAL RUNOFF(CFS) =      2.50

****************************************************************************
  FLOW PROCESS FROM NODE    603.00 TO NODE    604.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.591
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2798
  SUBAREA AREA(ACRES) =    7.50   SUBAREA RUNOFF(CFS) =    4.18
  TOTAL AREA(ACRES) =       15.0   TOTAL RUNOFF(CFS) =       6.68
  TC(MIN.) =   51.00

****************************************************************************
  FLOW PROCESS FROM NODE    603.00 TO NODE    604.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  30.00   RAIN INTENSITY(INCH/HOUR) =  2.24
  TOTAL AREA(ACRES) =    15.00   TOTAL RUNOFF(CFS) =     13.00

****************************************************************************
  FLOW PROCESS FROM NODE    604.00 TO NODE    605.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    36.10  DOWNSTREAM(FEET) =    34.90
  FLOW LENGTH(FEET) =   210.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  14.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.81
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.00
  PIPE TRAVEL TIME(MIN.) =   0.60    Tc(MIN.) =   30.60
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    605.00 =     930.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    605.00 TO NODE    606.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    34.90  DOWNSTREAM(FEET) =    30.80
  FLOW LENGTH(FEET) =   840.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  14.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.48
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.00
  PIPE TRAVEL TIME(MIN.) =   2.56    Tc(MIN.) =   33.16
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    606.00 =    1770.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    605.00 TO NODE    606.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
```

```
==========================================================================

**************************************************************************
  FLOW PROCESS FROM NODE    730.00 TO NODE    731.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =     50.60
  DOWNSTREAM ELEVATION(FEET) =     49.40
  ELEVATION DIFFERENCE(FEET) =      1.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.256
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.595
  SUBAREA RUNOFF(CFS) =      0.67
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.67

**************************************************************************
  FLOW PROCESS FROM NODE    731.00 TO NODE    732.00 IS CODE =  61
--------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==========================================================================
  UPSTREAM ELEVATION(FEET) =   49.40  DOWNSTREAM ELEVATION(FEET) =   46.00
  STREET LENGTH(FEET) =   380.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.59
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.43
    HALFSTREET FLOOD WIDTH(FEET) =   15.18
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.72
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.17
  STREET FLOW TRAVEL TIME(MIN.) =   2.33   Tc(MIN.) =    9.59
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.675
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.600
  SUBAREA AREA(ACRES) =    4.20      SUBAREA RUNOFF(CFS) =   11.78
  TOTAL AREA(ACRES) =        4.4        PEAK FLOW RATE(CFS) =      12.34

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.45   HALFSTREET FLOOD WIDTH(FEET) =  16.00
  FLOW VELOCITY(FEET/SEC.) =  2.79   DEPTH*VELOCITY(FT*FT/SEC.) =   1.24
  LONGEST FLOWPATH FROM NODE    730.00 TO NODE    732.00 =     500.00 FEET.

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

```
 FLOW PROCESS FROM NODE    732.00 TO NODE    732.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.675
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6300
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6185
 SUBAREA AREA(ACRES) =    7.10   SUBAREA RUNOFF(CFS) =   20.91
 TOTAL AREA(ACRES) =       11.5   TOTAL RUNOFF(CFS) =      33.25
 TC(MIN.) =    9.59

****************************************************************************
 FLOW PROCESS FROM NODE    732.00 TO NODE    733.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    41.00  DOWNSTREAM(FEET) =    36.00
 FLOW LENGTH(FEET) =   480.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.06
 ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      33.25
 PIPE TRAVEL TIME(MIN.) =   0.88    Tc(MIN.) =   10.47
 LONGEST FLOWPATH FROM NODE    730.00 TO NODE    733.00 =     980.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    733.10 TO NODE    733.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.417
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6300
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6226
 SUBAREA AREA(ACRES) =    6.40   SUBAREA RUNOFF(CFS) =   17.81
 TOTAL AREA(ACRES) =       17.9   TOTAL RUNOFF(CFS) =      49.23
 TC(MIN.) =   10.47

****************************************************************************
 FLOW PROCESS FROM NODE    733.20 TO NODE    733.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.417
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6096
 SUBAREA AREA(ACRES) =    0.90   SUBAREA RUNOFF(CFS) =    1.39
 TOTAL AREA(ACRES) =       18.8   TOTAL RUNOFF(CFS) =      50.62
 TC(MIN.) =   10.47

****************************************************************************
 FLOW PROCESS FROM NODE    733.00 TO NODE    715.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.417
 *USER SPECIFIED(SUBAREA):
```

```
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5916
  SUBAREA AREA(ACRES) =    1.40   SUBAREA RUNOFF(CFS) =    2.16
  TOTAL AREA(ACRES) =       20.2   TOTAL RUNOFF(CFS) =      52.78
  TC(MIN.) =   10.47

****************************************************************************
  FLOW PROCESS FROM NODE    733.00 TO NODE    715.00 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.) =   10.47
  RAINFALL INTENSITY(INCH/HR) =   4.42
  TOTAL STREAM AREA(ACRES) =    20.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     52.78

****************************************************************************
  FLOW PROCESS FROM NODE    710.00 TO NODE    711.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =     49.00
  DOWNSTREAM ELEVATION(FEET) =     47.80
  ELEVATION DIFFERENCE(FEET) =      1.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.577
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    60.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.630
  SUBAREA RUNOFF(CFS) =      3.71
  TOTAL AREA(ACRES) =      0.80   TOTAL RUNOFF(CFS) =      3.71

****************************************************************************
  FLOW PROCESS FROM NODE    711.00 TO NODE    712.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   47.80  DOWNSTREAM ELEVATION(FEET) =   46.10
  STREET LENGTH(FEET) =   300.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

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

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.82
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.40
    HALFSTREET FLOOD WIDTH(FEET) =   13.54
```

```
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.00
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.80
  STREET FLOW TRAVEL TIME(MIN.) =   2.49   Tc(MIN.) =    8.07
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.223
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.663
  SUBAREA AREA(ACRES) =    2.40      SUBAREA RUNOFF(CFS) =    8.15
  TOTAL AREA(ACRES) =        3.2        PEAK FLOW RATE(CFS) =      11.07

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.44   HALFSTREET FLOOD WIDTH(FEET) =  15.57
  FLOW VELOCITY(FEET/SEC.) =  2.18   DEPTH*VELOCITY(FT*FT/SEC.) =   0.95
  LONGEST FLOWPATH FROM NODE    710.00 TO NODE    712.00 =     420.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    712.00 TO NODE    713.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    41.40  DOWNSTREAM(FEET) =    40.40
  FLOW LENGTH(FEET) =   250.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.82
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.07
  PIPE TRAVEL TIME(MIN.) =   0.86    Tc(MIN.) =    8.94
  LONGEST FLOWPATH FROM NODE    710.00 TO NODE    713.00 =     670.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    713.10 TO NODE    713.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.892
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6571
  SUBAREA AREA(ACRES) =    2.40   SUBAREA RUNOFF(CFS) =    7.63
  TOTAL AREA(ACRES) =        5.6   TOTAL RUNOFF(CFS) =      18.00
  TC(MIN.) =    8.94

****************************************************************************
  FLOW PROCESS FROM NODE    713.00 TO NODE    714.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    40.40  DOWNSTREAM(FEET) =    36.10
  FLOW LENGTH(FEET) =   620.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  16.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.77
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      18.00
  PIPE TRAVEL TIME(MIN.) =   1.53    Tc(MIN.) =   10.46
  LONGEST FLOWPATH FROM NODE    710.00 TO NODE    714.00 =    1290.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    714.10 TO NODE    714.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.419
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6531
  SUBAREA AREA(ACRES) =    7.30   SUBAREA RUNOFF(CFS) =   20.97
  TOTAL AREA(ACRES) =       12.9   TOTAL RUNOFF(CFS) =      37.23
  TC(MIN.) =   10.46

****************************************************************************
  FLOW PROCESS FROM NODE    714.00 TO NODE    715.00 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.) =   10.46
  RAINFALL INTENSITY(INCH/HR) =   4.42
  TOTAL STREAM AREA(ACRES) =    12.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     37.23

  ** CONFLUENCE DATA **
  STREAM     RUNOFF        Tc       INTENSITY       AREA
  NUMBER      (CFS)      (MIN.)    (INCH/HOUR)     (ACRE)
      1       52.78    10.47         4.417          20.20
      2       37.23    10.46         4.419          12.90

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF       Tc       INTENSITY
  NUMBER      (CFS)     (MIN.)    (INCH/HOUR)
      1       89.97    10.46        4.419
      2       89.99    10.47        4.417

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      89.99   Tc(MIN.) =   10.47
  TOTAL AREA(ACRES) =       33.1
  LONGEST FLOWPATH FROM NODE    710.00 TO NODE    715.00 =    1290.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    715.00 TO NODE    716.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
================================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  36.00   RAIN INTENSITY(INCH/HOUR) =  1.99
  TOTAL AREA(ACRES) =    33.10   TOTAL RUNOFF(CFS) =     12.50

****************************************************************************
  FLOW PROCESS FROM NODE    716.00 TO NODE    606.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    31.50  DOWNSTREAM(FEET) =    30.80
  FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  10.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.15
```

```
 GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      12.50
 PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =   36.15
 LONGEST FLOWPATH FROM NODE    710.00 TO NODE    606.00 =    1355.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    716.00 TO NODE    606.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       12.50    36.15       1.986       33.10
 LONGEST FLOWPATH FROM NODE    710.00 TO NODE    606.00 =    1355.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       13.00    33.16       2.100       15.00
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    606.00 =    1770.00 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      24.47      33.16        2.100
     2      24.80      36.15        1.986

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      24.80   Tc(MIN.) =   36.15
 TOTAL AREA(ACRES) =       48.1

****************************************************************************
 FLOW PROCESS FROM NODE    606.00 TO NODE    607.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    30.70  DOWNSTREAM(FEET) =    29.40
 FLOW LENGTH(FEET) =   220.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  48.0 INCH PIPE IS  15.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.82
 GIVEN PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      24.80
 PIPE TRAVEL TIME(MIN.) =   0.54    Tc(MIN.) =   36.69
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    607.00 =    1990.00 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =       48.1  TC(MIN.) =     36.69
 PEAK FLOW RATE(CFS)   =      24.80
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

B. 10-Year Rational Method

2a-zsw10

2b-zne10

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2016 Advanced Engineering Software (aes)
              Ver. 23.0 Release Date: 07/01/2016  License ID 1532

                            Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* Ocean Kamp - Rational Method - SW Area                                 *
* December 16, 2019                                                      *
* 10-year analysis                                                       *
 ************************************************************************

  FILE NAME: ZSW10.DAT
  TIME/DATE OF STUDY: 09:45 12/19/2019
------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =  10.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   1.800
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-   CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =     48.00
  DOWNSTREAM ELEVATION(FEET) =     47.50
  ELEVATION DIFFERENCE(FEET) =      0.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.216
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
```

```
          THE MAXIMUM OVERLAND FLOW LENGTH =    50.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.743
  SUBAREA RUNOFF(CFS) =      0.73
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      0.73

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     47.50  DOWNSTREAM(FEET) =     46.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   270.00   CHANNEL SLOPE =  0.0056
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.020   MAXIMUM DEPTH(FEET) =   2.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.891
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.78
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.27
  AVERAGE FLOW DEPTH(FEET) =   0.12   TRAVEL TIME(MIN.) =   3.56
  Tc(MIN.) =   10.77
  SUBAREA AREA(ACRES) =     1.10       SUBAREA RUNOFF(CFS) =    2.07
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  TOTAL AREA(ACRES) =        1.4         PEAK FLOW RATE(CFS) =       2.63

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.16   FLOW VELOCITY(FEET/SEC.) =   1.46
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     390.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    42.00  DOWNSTREAM(FEET) =    38.00
  FLOW LENGTH(FEET) =   420.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.68
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.63
  PIPE TRAVEL TIME(MIN.) =   1.50    Tc(MIN.) =   12.27
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     810.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.10 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.658
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6167
  SUBAREA AREA(ACRES) =    2.80   SUBAREA RUNOFF(CFS) =    4.47
  TOTAL AREA(ACRES) =        4.2   TOTAL RUNOFF(CFS) =       6.88
  TC(MIN.) =   12.27
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    103.20 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.658
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6097
  SUBAREA AREA(ACRES) =    3.00   SUBAREA RUNOFF(CFS) =    4.78
  TOTAL AREA(ACRES) =        7.2   TOTAL RUNOFF(CFS) =      11.67
  TC(MIN.) =   12.27

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    38.00  DOWNSTREAM(FEET) =    32.60
  FLOW LENGTH(FEET) =   350.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.97
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.67
  PIPE TRAVEL TIME(MIN.) =   0.73    Tc(MIN.) =   13.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    1160.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.10 TO NODE    107.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.560
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5888
  SUBAREA AREA(ACRES) =    1.70   SUBAREA RUNOFF(CFS) =    2.18
  TOTAL AREA(ACRES) =        8.9   TOTAL RUNOFF(CFS) =      13.42
  TC(MIN.) =   13.00

****************************************************************************
  FLOW PROCESS FROM NODE    107.20 TO NODE    107.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.560
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6064
  SUBAREA AREA(ACRES) =    3.60   SUBAREA RUNOFF(CFS) =    5.99
  TOTAL AREA(ACRES) =       12.5   TOTAL RUNOFF(CFS) =      19.41
  TC(MIN.) =   13.00

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
```

```
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   13.00
 RAINFALL INTENSITY(INCH/HR) =   2.56
 TOTAL STREAM AREA(ACRES) =    12.50
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     19.41

****************************************************************************
 FLOW PROCESS FROM NODE    108.00 TO NODE    109.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8000
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
 UPSTREAM ELEVATION(FEET) =     46.50
 DOWNSTREAM ELEVATION(FEET) =     45.50
 ELEVATION DIFFERENCE(FEET) =      1.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.320
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    56.67
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.743
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      1.14
 TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      1.14

****************************************************************************
 FLOW PROCESS FROM NODE    109.00 TO NODE    110.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     45.50  DOWNSTREAM(FEET) =     42.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   370.00   CHANNEL SLOPE =  0.0081
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   5.000
 MANNING'S FACTOR = 0.013   MAXIMUM DEPTH(FEET) =   2.00
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.275
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8000
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.11
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.97
 AVERAGE FLOW DEPTH(FEET) =   0.33   TRAVEL TIME(MIN.) =   1.55
 Tc(MIN.) =    5.87
 SUBAREA AREA(ACRES) =     2.90       SUBAREA RUNOFF(CFS) =    9.92
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.800
 TOTAL AREA(ACRES) =        3.2         PEAK FLOW RATE(CFS) =      10.94

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.45   FLOW VELOCITY(FEET/SEC.) =   4.70
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    110.00 =     490.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    38.00  DOWNSTREAM(FEET) =    36.00
 FLOW LENGTH(FEET) =   360.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.8 INCHES
```

```
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.31
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      10.94
 PIPE TRAVEL TIME(MIN.) =   1.13    Tc(MIN.) =    7.00
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    111.00 =     850.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    111.10 TO NODE    111.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.816
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .7000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.7508
 SUBAREA AREA(ACRES) =    3.10   SUBAREA RUNOFF(CFS) =    8.28
 TOTAL AREA(ACRES) =        6.3   TOTAL RUNOFF(CFS) =      18.05
 TC(MIN.) =    7.00

****************************************************************************
 FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    36.00  DOWNSTREAM(FEET) =    34.20
 FLOW LENGTH(FEET) =   265.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.67
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      18.05
 PIPE TRAVEL TIME(MIN.) =   0.66    Tc(MIN.) =    7.67
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    112.00 =    1115.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    112.10 TO NODE    112.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.600
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .7000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.7405
 SUBAREA AREA(ACRES) =    1.60   SUBAREA RUNOFF(CFS) =    4.03
 TOTAL AREA(ACRES) =        7.9   TOTAL RUNOFF(CFS) =      21.06
 TC(MIN.) =    7.67

****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    34.20  DOWNSTREAM(FEET) =    32.60
 FLOW LENGTH(FEET) =   130.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.56
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      21.06
 PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =    7.92
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    107.00 =    1245.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    107.00 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.) =    7.92
 RAINFALL INTENSITY(INCH/HR) =   3.53
 TOTAL STREAM AREA(ACRES) =     7.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     21.06

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       19.41    13.00        2.560         12.50
     2       21.06     7.92        3.525          7.90

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       32.88     7.92       3.525
     2       34.70    13.00       2.560

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      34.70   Tc(MIN.) =   13.00
 TOTAL AREA(ACRES) =       20.4
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    107.00 =    1245.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    107.00 TO NODE    123.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     32.80  DOWNSTREAM(FEET) =     32.30
 CHANNEL LENGTH THRU SUBAREA(FEET) =    50.00   CHANNEL SLOPE =  0.0100
 CHANNEL BASE(FEET) =   30.00   "Z" FACTOR =  20.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.517
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      35.19
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.36
 AVERAGE FLOW DEPTH(FEET) =   0.39   TRAVEL TIME(MIN.) =   0.35
 Tc(MIN.) =   13.35
 SUBAREA AREA(ACRES) =     1.10       SUBAREA RUNOFF(CFS) =    0.97
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.643
 TOTAL AREA(ACRES) =       21.5         PEAK FLOW RATE(CFS) =      34.77

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.39   FLOW VELOCITY(FEET/SEC.) =   2.34
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    123.00 =    1295.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    107.00 TO NODE    123.00 IS CODE =   1
----------------------------------------------------------------------------
```

```
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
================================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.35
  RAINFALL INTENSITY(INCH/HR) =   2.52
  TOTAL STREAM AREA(ACRES) =    21.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     34.77

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    121.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   150.00
  UPSTREAM ELEVATION(FEET) =     48.90
  DOWNSTREAM ELEVATION(FEET) =     47.80
  ELEVATION DIFFERENCE(FEET) =      1.10
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.641
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    54.67
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.949
  SUBAREA RUNOFF(CFS) =      1.28
  TOTAL AREA(ACRES) =      0.50   TOTAL RUNOFF(CFS) =      1.28

****************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   47.80  DOWNSTREAM ELEVATION(FEET) =   41.60
  STREET LENGTH(FEET) =   570.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

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

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.62
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.52
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.14
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.64
  STREET FLOW TRAVEL TIME(MIN.) =   4.43   Tc(MIN.) =   11.08
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.839
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.608
  SUBAREA AREA(ACRES) =    2.70      SUBAREA RUNOFF(CFS) =    4.60
  TOTAL AREA(ACRES) =        3.2        PEAK FLOW RATE(CFS) =       5.52
```

```
  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.24
  FLOW VELOCITY(FEET/SEC.) =  2.37   DEPTH*VELOCITY(FT*FT/SEC.) =   0.78
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    122.00 =     720.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    123.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    34.70  DOWNSTREAM(FEET) =    32.60
  FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.73
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.52
  PIPE TRAVEL TIME(MIN.) =   0.35    Tc(MIN.) =   11.42
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    123.00 =     860.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    123.00 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.) =   11.42
  RAINFALL INTENSITY(INCH/HR) =   2.78
  TOTAL STREAM AREA(ACRES) =     3.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.52

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       34.77    13.35        2.517         21.50
      2        5.52    11.42        2.784          3.20

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
      1       36.95    11.42       2.784
      2       39.76    13.35       2.517

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      39.76   Tc(MIN.) =   13.35
  TOTAL AREA(ACRES) =       24.7
  LONGEST FLOWPATH FROM NODE    108.00 TO NODE    123.00 =    1295.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    123.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  55.00   RAIN INTENSITY(INCH/HOUR) =  1.01
  TOTAL AREA(ACRES) =    24.70   TOTAL RUNOFF(CFS) =      4.50
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    306.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    28.60  DOWNSTREAM(FEET) =    25.60
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS   5.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.69
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.50
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =   55.36
  LONGEST FLOWPATH FROM NODE    108.00 TO NODE    306.00 =    1440.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    306.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =     51.00
  DOWNSTREAM ELEVATION(FEET) =     49.80
  ELEVATION DIFFERENCE(FEET) =      1.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.256
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.730
  SUBAREA RUNOFF(CFS) =      0.67
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      0.67

****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   49.30  DOWNSTREAM ELEVATION(FEET) =   46.30
  STREET LENGTH(FEET) =   300.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  13.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.30
```

```
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.65
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.20
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.70
  STREET FLOW TRAVEL TIME(MIN.) =   2.28   Tc(MIN.) =    9.53
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.128
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.642
  SUBAREA AREA(ACRES) =    1.60      SUBAREA RUNOFF(CFS) =    3.25
  TOTAL AREA(ACRES) =        1.9        PEAK FLOW RATE(CFS) =       3.82

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.93
  FLOW VELOCITY(FEET/SEC.) =  2.48   DEPTH*VELOCITY(FT*FT/SEC.) =   0.90
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =     420.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    503.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    41.00  DOWNSTREAM(FEET) =    38.00
  FLOW LENGTH(FEET) =   300.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.27
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.82
  PIPE TRAVEL TIME(MIN.) =   0.95    Tc(MIN.) =   10.48
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    503.00 =     720.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    503.10 TO NODE    503.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.942
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6474
  SUBAREA AREA(ACRES) =    3.80   SUBAREA RUNOFF(CFS) =    7.27
  TOTAL AREA(ACRES) =        5.7   TOTAL RUNOFF(CFS) =      10.86
  TC(MIN.) =   10.48

****************************************************************************
  FLOW PROCESS FROM NODE    503.20 TO NODE    503.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.942
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6234
  SUBAREA AREA(ACRES) =    0.50   SUBAREA RUNOFF(CFS) =    0.51
  TOTAL AREA(ACRES) =        6.2   TOTAL RUNOFF(CFS) =      11.37
  TC(MIN.) =   10.48
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    503.00 TO NODE    503.00 IS CODE =   7
----------------------------------------------------------------------------
 >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
 USER-SPECIFIED VALUES ARE AS FOLLOWS:
 TC(MIN) =  28.00   RAIN INTENSITY(INCH/HOUR) =  1.56
 TOTAL AREA(ACRES) =     6.20   TOTAL RUNOFF(CFS) =      2.80

****************************************************************************
 FLOW PROCESS FROM NODE    503.00 TO NODE    504.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    38.50  DOWNSTREAM(FEET) =    38.00
 FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.53
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.80
 PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =   28.22
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    504.00 =     780.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    504.00 TO NODE    505.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     38.00  DOWNSTREAM(FEET) =     36.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   280.00   CHANNEL SLOPE =  0.0054
 CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.501
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.83
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.01
 AVERAGE FLOW DEPTH(FEET) =   0.35   TRAVEL TIME(MIN.) =   1.55
 Tc(MIN.) =   29.77
 SUBAREA AREA(ACRES) =     0.10       SUBAREA RUNOFF(CFS) =    0.05
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.290
 TOTAL AREA(ACRES) =        6.3         PEAK FLOW RATE(CFS) =       2.80

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.35   FLOW VELOCITY(FEET/SEC.) =   2.98
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    505.00 =    1060.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    505.10 TO NODE    505.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.501
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3170
 SUBAREA AREA(ACRES) =    5.10   SUBAREA RUNOFF(CFS) =    2.68
 TOTAL AREA(ACRES) =       11.4   TOTAL RUNOFF(CFS) =       5.42
```

```
 TC(MIN.) =   29.77

****************************************************************************
 FLOW PROCESS FROM NODE    505.00 TO NODE    506.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    36.50  DOWNSTREAM(FEET) =    36.35
 FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.03
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       5.42
 PIPE TRAVEL TIME(MIN.) =   0.44    Tc(MIN.) =   30.21
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    506.00 =    1140.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    506.00 TO NODE    506.00 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.) =   30.21
 RAINFALL INTENSITY(INCH/HR) =   1.49
 TOTAL STREAM AREA(ACRES) =    11.40
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.42

****************************************************************************
 FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .7000
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
 UPSTREAM ELEVATION(FEET) =     49.00
 DOWNSTREAM ELEVATION(FEET) =      4.00
 ELEVATION DIFFERENCE(FEET) =     45.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.342
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.743
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      3.65
 TOTAL AREA(ACRES) =      1.10   TOTAL RUNOFF(CFS) =      3.65

****************************************************************************
 FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    44.00  DOWNSTREAM(FEET) =    42.60
 FLOW LENGTH(FEET) =   180.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.74
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```

```
 PIPE-FLOW(CFS) =       3.65
 PIPE TRAVEL TIME(MIN.) =   0.63    Tc(MIN.) =    3.97
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     300.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    302.10 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.743
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .4500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.5646
 SUBAREA AREA(ACRES) =    1.30   SUBAREA RUNOFF(CFS) =    2.77
 TOTAL AREA(ACRES) =        2.4   TOTAL RUNOFF(CFS) =       6.43
 TC(MIN.) =    3.97

****************************************************************************
 FLOW PROCESS FROM NODE    506.00 TO NODE    506.00 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.) =    3.97
 RAINFALL INTENSITY(INCH/HR) =   4.74
 TOTAL STREAM AREA(ACRES) =     2.40
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.43

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        5.42    30.21        1.486         11.40
     2        6.43     3.97        4.743          2.40

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc      INTENSITY
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
     1        7.14     3.97       4.743
     2        7.44    30.21       1.486

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       7.44   Tc(MIN.) =   30.21
 TOTAL AREA(ACRES) =       13.8
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    506.00 =    1140.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    506.00 TO NODE    304.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    36.35  DOWNSTREAM(FEET) =    36.00
 FLOW LENGTH(FEET) =   160.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.50
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       7.44
  PIPE TRAVEL TIME(MIN.) =   0.76    Tc(MIN.) =   30.97
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    304.00 =    1300.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    304.10 TO NODE    304.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.463
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3659
  SUBAREA AREA(ACRES) =    0.60   SUBAREA RUNOFF(CFS) =    0.44
  TOTAL AREA(ACRES) =       14.4   TOTAL RUNOFF(CFS) =       7.71
  TC(MIN.) =   30.97

****************************************************************************
  FLOW PROCESS FROM NODE    304.00 TO NODE    305.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     36.00  DOWNSTREAM(FEET) =     33.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   720.00   CHANNEL SLOPE =  0.0042
  CHANNEL BASE(FEET) =    7.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.50
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.355
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.97
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.07
  AVERAGE FLOW DEPTH(FEET) =   0.38   TRAVEL TIME(MIN.) =   3.91
  Tc(MIN.) =   34.88
  SUBAREA AREA(ACRES) =     3.10       SUBAREA RUNOFF(CFS) =    2.52
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.407
  TOTAL AREA(ACRES) =       17.5         PEAK FLOW RATE(CFS) =       9.66

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.39   FLOW VELOCITY(FEET/SEC.) =   3.17
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    305.00 =    2020.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    305.00 TO NODE    306.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    29.30  DOWNSTREAM(FEET) =    27.80
  FLOW LENGTH(FEET) =   364.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  60.0 INCH PIPE IS  10.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.46
  GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.66
  PIPE TRAVEL TIME(MIN.) =   1.36    Tc(MIN.) =   36.24
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    306.00 =    2384.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    306.10 TO NODE    306.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

```
================================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.322
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4579
  SUBAREA AREA(ACRES) =    2.00   SUBAREA RUNOFF(CFS) =    2.38
  TOTAL AREA(ACRES) =       19.5   TOTAL RUNOFF(CFS) =      11.80
  TC(MIN.) =   36.24

****************************************************************************
  FLOW PROCESS FROM NODE    306.00 TO NODE    306.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       11.80    36.24       1.322       19.50
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    306.00 =    2384.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        4.50    55.36       1.006       24.70
  LONGEST FLOWPATH FROM NODE    108.00 TO NODE    306.00 =    1440.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      14.75      36.24        1.322
      2      13.48      55.36        1.006

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      14.75   Tc(MIN.) =   36.24
  TOTAL AREA(ACRES) =       44.2

****************************************************************************
  FLOW PROCESS FROM NODE    306.00 TO NODE    307.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    27.80  DOWNSTREAM(FEET) =    26.60
  FLOW LENGTH(FEET) =   198.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  60.0 INCH PIPE IS  11.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.79
  GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      14.75
  PIPE TRAVEL TIME(MIN.) =   0.57    Tc(MIN.) =   36.81
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    307.00 =    2582.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    307.10 TO NODE    307.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.309
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3199
```

```
  SUBAREA AREA(ACRES) =    1.30   SUBAREA RUNOFF(CFS) =    1.53
  TOTAL AREA(ACRES) =       45.5   TOTAL RUNOFF(CFS) =      19.04
  TC(MIN.) =   36.81

****************************************************************************
  FLOW PROCESS FROM NODE    307.00 TO NODE    127.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    26.60  DOWNSTREAM(FEET) =    25.50
  FLOW LENGTH(FEET) =   198.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  60.0 INCH PIPE IS  13.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.06
  GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      19.04
  PIPE TRAVEL TIME(MIN.) =   0.54    Tc(MIN.) =   37.36
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    127.00 =    2780.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    125.00 TO NODE    127.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.296
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3213
  SUBAREA AREA(ACRES) =    2.20   SUBAREA RUNOFF(CFS) =    1.00
  TOTAL AREA(ACRES) =       47.7   TOTAL RUNOFF(CFS) =      19.86
  TC(MIN.) =   37.36

****************************************************************************
  FLOW PROCESS FROM NODE    125.10 TO NODE    127.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.296
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3544
  SUBAREA AREA(ACRES) =    2.90   SUBAREA RUNOFF(CFS) =    3.38
  TOTAL AREA(ACRES) =       50.6   TOTAL RUNOFF(CFS) =      23.25
  TC(MIN.) =   37.36

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    127.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.296
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3640
  SUBAREA AREA(ACRES) =    0.90   SUBAREA RUNOFF(CFS) =    1.05
  TOTAL AREA(ACRES) =       51.5   TOTAL RUNOFF(CFS) =      24.30
  TC(MIN.) =   37.36

****************************************************************************
  FLOW PROCESS FROM NODE    127.00 TO NODE    128.00 IS CODE =  41
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    25.50  DOWNSTREAM(FEET) =    25.32
  FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  60.0 INCH PIPE IS  18.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.71
  GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      24.30
  PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =   37.64
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    128.00 =    2860.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       51.5  TC(MIN.) =     37.64
  PEAK FLOW RATE(CFS)   =      24.30
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2016 Advanced Engineering Software (aes)
              Ver. 23.0 Release Date: 07/01/2016  License ID 1532

                            Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* Ocean Kamp - Rational Method Northerly area nodes 600-700               *
* December 13, 2019                                                       *
* 10-year analysis                                                        *
 *************************************************************************

  FILE NAME: ZNE10.DAT
  TIME/DATE OF STUDY: 09:47 12/19/2019
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =  10.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   1.800
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-   CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    601.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6300
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =     51.00
  DOWNSTREAM ELEVATION(FEET) =     49.80
  ELEVATION DIFFERENCE(FEET) =      1.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.821
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
```

```
          THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.882
  SUBAREA RUNOFF(CFS) =      0.73
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      0.73

****************************************************************************
  FLOW PROCESS FROM NODE    601.00 TO NODE    602.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   49.80  DOWNSTREAM ELEVATION(FEET) =   44.80
  STREET LENGTH(FEET) =   600.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.46
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.36
    HALFSTREET FLOOD WIDTH(FEET) =   11.59
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.21
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.79
  STREET FLOW TRAVEL TIME(MIN.) =   4.52   Tc(MIN.) =   11.34
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.797
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.601
  SUBAREA AREA(ACRES) =    6.70      SUBAREA RUNOFF(CFS) =   11.24
  TOTAL AREA(ACRES) =        7.0        PEAK FLOW RATE(CFS) =      11.77

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.42   HALFSTREET FLOOD WIDTH(FEET) =  14.79
  FLOW VELOCITY(FEET/SEC.) =  2.55   DEPTH*VELOCITY(FT*FT/SEC.) =   1.08
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    602.00 =     720.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    602.00 TO NODE    603.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.797
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5845
  SUBAREA AREA(ACRES) =    0.50   SUBAREA RUNOFF(CFS) =    0.49
  TOTAL AREA(ACRES) =        7.5   TOTAL RUNOFF(CFS) =      12.26
  TC(MIN.) =   11.34

****************************************************************************
  FLOW PROCESS FROM NODE    602.00 TO NODE    603.00 IS CODE =   7
----------------------------------------------------------------------------
```

```
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  60.00   RAIN INTENSITY(INCH/HOUR) =  0.95
  TOTAL AREA(ACRES) =     7.50   TOTAL RUNOFF(CFS) =      1.80

****************************************************************************
  FLOW PROCESS FROM NODE    603.00 TO NODE    604.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  0.955
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3007
  SUBAREA AREA(ACRES) =    7.50   SUBAREA RUNOFF(CFS) =    2.51
  TOTAL AREA(ACRES) =       15.0   TOTAL RUNOFF(CFS) =       4.31
  TC(MIN.) =   60.00

****************************************************************************
  FLOW PROCESS FROM NODE    603.00 TO NODE    604.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  40.00   RAIN INTENSITY(INCH/HOUR) =  1.24
  TOTAL AREA(ACRES) =    15.00   TOTAL RUNOFF(CFS) =     10.00

****************************************************************************
  FLOW PROCESS FROM NODE    604.00 TO NODE    605.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    36.10  DOWNSTREAM(FEET) =    34.90
  FLOW LENGTH(FEET) =   210.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  12.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.42
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.00
  PIPE TRAVEL TIME(MIN.) =   0.65    Tc(MIN.) =   40.65
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    605.00 =     930.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    605.00 TO NODE    606.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    34.90  DOWNSTREAM(FEET) =    30.80
  FLOW LENGTH(FEET) =   840.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  12.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.11
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.00
  PIPE TRAVEL TIME(MIN.) =   2.74    Tc(MIN.) =   43.38
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    606.00 =    1770.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    605.00 TO NODE    606.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
```

```
==========================================================================

**************************************************************************
 FLOW PROCESS FROM NODE    730.00 TO NODE    731.00 IS CODE =  21
--------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6000
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
 UPSTREAM ELEVATION(FEET) =     50.60
 DOWNSTREAM ELEVATION(FEET) =     49.40
 ELEVATION DIFFERENCE(FEET) =      1.20
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.256
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.730
 SUBAREA RUNOFF(CFS) =      0.45
 TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.45

**************************************************************************
 FLOW PROCESS FROM NODE    731.00 TO NODE    732.00 IS CODE =  61
--------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STANDARD CURB SECTION USED)<<<<<
==========================================================================
 UPSTREAM ELEVATION(FEET) =   49.40  DOWNSTREAM ELEVATION(FEET) =   46.00
 STREET LENGTH(FEET) =   380.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 16.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.34
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.38
   HALFSTREET FLOOD WIDTH(FEET) =   12.84
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.46
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.94
 STREET FLOW TRAVEL TIME(MIN.) =   2.58   Tc(MIN.) =    9.84
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.065
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.600
 SUBAREA AREA(ACRES) =    4.20      SUBAREA RUNOFF(CFS) =    7.72
 TOTAL AREA(ACRES) =        4.4        PEAK FLOW RATE(CFS) =       8.09

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.45   HALFSTREET FLOOD WIDTH(FEET) =  16.00
 FLOW VELOCITY(FEET/SEC.) =  2.79   DEPTH*VELOCITY(FT*FT/SEC.) =   1.24
 LONGEST FLOWPATH FROM NODE    730.00 TO NODE    732.00 =     500.00 FEET.

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

```
 FLOW PROCESS FROM NODE    732.00 TO NODE    732.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.065
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6300
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6185
 SUBAREA AREA(ACRES) =    7.10   SUBAREA RUNOFF(CFS) =   13.71
 TOTAL AREA(ACRES) =       11.5   TOTAL RUNOFF(CFS) =      21.80
 TC(MIN.) =    9.84

****************************************************************************
 FLOW PROCESS FROM NODE    732.00 TO NODE    733.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    41.00  DOWNSTREAM(FEET) =    36.00
 FLOW LENGTH(FEET) =   480.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  19.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.95
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      21.80
 PIPE TRAVEL TIME(MIN.) =   1.01    Tc(MIN.) =   10.84
 LONGEST FLOWPATH FROM NODE    730.00 TO NODE    733.00 =     980.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    733.10 TO NODE    733.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.879
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6300
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6226
 SUBAREA AREA(ACRES) =    6.40   SUBAREA RUNOFF(CFS) =   11.61
 TOTAL AREA(ACRES) =       17.9   TOTAL RUNOFF(CFS) =      32.08
 TC(MIN.) =   10.84

****************************************************************************
 FLOW PROCESS FROM NODE    733.20 TO NODE    733.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.879
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6096
 SUBAREA AREA(ACRES) =    0.90   SUBAREA RUNOFF(CFS) =    0.91
 TOTAL AREA(ACRES) =       18.8   TOTAL RUNOFF(CFS) =      32.99
 TC(MIN.) =   10.84

****************************************************************************
 FLOW PROCESS FROM NODE    733.00 TO NODE    715.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.879
 *USER SPECIFIED(SUBAREA):
```

```
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5916
  SUBAREA AREA(ACRES) =    1.40   SUBAREA RUNOFF(CFS) =    1.41
  TOTAL AREA(ACRES) =       20.2   TOTAL RUNOFF(CFS) =      34.40
  TC(MIN.) =   10.84

****************************************************************************
  FLOW PROCESS FROM NODE    733.00 TO NODE    715.00 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.) =   10.84
  RAINFALL INTENSITY(INCH/HR) =   2.88
  TOTAL STREAM AREA(ACRES) =    20.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     34.40

****************************************************************************
  FLOW PROCESS FROM NODE    710.00 TO NODE    711.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =     49.00
  DOWNSTREAM ELEVATION(FEET) =     47.80
  ELEVATION DIFFERENCE(FEET) =      1.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.577
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    60.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.420
  SUBAREA RUNOFF(CFS) =      2.48
  TOTAL AREA(ACRES) =      0.80   TOTAL RUNOFF(CFS) =      2.48

****************************************************************************
  FLOW PROCESS FROM NODE    711.00 TO NODE    712.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   47.80  DOWNSTREAM ELEVATION(FEET) =   46.10
  STREET LENGTH(FEET) =   300.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

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

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.16
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.35
    HALFSTREET FLOOD WIDTH(FEET) =   11.43
```

```
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.81
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.64
  STREET FLOW TRAVEL TIME(MIN.) =   2.76   Tc(MIN.) =    8.34
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.410
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.663
  SUBAREA AREA(ACRES) =    2.40      SUBAREA RUNOFF(CFS) =    5.32
  TOTAL AREA(ACRES) =        3.2        PEAK FLOW RATE(CFS) =       7.23

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  13.07
  FLOW VELOCITY(FEET/SEC.) =  1.98   DEPTH*VELOCITY(FT*FT/SEC.) =   0.77
  LONGEST FLOWPATH FROM NODE    710.00 TO NODE    712.00 =     420.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    712.00 TO NODE    713.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    41.40  DOWNSTREAM(FEET) =    40.40
  FLOW LENGTH(FEET) =   250.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  12.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.39
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.23
  PIPE TRAVEL TIME(MIN.) =   0.95    Tc(MIN.) =    9.29
  LONGEST FLOWPATH FROM NODE    710.00 TO NODE    713.00 =     670.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    713.10 TO NODE    713.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.181
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6571
  SUBAREA AREA(ACRES) =    2.40   SUBAREA RUNOFF(CFS) =    4.96
  TOTAL AREA(ACRES) =        5.6   TOTAL RUNOFF(CFS) =      11.71
  TC(MIN.) =    9.29

****************************************************************************
  FLOW PROCESS FROM NODE    713.00 TO NODE    714.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    40.40  DOWNSTREAM(FEET) =    36.10
  FLOW LENGTH(FEET) =   620.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  12.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.07
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.71
  PIPE TRAVEL TIME(MIN.) =   1.70    Tc(MIN.) =   10.99
  LONGEST FLOWPATH FROM NODE    710.00 TO NODE    714.00 =    1290.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    714.10 TO NODE    714.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.854
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6531
  SUBAREA AREA(ACRES) =    7.30   SUBAREA RUNOFF(CFS) =   13.54
  TOTAL AREA(ACRES) =       12.9   TOTAL RUNOFF(CFS) =      24.04
  TC(MIN.) =   10.99

****************************************************************************
  FLOW PROCESS FROM NODE    714.00 TO NODE    715.00 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.) =   10.99
  RAINFALL INTENSITY(INCH/HR) =   2.85
  TOTAL STREAM AREA(ACRES) =    12.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     24.04

  ** CONFLUENCE DATA **
  STREAM     RUNOFF        Tc       INTENSITY       AREA
  NUMBER      (CFS)      (MIN.)    (INCH/HOUR)     (ACRE)
      1       34.40    10.84         2.879          20.20
      2       24.04    10.99         2.854          12.90

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF       Tc       INTENSITY
  NUMBER      (CFS)     (MIN.)    (INCH/HOUR)
      1       58.12    10.84        2.879
      2       58.15    10.99        2.854

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      58.15   Tc(MIN.) =   10.99
  TOTAL AREA(ACRES) =       33.1
  LONGEST FLOWPATH FROM NODE    710.00 TO NODE    715.00 =    1290.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    715.00 TO NODE    716.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
================================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  45.00   RAIN INTENSITY(INCH/HOUR) =  1.15
  TOTAL AREA(ACRES) =    33.10   TOTAL RUNOFF(CFS) =     19.00

****************************************************************************
  FLOW PROCESS FROM NODE    716.00 TO NODE    606.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    31.50  DOWNSTREAM(FEET) =    30.80
  FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  13.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.04
```

```
 GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      19.00
 PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =   45.13
 LONGEST FLOWPATH FROM NODE    710.00 TO NODE    606.00 =    1355.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    716.00 TO NODE    606.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
    1       19.00    45.13       1.147       33.10
 LONGEST FLOWPATH FROM NODE    710.00 TO NODE    606.00 =    1355.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
    1       10.00    43.38       1.177       15.00
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    606.00 =    1770.00 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
    1      28.26      43.38        1.177
    2      28.75      45.13        1.147

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      28.75   Tc(MIN.) =   45.13
 TOTAL AREA(ACRES) =       48.1

****************************************************************************
 FLOW PROCESS FROM NODE    606.00 TO NODE    607.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    30.70  DOWNSTREAM(FEET) =    29.40
 FLOW LENGTH(FEET) =   220.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  48.0 INCH PIPE IS  17.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.11
 GIVEN PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      28.75
 PIPE TRAVEL TIME(MIN.) =   0.52    Tc(MIN.) =   45.65
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    607.00 =    1990.00 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =       48.1  TC(MIN.) =     45.65
 PEAK FLOW RATE(CFS)   =      28.75
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

B. 2-Year Rational Method

3a-zsw2

3b-zne2

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2016 Advanced Engineering Software (aes)
              Ver. 23.0 Release Date: 07/01/2016  License ID 1532

                            Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* Ocean Kamp - Rational Method - SW Area                                 *
* December 16, 2019                                                      *
* 2-year analysis                                                        *
 ************************************************************************

  FILE NAME: ZSW2.DAT
  TIME/DATE OF STUDY: 09:46 12/19/2019
------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =   2.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   1.250
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-   CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =     48.00
  DOWNSTREAM ELEVATION(FEET) =     47.50
  ELEVATION DIFFERENCE(FEET) =      0.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.216
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
```

```
          THE MAXIMUM OVERLAND FLOW LENGTH =    50.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.599
  SUBAREA RUNOFF(CFS) =      0.51
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      0.51

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     47.50  DOWNSTREAM(FEET) =     46.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   270.00   CHANNEL SLOPE =  0.0056
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.020   MAXIMUM DEPTH(FEET) =   2.00
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.965
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.21
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.15
  AVERAGE FLOW DEPTH(FEET) =   0.10   TRAVEL TIME(MIN.) =   3.92
  Tc(MIN.) =   11.13
  SUBAREA AREA(ACRES) =     1.10       SUBAREA RUNOFF(CFS) =    1.41
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  TOTAL AREA(ACRES) =        1.4         PEAK FLOW RATE(CFS) =       1.79

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.12   FLOW VELOCITY(FEET/SEC.) =   1.27
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     390.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    42.00  DOWNSTREAM(FEET) =    38.00
  FLOW LENGTH(FEET) =   420.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.19
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.79
  PIPE TRAVEL TIME(MIN.) =   1.67    Tc(MIN.) =   12.80
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     810.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.10 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.796
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6167
  SUBAREA AREA(ACRES) =    2.80   SUBAREA RUNOFF(CFS) =    3.02
  TOTAL AREA(ACRES) =        4.2   TOTAL RUNOFF(CFS) =       4.65
  TC(MIN.) =   12.80
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    103.20 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.796
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6097
 SUBAREA AREA(ACRES) =    3.00   SUBAREA RUNOFF(CFS) =    3.23
 TOTAL AREA(ACRES) =        7.2   TOTAL RUNOFF(CFS) =       7.88
 TC(MIN.) =   12.80

****************************************************************************
 FLOW PROCESS FROM NODE    103.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    38.00  DOWNSTREAM(FEET) =    32.60
 FLOW LENGTH(FEET) =   350.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.42
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       7.88
 PIPE TRAVEL TIME(MIN.) =   0.79    Tc(MIN.) =   13.59
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    1160.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    107.10 TO NODE    107.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.728
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .5000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.5888
 SUBAREA AREA(ACRES) =    1.70   SUBAREA RUNOFF(CFS) =    1.47
 TOTAL AREA(ACRES) =        8.9   TOTAL RUNOFF(CFS) =       9.06
 TC(MIN.) =   13.59

****************************************************************************
 FLOW PROCESS FROM NODE    107.20 TO NODE    107.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.728
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6064
 SUBAREA AREA(ACRES) =    3.60   SUBAREA RUNOFF(CFS) =    4.04
 TOTAL AREA(ACRES) =       12.5   TOTAL RUNOFF(CFS) =      13.10
 TC(MIN.) =   13.59

****************************************************************************
 FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
```

```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.59
  RAINFALL INTENSITY(INCH/HR) =   1.73
  TOTAL STREAM AREA(ACRES) =    12.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.10

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    109.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =     46.50
  DOWNSTREAM ELEVATION(FEET) =     45.50
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.320
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    56.67
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.293
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.79
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      0.79

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    110.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     45.50  DOWNSTREAM(FEET) =     42.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   370.00   CHANNEL SLOPE =  0.0081
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.013   MAXIMUM DEPTH(FEET) =   2.00
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.912
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.18
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.56
  AVERAGE FLOW DEPTH(FEET) =   0.27   TRAVEL TIME(MIN.) =   1.73
  Tc(MIN.) =    6.05
  SUBAREA AREA(ACRES) =     2.90       SUBAREA RUNOFF(CFS) =    6.76
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.800
  TOTAL AREA(ACRES) =        3.2         PEAK FLOW RATE(CFS) =       7.46

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.36   FLOW VELOCITY(FEET/SEC.) =   4.26
  LONGEST FLOWPATH FROM NODE    108.00 TO NODE    110.00 =     490.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    38.00  DOWNSTREAM(FEET) =    36.00
  FLOW LENGTH(FEET) =   360.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.5 INCHES
```

```
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.98
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       7.46
 PIPE TRAVEL TIME(MIN.) =   1.20    Tc(MIN.) =    7.25
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    111.00 =     850.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    111.10 TO NODE    111.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.591
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .7000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.7508
 SUBAREA AREA(ACRES) =    3.10   SUBAREA RUNOFF(CFS) =    5.62
 TOTAL AREA(ACRES) =        6.3   TOTAL RUNOFF(CFS) =      12.25
 TC(MIN.) =    7.25

****************************************************************************
 FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    36.00  DOWNSTREAM(FEET) =    34.20
 FLOW LENGTH(FEET) =   265.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  17.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.87
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      12.25
 PIPE TRAVEL TIME(MIN.) =   0.75    Tc(MIN.) =    8.01
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    112.00 =    1115.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    112.10 TO NODE    112.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.431
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .7000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.7405
 SUBAREA AREA(ACRES) =    1.60   SUBAREA RUNOFF(CFS) =    2.72
 TOTAL AREA(ACRES) =        7.9   TOTAL RUNOFF(CFS) =      14.22
 TC(MIN.) =    8.01

****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    34.20  DOWNSTREAM(FEET) =    32.60
 FLOW LENGTH(FEET) =   130.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.79
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      14.22
 PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =    8.28
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    107.00 =    1245.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    107.00 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.) =    8.28
 RAINFALL INTENSITY(INCH/HR) =   2.38
 TOTAL STREAM AREA(ACRES) =     7.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     14.22

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       13.10    13.59        1.728         12.50
     2       14.22     8.28        2.378          7.90

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc      INTENSITY
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
     1       22.21     8.28       2.378
     2       23.44    13.59       1.728

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      23.44   Tc(MIN.) =   13.59
 TOTAL AREA(ACRES) =       20.4
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    107.00 =    1245.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    107.00 TO NODE    123.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     32.80  DOWNSTREAM(FEET) =     32.30
 CHANNEL LENGTH THRU SUBAREA(FEET) =    50.00   CHANNEL SLOPE =  0.0100
 CHANNEL BASE(FEET) =   30.00   "Z" FACTOR =  20.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.696
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      23.76
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.07
 AVERAGE FLOW DEPTH(FEET) =   0.32   TRAVEL TIME(MIN.) =   0.40
 Tc(MIN.) =   13.99
 SUBAREA AREA(ACRES) =     1.10       SUBAREA RUNOFF(CFS) =    0.65
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.643
 TOTAL AREA(ACRES) =       21.5         PEAK FLOW RATE(CFS) =      23.44

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.32   FLOW VELOCITY(FEET/SEC.) =   2.04
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    123.00 =    1295.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    107.00 TO NODE    123.00 IS CODE =   1
----------------------------------------------------------------------------
```

```
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
================================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.99
  RAINFALL INTENSITY(INCH/HR) =   1.70
  TOTAL STREAM AREA(ACRES) =    21.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.44

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    121.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   150.00
  UPSTREAM ELEVATION(FEET) =     48.90
  DOWNSTREAM ELEVATION(FEET) =     47.80
  ELEVATION DIFFERENCE(FEET) =      1.10
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.641
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    54.67
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.742
  SUBAREA RUNOFF(CFS) =      0.89
  TOTAL AREA(ACRES) =      0.50   TOTAL RUNOFF(CFS) =      0.89

****************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   47.80  DOWNSTREAM ELEVATION(FEET) =   41.60
  STREET LENGTH(FEET) =   570.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

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

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.48
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.27
    HALFSTREET FLOOD WIDTH(FEET) =    7.12
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.99
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.53
  STREET FLOW TRAVEL TIME(MIN.) =   4.78   Tc(MIN.) =   11.42
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.933
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.608
  SUBAREA AREA(ACRES) =    2.70      SUBAREA RUNOFF(CFS) =    3.13
  TOTAL AREA(ACRES) =        3.2        PEAK FLOW RATE(CFS) =       3.76
```

```
 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =   8.68
 FLOW VELOCITY(FEET/SEC.) =  2.16   DEPTH*VELOCITY(FT*FT/SEC.) =   0.65
 LONGEST FLOWPATH FROM NODE    120.00 TO NODE    122.00 =     720.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    122.00 TO NODE    123.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    34.70  DOWNSTREAM(FEET) =    32.60
 FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.08
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       3.76
 PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =   11.80
 LONGEST FLOWPATH FROM NODE    120.00 TO NODE    123.00 =     860.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    122.00 TO NODE    123.00 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.) =   11.80
 RAINFALL INTENSITY(INCH/HR) =   1.89
 TOTAL STREAM AREA(ACRES) =     3.20
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.76

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       23.44    13.99        1.696         21.50
     2        3.76    11.80        1.892          3.20

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       24.76    11.80       1.892
     2       26.81    13.99       1.696

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      26.81   Tc(MIN.) =   13.99
 TOTAL AREA(ACRES) =       24.7
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    123.00 =    1295.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    123.00 TO NODE    123.00 IS CODE =   7
----------------------------------------------------------------------------
 >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
 USER-SPECIFIED VALUES ARE AS FOLLOWS:
 TC(MIN) =  60.00   RAIN INTENSITY(INCH/HOUR) =  0.66
 TOTAL AREA(ACRES) =    24.70   TOTAL RUNOFF(CFS) =      3.00
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    123.00 TO NODE    306.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    28.60  DOWNSTREAM(FEET) =    25.60
 FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS   4.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.92
 GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       3.00
 PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =   60.41
 LONGEST FLOWPATH FROM NODE    108.00 TO NODE    306.00 =    1440.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    123.00 TO NODE    306.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6000
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
 UPSTREAM ELEVATION(FEET) =     51.00
 DOWNSTREAM ELEVATION(FEET) =     49.80
 ELEVATION DIFFERENCE(FEET) =      1.20
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.256
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.590
 SUBAREA RUNOFF(CFS) =      0.47
 TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      0.47

****************************************************************************
 FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  61
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   49.30  DOWNSTREAM ELEVATION(FEET) =   46.30
 STREET LENGTH(FEET) =   300.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 18.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  13.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.58
```

```
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.17
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.02
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.58
  STREET FLOW TRAVEL TIME(MIN.) =   2.48   Tc(MIN.) =    9.74
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.143
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.642
  SUBAREA AREA(ACRES) =    1.60      SUBAREA RUNOFF(CFS) =    2.23
  TOTAL AREA(ACRES) =        1.9        PEAK FLOW RATE(CFS) =       2.61

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.15
  FLOW VELOCITY(FEET/SEC.) =  2.27   DEPTH*VELOCITY(FT*FT/SEC.) =   0.75
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =     420.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    503.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    41.00  DOWNSTREAM(FEET) =    38.00
  FLOW LENGTH(FEET) =   300.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.75
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.61
  PIPE TRAVEL TIME(MIN.) =   1.05    Tc(MIN.) =   10.79
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    503.00 =     720.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    503.10 TO NODE    503.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.005
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6474
  SUBAREA AREA(ACRES) =    3.80   SUBAREA RUNOFF(CFS) =    4.95
  TOTAL AREA(ACRES) =        5.7   TOTAL RUNOFF(CFS) =       7.40
  TC(MIN.) =   10.79

****************************************************************************
  FLOW PROCESS FROM NODE    503.20 TO NODE    503.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.005
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6234
  SUBAREA AREA(ACRES) =    0.50   SUBAREA RUNOFF(CFS) =    0.35
  TOTAL AREA(ACRES) =        6.2   TOTAL RUNOFF(CFS) =       7.75
  TC(MIN.) =   10.79
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    503.00 TO NODE    503.00 IS CODE =   7
----------------------------------------------------------------------------
 >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
 USER-SPECIFIED VALUES ARE AS FOLLOWS:
 TC(MIN) =  45.00   RAIN INTENSITY(INCH/HOUR) =  0.80
 TOTAL AREA(ACRES) =     6.20   TOTAL RUNOFF(CFS) =      1.50

****************************************************************************
 FLOW PROCESS FROM NODE    503.00 TO NODE    504.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    38.50  DOWNSTREAM(FEET) =    38.00
 FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.80
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       1.50
 PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =   45.26
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    504.00 =     780.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    504.00 TO NODE    505.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     38.00  DOWNSTREAM(FEET) =     36.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   280.00   CHANNEL SLOPE =  0.0054
 CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  0.774
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.51
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.46
 AVERAGE FLOW DEPTH(FEET) =   0.25   TRAVEL TIME(MIN.) =   1.90
 Tc(MIN.) =   47.16
 SUBAREA AREA(ACRES) =     0.10       SUBAREA RUNOFF(CFS) =    0.03
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.304
 TOTAL AREA(ACRES) =        6.3         PEAK FLOW RATE(CFS) =       1.50

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.25   FLOW VELOCITY(FEET/SEC.) =   2.43
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    505.00 =    1060.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    505.10 TO NODE    505.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  0.774
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3245
 SUBAREA AREA(ACRES) =    5.10   SUBAREA RUNOFF(CFS) =    1.38
 TOTAL AREA(ACRES) =       11.4   TOTAL RUNOFF(CFS) =       2.86
```

```
 TC(MIN.) =   47.16

****************************************************************************
 FLOW PROCESS FROM NODE    505.00 TO NODE    506.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    36.50  DOWNSTREAM(FEET) =    36.35
 FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   2.61
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.86
 PIPE TRAVEL TIME(MIN.) =   0.51    Tc(MIN.) =   47.67
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    506.00 =    1140.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    506.00 TO NODE    506.00 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.) =   47.67
 RAINFALL INTENSITY(INCH/HR) =   0.77
 TOTAL STREAM AREA(ACRES) =    11.40
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.86

****************************************************************************
 FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .7000
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
 UPSTREAM ELEVATION(FEET) =     49.00
 DOWNSTREAM ELEVATION(FEET) =      4.00
 ELEVATION DIFFERENCE(FEET) =     45.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.342
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.293
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      2.54
 TOTAL AREA(ACRES) =      1.10   TOTAL RUNOFF(CFS) =      2.54

****************************************************************************
 FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    44.00  DOWNSTREAM(FEET) =    42.60
 FLOW LENGTH(FEET) =   180.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.31
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```

```
 PIPE-FLOW(CFS) =       2.54
 PIPE TRAVEL TIME(MIN.) =   0.70    Tc(MIN.) =    4.04
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     300.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    302.10 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.293
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .4500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.5646
 SUBAREA AREA(ACRES) =    1.30   SUBAREA RUNOFF(CFS) =    1.93
 TOTAL AREA(ACRES) =        2.4   TOTAL RUNOFF(CFS) =       4.46
 TC(MIN.) =    4.04

****************************************************************************
 FLOW PROCESS FROM NODE    506.00 TO NODE    506.00 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.) =    4.04
 RAINFALL INTENSITY(INCH/HR) =   3.29
 TOTAL STREAM AREA(ACRES) =     2.40
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.46

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        2.86    47.67        0.769         11.40
     2        4.46     4.04        3.293          2.40

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1        4.71     4.04       3.293
     2        3.91    47.67       0.769

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       4.71   Tc(MIN.) =    4.04
 TOTAL AREA(ACRES) =       13.8
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    506.00 =    1140.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    506.00 TO NODE    304.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    36.35  DOWNSTREAM(FEET) =    36.00
 FLOW LENGTH(FEET) =   160.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.13
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
```

```
 PIPE-FLOW(CFS) =       4.71
 PIPE TRAVEL TIME(MIN.) =   0.85    Tc(MIN.) =    4.89
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    304.00 =    1300.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    304.10 TO NODE    304.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.293
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .5000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3718
 SUBAREA AREA(ACRES) =    0.60   SUBAREA RUNOFF(CFS) =    0.99
 TOTAL AREA(ACRES) =       14.4   TOTAL RUNOFF(CFS) =      17.63
 TC(MIN.) =    4.89

****************************************************************************
 FLOW PROCESS FROM NODE    304.00 TO NODE    305.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     36.00  DOWNSTREAM(FEET) =     33.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   720.00   CHANNEL SLOPE =  0.0042
 CHANNEL BASE(FEET) =    7.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.50
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.464
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6000
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      19.92
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.06
 AVERAGE FLOW DEPTH(FEET) =   0.60   TRAVEL TIME(MIN.) =   2.95
 Tc(MIN.) =    7.84
 SUBAREA AREA(ACRES) =     3.10       SUBAREA RUNOFF(CFS) =    4.58
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.412
 TOTAL AREA(ACRES) =       17.5         PEAK FLOW RATE(CFS) =      17.77

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.56   FLOW VELOCITY(FEET/SEC.) =   3.91
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    305.00 =    2020.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    305.00 TO NODE    306.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    29.30  DOWNSTREAM(FEET) =    27.80
 FLOW LENGTH(FEET) =   364.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  60.0 INCH PIPE IS  13.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.34
 GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      17.77
 PIPE TRAVEL TIME(MIN.) =   1.14    Tc(MIN.) =    8.98
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    306.00 =    2384.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    306.10 TO NODE    306.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.258
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4623
  SUBAREA AREA(ACRES) =    2.00   SUBAREA RUNOFF(CFS) =    4.06
  TOTAL AREA(ACRES) =       19.5   TOTAL RUNOFF(CFS) =      20.35
  TC(MIN.) =    8.98

****************************************************************************
  FLOW PROCESS FROM NODE    306.00 TO NODE    306.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       20.35     8.98       2.258       19.50
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    306.00 =    2384.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        3.00    60.41       0.660       24.70
  LONGEST FLOWPATH FROM NODE    108.00 TO NODE    306.00 =    1440.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      20.80       8.98        2.258
      2       8.95      60.41        0.660

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      20.80   Tc(MIN.) =    8.98
  TOTAL AREA(ACRES) =       44.2

****************************************************************************
  FLOW PROCESS FROM NODE    306.00 TO NODE    307.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    27.80  DOWNSTREAM(FEET) =    26.60
  FLOW LENGTH(FEET) =   198.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  60.0 INCH PIPE IS  13.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.41
  GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      20.80
  PIPE TRAVEL TIME(MIN.) =   0.51    Tc(MIN.) =    9.49
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    307.00 =    2582.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    307.10 TO NODE    307.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.178
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
```

```
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3233
 SUBAREA AREA(ACRES) =     1.30   SUBAREA RUNOFF(CFS) =     2.55
 TOTAL AREA(ACRES) =       45.5   TOTAL RUNOFF(CFS) =      32.03
 TC(MIN.) =    9.49

****************************************************************************
 FLOW PROCESS FROM NODE    307.00 TO NODE    127.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    26.60  DOWNSTREAM(FEET) =    25.50
 FLOW LENGTH(FEET) =   198.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  60.0 INCH PIPE IS  16.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.04
 GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      32.03
 PIPE TRAVEL TIME(MIN.) =   0.47    Tc(MIN.) =    9.96
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    127.00 =    2780.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    125.00 TO NODE    127.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.111
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3245
 SUBAREA AREA(ACRES) =     2.20   SUBAREA RUNOFF(CFS) =     1.63
 TOTAL AREA(ACRES) =       47.7   TOTAL RUNOFF(CFS) =      32.68
 TC(MIN.) =    9.96

****************************************************************************
 FLOW PROCESS FROM NODE    125.10 TO NODE    127.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.111
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3575
 SUBAREA AREA(ACRES) =     2.90   SUBAREA RUNOFF(CFS) =     5.51
 TOTAL AREA(ACRES) =       50.6   TOTAL RUNOFF(CFS) =      38.19
 TC(MIN.) =    9.96

****************************************************************************
 FLOW PROCESS FROM NODE    126.00 TO NODE    127.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.111
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9000
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3670
 SUBAREA AREA(ACRES) =     0.90   SUBAREA RUNOFF(CFS) =     1.71
 TOTAL AREA(ACRES) =       51.5   TOTAL RUNOFF(CFS) =      39.90
 TC(MIN.) =    9.96

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

```
 FLOW PROCESS FROM NODE    127.00 TO NODE    128.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    25.50  DOWNSTREAM(FEET) =    25.32
 FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  60.0 INCH PIPE IS  24.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.40
 GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      39.90
 PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =   10.21
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    128.00 =    2860.00 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =       51.5  TC(MIN.) =     10.21
 PEAK FLOW RATE(CFS)   =      39.90
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2016 Advanced Engineering Software (aes)
              Ver. 23.0 Release Date: 07/01/2016  License ID 1532

                            Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* Ocean Kamp - Rational Method Northerly area nodes 600-700               *
* December 13, 2019                                                       *
* 2-year analysis                                                         *
 ************************************************************************

  FILE NAME: ZNE2.DAT
  TIME/DATE OF STUDY: 09:49 12/19/2019
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =   2.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   1.250
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-   CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    601.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6300
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =     51.00
  DOWNSTREAM ELEVATION(FEET) =     49.80
  ELEVATION DIFFERENCE(FEET) =      1.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.821
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
```

```
          THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.696
  SUBAREA RUNOFF(CFS) =      0.51
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      0.51

****************************************************************************
  FLOW PROCESS FROM NODE    601.00 TO NODE    602.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   49.80  DOWNSTREAM ELEVATION(FEET) =   44.80
  STREET LENGTH(FEET) =   600.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.41
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.87
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.02
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.65
  STREET FLOW TRAVEL TIME(MIN.) =   4.95   Tc(MIN.) =   11.77
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.896
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.601
  SUBAREA AREA(ACRES) =    6.70      SUBAREA RUNOFF(CFS) =    7.62
  TOTAL AREA(ACRES) =        7.0        PEAK FLOW RATE(CFS) =       7.98

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.60
  FLOW VELOCITY(FEET/SEC.) =  2.34   DEPTH*VELOCITY(FT*FT/SEC.) =   0.88
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    602.00 =     720.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    602.00 TO NODE    603.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.896
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5845
  SUBAREA AREA(ACRES) =    0.50   SUBAREA RUNOFF(CFS) =    0.33
  TOTAL AREA(ACRES) =        7.5   TOTAL RUNOFF(CFS) =       8.31
  TC(MIN.) =   11.77

****************************************************************************
  FLOW PROCESS FROM NODE    602.00 TO NODE    603.00 IS CODE =   7
----------------------------------------------------------------------------
```

```
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
================================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  70.00   RAIN INTENSITY(INCH/HOUR) =  0.60
  TOTAL AREA(ACRES) =     7.50   TOTAL RUNOFF(CFS) =      1.00

****************************************************************************
  FLOW PROCESS FROM NODE    603.00 TO NODE    604.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  0.600
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2860
  SUBAREA AREA(ACRES) =    7.50   SUBAREA RUNOFF(CFS) =    1.58
  TOTAL AREA(ACRES) =       15.0   TOTAL RUNOFF(CFS) =       2.58
  TC(MIN.) =   70.00

****************************************************************************
  FLOW PROCESS FROM NODE    603.00 TO NODE    604.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  60.00   RAIN INTENSITY(INCH/HOUR) =  0.66
  TOTAL AREA(ACRES) =    15.00   TOTAL RUNOFF(CFS) =      7.00

****************************************************************************
  FLOW PROCESS FROM NODE    604.00 TO NODE    605.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    36.10  DOWNSTREAM(FEET) =    34.90
  FLOW LENGTH(FEET) =   210.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  10.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.91
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.00
  PIPE TRAVEL TIME(MIN.) =   0.71    Tc(MIN.) =   60.71
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    605.00 =     930.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    605.00 TO NODE    606.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    34.90  DOWNSTREAM(FEET) =    30.80
  FLOW LENGTH(FEET) =   840.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  10.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.64
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.00
  PIPE TRAVEL TIME(MIN.) =   3.02    Tc(MIN.) =   63.73
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    606.00 =    1770.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    605.00 TO NODE    606.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
```

```
==========================================================================

**************************************************************************
  FLOW PROCESS FROM NODE    730.00 TO NODE    731.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =     50.60
  DOWNSTREAM ELEVATION(FEET) =     49.40
  ELEVATION DIFFERENCE(FEET) =      1.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.256
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.590
  SUBAREA RUNOFF(CFS) =      0.31
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.31

**************************************************************************
  FLOW PROCESS FROM NODE    731.00 TO NODE    732.00 IS CODE =  61
--------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==========================================================================
  UPSTREAM ELEVATION(FEET) =   49.40  DOWNSTREAM ELEVATION(FEET) =   46.00
  STREET LENGTH(FEET) =   380.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.97
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.35
    HALFSTREET FLOOD WIDTH(FEET) =   10.96
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.25
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.78
  STREET FLOW TRAVEL TIME(MIN.) =   2.81   Tc(MIN.) =   10.07
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.097
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.600
  SUBAREA AREA(ACRES) =    4.20      SUBAREA RUNOFF(CFS) =    5.28
  TOTAL AREA(ACRES) =        4.4        PEAK FLOW RATE(CFS) =       5.53

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.41   HALFSTREET FLOOD WIDTH(FEET) =  14.16
  FLOW VELOCITY(FEET/SEC.) =  2.61   DEPTH*VELOCITY(FT*FT/SEC.) =   1.07
  LONGEST FLOWPATH FROM NODE    730.00 TO NODE    732.00 =     500.00 FEET.

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

```
 FLOW PROCESS FROM NODE    732.00 TO NODE    732.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.097
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6300
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6185
 SUBAREA AREA(ACRES) =    7.10   SUBAREA RUNOFF(CFS) =    9.38
 TOTAL AREA(ACRES) =       11.5   TOTAL RUNOFF(CFS) =      14.91
 TC(MIN.) =   10.07

****************************************************************************
 FLOW PROCESS FROM NODE    732.00 TO NODE    733.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    41.00  DOWNSTREAM(FEET) =    36.00
 FLOW LENGTH(FEET) =   480.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.27
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      14.91
 PIPE TRAVEL TIME(MIN.) =   1.10    Tc(MIN.) =   11.17
 LONGEST FLOWPATH FROM NODE    730.00 TO NODE    733.00 =     980.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    733.10 TO NODE    733.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.961
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6300
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6226
 SUBAREA AREA(ACRES) =    6.40   SUBAREA RUNOFF(CFS) =    7.91
 TOTAL AREA(ACRES) =       17.9   TOTAL RUNOFF(CFS) =      21.85
 TC(MIN.) =   11.17

****************************************************************************
 FLOW PROCESS FROM NODE    733.20 TO NODE    733.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.961
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6096
 SUBAREA AREA(ACRES) =    0.90   SUBAREA RUNOFF(CFS) =    0.62
 TOTAL AREA(ACRES) =       18.8   TOTAL RUNOFF(CFS) =      22.47
 TC(MIN.) =   11.17

****************************************************************************
 FLOW PROCESS FROM NODE    733.00 TO NODE    715.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.961
 *USER SPECIFIED(SUBAREA):
```

```
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5916
  SUBAREA AREA(ACRES) =    1.40   SUBAREA RUNOFF(CFS) =    0.96
  TOTAL AREA(ACRES) =       20.2   TOTAL RUNOFF(CFS) =      23.43
  TC(MIN.) =   11.17

****************************************************************************
  FLOW PROCESS FROM NODE    733.00 TO NODE    715.00 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.) =   11.17
  RAINFALL INTENSITY(INCH/HR) =   1.96
  TOTAL STREAM AREA(ACRES) =    20.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.43

****************************************************************************
  FLOW PROCESS FROM NODE    710.00 TO NODE    711.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =     49.00
  DOWNSTREAM ELEVATION(FEET) =     47.80
  ELEVATION DIFFERENCE(FEET) =      1.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.577
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    60.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.069
  SUBAREA RUNOFF(CFS) =      1.72
  TOTAL AREA(ACRES) =      0.80   TOTAL RUNOFF(CFS) =      1.72

****************************************************************************
  FLOW PROCESS FROM NODE    711.00 TO NODE    712.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   47.80  DOWNSTREAM ELEVATION(FEET) =   46.10
  STREET LENGTH(FEET) =   300.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

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

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.55
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.70
```

```
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.67
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.54
  STREET FLOW TRAVEL TIME(MIN.) =   2.99   Tc(MIN.) =    8.56
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.328
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.663
  SUBAREA AREA(ACRES) =    2.40      SUBAREA RUNOFF(CFS) =    3.63
  TOTAL AREA(ACRES) =        3.2        PEAK FLOW RATE(CFS) =       4.94

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.20
  FLOW VELOCITY(FEET/SEC.) =  1.80   DEPTH*VELOCITY(FT*FT/SEC.) =   0.63
  LONGEST FLOWPATH FROM NODE    710.00 TO NODE    712.00 =     420.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    712.00 TO NODE    713.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    41.40  DOWNSTREAM(FEET) =    40.40
  FLOW LENGTH(FEET) =   250.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  10.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.98
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.94
  PIPE TRAVEL TIME(MIN.) =   1.05    Tc(MIN.) =    9.61
  LONGEST FLOWPATH FROM NODE    710.00 TO NODE    713.00 =     670.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    713.10 TO NODE    713.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.161
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6571
  SUBAREA AREA(ACRES) =    2.40   SUBAREA RUNOFF(CFS) =    3.37
  TOTAL AREA(ACRES) =        5.6   TOTAL RUNOFF(CFS) =       7.95
  TC(MIN.) =    9.61

****************************************************************************
  FLOW PROCESS FROM NODE    713.00 TO NODE    714.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    40.40  DOWNSTREAM(FEET) =    36.10
  FLOW LENGTH(FEET) =   620.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  10.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.46
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.95
  PIPE TRAVEL TIME(MIN.) =   1.89    Tc(MIN.) =   11.50
  LONGEST FLOWPATH FROM NODE    710.00 TO NODE    714.00 =    1290.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    714.10 TO NODE    714.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.924
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6531
  SUBAREA AREA(ACRES) =    7.30   SUBAREA RUNOFF(CFS) =    9.13
  TOTAL AREA(ACRES) =       12.9   TOTAL RUNOFF(CFS) =      16.21
  TC(MIN.) =   11.50

****************************************************************************
  FLOW PROCESS FROM NODE    714.00 TO NODE    715.00 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.) =   11.50
  RAINFALL INTENSITY(INCH/HR) =   1.92
  TOTAL STREAM AREA(ACRES) =    12.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     16.21

  ** CONFLUENCE DATA **
  STREAM     RUNOFF        Tc       INTENSITY       AREA
  NUMBER      (CFS)      (MIN.)    (INCH/HOUR)     (ACRE)
      1       23.43    11.17         1.961          20.20
      2       16.21    11.50         1.924          12.90

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF       Tc       INTENSITY
  NUMBER      (CFS)     (MIN.)    (INCH/HOUR)
      1       39.18    11.17        1.961
      2       39.21    11.50        1.924

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      39.21   Tc(MIN.) =   11.50
  TOTAL AREA(ACRES) =       33.1
  LONGEST FLOWPATH FROM NODE    710.00 TO NODE    715.00 =    1290.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    715.00 TO NODE    716.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
================================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  60.00   RAIN INTENSITY(INCH/HOUR) =  0.66
  TOTAL AREA(ACRES) =    33.10   TOTAL RUNOFF(CFS) =      6.00

****************************************************************************
  FLOW PROCESS FROM NODE    716.00 TO NODE    606.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    31.50  DOWNSTREAM(FEET) =    30.80
  FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS   7.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.79
```

```
 GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       6.00
 PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =   60.19
 LONGEST FLOWPATH FROM NODE    710.00 TO NODE    606.00 =    1355.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    716.00 TO NODE    606.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        6.00    60.19       0.662       33.10
 LONGEST FLOWPATH FROM NODE    710.00 TO NODE    606.00 =    1355.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        7.00    63.73       0.638       15.00
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    606.00 =    1770.00 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      12.61      60.19        0.662
     2      12.78      63.73        0.638

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      12.78   Tc(MIN.) =   63.73
 TOTAL AREA(ACRES) =       48.1

****************************************************************************
 FLOW PROCESS FROM NODE    606.00 TO NODE    607.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    30.70  DOWNSTREAM(FEET) =    29.40
 FLOW LENGTH(FEET) =   220.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  48.0 INCH PIPE IS  11.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.65
 GIVEN PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      12.78
 PIPE TRAVEL TIME(MIN.) =   0.65    Tc(MIN.) =   64.38
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    607.00 =    1990.00 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =       48.1  TC(MIN.) =     64.38
 PEAK FLOW RATE(CFS)   =      12.78
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

APPENDIX C

Detention Basin Routing

Rational Method Hydrograph Calculations
for Post Developed Conditions
Node 123 (DMA-1A)

Q_{100}= 62.1 cfs

Tc= 12 min C= 0.67

#= 30 $P_{100,6}$= 2.7 in A= 24.7 acres

#	D (MIN)	I (IN/HR)	VOL (IN)	ΔVOL (IN)	I (INCR) (IN/HR)	Q (CFS)	VOL (CF)	ORDINATE SUM=
		*(7.44*P6*D^-.645)*	*(I*D/60)*	*(V1-V0)*	*(ΔV/ΔT)*	*(Q=ciA)*		*(Re-ordered)*
0	0	0.00	0.00	0.81	4.04	62.10	44712	0.00
1	12	4.04	0.81	0.23	1.13	18.67	13445	2.68
2	24	2.59	1.03	0.16	0.80	13.25	9542	2.74
3	36	1.99	1.19	0.13	0.64	10.63	7653	2.87
4	48	1.65	1.32	0.11	0.55	9.03	6499	2.94
5	60	1.43	1.43	0.10	0.48	7.92	5706	3.10
6	72	1.27	1.53	0.09	0.43	7.11	5121	3.19
7	84	1.15	1.61	0.08	0.39	6.48	4668	3.39
8	96	1.06	1.69	0.07	0.36	5.98	4305	3.50
9	108	0.98	1.76	0.07	0.34	5.56	4007	3.75
10	120	0.92	1.83	0.06	0.32	5.22	3756	3.90
11	132	0.86	1.89	0.06	0.30	4.92	3542	4.24
12	144	0.81	1.95	0.06	0.28	4.66	3356	4.44
13	156	0.77	2.01	0.05	0.27	4.44	3193	4.92
14	168	0.74	2.06	0.05	0.26	4.24	3049	5.22
15	180	0.71	2.12	0.05	0.25	4.06	2921	5.98
16	192	0.68	2.16	0.05	0.24	3.90	2805	6.48
17	204	0.65	2.21	0.05	0.23	3.75	2701	7.92
18	216	0.63	2.26	0.04	0.22	3.62	2606	9.03
19	228	0.61	2.30	0.04	0.21	3.50	2519	13.25
20	240	0.59	2.34	0.04	0.20	3.39	2439	18.67
21	252	0.57	2.38	0.04	0.20	3.28	2365	62.10
22	264	0.55	2.42	0.04	0.19	3.19	2297	10.63
23	276	0.54	2.46	0.04	0.19	3.10	2233	7.11
24	288	0.52	2.50	0.04	0.18	3.02	2174	5.56
25	300	0.51	2.54	0.04	0.18	2.94	2118	4.66
26	312	0.49	2.57	0.03	0.17	2.87	2066	4.06
27	324	0.48	2.61	0.03	0.17	2.80	2018	3.62
28	336	0.47	2.64	0.03	0.17	2.74	1972	3.28
29	348	0.46	2.67	0.03	0.16	2.68	1928	3.02
30	360	0.45	2.71	0.00	0.00	0.00	0	2.80
						SUM=	**157714**	**cubic feet**
							3.62	**acre-feet**

Check: $V = C*A*P_6$

V= 3.72 acre-feet

OK

Rational Method Hydrograph Calculations
for Post Developed Conditions
Node 716 (DMA 2)

		Q_{100}=	90.0	cfs				
		Tc=	10	min	C=	0.62		
#=	36	$P_{100,6}$=	2.7	in	A=	33.1	acres	

		*(7.44*P6*D^-.645)*	*(I*D/60)*	*(V1-V0)*	*(ΔV/ΔT)*	*(Q=ciA)*		*(Re-ordered)*
#	**D (MIN)**	**I (IN/HR)**	**VOL (IN)**	**ΔVOL (IN)**	**I (INCR) (IN/HR)**	**Q (CFS)**	**VOL (CF)**	**ORDINATE SUM=**
0	0	0.00	0.00	0.76	4.55	90.00	54000	0.00
1	10	4.55	0.76	0.21	1.27	26.05	15627	3.32
2	20	2.91	0.97	0.15	0.90	18.49	11091	3.38
3	30	2.24	1.12	0.12	0.72	14.83	8896	3.51
4	40	1.86	1.24	0.10	0.61	12.59	7554	3.58
5	50	1.61	1.34	0.09	0.54	11.05	6632	3.74
6	60	1.43	1.43	0.08	0.48	9.92	5952	3.82
7	70	1.30	1.51	0.07	0.44	9.04	5426	4.00
8	80	1.19	1.59	0.07	0.41	8.34	5004	4.10
9	90	1.10	1.65	0.06	0.38	7.76	4657	4.33
10	100	1.03	1.72	0.06	0.35	7.28	4366	4.45
11	110	0.97	1.78	0.06	0.33	6.86	4117	4.72
12	120	0.92	1.83	0.05	0.32	6.50	3901	4.88
13	130	0.87	1.88	0.05	0.30	6.19	3712	5.23
14	140	0.83	1.93	0.05	0.29	5.91	3544	5.43
15	150	0.79	1.98	0.05	0.28	5.66	3395	5.91
16	160	0.76	2.03	0.04	0.26	5.43	3261	6.19
17	170	0.73	2.07	0.04	0.25	5.23	3139	6.86
18	180	0.71	2.12	0.04	0.25	5.05	3029	7.28
19	190	0.68	2.16	0.04	0.24	4.88	2928	8.34
20	200	0.66	2.20	0.04	0.23	4.72	2835	9.04
21	210	0.64	2.23	0.04	0.22	4.58	2749	11.05
22	220	0.62	2.27	0.04	0.22	4.45	2669	12.59
23	230	0.60	2.31	0.04	0.21	4.33	2596	18.49
24	240	0.59	2.34	0.03	0.21	4.21	2527	26.05
25	250	0.57	2.38	0.03	0.20	4.10	2462	90.00
26	260	0.56	2.41	0.03	0.20	4.00	2402	14.83
27	270	0.54	2.44	0.03	0.19	3.91	2345	9.92
28	280	0.53	2.47	0.03	0.19	3.82	2292	7.76
29	290	0.52	2.51	0.03	0.18	3.74	2241	6.50
30	300	0.51	2.54	0.03	0.18	3.66	2194	5.66
31	310	0.50	2.57	0.03	0.17	3.58	2149	5.05
32	320	0.49	2.59	0.03	0.17	3.51	2106	4.58
33	330	0.48	2.62	0.03	0.17	3.44	2065	4.21
34	340	0.47	2.65	0.03	0.16	3.38	2026	3.91
35	350	0.46	2.68	0.03	0.16	3.32	1989	3.66
36	360	0.45	2.71	0.00	0.00	0.00	0	3.44
						SUM=	**197876**	**cubic feet**
							4.54	**acre-feet**

Check: $V = C*A*P_6$

V= 4.62 acre-feet

Rational Method Hydrograph Calculations
for Post Developed Conditions
Node 716 (DMA 2)

#	D (MIN)	I (IN/HR)	VOL (IN)	ΔVOL (IN)	I (INCR) (IN/HR)	Q (CFS)	VOL (CF)	ORDINATE SUM=
							OK	

Rational Method Hydrograph Calculations
for Post Developed Conditions
Node 602 (DMA-3)

		Q_{100}=	18.9	cfs				
		Tc=	10	min	C=	0.6		
#=	36	$P_{100,6}$=	2.7	in	A=	7.5	acres	

		*(7.44*P6*D^-.645)*	*(I*D/60)*	*(V1-V0)*	*(ΔV/ΔT)*	*(Q=ciA)*		*(Re-ordered)*
	D	**I**	**VOL**	**ΔVOL**	**I (INCR)**	**Q**	**VOL**	**ORDINATE**
#	**(MIN)**	**(IN/HR)**	**(IN)**	**(IN)**	**(IN/HR)**	**(CFS)**	**(CF)**	**SUM=**
0	0	0.00	0.00	0.76	4.55	18.90	11340	0.00
1	10	4.55	0.76	0.21	1.27	5.71	3427	0.73
2	20	2.91	0.97	0.15	0.90	4.05	2432	0.74
3	30	2.24	1.12	0.12	0.72	3.25	1951	0.77
4	40	1.86	1.24	0.10	0.61	2.76	1656	0.79
5	50	1.61	1.34	0.09	0.54	2.42	1454	0.82
6	60	1.43	1.43	0.08	0.48	2.18	1305	0.84
7	70	1.30	1.51	0.07	0.44	1.98	1190	0.88
8	80	1.19	1.59	0.07	0.41	1.83	1097	0.90
9	90	1.10	1.65	0.06	0.38	1.70	1021	0.95
10	100	1.03	1.72	0.06	0.35	1.60	957	0.98
11	110	0.97	1.78	0.06	0.33	1.50	903	1.04
12	120	0.92	1.83	0.05	0.32	1.43	855	1.07
13	130	0.87	1.88	0.05	0.30	1.36	814	1.15
14	140	0.83	1.93	0.05	0.29	1.30	777	1.19
15	150	0.79	1.98	0.05	0.28	1.24	744	1.30
16	160	0.76	2.03	0.04	0.26	1.19	715	1.36
17	170	0.73	2.07	0.04	0.25	1.15	688	1.50
18	180	0.71	2.12	0.04	0.25	1.11	664	1.60
19	190	0.68	2.16	0.04	0.24	1.07	642	1.83
20	200	0.66	2.20	0.04	0.23	1.04	622	1.98
21	210	0.64	2.23	0.04	0.22	1.00	603	2.42
22	220	0.62	2.27	0.04	0.22	0.98	585	2.76
23	230	0.60	2.31	0.04	0.21	0.95	569	4.05
24	240	0.59	2.34	0.03	0.21	0.92	554	5.71
25	250	0.57	2.38	0.03	0.20	0.90	540	18.90
26	260	0.56	2.41	0.03	0.20	0.88	527	3.25
27	270	0.54	2.44	0.03	0.19	0.86	514	2.18
28	280	0.53	2.47	0.03	0.19	0.84	503	1.70
29	290	0.52	2.51	0.03	0.18	0.82	491	1.43
30	300	0.51	2.54	0.03	0.18	0.80	481	1.24
31	310	0.50	2.57	0.03	0.17	0.79	471	1.11
32	320	0.49	2.59	0.03	0.17	0.77	462	1.00
33	330	0.48	2.62	0.03	0.17	0.75	453	0.92
34	340	0.47	2.65	0.03	0.16	0.74	444	0.86
35	350	0.46	2.68	0.03	0.16	0.73	436	0.80
36	360	0.45	2.71	0.00	0.00	0.00	0	0.75
						SUM=	**42889**	**cubic feet**
							0.98	**acre-feet**

Check: $V = C*A*P_6$

V= 1.01 acre-feet

Rational Method Hydrograph Calculations
for Post Developed Conditions
Node 602 (DMA-3)

#	D (MIN)	I (IN/HR)	VOL (IN)	ΔVOL (IN)	I (INCR) (IN/HR)	Q (CFS)	VOL (CF)	ORDINATE SUM=
							OK	

Rational Method Hydrograph Calculations
for Post Developed Conditions
Node 503 (DMA-4)

		Q_{100}=	17.4	cfs				
		Tc=	10	min	C=	0.62		
#=	36	$P_{100,6}$=	2.7	in	A=	6.2	acres	
		*(7.44*P6*D^-.645)*	*(I*D/60)*	*(V1-V0)*	*(ΔV/ΔT)*	*(Q=ciA)*		*(Re-ordered)*
#	**D (MIN)**	**I (IN/HR)**	**VOL (IN)**	**ΔVOL (IN)**	**I (INCR) (IN/HR)**	**Q (CFS)**	**VOL (CF)**	**ORDINATE SUM=**
0	0	0.00	0.00	0.76	4.55	17.40	10440	0.00
1	10	4.55	0.76	0.21	1.27	4.88	2927	0.62
2	20	2.91	0.97	0.15	0.90	3.46	2078	0.63
3	30	2.24	1.12	0.12	0.72	2.78	1666	0.66
4	40	1.86	1.24	0.10	0.61	2.36	1415	0.67
5	50	1.61	1.34	0.09	0.54	2.07	1242	0.70
6	60	1.43	1.43	0.08	0.48	1.86	1115	0.72
7	70	1.30	1.51	0.07	0.44	1.69	1016	0.75
8	80	1.19	1.59	0.07	0.41	1.56	937	0.77
9	90	1.10	1.65	0.06	0.38	1.45	872	0.81
10	100	1.03	1.72	0.06	0.35	1.36	818	0.83
11	110	0.97	1.78	0.06	0.33	1.29	771	0.88
12	120	0.92	1.83	0.05	0.32	1.22	731	0.91
13	130	0.87	1.88	0.05	0.30	1.16	695	0.98
14	140	0.83	1.93	0.05	0.29	1.11	664	1.02
15	150	0.79	1.98	0.05	0.28	1.06	636	1.11
16	160	0.76	2.03	0.04	0.26	1.02	611	1.16
17	170	0.73	2.07	0.04	0.25	0.98	588	1.29
18	180	0.71	2.12	0.04	0.25	0.95	567	1.36
19	190	0.68	2.16	0.04	0.24	0.91	548	1.56
20	200	0.66	2.20	0.04	0.23	0.88	531	1.69
21	210	0.64	2.23	0.04	0.22	0.86	515	2.07
22	220	0.62	2.27	0.04	0.22	0.83	500	2.36
23	230	0.60	2.31	0.04	0.21	0.81	486	3.46
24	240	0.59	2.34	0.03	0.21	0.79	473	4.88
25	250	0.57	2.38	0.03	0.20	0.77	461	17.40
26	260	0.56	2.41	0.03	0.20	0.75	450	2.78
27	270	0.54	2.44	0.03	0.19	0.73	439	1.86
28	280	0.53	2.47	0.03	0.19	0.72	429	1.45
29	290	0.52	2.51	0.03	0.18	0.70	420	1.22
30	300	0.51	2.54	0.03	0.18	0.68	411	1.06
31	310	0.50	2.57	0.03	0.17	0.67	402	0.95
32	320	0.49	2.59	0.03	0.17	0.66	394	0.86
33	330	0.48	2.62	0.03	0.17	0.64	387	0.79
34	340	0.47	2.65	0.03	0.16	0.63	380	0.73
35	350	0.46	2.68	0.03	0.16	0.62	373	0.68
36	360	0.45	2.71	0.00	0.00	0.00	0	0.64
						SUM=	**37390**	**cubic feet**
							0.86	**acre-feet**

Check: $V = C*A*P_6$

V= 0.86 acre-feet

Rational Method Hydrograph Calculations
for Post Developed Conditions
Node 503 (DMA-4)

#	D (MIN)	I (IN/HR)	VOL (IN)	ΔVOL (IN)	I (INCR) (IN/HR)	Q (CFS)	VOL (CF)	ORDINATE SUM=
							OK	

Stage-Area for BMP-1A

Depth (ft)	Area (ft^2)	Volume (ft^3)	
0.00	29800	0	**BIOFILTRATION (1)**
0.50	31000	15199	**SURFACE OUTLET (2)**
4.00	35471	131435	
9.00	45594	333569	

SUB SURFACE STORAGE

Elevation (ft)	Area (ft^2)	Volume (ft^3)	
-1.75	29800	10430	**Amended Soil Base (0.2 voids)**
-2.75	29800	11920	**Gravel Base (0.4 voids)**
Gravel & Amended Soil	**TOTAL =**	22350	(ft^3)
Surface Total	**TOTAL =**	333569	(ft^3)
BMP	**TOTAL =**	**355919**	**(ft^3)**

(1): The area at this surface elevation corresponds to the area of gravel and amended soil (biofiltration layer)
(2): Volume at this elevation coresponds with surface volume for WQ purposes (invert of lowest surface outlet)

Effective Depth:	6.12 in

Stage-Area for BMP-2

Depth (ft)	Area (ft^2)	Volume (ft^3)	
0.00	42600	0	**BIOFILTRATION (1)**
0.50	43856	21613	**SURFACE OUTLET (2)**
3.00	50357	139286	
6.00	58625	302602	

SUB SURFACE STORAGE

Elevation (ft)	Area (ft^2)	Volume (ft^3)	
-1.75	42600	14910	**Amended Soil Base (0.2 voids)**
-2.75	42600	17040	**Gravel Base (0.4 voids)**
Gravel & Amended Soil	**TOTAL =**	31950	(ft^3)
Surface Total	**TOTAL =**	302602	(ft^3)
BMP	**TOTAL =**	**334552**	**(ft^3)**

(1): The area at this surface elevation corresponds to the area of gravel and amended soil (biofiltration layer)
(2): Volume at this elevation coresponds with surface volume for WQ purposes (invert of lowest surface outlet)

Effective Depth:	6.09 in

Stage-Area for BMP-3

Depth (ft)	Area (ft^2)	Volume (ft^3)	
0.00	10800	0	**BIOFILTRATION (1)**
0.50	11422	5555	**SURFACE OUTLET (2)**
3.00	14698	38119	
5.00	17573	70347	

SUB SURFACE STORAGE

Elevation (ft)	Area (ft^2)	Volume (ft^3)	
-1.75	10800	3780	**Amended Soil Base (0.2 voids)**
-2.75	10800	4320	**Gravel Base (0.4 voids)**
Gravel & Amended Soil	**TOTAL =**	8100	(ft^3)
Surface Total	**TOTAL =**	70347	(ft^3)
BMP	**TOTAL =**	**78447**	**(ft^3)**

(1): The area at this surface elevation corresponds to the area of gravel and amended soil (biofiltration layer)
(2): Volume at this elevation coresponds with surface volume for WQ purposes (invert of lowest surface outlet)

Effective Depth:	6.17 in

Stage-Area for BMP-4

Depth (ft)	Area (ft^2)	Volume (ft^3)	
0.00	8800	0	**BIOFILTRATION (1)**
0.50	9357	4539	**SURFACE OUTLET (2)**
2.00	11082	19850	
3.00	12553	31659	

SUB SURFACE STORAGE

Elevation (ft)	Area (ft^2)	Volume (ft^3)	
-1.75	8800	3080	**Amended Soil Base (0.2 voids)**
-2.75	8800	3520	**Gravel Base (0.4 voids)**
Gravel & Amended Soil	**TOTAL =**	6600	(ft^3)
Surface Total	**TOTAL =**	31659	(ft^3)
BMP	**TOTAL =**	**38259**	**(ft^3)**

(1): The area at this surface elevation corresponds to the area of gravel and amended soil (biofiltration layer)
(2): Volume at this elevation coresponds with surface volume for WQ purposes (invert of lowest surface outlet)

Effective Depth:	6.19 in

Stage-Discharge for BMP-1A

Lowest Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Lower Slot

Quantity:	1	
Invert Elevation:	0.00	ft
Width:	0.33	ft
Height:	84.00	in
	7.000	ft

Lower Weir

Quantity:	0	
Invert Elevation:	0.00	ft
Length:	0.00	ft
H_w:	0.50	ft

Upper Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Upper Slot

Quantity:	0	
Invert Elevation:	0.00	ft
Width:	0.00	ft
Height:	0.00	in
	0.000	ft
H_w:	0.50	ft

Emergency Weir

Invert Elevation:	7.50	ft
Length:	20.00	ft
H_w:	8.00	ft

(H_w = height of slot/weir invert above basin bottom)

Absolute Invert Elevation of Lowest Discharge Opening

Invert Elevation: 0.50 ft

**Head taken as total depth above the invert of the lowest discharge opening.*

h* (ft)	h/D	h/D	$Q_{LOWEST\ ORIFICE}$ (cfs)				$Q_{UPPER\ ORIFICE}$ (cfs)				$Q_{LOWER\ SLOT}$ (cfs)	$Q_{UPPER\ SLOT}$ (cfs)	$Q_{LOWER\ WEIR}$ (cfs)	$Q_{EMERGENCY}$ (cfs)	Q_{TOTAL} (cfs)
	Lowest Orifice	Upper Orifice	Discharge Coefficient	Orifice Flow	Weir Flow	$Q_{control}$	Discharge Coefficient	Orifice Flow	Weir Flow	$Q_{control}$					
0.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.000	N/A	N/A	0.000	0.000
0.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.033	N/A	N/A	0.000	0.033
0.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.092	N/A	N/A	0.000	0.092
0.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.170	N/A	N/A	0.000	0.170
0.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.261	N/A	N/A	0.000	0.261
0.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.365	N/A	N/A	0.000	0.365
0.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.480	N/A	N/A	0.000	0.480
0.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.605	N/A	N/A	0.000	0.605
0.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.739	N/A	N/A	0.000	0.739
0.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.882	N/A	N/A	0.000	0.882
1.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	1.033	N/A	N/A	0.000	1.033
1.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	1.192	N/A	N/A	0.000	1.192
1.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	1.358	N/A	N/A	0.000	1.358
1.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	1.532	N/A	N/A	0.000	1.532
1.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	1.712	N/A	N/A	0.000	1.712
1.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	1.898	N/A	N/A	0.000	1.898
1.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	2.091	N/A	N/A	0.000	2.091
1.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	2.290	N/A	N/A	0.000	2.290
1.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	2.495	N/A	N/A	0.000	2.495
1.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	2.706	N/A	N/A	0.000	2.706
2.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	2.923	N/A	N/A	0.000	2.923
2.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	3.145	N/A	N/A	0.000	3.145
2.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	3.372	N/A	N/A	0.000	3.372
2.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	3.604	N/A	N/A	0.000	3.604
2.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	3.842	N/A	N/A	0.000	3.842
2.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	4.085	N/A	N/A	0.000	4.085
2.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	4.332	N/A	N/A	0.000	4.332

Stage-Discharge for BMP-1A

Lowest Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Lower Slot

Quantity:	1	
Invert Elevation:	0.00	ft
Width:	0.33	ft
Height:	84.00	in
	7.000	ft

Lower Weir

Quantity:	0	
Invert Elevation:	0.00	ft
Length:	0.00	ft
H_w:	0.50	ft

Upper Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Upper Slot

Quantity:	0	
Invert Elevation:	0.00	ft
Width:	0.00	ft
Height:	0.00	in
	0.000	ft
H_w:	0.50	ft

Emergency Weir

Invert Elevation:	7.50	ft
Length:	20.00	ft
H_w:	8.00	ft

(H_w = height of slot/weir invert above basin bottom)

Absolute Invert Elevation of Lowest Discharge Opening

Invert Elevation: 0.50 ft

**Head taken as total depth above the invert of the lowest discharge opening.*

h* (ft)	h/D	h/D	$Q_{LOWEST\ ORIFICE}$ (cfs)				$Q_{UPPER\ ORIFICE}$ (cfs)				$Q_{LOWER\ SLOT}$ (cfs)	$Q_{UPPER\ SLOT}$ (cfs)	$Q_{LOWER\ WEIR}$ (cfs)	$Q_{EMERGENCY}$ (cfs)	Q_{TOTAL} (cfs)
	Lowest Orifice	Upper Orifice	Discharge Coefficient	Orifice Flow	Weir Flow	$Q_{control}$	Discharge Coefficient	Orifice Flow	Weir Flow	$Q_{control}$					
2.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	4.584	N/A	N/A	0.000	4.584
2.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	4.841	N/A	N/A	0.000	4.841
2.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	5.103	N/A	N/A	0.000	5.103
3.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	5.369	N/A	N/A	0.000	5.369
3.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	5.640	N/A	N/A	0.000	5.640
3.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	5.915	N/A	N/A	0.000	5.915
3.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	6.195	N/A	N/A	0.000	6.195
3.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	6.478	N/A	N/A	0.000	6.478
3.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	6.766	N/A	N/A	0.000	6.766
3.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	7.058	N/A	N/A	0.000	7.058
3.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	7.354	N/A	N/A	0.000	7.354
3.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	7.654	N/A	N/A	0.000	7.654
3.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	7.959	N/A	N/A	0.000	7.959
4.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	8.267	N/A	N/A	0.000	8.267
4.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	8.579	N/A	N/A	0.000	8.579
4.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	8.894	N/A	N/A	0.000	8.894
4.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	9.214	N/A	N/A	0.000	9.214
4.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	9.537	N/A	N/A	0.000	9.537
4.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	9.864	N/A	N/A	0.000	9.864
4.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	10.195	N/A	N/A	0.000	10.195
4.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	10.529	N/A	N/A	0.000	10.529
4.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	10.867	N/A	N/A	0.000	10.867
4.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	11.208	N/A	N/A	0.000	11.208
5.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	11.553	N/A	N/A	0.000	11.553
5.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	11.901	N/A	N/A	0.000	11.901
5.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	12.253	N/A	N/A	0.000	12.253
5.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	12.608	N/A	N/A	0.000	12.608

Stage-Discharge for BMP-1A

Lowest Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Lower Slot

Quantity:	1	
Invert Elevation:	0.00	ft
Width:	0.33	ft
Height:	84.00	in
	7.000	ft

Lower Weir

Quantity:	0	
Invert Elevation:	0.00	ft
Length:	0.00	ft
H_w:	0.50	ft

Upper Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Upper Slot

Quantity:	0	
Invert Elevation:	0.00	ft
Width:	0.00	ft
Height:	0.00	in
	0.000	ft
H_w:	0.50	ft

Emergency Weir

Invert Elevation:	7.50	ft
Length:	20.00	ft
H_w:	8.00	ft

(H_w = height of slot/weir invert above basin bottom)

Absolute Invert Elevation of Lowest Discharge Opening

Invert Elevation: 0.50 ft

**Head taken as total depth above the invert of the lowest discharge opening.*

h* (ft)	h/D	h/D	$Q_{LOWEST\ ORIFICE}$ (cfs)				$Q_{UPPER\ ORIFICE}$ (cfs)				$Q_{LOWER\ SLOT}$ (cfs)	$Q_{UPPER\ SLOT}$ (cfs)	$Q_{LOWER\ WEIR}$ (cfs)	$Q_{EMERGENCY}$ (cfs)	Q_{TOTAL} (cfs)
	Lowest Orifice	Upper Orifice	Discharge Coefficient	Orifice Flow	Weir Flow	$Q_{control}$	Discharge Coefficient	Orifice Flow	Weir Flow	$Q_{control}$					
5.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	12.967	N/A	N/A	0.000	12.967
5.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	13.329	N/A	N/A	0.000	13.329
5.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	13.694	N/A	N/A	0.000	13.694
5.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	14.062	N/A	N/A	0.000	14.062
5.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	14.434	N/A	N/A	0.000	14.434
5.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	14.809	N/A	N/A	0.000	14.809
6.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	15.187	N/A	N/A	0.000	15.187
6.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	15.568	N/A	N/A	0.000	15.568
6.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	15.952	N/A	N/A	0.000	15.952
6.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	16.340	N/A	N/A	0.000	16.340
6.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	16.731	N/A	N/A	0.000	16.731
6.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	17.124	N/A	N/A	0.000	17.124
6.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	17.521	N/A	N/A	0.000	17.521
6.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	17.921	N/A	N/A	0.000	17.921
6.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	18.323	N/A	N/A	0.000	18.323
6.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	18.729	N/A	N/A	0.000	18.729
7.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	19.138	N/A	N/A	0.000	19.138
7.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	19.549	N/A	N/A	0.000	19.549
7.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	19.964	N/A	N/A	0.000	19.964
7.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	20.381	N/A	N/A	0.000	20.381
7.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	20.801	N/A	N/A	0.000	20.801
7.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	21.224	N/A	N/A	0.000	21.224
7.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	21.650	N/A	N/A	2.071	23.721
7.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	22.079	N/A	N/A	5.867	27.946
7.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	22.510	N/A	N/A	10.796	33.306
7.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	22.945	N/A	N/A	16.646	39.591
8.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	23.382	N/A	N/A	23.299	46.681

Stage-Discharge for BMP-1A

Lowest Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Lower Slot

Quantity:	1	
Invert Elevation:	0.00	ft
Width:	0.33	ft
Height:	84.00	in
	7.000	ft

Lower Weir

Quantity:	0	
Invert Elevation:	0.00	ft
Length:	0.00	ft
H_w:	0.50	ft

Upper Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Upper Slot

Quantity:	0	
Invert Elevation:	0.00	ft
Width:	0.00	ft
Height:	0.00	in
	0.000	ft
H_w:	0.50	ft

Emergency Weir

Invert Elevation:	7.50	ft
Length:	20.00	ft
H_w:	8.00	ft

(H_w = height of slot/weir invert above basin bottom)

Absolute Invert Elevation of Lowest Discharge Opening

Invert Elevation: 0.50 ft

**Head taken as total depth above the invert of the lowest discharge opening.*

h* **(ft)**	***h/D***	***h/D***	**$Q_{LOWEST\ ORIFICE}$ (cfs)**				**$Q_{UPPER\ ORIFICE}$ (cfs)**				**$Q_{LOWER\ SLOT}$ (cfs)**	**$Q_{UPPER\ SLOT}$ (cfs)**	**$Q_{LOWER\ WEIR}$ (cfs)**	**$Q_{EMERGENCY}$ (cfs)**	**Q_{TOTAL} (cfs)**
	Lowest Orifice	*Upper Orifice*	*Discharge Coefficient*	*Orifice Flow*	*Weir Flow*	$Q_{control}$	*Discharge Coefficient*	*Orifice Flow*	*Weir Flow*	$Q_{control}$					
8.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	23.821	N/A	N/A	30.674	54.495
8.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	24.264	N/A	N/A	38.712	62.976
8.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	24.709	N/A	N/A	47.369	72.078
8.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	25.157	N/A	N/A	56.608	81.765
8.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	25.608	N/A	N/A	66.400	92.008

Stage-Discharge for BMP-2

Lowest Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Lower Slot

Quantity:	1	
Invert Elevation:	0.00	ft
Width:	1.50	ft
Height:	48.00	in
	4.000	ft

Lower Weir

Quantity:	0	
Invert Elevation:	0.00	ft
Length:	0.00	ft
H_w:	0.50	ft

Upper Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Upper Slot

Quantity:	0	
Invert Elevation:	0.00	ft
Width:	0.00	ft
Height:	0.00	in
	0.000	ft
H_w:	0.50	ft

Emergency Weir

Invert Elevation:	4.50	ft
Length:	28.00	ft
H_w:	5.00	ft

(H_w = height of slot/weir invert above basin bottom)

Absolute Invert Elevation of Lowest Discharge Opening

Invert Elevation: 0.50 ft

**Head taken as total depth above the invert of the lowest discharge opening.*

h* (ft)	h/D	h/D	$Q_{LOWEST\ ORIFICE}$ (cfs)				$Q_{UPPER\ ORIFICE}$ (cfs)				$Q_{LOWER\ SLOT}$ (cfs)	$Q_{UPPER\ SLOT}$ (cfs)	$Q_{LOWER\ WEIR}$ (cfs)	$Q_{EMERGENCY}$ (cfs)	Q_{TOTAL} (cfs)
	Lowest Orifice	Upper Orifice	Discharge Coefficient	Orifice Flow	Weir Flow	$Q_{control}$	Discharge Coefficient	Orifice Flow	Weir Flow	$Q_{control}$					
0.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.000	N/A	N/A	0.000	0.000
0.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.147	N/A	N/A	0.000	0.147
0.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.416	N/A	N/A	0.000	0.416
0.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.764	N/A	N/A	0.000	0.764
0.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	1.176	N/A	N/A	0.000	1.176
0.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	1.644	N/A	N/A	0.000	1.644
0.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	2.161	N/A	N/A	0.000	2.161
0.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	2.723	N/A	N/A	0.000	2.723
0.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	3.327	N/A	N/A	0.000	3.327
0.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	3.970	N/A	N/A	0.000	3.970
1.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	4.650	N/A	N/A	0.000	4.650
1.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	5.365	N/A	N/A	0.000	5.365
1.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	6.113	N/A	N/A	0.000	6.113
1.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	6.892	N/A	N/A	0.000	6.892
1.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	7.703	N/A	N/A	0.000	7.703
1.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	8.543	N/A	N/A	0.000	8.543
1.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	9.411	N/A	N/A	0.000	9.411
1.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	10.307	N/A	N/A	0.000	10.307
1.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	11.230	N/A	N/A	0.000	11.230
1.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	12.178	N/A	N/A	0.000	12.178
2.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	13.152	N/A	N/A	0.000	13.152
2.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	14.151	N/A	N/A	0.000	14.151
2.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	15.174	N/A	N/A	0.000	15.174
2.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	16.220	N/A	N/A	0.000	16.220
2.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	17.289	N/A	N/A	0.000	17.289
2.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	18.381	N/A	N/A	0.000	18.381
2.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	19.495	N/A	N/A	0.000	19.495

Stage-Discharge for BMP-2

Lowest Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Lower Slot

Quantity:	1	
Invert Elevation:	0.00	ft
Width:	1.50	ft
Height:	48.00	in
	4.000	ft

Lower Weir

Quantity:	0	
Invert Elevation:	0.00	ft
Length:	0.00	ft
H_w:	0.50	ft

Upper Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Upper Slot

Quantity:	0	
Invert Elevation:	0.00	ft
Width:	0.00	ft
Height:	0.00	in
	0.000	ft
H_w:	0.50	ft

Emergency Weir

Invert Elevation:	4.50	ft
Length:	28.00	ft
H_w:	5.00	ft

Absolute Invert Elevation of Lowest Discharge Opening

Invert Elevation: 0.50 ft

(H_w = height of slot/weir invert above basin bottom)

**Head taken as total depth above the invert of the lowest discharge opening.*

h* (ft)	h/D	h/D	$Q_{LOWEST\ ORIFICE}$ (cfs)				$Q_{UPPER\ ORIFICE}$ (cfs)				$Q_{LOWER\ SLOT}$ (cfs)	$Q_{UPPER\ SLOT}$ (cfs)	$Q_{LOWER\ WEIR}$ (cfs)	$Q_{EMERGENCY}$ (cfs)	Q_{TOTAL} (cfs)
	Lowest Orifice	Upper Orifice	Discharge Coefficient	Orifice Flow	Weir Flow	$Q_{control}$	Discharge Coefficient	Orifice Flow	Weir Flow	$Q_{control}$					
2.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	20.630	N/A	N/A	0.000	20.630
2.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	21.787	N/A	N/A	0.000	21.787
2.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	22.964	N/A	N/A	0.000	22.964
3.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	24.162	N/A	N/A	0.000	24.162
3.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	25.380	N/A	N/A	0.000	25.380
3.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	26.618	N/A	N/A	0.000	26.618
3.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	27.876	N/A	N/A	0.000	27.876
3.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	29.152	N/A	N/A	0.000	29.152
3.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	30.448	N/A	N/A	0.000	30.448
3.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	31.762	N/A	N/A	0.000	31.762
3.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	33.094	N/A	N/A	0.000	33.094
3.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	34.445	N/A	N/A	0.000	34.445
3.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	35.814	N/A	N/A	0.000	35.814
4.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	37.200	N/A	N/A	0.000	37.200
4.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	38.604	N/A	N/A	0.000	38.604
4.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	40.025	N/A	N/A	0.000	40.025
4.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	41.463	N/A	N/A	0.000	41.463
4.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	42.917	N/A	N/A	0.000	42.917
4.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	44.389	N/A	N/A	0.000	44.389
4.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	45.876	N/A	N/A	2.902	48.779
4.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	47.381	N/A	N/A	8.229	55.610
4.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	48.901	N/A	N/A	15.155	64.056
4.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	50.437	N/A	N/A	23.390	73.826
5.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	51.989	N/A	N/A	32.767	84.756
5.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	53.556	N/A	N/A	43.178	96.734
5.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	55.139	N/A	N/A	54.542	109.680
5.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	56.737	N/A	N/A	66.797	123.534

Stage-Discharge for BMP-2

Lowest Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Lower Slot

Quantity:	1	
Invert Elevation:	0.00	ft
Width:	1.50	ft
Height:	48.00	in
	4.000	ft

Lower Weir

Quantity:	0	
Invert Elevation:	0.00	ft
Length:	0.00	ft
H_w:	0.50	ft

Upper Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Upper Slot

Quantity:	0	
Invert Elevation:	0.00	ft
Width:	0.00	ft
Height:	0.00	in
	0.000	ft
H_w:	0.50	ft

Emergency Weir

Invert Elevation:	4.50	ft
Length:	28.00	ft
H_w:	5.00	ft

(H_w = height of slot/weir invert above basin bottom)

Absolute Invert Elevation of Lowest Discharge Opening

Invert Elevation: 0.50 ft

**Head taken as total depth above the invert of the lowest discharge opening.*

h* **(ft)**	***h/D***	***h/D***	***Q LOWEST ORIFICE* (cfs)**				***Q UPPER ORIFICE* (cfs)**				***Q LOWER SLOT*** **(cfs)**	***Q UPPER SLOT*** **(cfs)**	***Q LOWER WEIR*** **(cfs)**	***Q EMERGENCY*** **(cfs)**	***Q TOTAL*** **(cfs)**
	Lowest Orifice	*Upper Orifice*	*Discharge Coefficient*	*Orifice Flow*	*Weir Flow*	$Q_{control}$	*Discharge Coefficient*	*Orifice Flow*	*Weir Flow*	$Q_{control}$					
5.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	57.709	N/A	N/A	79.897	137.606
5.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	58.552	N/A	N/A	93.800	152.352

Stage-Discharge for BMP-3

Lowest Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Lower Slot

Quantity:	1	
Invert Elevation:	0.00	ft
Width:	0.50	ft
Height:	36.00	in
	3.000	ft

Lower Weir

Quantity:	0	
Invert Elevation:	0.00	ft
Length:	0.00	ft
H_w:	0.50	ft

Upper Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Upper Slot

Quantity:	0	
Invert Elevation:	0.00	ft
Width:	0.00	ft
Height:	0.00	in
	0.000	ft
H_w:	0.50	ft

Emergency Weir

Invert Elevation:	3.50	ft
Length:	12.00	ft
H_w:	4.00	ft

Absolute Invert Elevation of Lowest Discharge Opening

Invert Elevation: 0.50 ft

(H_w = height of slot/weir invert above basin bottom)

**Head taken as total depth above the invert of the lowest discharge opening.*

*h** (ft)	*h/D*	*h/D*	$Q_{LOWEST\ ORIFICE}$ (cfs)				$Q_{UPPER\ ORIFICE}$ (cfs)				$Q_{LOWER\ SLOT}$ (cfs)	$Q_{UPPER\ SLOT}$ (cfs)	$Q_{LOWER\ WEIR}$ (cfs)	$Q_{EMERGENCY}$ (cfs)	Q_{TOTAL} (cfs)
	Lowest Orifice	*Upper Orifice*	*Discharge Coefficient*	*Orifice Flow*	*Weir Flow*	$Q_{control}$	*Discharge Coefficient*	*Orifice Flow*	*Weir Flow*	$Q_{control}$					
0.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.000	N/A	N/A	0.000	0.000
0.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.049	N/A	N/A	0.000	0.049
0.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.139	N/A	N/A	0.000	0.139
0.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.255	N/A	N/A	0.000	0.255
0.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.392	N/A	N/A	0.000	0.392
0.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.548	N/A	N/A	0.000	0.548
0.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.720	N/A	N/A	0.000	0.720
0.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.908	N/A	N/A	0.000	0.908
0.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	1.109	N/A	N/A	0.000	1.109
0.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	1.323	N/A	N/A	0.000	1.323
1.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	1.550	N/A	N/A	0.000	1.550
1.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	1.788	N/A	N/A	0.000	1.788
1.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	2.038	N/A	N/A	0.000	2.038
1.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	2.297	N/A	N/A	0.000	2.297
1.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	2.568	N/A	N/A	0.000	2.568
1.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	2.848	N/A	N/A	0.000	2.848
1.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	3.137	N/A	N/A	0.000	3.137
1.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	3.436	N/A	N/A	0.000	3.436
1.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	3.743	N/A	N/A	0.000	3.743
1.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	4.059	N/A	N/A	0.000	4.059
2.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	4.384	N/A	N/A	0.000	4.384
2.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	4.717	N/A	N/A	0.000	4.717
2.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	5.058	N/A	N/A	0.000	5.058
2.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	5.407	N/A	N/A	0.000	5.407
2.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	5.763	N/A	N/A	0.000	5.763
2.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	6.127	N/A	N/A	0.000	6.127
2.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	6.498	N/A	N/A	0.000	6.498

Stage-Discharge for BMP-3

Lowest Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Lower Slot

Quantity:	1	
Invert Elevation:	0.00	ft
Width:	0.50	ft
Height:	36.00	in
	3.000	ft

Lower Weir

Quantity:	0	
Invert Elevation:	0.00	ft
Length:	0.00	ft
H_w:	0.50	ft

Upper Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Upper Slot

Quantity:	0	
Invert Elevation:	0.00	ft
Width:	0.00	ft
Height:	0.00	in
	0.000	ft
H_w:	0.50	ft

Emergency Weir

Invert Elevation:	3.50	ft
Length:	12.00	ft
H_w:	4.00	ft

(H_w = height of slot/weir invert above basin bottom)

Absolute Invert Elevation of Lowest Discharge Opening

Invert Elevation: 0.50 ft

**Head taken as total depth above the invert of the lowest discharge opening.*

h* (ft)	h/D	h/D	$Q_{LOWEST\ ORIFICE}$ (cfs)				$Q_{UPPER\ ORIFICE}$ (cfs)				$Q_{LOWER\ SLOT}$ (cfs)	$Q_{UPPER\ SLOT}$ (cfs)	$Q_{LOWER\ WEIR}$ (cfs)	$Q_{EMERGENCY}$ (cfs)	Q_{TOTAL} (cfs)
	Lowest Orifice	Upper Orifice	Discharge Coefficient	Orifice Flow	Weir Flow	$Q_{control}$	Discharge Coefficient	Orifice Flow	Weir Flow	$Q_{control}$					
2.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	6.877	N/A	N/A	0.000	6.877
2.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	7.262	N/A	N/A	0.000	7.262
2.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	7.655	N/A	N/A	0.000	7.655
3.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	8.054	N/A	N/A	0.000	8.054
3.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	8.460	N/A	N/A	0.000	8.460
3.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	8.873	N/A	N/A	0.000	8.873
3.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	9.292	N/A	N/A	0.000	9.292
3.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	9.717	N/A	N/A	0.000	9.717
3.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	10.149	N/A	N/A	0.000	10.149
3.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	10.587	N/A	N/A	1.245	11.832
3.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	11.031	N/A	N/A	3.531	14.563
3.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	11.482	N/A	N/A	6.507	17.989
3.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	11.938	N/A	N/A	10.048	21.986
4.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	12.371	N/A	N/A	14.086	26.457
4.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	12.616	N/A	N/A	18.572	31.188
4.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	12.857	N/A	N/A	23.473	36.330
4.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	13.093	N/A	N/A	28.765	41.857
4.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	13.324	N/A	N/A	34.426	47.750
4.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	13.552	N/A	N/A	40.440	53.992

Stage-Discharge for BMP-4

Lowest Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Lower Slot

Quantity:	1	
Invert Elevation:	0.00	ft
Width:	1.00	ft
Height:	18.00	in
	1.500	ft

Lower Weir

Quantity:	0	
Invert Elevation:	0.00	ft
Length:	0.00	ft
H_w:	0.50	ft

Upper Orifice

Diameter:	0.000	inches
Quantity:	0	
Invert Elevation:	0.000	ft

Upper Slot

Quantity:	0	
Invert Elevation:	0.00	ft
Width:	0.00	ft
Height:	0.00	in
	0.000	ft
H_w:	0.50	ft

Emergency Weir

Invert Elevation:	2.00	ft
Length:	12.00	ft
H_w:	2.50	ft

(H_w = height of slot/weir invert above basin bottom)

Absolute Invert Elevation of Lowest Discharge Opening

Invert Elevation:	0.50	ft

**Head taken as total depth above the invert of the lowest discharge opening.*

h* **(ft)**	***h/D***	***h/D***	**$Q_{LOWEST\ ORIFICE}$ (cfs)**				**$Q_{UPPER\ ORIFICE}$ (cfs)**				**$Q_{LOWER\ SLOT}$ (cfs)**	**$Q_{UPPER\ SLOT}$ (cfs)**	**$Q_{LOWER\ WEIR}$ (cfs)**	**$Q_{EMERGENCY}$ (cfs)**	**Q_{TOTAL} (cfs)**
	Lowest Orifice	*Upper Orifice*	*Discharge Coefficient*	*Orifice Flow*	*Weir Flow*	$Q_{control}$	*Discharge Coefficient*	*Orifice Flow*	*Weir Flow*	$Q_{control}$					
0.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.000	N/A	N/A	0.000	0.000
0.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.098	N/A	N/A	0.000	0.098
0.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.277	N/A	N/A	0.000	0.277
0.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.509	N/A	N/A	0.000	0.509
0.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	0.784	N/A	N/A	0.000	0.784
0.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	1.096	N/A	N/A	0.000	1.096
0.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	1.441	N/A	N/A	0.000	1.441
0.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	1.816	N/A	N/A	0.000	1.816
0.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	2.218	N/A	N/A	0.000	2.218
0.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	2.647	N/A	N/A	0.000	2.647
1.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	3.100	N/A	N/A	0.000	3.100
1.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	3.576	N/A	N/A	0.000	3.576
1.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	4.075	N/A	N/A	0.000	4.075
1.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	4.595	N/A	N/A	0.000	4.595
1.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	5.135	N/A	N/A	0.000	5.135
1.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	5.695	N/A	N/A	0.000	5.695
1.600	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	6.274	N/A	N/A	0.000	6.274
1.700	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	6.871	N/A	N/A	0.000	6.871
1.800	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	7.486	N/A	N/A	0.000	7.486
1.900	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	8.119	N/A	N/A	0.000	8.119
2.000	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	8.748	N/A	N/A	0.000	8.748
2.100	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	9.091	N/A	N/A	1.247	10.338
2.200	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	9.422	N/A	N/A	3.544	12.966
2.300	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	9.741	N/A	N/A	6.542	16.284
2.400	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	10.051	N/A	N/A	10.121	20.172
2.500	0.000	N/A	N/A	N/A	0.000	0.000	N/A	N/A	N/A	N/A	10.351	N/A	N/A	14.213	24.563

```
[TITLE]
;;Project Title/Notes
537-03

[OPTIONS]
;;Option             Value
FLOW_UNITS           CFS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         KINWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           01/01/2000
START_TIME           00:00:00
REPORT_START_DATE    01/01/2000
REPORT_START_TIME    00:00:00
END_DATE             01/01/2000
END_TIME             12:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:01:00
DRY_STEP             00:01:00
ROUTING_STEP         0:00:10
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         12.566
MAX_TRIALS           8
HEAD_TOLERANCE       0.005
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              1

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- ------ ------ ----------
Zero-Rain        INTENSITY 6:00     1.0      TIMESERIES Zero-Rain
```

[SUBCATCHMENTS]

;;Name	Rain Gage	Outlet	Area	%Imperv	Width	%Slope	CurbLen	SnowPack
BMP-1A	Zero-Rain	SURF-1A	0.684113866	0	10	0.5	0	
BMP-2	Zero-Rain	SURF-2	0.977961433	0	10	0.5	0	
BMP-3	Zero-Rain	SURF-3	0.247933884	0	10	0.5	0	
BMP-4	Zero-Rain	SURF-4	0.202020202	0	10	0.5	0	

[SUBAREAS]

;;Subcatchment	N-Imperv	N-Perv	S-Imperv	S-Perv	PctZero	RouteTo	PctRouted
BMP-1A	0.012	0.05	0.05	0.10	25	OUTLET	
BMP-2	0.012	0.05	0.05	0.10	25	OUTLET	
BMP-3	0.012	0.05	0.05	0.10	25	OUTLET	
BMP-4	0.012	0.05	0.05	0.10	25	OUTLET	

[INFILTRATION]

;;Subcatchment	Suction	Ksat	IMD
BMP-1A	9	0.01875	0.3
BMP-2	9	0.01875	0.3
BMP-3	9	0.01875	0.3
BMP-4	9	0.01875	0.3

[LID_CONTROLS]

;;Name	Type/Layer	Parameters						
BMP-1A	BC							
BMP-1A	SURFACE	6.12	0.0	0	0	5		
BMP-1A	SOIL	21	0.4	0.2	0.1	5	5	1.5
BMP-1A	STORAGE	15	0.67	0	0			
BMP-1A	DRAIN	1.1173	0.5	3	6	0	0	
BMP-2	BC							
BMP-2	SURFACE	6.09	0.0	0	0	5		
BMP-2	SOIL	21	0.4	0.2	0.1	5	5	1.5
BMP-2	STORAGE	15	0.67	0	0			
BMP-2	DRAIN	1.1255	0.5	3	6	0	0	
BMP-3	BC							
BMP-3	SURFACE	6.17	0.0	0	0	5		
BMP-3	SOIL	21	0.4	0.2	0.1	5	5	1.5
BMP-3	STORAGE	15	0.67	0	0			
BMP-3	DRAIN	1.1099	0.5	3	6	0	0	
BMP-4	BC							
BMP-4	SURFACE	6.19	0.0	0	0	5		
BMP-4	SOIL	21	0.4	0.2	0.1	5	5	1.5
BMP-4	STORAGE	15	0.67	0	0			
BMP-4	DRAIN	1.3621	0.5	3	6	0	0	

[LID_USAGE]

;;Subcatchment	LID Process	Number	Area	Width	InitSat	FromImp	ToPerv	RptFile	DrainTo	FromPerv
BMP-1A	BMP-1A	1	29800.00	0	0	100	0	*	Node_306	0
BMP-2	BMP-2	1	42600.00	0	0	100	0	*	Node_606	0
BMP-3	BMP-3	1	10800.00	0	0	100	0	*	Node_603	0
BMP-4	BMP-4	1	8800.00	0	0	100	0	*	Node_504	0

[OUTFALLS]

;;Name	Elevation	Type	Stage Data	Gated	Route To
Node_123	0	FREE		NO	BMP-1A
Node_716	0	FREE		NO	BMP-2
Node_602	0	FREE		NO	BMP-3
Node_306	0	FREE		NO	
Node_603	0	FREE		NO	
Node_503	0	FREE		NO	BMP-4
Node_606	0	FREE		NO	
Node_504	0	FREE		NO	

[STORAGE]

;;Name	Elev.	MaxDepth	InitDepth	Shape	Curve Name/Params	N/A	Fevap	Psi	Ksat	IMD
SURF-1A	0	8.50	0	TABULAR	BMP-1A	0	0			
SURF-2	0	5.5	0	TABULAR	BMP-2	0	0			
SURF-3	0	4.5	0	TABULAR	BMP-3	0	0			
SURF-4	0	2.5	0	TABULAR	BMP-4	0	0			

[OUTLETS]

;;Name	From Node	To Node	Offset	Type	QTable/Qcoeff	Qexpon	Gated
1A	SURF-1A	Node_306	0	TABULAR/HEAD	BMP_1A		NO
2	SURF-2	Node_606	0	TABULAR/HEAD	BMP_2		NO
3	SURF-3	Node_603	0	TABULAR/HEAD	BMP_3		NO
4	SURF-4	Node_504	0	TABULAR/HEAD	BMP_4		NO

[INFLOWS]

;;Node	Constituent	Time Series	Type	Mfactor	Sfactor	Baseline	Pattern
Node_123	FLOW	Node_123	FLOW	1.0	1.0		
Node_716	FLOW	Node_716	FLOW	1.0	1.0		
Node_602	FLOW	Node_602	FLOW	1.0	1.0		
Node_503	FLOW	Node_503	FLOW	1.0	1.0		

[CURVES]

;;Name	Type	X-Value	Y-Value
BMP_1A	Rating	0.000	0.000

BMP_1A	0.100	0.033
BMP_1A	0.200	0.092
BMP_1A	0.300	0.170
BMP_1A	0.400	0.261
BMP_1A	0.500	0.365
BMP_1A	0.600	0.480
BMP_1A	0.700	0.605
BMP_1A	0.800	0.739
BMP_1A	0.900	0.882
BMP_1A	1.000	1.033
BMP_1A	1.100	1.192
BMP_1A	1.200	1.358
BMP_1A	1.300	1.532
BMP_1A	1.400	1.712
BMP_1A	1.500	1.898
BMP_1A	1.600	2.091
BMP_1A	1.700	2.290
BMP_1A	1.800	2.495
BMP_1A	1.900	2.706
BMP_1A	2.000	2.923
BMP_1A	2.100	3.145
BMP_1A	2.200	3.372
BMP_1A	2.300	3.604
BMP_1A	2.400	3.842
BMP_1A	2.500	4.085
BMP_1A	2.600	4.332
BMP_1A	2.700	4.584
BMP_1A	2.800	4.841
BMP_1A	2.900	5.103
BMP_1A	3.000	5.369
BMP_1A	3.100	5.640
BMP_1A	3.200	5.915
BMP_1A	3.300	6.195
BMP_1A	3.400	6.478
BMP_1A	3.500	6.766
BMP_1A	3.600	7.058
BMP_1A	3.700	7.354
BMP_1A	3.800	7.654
BMP_1A	3.900	7.959
BMP_1A	4.000	8.267
BMP_1A	4.100	8.579
BMP_1A	4.200	8.894
BMP_1A	4.300	9.214
BMP_1A	4.400	9.537
BMP_1A	4.500	9.864
BMP_1A	4.600	10.195
BMP_1A	4.700	10.529
BMP_1A	4.800	10.867
BMP_1A	4.900	11.208
BMP_1A	5.000	11.553
BMP_1A	5.100	11.901
BMP_1A	5.200	12.253

```
BMP_1A                   5.300      12.608
BMP_1A                   5.400      12.967
BMP_1A                   5.500      13.329
BMP_1A                   5.600      13.694
BMP_1A                   5.700      14.062
BMP_1A                   5.800      14.434
BMP_1A                   5.900      14.809
BMP_1A                   6.000      15.187
BMP_1A                   6.100      15.568
BMP_1A                   6.200      15.952
BMP_1A                   6.300      16.340
BMP_1A                   6.400      16.731
BMP_1A                   6.500      17.124
BMP_1A                   6.600      17.521
BMP_1A                   6.700      17.921
BMP_1A                   6.800      18.323
BMP_1A                   6.900      18.729
BMP_1A                   7.000      19.138
BMP_1A                   7.100      19.549
BMP_1A                   7.200      19.964
BMP_1A                   7.300      20.381
BMP_1A                   7.400      20.801
BMP_1A                   7.500      21.224
BMP_1A                   7.600      23.721
BMP_1A                   7.700      27.946
BMP_1A                   7.800      33.306
BMP_1A                   7.900      39.591
BMP_1A                   8.000      46.681
BMP_1A                   8.100      54.495
BMP_1A                   8.200      62.976
BMP_1A                   8.300      72.078
BMP_1A                   8.400      81.765
BMP_1A                   8.500      92.008
;
BMP_2            Rating  0.000      0.000
BMP_2                    0.100      0.147
BMP_2                    0.200      0.416
BMP_2                    0.300      0.764
BMP_2                    0.400      1.176
BMP_2                    0.500      1.644
BMP_2                    0.600      2.161
BMP_2                    0.700      2.723
BMP_2                    0.800      3.327
BMP_2                    0.900      3.970
BMP_2                    1.000      4.650
BMP_2                    1.100      5.365
BMP_2                    1.200      6.113
BMP_2                    1.300      6.892
BMP_2                    1.400      7.703
BMP_2                    1.500      8.543
BMP_2                    1.600      9.411
BMP_2                    1.700      10.307
```

```
BMP_2                    1.800      11.230
BMP_2                    1.900      12.178
BMP_2                    2.000      13.152
BMP_2                    2.100      14.151
BMP_2                    2.200      15.174
BMP_2                    2.300      16.220
BMP_2                    2.400      17.289
BMP_2                    2.500      18.381
BMP_2                    2.600      19.495
BMP_2                    2.700      20.630
BMP_2                    2.800      21.787
BMP_2                    2.900      22.964
BMP_2                    3.000      24.162
BMP_2                    3.100      25.380
BMP_2                    3.200      26.618
BMP_2                    3.300      27.876
BMP_2                    3.400      29.152
BMP_2                    3.500      30.448
BMP_2                    3.600      31.762
BMP_2                    3.700      33.094
BMP_2                    3.800      34.445
BMP_2                    3.900      35.814
BMP_2                    4.000      37.200
BMP_2                    4.100      38.604
BMP_2                    4.200      40.025
BMP_2                    4.300      41.463
BMP_2                    4.400      42.917
BMP_2                    4.500      44.389
BMP_2                    4.600      48.779
BMP_2                    4.700      55.610
BMP_2                    4.800      64.056
BMP_2                    4.900      73.826
BMP_2                    5.000      84.756
BMP_2                    5.100      96.734
BMP_2                    5.200      109.680
BMP_2                    5.300      123.534
BMP_2                    5.400      137.606
BMP_2                    5.500      152.352
;
BMP_3          Rating    0.000      0.000
BMP_3                    0.100      0.049
BMP_3                    0.200      0.139
BMP_3                    0.300      0.255
BMP_3                    0.400      0.392
BMP_3                    0.500      0.548
BMP_3                    0.600      0.720
BMP_3                    0.700      0.908
BMP_3                    0.800      1.109
BMP_3                    0.900      1.323
BMP_3                    1.000      1.550
BMP_3                    1.100      1.788
BMP_3                    1.200      2.038
```

```
BMP_3                    1.300      2.297
BMP_3                    1.400      2.568
BMP_3                    1.500      2.848
BMP_3                    1.600      3.137
BMP_3                    1.700      3.436
BMP_3                    1.800      3.743
BMP_3                    1.900      4.059
BMP_3                    2.000      4.384
BMP_3                    2.100      4.717
BMP_3                    2.200      5.058
BMP_3                    2.300      5.407
BMP_3                    2.400      5.763
BMP_3                    2.500      6.127
BMP_3                    2.600      6.498
BMP_3                    2.700      6.877
BMP_3                    2.800      7.262
BMP_3                    2.900      7.655
BMP_3                    3.000      8.054
BMP_3                    3.100      8.460
BMP_3                    3.200      8.873
BMP_3                    3.300      9.292
BMP_3                    3.400      9.717
BMP_3                    3.500      10.149
BMP_3                    3.600      11.832
BMP_3                    3.700      14.563
BMP_3                    3.800      17.989
BMP_3                    3.900      21.986
BMP_3                    4.000      26.457
BMP_3                    4.100      31.188
BMP_3                    4.200      36.330
BMP_3                    4.300      41.857
BMP_3                    4.400      47.750
BMP_3                    4.500      53.992
;
BMP_4            Rating  0.000      0.000
BMP_4                    0.100      0.098
BMP_4                    0.200      0.277
BMP_4                    0.300      0.509
BMP_4                    0.400      0.784
BMP_4                    0.500      1.096
BMP_4                    0.600      1.441
BMP_4                    0.700      1.816
BMP_4                    0.800      2.218
BMP_4                    0.900      2.647
BMP_4                    1.000      3.100
BMP_4                    1.100      3.576
BMP_4                    1.200      4.075
BMP_4                    1.300      4.595
BMP_4                    1.400      5.135
BMP_4                    1.500      5.695
BMP_4                    1.600      6.274
BMP_4                    1.700      6.871
```

```
BMP_4                      1.800      7.486
BMP_4                      1.900      8.119
BMP_4                      2.000      8.748
BMP_4                      2.100      10.338
BMP_4                      2.200      12.966
BMP_4                      2.300      16.284
BMP_4                      2.400      20.172
BMP_4                      2.500      24.563
;
BMP-1A           Storage   0.00       31000
BMP-1A                     3.50       35471
BMP-1A                     8.50       45594
;
BMP-2            Storage   0.00       43856
BMP-2                      2.50       50357
BMP-2                      5.50       58625
;
BMP-3            Storage   0.00       11422
BMP-3                      2.50       14698
BMP-3                      4.50       17573
;
BMP-4            Storage   0.00       9357
BMP-4                      1.50       11082
BMP-4                      2.50       12553

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
Zero-Rain                  0:00       0
Zero-Rain                  6:00       0
;
;DMA-1A
Node_123                   0:00       0.00
Node_123                   0:12       2.68
Node_123                   0:24       2.74
Node_123                   0:36       2.87
Node_123                   0:48       2.94
Node_123                   1:00       3.10
Node_123                   1:12       3.19
Node_123                   1:24       3.39
Node_123                   1:36       3.50
Node_123                   1:48       3.75
Node_123                   2:00       3.90
Node_123                   2:12       4.24
Node_123                   2:24       4.44
Node_123                   2:36       4.92
Node_123                   2:48       5.22
Node_123                   3:00       5.98
Node_123                   3:12       6.48
Node_123                   3:24       7.92
Node_123                   3:36       9.03
Node_123                   3:48       13.25
```

```
Node_123                4:00       18.67
Node_123                4:12       62.10
Node_123                4:24       10.63
Node_123                4:36       7.11
Node_123                4:48       5.56
Node_123                5:00       4.66
Node_123                5:12       4.06
Node_123                5:24       3.62
Node_123                5:36       3.28
Node_123                5:48       3.02
Node_123                6:00       2.80
;
;DMA-2
Node_716                0:00       0.00
Node_716                0:10       3.32
Node_716                0:20       3.38
Node_716                0:30       3.51
Node_716                0:40       3.58
Node_716                0:50       3.74
Node_716                1:00       3.82
Node_716                1:10       4.00
Node_716                1:20       4.10
Node_716                1:30       4.33
Node_716                1:40       4.45
Node_716                1:50       4.72
Node_716                2:00       4.88
Node_716                2:10       5.23
Node_716                2:20       5.43
Node_716                2:30       5.91
Node_716                2:40       6.19
Node_716                2:50       6.86
Node_716                3:00       7.28
Node_716                3:10       8.34
Node_716                3:20       9.04
Node_716                3:30       11.05
Node_716                3:40       12.59
Node_716                3:50       18.49
Node_716                4:00       26.05
Node_716                4:10       90.00
Node_716                4:20       14.83
Node_716                4:30       9.92
Node_716                4:40       7.76
Node_716                4:50       6.50
Node_716                5:00       5.66
Node_716                5:10       5.05
Node_716                5:20       4.58
Node_716                5:30       4.21
Node_716                5:40       3.91
Node_716                5:50       3.66
Node_716                6:00       3.44
;
;DMA-3
```

```
Node_602                0:00       0.00
Node_602                0:10       0.73
Node_602                0:20       0.74
Node_602                0:30       0.77
Node_602                0:40       0.79
Node_602                0:50       0.82
Node_602                1:00       0.84
Node_602                1:10       0.88
Node_602                1:20       0.90
Node_602                1:30       0.95
Node_602                1:40       0.98
Node_602                1:50       1.04
Node_602                2:00       1.07
Node_602                2:10       1.15
Node_602                2:20       1.19
Node_602                2:30       1.30
Node_602                2:40       1.36
Node_602                2:50       1.50
Node_602                3:00       1.60
Node_602                3:10       1.83
Node_602                3:20       1.98
Node_602                3:30       2.42
Node_602                3:40       2.76
Node_602                3:50       4.05
Node_602                4:00       5.71
Node_602                4:10       18.90
Node_602                4:20       3.25
Node_602                4:30       2.18
Node_602                4:40       1.70
Node_602                4:50       1.43
Node_602                5:00       1.24
Node_602                5:10       1.11
Node_602                5:20       1.00
Node_602                5:30       0.92
Node_602                5:40       0.86
Node_602                5:50       0.80
Node_602                6:00       0.75
;
;DMA-4
Node_503                0:00       0.00
Node_503                0:10       0.62
Node_503                0:20       0.63
Node_503                0:30       0.66
Node_503                0:40       0.67
Node_503                0:50       0.70
Node_503                1:00       0.72
Node_503                1:10       0.75
Node_503                1:20       0.77
Node_503                1:30       0.81
Node_503                1:40       0.83
Node_503                1:50       0.88
Node_503                2:00       0.91
```

```
Node_503                    2:10       0.98
Node_503                    2:20       1.02
Node_503                    2:30       1.11
Node_503                    2:40       1.16
Node_503                    2:50       1.29
Node_503                    3:00       1.36
Node_503                    3:10       1.56
Node_503                    3:20       1.69
Node_503                    3:30       2.07
Node_503                    3:40       2.36
Node_503                    3:50       3.46
Node_503                    4:00       4.88
Node_503                    4:10       17.40
Node_503                    4:20       2.78
Node_503                    4:30       1.86
Node_503                    4:40       1.45
Node_503                    4:50       1.22
Node_503                    5:00       1.06
Node_503                    5:10       0.95
Node_503                    5:20       0.86
Node_503                    5:30       0.79
Node_503                    5:40       0.73
Node_503                    5:50       0.68
Node_503                    6:00       0.64

[REPORT]
;;Reporting Options
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Node_123         983.359            7700.454
Node_716         3000.000           7791.225
Node_602         4500.000           7791.225
Node_306         1089.259           3978.820
Node_603         4500.000           4039.334
Node_503         6500.000           7791.225
Node_606         3000.000           4084.720
Node_504         6422.088           4099.849
SURF-1A          1059.002           5340.393
SURF-2           3000.000           5506.808
SURF-3           4500.000           5431.165
SURF-4           6452.345           5446.293
```

```
[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
BMP-1A           1043.873           6475.038
BMP-2            3000.000           6580.938
BMP-3            4500.000           6596.067
BMP-4            6422.088           6717.095

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Zero-Rain        9878.971           7942.511
```

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.013)

537-03

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2000 00:00:00
Ending Date 01/01/2000 12:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:01:00
Dry Time Step 00:01:00
Routing Time Step ..... 10.00 sec

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Initial LID Storage	0.370	2.100
Total Precipitation	0.000	0.000
Outfall Runon	9.949	56.527
Evaporation Loss	0.000	0.000
Infiltration Loss	0.000	0.000
Surface Runoff	4.011	22.791
LID Drainage	5.356	30.431
Final Storage	0.951	5.403
Continuity Error (%)	0.004	

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal

************************	---------	---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	9.367	3.052
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	9.949	3.242
External Outflow	18.490	6.025
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.825	0.269
Continuity Error (%)	0.005	

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	10.00 sec
Average Time Step	:	10.00 sec
Maximum Time Step	:	10.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	1.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Imperv Runoff in	Perv Runoff in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
BMP-1A	0.00	63.10	0.00	0.00	0.00	0.00	59.79	1.11	59.52	0.948
BMP-2	0.00	55.44	0.00	0.00	0.00	0.00	52.14	1.38	85.59	0.940
BMP-3	0.00	47.41	0.00	0.00	0.00	0.00	44.11	0.30	17.87	0.930
BMP-4	0.00	50.71	0.00	0.00	0.00	0.00	47.41	0.26	16.57	0.935

****
LID Performance Summary
****

Subcatchment	LID Control	Total Inflow in	Evap Loss in	Infil Loss in	Surface Outflow in	Drain Outflow in	Initial Storage in	Final Storage in	Continuity Error %
BMP-1A	BMP-1A	63.10	0.00	0.00	28.12	31.68	2.10	5.40	0.00
BMP-2	BMP-2	55.44	0.00	0.00	21.88	30.26	2.10	5.40	0.00
BMP-3	BMP-3	47.41	0.00	0.00	15.46	28.65	2.10	5.40	0.00
BMP-4	BMP-4	50.71	0.00	0.00	18.18	29.23	2.10	5.40	-0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
Node_123	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
Node_716	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
Node_602	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
Node_306	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
Node_603	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
Node_503	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
Node_606	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
Node_504	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
SURF-1A	STORAGE	0.86	1.92	1.92	0 04:45	1.92
SURF-2	STORAGE	0.39	1.40	1.40	0 04:26	1.40
SURF-3	STORAGE	0.26	0.97	0.97	0 04:26	0.97
SURF-4	STORAGE	0.15	1.01	1.01	0 04:21	1.01

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
Node_123	OUTFALL	62.10	62.10	0 04:12	1.17	1.17	0.000
Node_716	OUTFALL	90.00	90.00	0 04:10	1.47	1.47	0.000
Node_602	OUTFALL	18.90	18.90	0 04:10	0.319	0.319	0.000
Node_306	OUTFALL	4.41	6.19	0 04:45	0.588	0.923	0.000
Node_603	OUTFALL	1.59	2.53	0 04:51	0.193	0.286	0.000
Node_503	OUTFALL	17.40	17.40	0 04:10	0.278	0.278	0.000
Node_606	OUTFALL	6.37	12.46	0 04:36	0.804	1.32	0.000
Node_504	OUTFALL	1.59	3.96	0 04:21	0.16	0.258	0.000
SURF-1A	STORAGE	56.86	56.86	0 04:14	0.522	0.522	0.006
SURF-2	STORAGE	81.93	81.93	0 04:12	0.581	0.581	0.028

SURF-3	STORAGE	17.00	17.00	0	04:12	0.104	0.104	0.028
SURF-4	STORAGE	15.77	15.77	0	04:12	0.0997	0.0997	0.069

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
SURF-1A	27.377	9	0	0	61.799	19	0 04:44	2.74
SURF-2	17.649	6	0	0	64.079	23	0 04:26	7.73
SURF-3	3.047	5	0	0	11.648	18	0 04:26	1.47
SURF-4	1.399	5	0	0	10.026	37	0 04:20	3.14

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
Node_123	49.98	7.26	62.10	1.172
Node_716	49.98	9.12	90.00	1.472
Node_602	49.98	1.98	18.90	0.319
Node_306	89.84	3.18	6.19	0.923
Node_603	88.31	1.00	2.53	0.286
Node_503	49.98	1.72	17.40	0.278
Node_606	89.14	4.57	12.46	1.316
Node_504	88.59	0.90	3.96	0.258
System	69.47	29.73	3.96	6.025

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
1A	DUMMY	2.74	0	04:45			
2	DUMMY	7.73	0	04:26			
3	DUMMY	1.47	0	04:26			
4	DUMMY	3.14	0	04:21			

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Wed Dec 18 23:55:02 2019
Analysis ended on: Wed Dec 18 23:55:02 2019
Total elapsed time: < 1 sec

APPENDIX D

Retention Analysis and Hydraulics

NOAA Atlas 14, Volume 6, Version 2
Location name: Oceanside, California, USA*
Latitude: 33.2221°, Longitude: -117.3412°
Elevation: 40.7 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.143 (0.121-0.172)	0.183 (0.154-0.220)	0.241 (0.202-0.290)	0.292 (0.243-0.355)	0.369 (0.296-0.465)	0.435 (0.341-0.560)	0.507 (0.387-0.671)	0.589 (0.436-0.803)	0.711 (0.503-1.01)	0.815 (0.557-1.21)
10-min	0.205 (0.173-0.247)	0.262 (0.221-0.315)	0.345 (0.289-0.416)	0.419 (0.348-0.509)	0.529 (0.424-0.667)	0.623 (0.488-0.803)	0.727 (0.555-0.962)	0.844 (0.625-1.15)	1.02 (0.722-1.45)	1.17 (0.798-1.73)
15-min	0.248 (0.209-0.298)	0.317 (0.267-0.381)	0.417 (0.350-0.503)	0.506 (0.421-0.615)	0.640 (0.513-0.806)	0.754 (0.591-0.971)	0.879 (0.671-1.16)	1.02 (0.756-1.39)	1.23 (0.873-1.76)	1.41 (0.965-2.09)
30-min	0.351 (0.296-0.421)	0.448 (0.377-0.539)	0.589 (0.494-0.710)	0.715 (0.594-0.869)	0.904 (0.725-1.14)	1.06 (0.834-1.37)	1.24 (0.948-1.64)	1.44 (1.07-1.97)	1.74 (1.23-2.48)	2.00 (1.36-2.95)
60-min	0.469 (0.395-0.563)	0.599 (0.504-0.720)	0.788 (0.660-0.949)	0.956 (0.794-1.16)	1.21 (0.968-1.52)	1.42 (1.12-1.83)	1.66 (1.27-2.20)	1.93 (1.43-2.63)	2.33 (1.65-3.32)	2.67 (1.82-3.95)
2-hr	0.640 (0.539-0.768)	0.793 (0.666-0.952)	1.01 (0.849-1.22)	1.21 (1.00-1.47)	1.51 (1.21-1.90)	1.76 (1.38-2.27)	2.04 (1.55-2.69)	2.35 (1.74-3.20)	2.82 (2.00-4.02)	3.23 (2.20-4.77)
3-hr	0.755 (0.636-0.906)	0.930 (0.782-1.12)	1.18 (0.989-1.42)	1.40 (1.16-1.70)	1.73 (1.39-2.18)	2.01 (1.57-2.59)	2.31 (1.76-3.06)	2.65 (1.96-3.61)	3.15 (2.24-4.50)	3.58 (2.45-5.30)
6-hr	0.977 (0.822-1.17)	1.21 (1.02-1.45)	1.53 (1.29-1.85)	1.81 (1.50-2.20)	2.21 (1.77-2.78)	2.53 (1.99-3.27)	2.88 (2.20-3.81)	3.26 (2.41-4.44)	3.80 (2.69-5.42)	4.25 (2.90-6.28)
12-hr	1.21 (1.02-1.46)	1.56 (1.31-1.88)	2.02 (1.69-2.43)	2.39 (1.98-2.90)	2.89 (2.31-3.64)	3.27 (2.56-4.22)	3.66 (2.79-4.84)	4.06 (3.01-5.54)	4.60 (3.26-6.56)	5.02 (3.43-7.43)
24-hr	1.46 (1.29-1.69)	1.97 (1.73-2.28)	2.59 (2.28-3.01)	3.08 (2.69-3.60)	3.72 (3.14-4.49)	4.18 (3.47-5.15)	4.64 (3.76-5.85)	5.10 (4.02-6.59)	5.69 (4.31-7.65)	6.13 (4.50-8.52)
2-day	1.78 (1.57-2.06)	2.40 (2.11-2.77)	3.17 (2.79-3.68)	3.78 (3.30-4.42)	4.58 (3.87-5.52)	5.17 (4.29-6.36)	5.76 (4.66-7.25)	6.34 (5.00-8.21)	7.11 (5.39-9.57)	7.69 (5.65-10.7)
3-day	1.99 (1.76-2.30)	2.66 (2.35-3.08)	3.52 (3.10-4.08)	4.21 (3.67-4.92)	5.13 (4.34-6.19)	5.83 (4.83-7.18)	6.53 (5.29-8.22)	7.24 (5.71-9.36)	8.18 (6.21-11.0)	8.90 (6.54-12.4)
4-day	2.15 (1.90-2.49)	2.88 (2.54-3.34)	3.82 (3.36-4.43)	4.59 (4.00-5.36)	5.61 (4.75-6.77)	6.40 (5.31-7.88)	7.19 (5.83-9.06)	8.01 (6.32-10.4)	9.10 (6.90-12.2)	9.95 (7.30-13.8)
7-day	2.50 (2.20-2.89)	3.36 (2.96-3.88)	4.48 (3.94-5.20)	5.41 (4.72-6.32)	6.68 (5.65-8.06)	7.66 (6.35-9.43)	8.66 (7.02-10.9)	9.71 (7.66-12.6)	11.1 (8.45-15.0)	12.3 (9.00-17.1)
10-day	2.76 (2.44-3.19)	3.72 (3.28-4.31)	5.00 (4.40-5.81)	6.06 (5.29-7.09)	7.52 (6.36-9.08)	8.67 (7.19-10.7)	9.85 (7.98-12.4)	11.1 (8.75-14.3)	12.8 (9.71-17.2)	14.2 (10.4-19.7)
20-day	3.41 (3.01-3.94)	4.62 (4.08-5.35)	6.27 (5.51-7.27)	7.65 (6.68-8.95)	9.60 (8.12-11.6)	11.2 (9.25-13.7)	12.8 (10.4-16.1)	14.5 (11.5-18.8)	17.0 (12.9-22.8)	18.9 (13.9-26.3)
30-day	4.02 (3.55-4.64)	5.45 (4.81-6.31)	7.41 (6.52-8.60)	9.08 (7.92-10.6)	11.5 (9.68-13.8)	13.4 (11.1-16.4)	15.4 (12.5-19.4)	17.6 (13.9-22.7)	20.7 (15.7-27.8)	23.2 (17.0-32.3)
45-day	4.80 (4.24-5.55)	6.47 (5.71-7.49)	8.79 (7.73-10.2)	10.8 (9.41-12.6)	13.6 (11.5-16.5)	16.0 (13.2-19.7)	18.5 (15.0-23.3)	21.2 (16.7-27.4)	25.1 (19.0-33.8)	28.3 (20.8-39.4)
60-day	5.57 (4.91-6.44)	7.45 (6.57-8.62)	10.1 (8.85-11.7)	12.3 (10.8-14.4)	15.6 (13.2-18.8)	18.3 (15.2-22.6)	21.2 (17.2-26.8)	24.4 (19.3-31.6)	29.1 (22.1-39.1)	33.0 (24.2-45.9)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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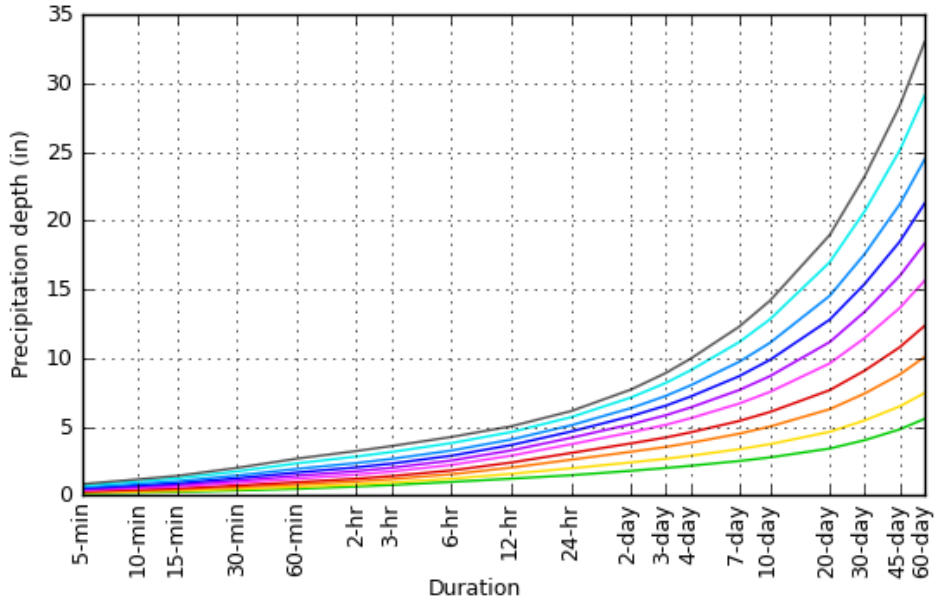
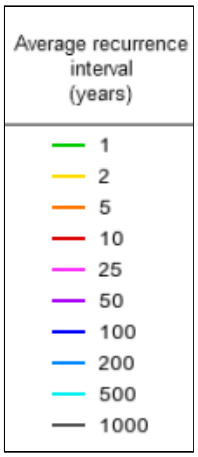
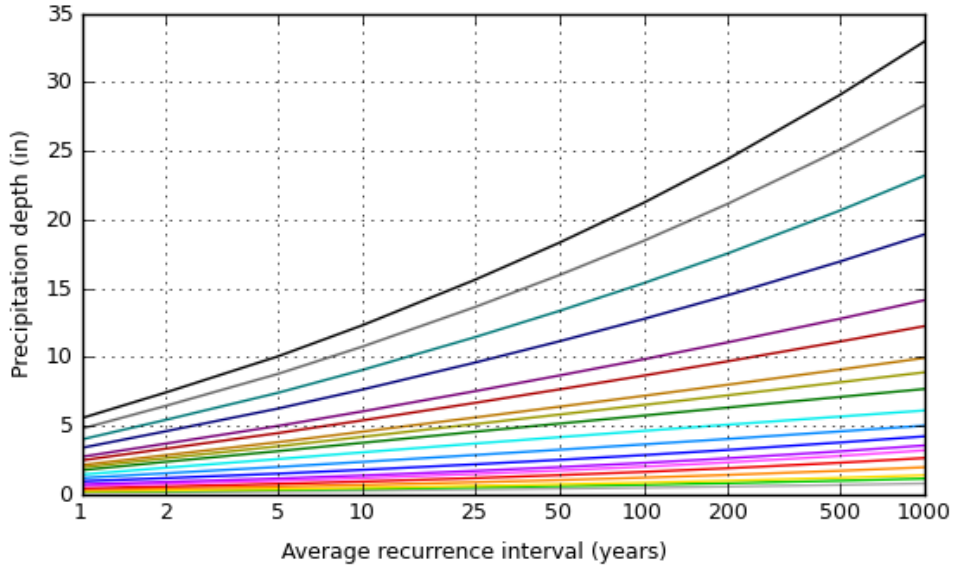
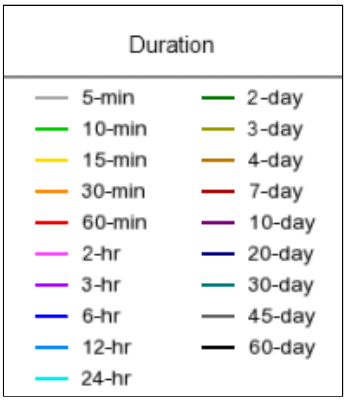
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 33.2221°, Longitude: -117.3412°









NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Tue Oct 8 18:11:23 2019

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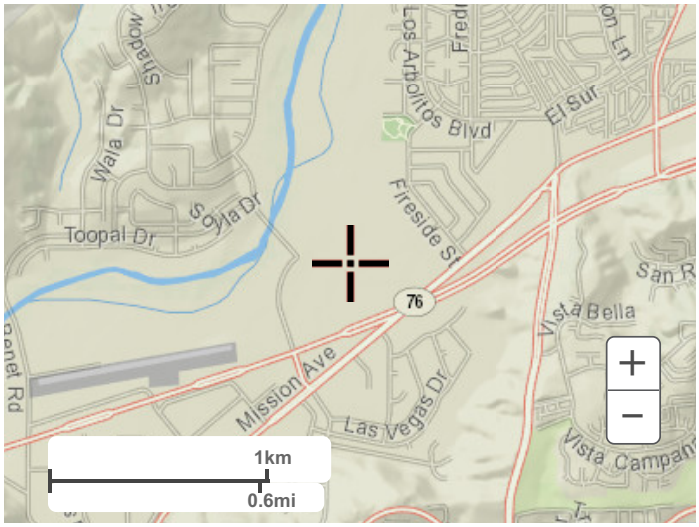
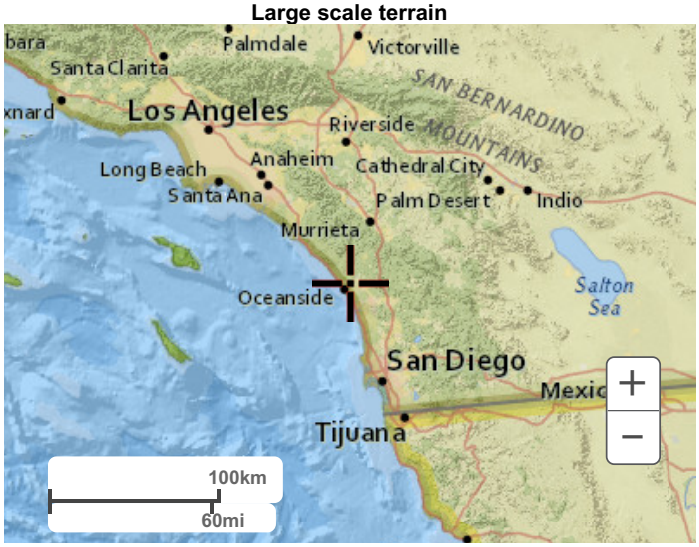
Maps & aerials

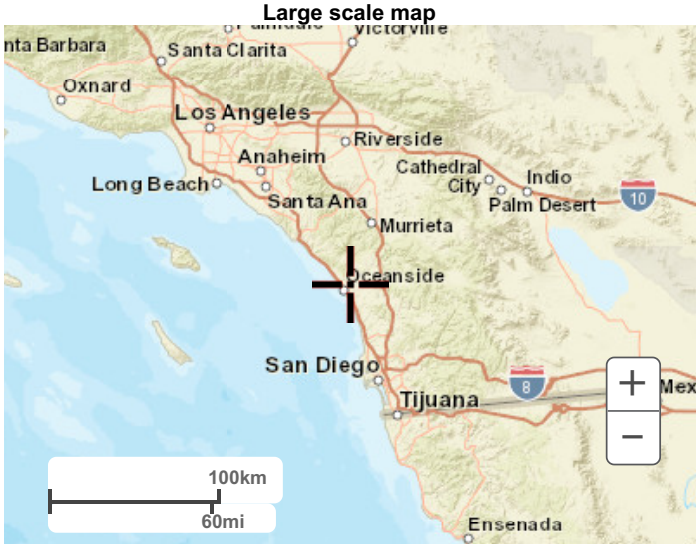
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
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Silver Spring, MD 20910
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Disclaimer

10yr-24hr Rainfall (NOAA Atlas 14)

Time Interval (min):	5	0:05				**Final 24 hour 5-min interval Storm Sorted per SDCHM (6 hr Storm is denoted by green range below)**					
Time (hr:min)	Time (min)	Cumulative Rain NOAA-14 Values* (in)	Incremental Rain (in)	Position		Time (hr:min)	Incremental Rain (in)	Position	Cumulative Rain (in)	Intensity (in/hr)	
0:00	0	0.000	0.2920	**193**		0:00	0.0039	1	0.0039	0.0470	
0:05	5	0.292	0.1270	192		0:05	0.0039	2	0.0078	0.0471	
0:10	10	0.419	0.0870	191		0:10	0.0039	3	0.0118	0.0473	
0:15	15	0.506	0.0781	**194**		0:15	0.0040	4	0.0157	0.0474	
0:20	20	0.584	0.0688	190		0:20	0.0040	5	0.0197	0.0476	
0:25	25	0.653	0.0622	189		0:25	0.0040	6	0.0237	0.0478	
0:30	30	0.715	0.0477	**195**		0:30	0.0040	7	0.0277	0.0480	
0:35	35	0.763	0.0439	188		0:35	0.0040	8	0.0317	0.0481	
0:40	40	0.807	0.0408	187		0:40	0.0040	9	0.0357	0.0483	
0:45	45	0.847	0.0383	**196**		0:45	0.0040	10	0.0398	0.0484	
0:50	50	0.886	0.0361	186		0:50	0.0041	11	0.0438	0.0486	
0:55	55	0.922	0.0342	185		0:55	0.0041	12	0.0479	0.0487	
1:00	60	0.956	0.0264	**197**		1:00	0.0041	13	0.0520	0.0490	
1:05	65	0.982	0.0251	184		1:05	0.0041	14	0.0560	0.0491	
1:10	70	1.007	0.0239	183		1:10	0.0041	15	0.0602	0.0493	
1:15	75	1.031	0.0229	**198**		1:15	0.0041	16	0.0643	0.0494	
1:20	80	1.054	0.0220	182		1:20	0.0041	17	0.0684	0.0497	
1:25	85	1.076	0.0211	181		1:25	0.0042	18	0.0726	0.0498	
1:30	90	1.097	0.0204	**199**		1:30	0.0042	19	0.0767	0.0500	
1:35	95	1.118	0.0197	180		1:35	0.0042	20	0.0809	0.0502	
1:40	100	1.137	0.0190	179		1:40	0.0042	21	0.0851	0.0504	
1:45	105	1.156	0.0184	**200**		1:45	0.0042	22	0.0893	0.0505	
1:50	110	1.175	0.0179	178		1:50	0.0042	23	0.0936	0.0508	
1:55	115	1.193	0.0174	177		1:55	0.0042	24	0.0978	0.0509	
2:00	120	1.210	0.0179	**201**		2:00	0.0043	25	0.1021	0.0512	
2:05	125	1.228	0.0174	176		2:05	0.0043	26	0.1063	0.0513	
2:10	130	1.245	0.0170	175		2:10	0.0043	27	0.1106	0.0516	
2:15	135	1.262	0.0166	**202**		2:15	0.0043	28	0.1149	0.0517	
2:20	140	1.279	0.0162	174		2:20	0.0043	29	0.1193	0.0520	
2:25	145	1.295	0.0159	173		2:25	0.0043	30	0.1236	0.0521	

2:30	150	1.311	0.0156	**203**		2:30	0.0044	31	0.1280	0.0524	
2:35	155	1.327	0.0152	172		2:35	0.0044	32	0.1324	0.0525	
2:40	160	1.342	0.0149	171		2:40	0.0044	33	0.1368	0.0528	
2:45	165	1.357	0.0146	**204**		2:45	0.0044	34	0.1412	0.0529	
2:50	170	1.372	0.0144	170		2:50	0.0044	35	0.1456	0.0532	
2:55	175	1.386	0.0141	169		2:55	0.0044	36	0.1500	0.0534	
3:00	180	1.400	0.0143	**205**		3:00	0.0045	37	0.1545	0.0536	
3:05	185	1.414	0.0140	168		3:05	0.0045	38	0.1590	0.0538	
3:10	190	1.428	0.0138	167		3:10	0.0045	39	0.1635	0.0541	
3:15	195	1.442	0.0136	**206**		3:15	0.0045	40	0.1680	0.0542	
3:20	200	1.456	0.0134	166		3:20	0.0045	41	0.1726	0.0545	
3:25	205	1.469	0.0132	165		3:25	0.0046	42	0.1771	0.0547	
3:30	210	1.482	0.0130	**207**		3:30	0.0046	43	0.1817	0.0550	
3:35	215	1.495	0.0128	164		3:35	0.0046	44	0.1863	0.0552	
3:40	220	1.508	0.0126	163		3:40	0.0046	45	0.1909	0.0555	
3:45	225	1.521	0.0124	**208**		3:45	0.0046	46	0.1956	0.0556	
3:50	230	1.533	0.0123	162		3:50	0.0047	47	0.2002	0.0559	
3:55	235	1.545	0.0121	161		3:55	0.0047	48	0.2049	0.0561	
4:00	240	1.557	0.0119	**209**		4:00	0.0047	49	0.2096	0.0564	
4:05	245	1.569	0.0118	160		4:05	0.0047	50	0.2143	0.0566	
4:10	250	1.581	0.0116	159		4:10	0.0047	51	0.2191	0.0569	
4:15	255	1.593	0.0115	**210**		4:15	0.0048	52	0.2238	0.0571	
4:20	260	1.604	0.0114	158		4:20	0.0048	53	0.2286	0.0575	
4:25	265	1.616	0.0112	157		4:25	0.0048	54	0.2334	0.0576	
4:30	270	1.627	0.0111	**211**		4:30	0.0048	55	0.2383	0.0580	
4:35	275	1.638	0.0110	156		4:35	0.0048	56	0.2431	0.0582	
4:40	280	1.649	0.0109	155		4:40	0.0049	57	0.2480	0.0585	
4:45	285	1.660	0.0107	**212**		4:45	0.0049	58	0.2529	0.0587	
4:50	290	1.671	0.0106	154		4:50	0.0049	59	0.2578	0.0591	
4:55	295	1.681	0.0105	153		4:55	0.0049	60	0.2627	0.0593	
5:00	300	1.692	0.0104	**213**		5:00	0.0050	61	0.2677	0.0596	
5:05	305	1.702	0.0103	152		5:05	0.0050	62	0.2727	0.0598	
5:10	310	1.712	0.0102	151		5:10	0.0050	63	0.2777	0.0602	
5:15	315	1.723	0.0101	**214**		5:15	0.0050	64	0.2827	0.0604	
5:20	320	1.733	0.0100	150		5:20	0.0051	65	0.2878	0.0608	
5:25	325	1.743	0.0099	149		5:25	0.0051	66	0.2929	0.0610	
5:30	330	1.753	0.0098	**215**		5:30	0.0051	67	0.2980	0.0614	

5:35	335	1.762	0.0097	148		5:35	0.0051	68	0.3032	0.0616	
5:40	340	1.772	0.0096	147		5:40	0.0052	69	0.3083	0.0621	
5:45	345	1.782	0.0095	**216**		5:45	0.0052	70	0.3135	0.0623	
5:50	350	1.791	0.0094	146		5:50	0.0052	71	0.3187	0.0627	
5:55	355	1.801	0.0094	145		5:55	0.0052	72	0.3240	0.0629	
6:00	360	1.810	0.0100	**217**		6:00	0.0053	73	0.3293	0.0634	
6:05	365	1.820	0.0100	144		6:05	0.0053	74	0.3346	0.0636	
6:10	370	1.830	0.0099	143		6:10	0.0053	75	0.3399	0.0641	
6:15	375	1.840	0.0098	**218**		6:15	0.0054	76	0.3453	0.0643	
6:20	380	1.850	0.0097	142		6:20	0.0054	77	0.3507	0.0648	
6:25	385	1.859	0.0096	141		6:25	0.0054	78	0.3561	0.0650	
6:30	390	1.869	0.0096	**219**		6:30	0.0055	79	0.3615	0.0655	
6:35	395	1.879	0.0095	140		6:35	0.0055	80	0.3670	0.0657	
6:40	400	1.888	0.0094	139		6:40	0.0055	81	0.3725	0.0662	
6:45	405	1.898	0.0094	**220**		6:45	0.0055	82	0.3781	0.0665	
6:50	410	1.907	0.0093	138		6:50	0.0056	83	0.3836	0.0670	
6:55	415	1.916	0.0092	137		6:55	0.0056	84	0.3893	0.0672	
7:00	420	1.925	0.0092	**221**		7:00	0.0056	85	0.3949	0.0678	
7:05	425	1.935	0.0091	136		7:05	0.0057	86	0.4006	0.0680	
7:10	430	1.944	0.0090	135		7:10	0.0057	87	0.4063	0.0686	
7:15	435	1.953	0.0090	**222**		7:15	0.0057	88	0.4120	0.0689	
7:20	440	1.962	0.0089	134		7:20	0.0058	89	0.4178	0.0694	
7:25	445	1.971	0.0088	133		7:25	0.0058	90	0.4236	0.0697	
7:30	450	1.979	0.0088	**223**		7:30	0.0059	91	0.4295	0.0703	
7:35	455	1.988	0.0087	132		7:35	0.0059	92	0.4354	0.0706	
7:40	460	1.997	0.0087	131		7:40	0.0059	93	0.4413	0.0712	
7:45	465	2.006	0.0086	**224**		7:45	0.0060	94	0.4472	0.0715	
7:50	470	2.014	0.0086	130		7:50	0.0060	95	0.4532	0.0721	
7:55	475	2.023	0.0085	129		7:55	0.0060	96	0.4593	0.0724	
8:00	480	2.031	0.0085	**225**		8:00	0.0067	97	0.4659	0.0800	
8:05	485	2.040	0.0084	128		8:05	0.0067	98	0.4726	0.0804	
8:10	490	2.048	0.0084	127		8:10	0.0068	99	0.4794	0.0811	
8:15	495	2.057	0.0083	**226**		8:15	0.0068	100	0.4862	0.0814	
8:20	500	2.065	0.0083	126		8:20	0.0068	101	0.4930	0.0821	
8:25	505	2.073	0.0082	125		8:25	0.0069	102	0.4999	0.0825	
8:30	510	2.081	0.0082	**227**		8:30	0.0069	103	0.5068	0.0832	
8:35	515	2.089	0.0081	124		8:35	0.0070	104	0.5138	0.0836	

8:40	520	2.098	0.0081	123		8:40	0.0070	105	0.5208	0.0843	
8:45	525	2.106	0.0080	**228**		8:45	0.0071	106	0.5279	0.0847	
8:50	530	2.114	0.0080	122		8:50	0.0071	107	0.5350	0.0855	
8:55	535	2.122	0.0079	121		8:55	0.0072	108	0.5422	0.0859	
9:00	540	2.130	0.0079	**229**		9:00	0.0072	109	0.5494	0.0867	
9:05	545	2.137	0.0078	120		9:05	0.0073	110	0.5567	0.0871	
9:10	550	2.145	0.0078	119		9:10	0.0073	111	0.5640	0.0880	
9:15	555	2.153	0.0078	**230**		9:15	0.0074	112	0.5714	0.0884	
9:20	560	2.161	0.0077	118		9:20	0.0074	113	0.5788	0.0893	
9:25	565	2.169	0.0077	117		9:25	0.0075	114	0.5863	0.0898	
9:30	570	2.176	0.0076	**231**		9:30	0.0076	115	0.5938	0.0907	
9:35	575	2.184	0.0076	116		9:35	0.0076	116	0.6014	0.0911	
9:40	580	2.191	0.0076	115		9:40	0.0077	117	0.6091	0.0921	
9:45	585	2.199	0.0075	**232**		9:45	0.0077	118	0.6168	0.0926	
9:50	590	2.207	0.0075	114		9:50	0.0078	119	0.6246	0.0936	
9:55	595	2.214	0.0074	113		9:55	0.0078	120	0.6325	0.0941	
10:00	600	2.221	0.0074	**233**		10:00	0.0079	121	0.6404	0.0952	
10:05	605	2.229	0.0074	112		10:05	0.0080	122	0.6484	0.0957	
10:10	610	2.236	0.0073	111		10:10	0.0081	123	0.6564	0.0968	
10:15	615	2.244	0.0073	**234**		10:15	0.0081	124	0.6646	0.0973	
10:20	620	2.251	0.0073	110		10:20	0.0082	125	0.6728	0.0985	
10:25	625	2.258	0.0072	109		10:25	0.0083	126	0.6810	0.0991	
10:30	630	2.265	0.0072	**235**		10:30	0.0084	127	0.6894	0.1003	
10:35	635	2.273	0.0072	108		10:35	0.0084	128	0.6978	0.1009	
10:40	640	2.280	0.0071	107		10:40	0.0085	129	0.7063	0.1021	
10:45	645	2.287	0.0071	**236**		10:45	0.0086	130	0.7149	0.1028	
10:50	650	2.294	0.0071	106		10:50	0.0087	131	0.7235	0.1041	
10:55	655	2.301	0.0070	105		10:55	0.0087	132	0.7323	0.1048	
11:00	660	2.308	0.0070	**237**		11:00	0.0088	133	0.7411	0.1062	
11:05	665	2.315	0.0070	104		11:05	0.0089	134	0.7500	0.1069	
11:10	670	2.322	0.0069	103		11:10	0.0090	135	0.7591	0.1084	
11:15	675	2.329	0.0069	**238**		11:15	0.0091	136	0.7682	0.1091	
11:20	680	2.336	0.0069	102		11:20	0.0092	137	0.7774	0.1107	
11:25	685	2.343	0.0068	101		11:25	0.0093	138	0.7867	0.1115	
11:30	690	2.350	0.0068	**239**		11:30	0.0094	139	0.7961	0.1132	
11:35	695	2.356	0.0068	100		11:35	0.0095	140	0.8056	0.1140	
11:40	700	2.363	0.0068	99		11:40	0.0096	141	0.8152	0.1158	

11:45	705	2.370	0.0067	**240**		11:45	0.0097	142	0.8250	0.1167	
11:50	710	2.377	0.0067	98		11:50	0.0099	143	0.8348	0.1185	
11:55	715	2.383	0.0067	97		11:55	0.0100	144	0.8448	0.1195	
12:00	720	2.390	0.0061	**241**		12:00	0.0094	145	0.8542	0.1123	
12:05	725	2.396	0.0060	96		12:05	0.0094	146	0.8636	0.1133	
12:10	730	2.402	0.0060	95		12:10	0.0096	147	0.8732	0.1153	
12:15	735	2.408	0.0060	**242**		12:15	0.0097	148	0.8829	0.1164	
12:20	740	2.414	0.0060	94		12:20	0.0099	149	0.8928	0.1186	
12:25	745	2.420	0.0059	93		12:25	0.0100	150	0.9028	0.1198	
12:30	750	2.426	0.0059	**243**		12:30	0.0102	151	0.9130	0.1222	
12:35	755	2.432	0.0059	92		12:35	0.0103	152	0.9233	0.1234	
12:40	760	2.438	0.0059	91		12:40	0.0105	153	0.9338	0.1260	
12:45	765	2.444	0.0058	**244**		12:45	0.0106	154	0.9444	0.1274	
12:50	770	2.449	0.0058	90		12:50	0.0109	155	0.9552	0.1302	
12:55	775	2.455	0.0058	89		12:55	0.0110	156	0.9662	0.1317	
13:00	780	2.461	0.0058	**245**		13:00	0.0112	157	0.9774	0.1348	
13:05	785	2.467	0.0057	88		13:05	0.0114	158	0.9888	0.1364	
13:10	790	2.473	0.0057	87		13:10	0.0116	159	1.0004	0.1398	
13:15	795	2.478	0.0057	**246**		13:15	0.0118	160	1.0122	0.1415	
13:20	800	2.484	0.0057	86		13:20	0.0121	161	1.0243	0.1452	
13:25	805	2.490	0.0056	85		13:25	0.0123	162	1.0366	0.1472	
13:30	810	2.495	0.0056	**247**		13:30	0.0126	163	1.0492	0.1513	
13:35	815	2.501	0.0056	84		13:35	0.0128	164	1.0620	0.1535	
13:40	820	2.506	0.0056	83		13:40	0.0132	165	1.0752	0.1581	
13:45	825	2.512	0.0056	**248**		13:45	0.0134	166	1.0886	0.1606	
13:50	830	2.518	0.0055	82		13:50	0.0138	167	1.1024	0.1658	
13:55	835	2.523	0.0055	81		13:55	0.0140	168	1.1164	0.1685	
14:00	840	2.529	0.0055	**249**		14:00	0.0141	169	1.1305	0.1694	
14:05	845	2.534	0.0055	80		14:05	0.0144	170	1.1449	0.1725	
14:10	850	2.540	0.0055	79		14:10	0.0149	171	1.1599	0.1792	
14:15	855	2.545	0.0054	**250**		14:15	0.0152	172	1.1751	0.1829	
14:20	860	2.551	0.0054	78		14:20	0.0159	173	1.1910	0.1907	
14:25	865	2.556	0.0054	77		14:25	0.0162	174	1.2072	0.1950	
14:30	870	2.561	0.0054	**251**		14:30	0.0170	175	1.2243	0.2043	
14:35	875	2.567	0.0054	76		14:35	0.0174	176	1.2417	0.2094	
14:40	880	2.572	0.0053	75		14:40	0.0174	177	1.2591	0.2085	
14:45	885	2.577	0.0053	**252**		14:45	0.0179	178	1.2770	0.2146	

14:50	890	2.583	0.0053	74		14:50	0.0190	179	1.2960	0.2282	
14:55	895	2.588	0.0053	73		14:55	0.0197	180	1.3156	0.2359	
15:00	900	2.593	0.0053	**253**		15:00	0.0211	181	1.3368	0.2534	
15:05	905	2.599	0.0052	72		15:05	0.0220	182	1.3587	0.2634	
15:10	910	2.604	0.0052	71		15:10	0.0239	183	1.3826	0.2869	
15:15	915	2.609	0.0052	**254**		15:15	0.0251	184	1.4077	0.3007	
15:20	920	2.614	0.0052	70		15:20	0.0342	185	1.4419	0.4108	
15:25	925	2.619	0.0052	69		15:25	0.0361	186	1.4780	0.4331	
15:30	930	2.625	0.0052	**255**		15:30	0.0408	187	1.5188	0.4897	
15:35	935	2.630	0.0051	68		15:35	0.0439	188	1.5627	0.5268	
15:40	940	2.635	0.0051	67		15:40	0.0622	189	1.6249	0.7459	
15:45	945	2.640	0.0051	**256**		15:45	0.0688	190	1.6936	0.8252	
15:50	950	2.645	0.0051	66		15:50	0.0870	191	1.7806	1.0440	
15:55	955	2.650	0.0051	65		15:55	0.1270	192	1.9076	1.5240	
16:00	960	2.655	0.0051	**257**		**16:00**	0.2920	193	**2.1996**	**3.5040**	
16:05	965	2.660	0.0050	64		16:05	0.0781	194	2.2777	0.9369	
16:10	970	2.665	0.0050	63		16:10	0.0477	195	2.3254	0.5726	
16:15	975	2.670	0.0050	**258**		16:15	0.0383	196	2.3637	0.4591	
16:20	980	2.675	0.0050	62		16:20	0.0264	197	2.3900	0.3164	
16:25	985	2.680	0.0050	61		16:25	0.0229	198	2.4129	0.2745	
16:30	990	2.685	0.0050	**259**		16:30	0.0204	199	2.4333	0.2442	
16:35	995	2.690	0.0049	60		16:35	0.0184	200	2.4517	0.2212	
16:40	1000	2.695	0.0049	59		16:40	0.0179	201	2.4696	0.2148	
16:45	1005	2.700	0.0049	**260**		16:45	0.0166	202	2.4862	0.1995	
16:50	1010	2.705	0.0049	58		16:50	0.0156	203	2.5018	0.1867	
16:55	1015	2.710	0.0049	57		16:55	0.0146	204	2.5164	0.1758	
17:00	1020	2.715	0.0049	**261**		17:00	0.0143	205	2.5307	0.1714	
17:05	1025	2.720	0.0048	56		17:05	0.0136	206	2.5443	0.1631	
17:10	1030	2.725	0.0048	55		17:10	0.0130	207	2.5573	0.1558	
17:15	1035	2.729	0.0048	**262**		17:15	0.0124	208	2.5697	0.1492	
17:20	1040	2.734	0.0048	54		17:20	0.0119	209	2.5817	0.1434	
17:25	1045	2.739	0.0048	53		17:25	0.0115	210	2.5932	0.1380	
17:30	1050	2.744	0.0048	**263**		17:30	0.0111	211	2.6043	0.1332	
17:35	1055	2.749	0.0048	52		17:35	0.0107	212	2.6150	0.1288	
17:40	1060	2.753	0.0047	51		17:40	0.0104	213	2.6254	0.1247	
17:45	1065	2.758	0.0047	**264**		17:45	0.0101	214	2.6355	0.1210	
17:50	1070	2.763	0.0047	50		17:50	0.0098	215	2.6453	0.1175	

17:55	1075	2.768	0.0047	49		17:55	0.0095	216	2.6548	0.1143	
18:00	1080	2.772	0.0047	**265**		18:00	0.0100	217	2.6648	0.1205	
18:05	1085	2.777	0.0047	48		18:05	0.0098	218	2.6746	0.1176	
18:10	1090	2.782	0.0047	47		18:10	0.0096	219	2.6842	0.1149	
18:15	1095	2.786	0.0046	**266**		18:15	0.0094	220	2.6936	0.1123	
18:20	1100	2.791	0.0046	46		18:20	0.0092	221	2.7027	0.1099	
18:25	1105	2.796	0.0046	45		18:25	0.0090	222	2.7117	0.1076	
18:30	1110	2.800	0.0046	**267**		18:30	0.0088	223	2.7205	0.1055	
18:35	1115	2.805	0.0046	44		18:35	0.0086	224	2.7291	0.1034	
18:40	1120	2.809	0.0046	43		18:40	0.0085	225	2.7376	0.1015	
18:45	1125	2.814	0.0046	**268**		18:45	0.0083	226	2.7459	0.0997	
18:50	1130	2.819	0.0046	42		18:50	0.0082	227	2.7540	0.0979	
18:55	1135	2.823	0.0045	41		18:55	0.0080	228	2.7621	0.0962	
19:00	1140	2.828	0.0045	**269**		19:00	0.0079	229	2.7699	0.0946	
19:05	1145	2.832	0.0045	40		19:05	0.0078	230	2.7777	0.0931	
19:10	1150	2.837	0.0045	39		19:10	0.0076	231	2.7853	0.0916	
19:15	1155	2.841	0.0045	**270**		19:15	0.0075	232	2.7929	0.0902	
19:20	1160	2.846	0.0045	38		19:20	0.0074	233	2.8003	0.0889	
19:25	1165	2.850	0.0045	37		19:25	0.0073	234	2.8076	0.0876	
19:30	1170	2.855	0.0045	**271**		19:30	0.0072	235	2.8147	0.0863	
19:35	1175	2.859	0.0044	36		19:35	0.0071	236	2.8218	0.0851	
19:40	1180	2.864	0.0044	35		19:40	0.0070	237	2.8288	0.0840	
19:45	1185	2.868	0.0044	**272**		19:45	0.0069	238	2.8357	0.0828	
19:50	1190	2.872	0.0044	34		19:50	0.0068	239	2.8426	0.0818	
19:55	1195	2.877	0.0044	33		19:55	0.0067	240	2.8493	0.0807	
20:00	1200	2.881	0.0044	**273**		20:00	0.0061	241	2.8553	0.0727	
20:05	1205	2.886	0.0044	32		20:05	0.0060	242	2.8613	0.0718	
20:10	1210	2.890	0.0044	31		20:10	0.0059	243	2.8672	0.0709	
20:15	1215	2.894	0.0044	**274**		20:15	0.0058	244	2.8731	0.0700	
20:20	1220	2.899	0.0043	30		20:20	0.0058	245	2.8788	0.0691	
20:25	1225	2.903	0.0043	29		20:25	0.0057	246	2.8845	0.0683	
20:30	1230	2.907	0.0043	**275**		20:30	0.0056	247	2.8901	0.0675	
20:35	1235	2.912	0.0043	28		20:35	0.0056	248	2.8957	0.0667	
20:40	1240	2.916	0.0043	27		20:40	0.0055	249	2.9012	0.0660	
20:45	1245	2.920	0.0043	**276**		20:45	0.0054	250	2.9066	0.0652	
20:50	1250	2.925	0.0043	26		20:50	0.0054	251	2.9120	0.0645	
20:55	1255	2.929	0.0043	25		20:55	0.0053	252	2.9173	0.0638	

21:00	1260	2.933	0.0043	**277**		21:00	0.0053	253	2.9226	0.0632	
21:05	1265	2.937	0.0042	24		21:05	0.0052	254	2.9278	0.0625	
21:10	1270	2.942	0.0042	23		21:10	0.0052	255	2.9330	0.0619	
21:15	1275	2.946	0.0042	**278**		21:15	0.0051	256	2.9381	0.0612	
21:20	1280	2.950	0.0042	22		21:20	0.0051	257	2.9431	0.0606	
21:25	1285	2.954	0.0042	21		21:25	0.0050	258	2.9481	0.0600	
21:30	1290	2.958	0.0042	**279**		21:30	0.0050	259	2.9531	0.0595	
21:35	1295	2.963	0.0042	20		21:35	0.0049	260	2.9580	0.0589	
21:40	1300	2.967	0.0042	19		21:40	0.0049	261	2.9628	0.0583	
21:45	1305	2.971	0.0042	**280**		21:45	0.0048	262	2.9677	0.0578	
21:50	1310	2.975	0.0042	18		21:50	0.0048	263	2.9724	0.0573	
21:55	1315	2.979	0.0041	17		21:55	0.0047	264	2.9772	0.0568	
22:00	1320	2.983	0.0041	**281**		22:00	0.0047	265	2.9818	0.0563	
22:05	1325	2.988	0.0041	16		22:05	0.0046	266	2.9865	0.0558	
22:10	1330	2.992	0.0041	15		22:10	0.0046	267	2.9911	0.0553	
22:15	1335	2.996	0.0041	**282**		22:15	0.0046	268	2.9957	0.0548	
22:20	1340	3.000	0.0041	14		22:20	0.0045	269	3.0002	0.0544	
22:25	1345	3.004	0.0041	13		22:25	0.0045	270	3.0047	0.0539	
22:30	1350	3.008	0.0041	**283**		22:30	0.0045	271	3.0092	0.0535	
22:35	1355	3.012	0.0041	12		22:35	0.0044	272	3.0136	0.0531	
22:40	1360	3.016	0.0041	11		22:40	0.0044	273	3.0180	0.0526	
22:45	1365	3.020	0.0040	**284**		22:45	0.0044	274	3.0223	0.0522	
22:50	1370	3.024	0.0040	10		22:50	0.0043	275	3.0266	0.0518	
22:55	1375	3.028	0.0040	9		22:55	0.0043	276	3.0309	0.0514	
23:00	1380	3.032	0.0040	**285**		23:00	0.0043	277	3.0352	0.0510	
23:05	1385	3.036	0.0040	8		23:05	0.0042	278	3.0394	0.0507	
23:10	1390	3.040	0.0040	7		23:10	0.0042	279	3.0436	0.0503	
23:15	1395	3.044	0.0040	**286**		23:15	0.0042	280	3.0478	0.0499	
23:20	1400	3.048	0.0040	6		23:20	0.0041	281	3.0519	0.0496	
23:25	1405	3.052	0.0040	5		23:25	0.0041	282	3.0560	0.0492	
23:30	1410	3.056	0.0040	**287**		23:30	0.0041	283	3.0601	0.0489	
23:35	1415	3.060	0.0040	4		23:35	0.0040	284	3.0641	0.0485	
23:40	1420	3.064	0.0039	3		23:40	0.0040	285	3.0681	0.0482	
23:45	1425	3.068	0.0039	**288**		23:45	0.0040	286	3.0721	0.0479	
23:50	1430	3.072	0.0039	2		23:50	0.0040	287	3.0761	0.0475	
23:55	1435	3.076	0.0039	1		23:55	0.0039	288	3.0800	0.0472	
0:00	1440	3.080				0:00					

*Note: Shaded values are taken directly from NOAA Atlas 14 data. Non-shaded values are obtained by log-log interpolation.											

TORY R. WALKER ENGINEERING
RELIABLE SOLUTIONS IN WATER RESOURCES

Project: Zephyr Oceanside
Project #: 537-03
Date:

HEC-HMS Inputs

Basin	Condition	Area (ac)	Area (mi^2)	[1]CN	Impervious (%)	[2]T_C (min)	[3]Lag (min)
BYPASS[4]	Proposed	15.0	0.023438	81	25.5%	15.0	12.00
DMA-2	Proposed	33.1	0.051719	81	61.0%	10.0	8.00

Notes:

[1] Pervious area Curve Number per 2003 SDCHM Table 4-2. Pervious areas assumed to be landscaped with native vegetation corresponding to "Open brush" cover description.

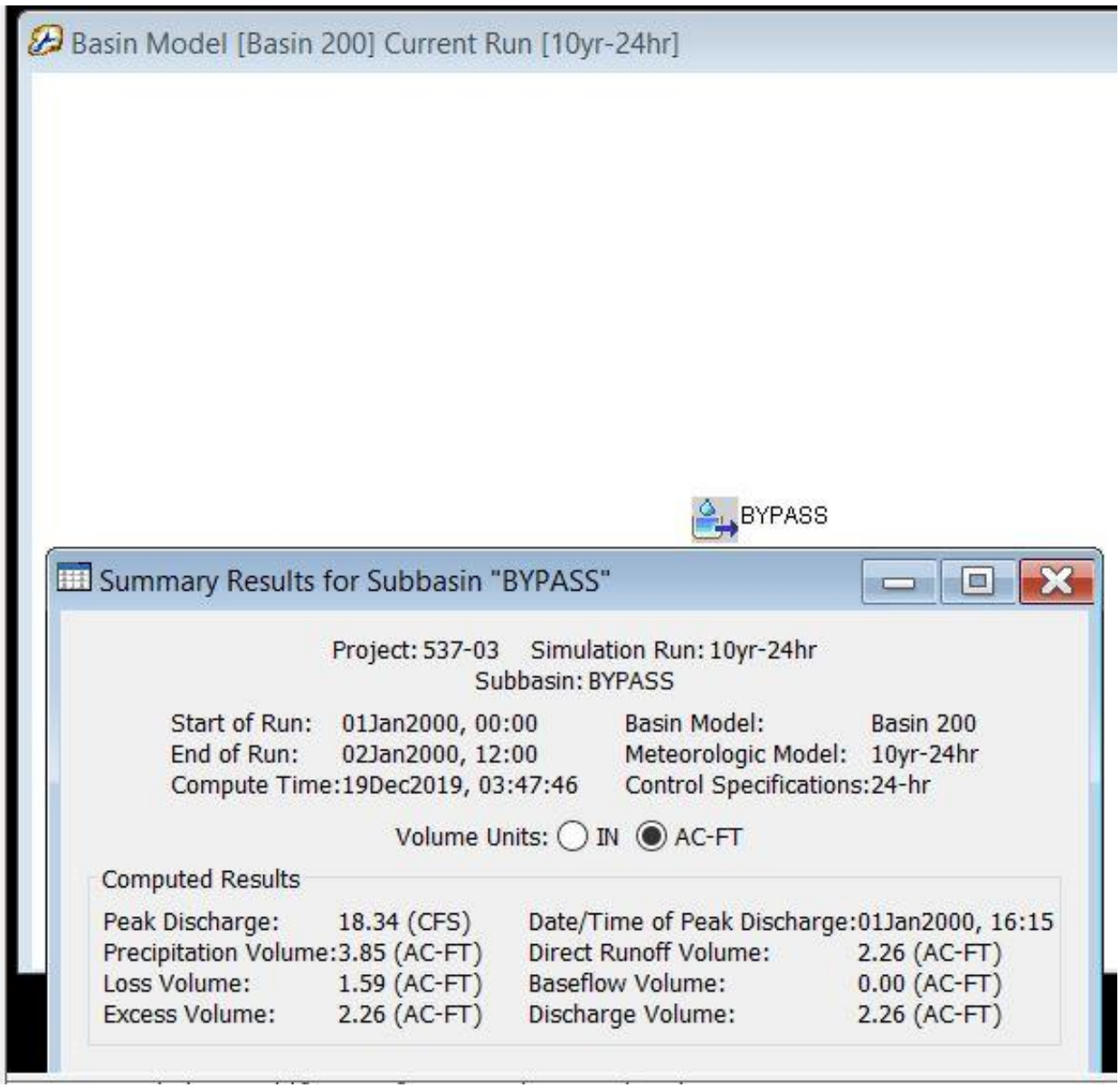
[2] Time of concentration taken from AES Q_{10} calculations

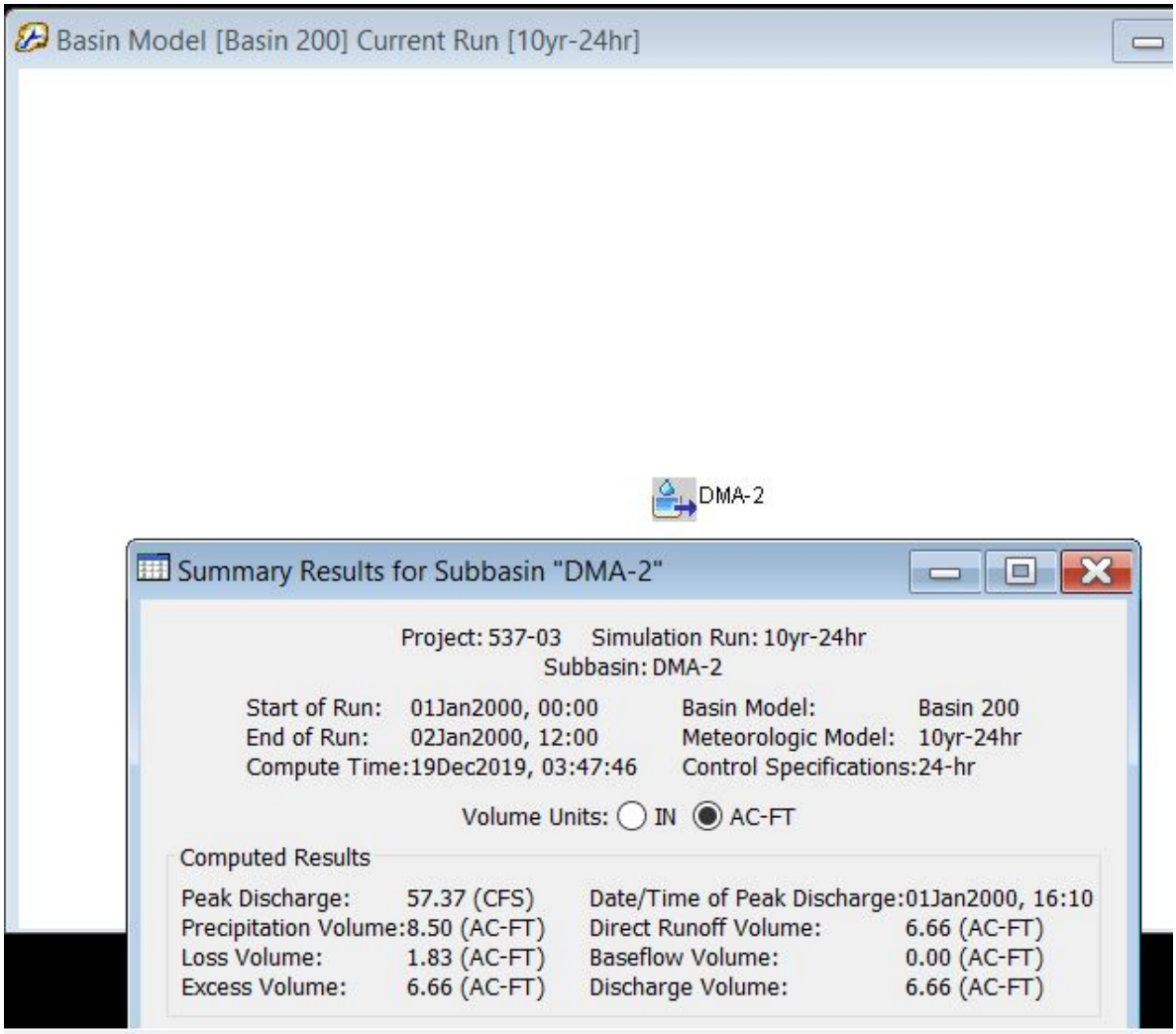
[3] Lag is equal to 80% of the time of concentration.

[4] Drainage area that bypasses BMP-2 (BASIN 2)

Table 4-2 (Continued)
RUNOFF CURVE NUMBERS[1] FOR PZN CONDITION = 2.0

Cover Description	Cover Treatment or Practice[2]	Hydrologic Condition[3]	Average Percent Impervious Area[4]	Curve Numbers for Hydrologic Soil Groups: A	B	C	D
Turf[8]		Poor		58	74	83	87
		Fair		44	65	77	82
		Good		33	58	72	79
Water surfaces (during floods)				97	98	99	99
Broadleaf chaparral		Poor		53	70	80	85
		Fair		40	63	75	81
		Good		31	57	71	78
Desert shrub–major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus		Poor		63	77	85	88
		Fair		55	72	81	86
		Good		49	68	79	84
Herbaceous–mixture of grass, weeds, and low-growing brush, with brush the minor element		Poor		[9]	80	87	93
		Fair		[9]	71	81	89
		Good		[9]	62	74	85
Narrowleaf chaparral		Poor		71	82	88	91
		Fair		55	72	81	86
Oak-aspen–mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush		Poor		[9]	66	74	79
		Fair		[9]	48	57	63
		Good		[9]	30	41	48
Open brush		Poor		62	76	84	88
		Fair		46	66	77	83
		Good		41	63	75	81


Basin Model [Basin 200] Current Run [10yr-24hr]
BYPASS
Summary Results for Subbasin "BYPASS"
Project: 537-03 Simulation Run: 10yr-24hr
Subbasin: BYPASS
Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 12:00
Compute Time: 19Dec2019, 03:47:46
Basin Model: Basin 200
Meteorologic Model: 10yr-24hr
Control Specifications: 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge: 18.34 (CFS)
Precipitation Volume: 3.85 (AC-FT)
Loss Volume: 1.59 (AC-FT)
Excess Volume: 2.26 (AC-FT)
Date/Time of Peak Discharge: 01Jan2000, 16:15
Direct Runoff Volume: 2.26 (AC-FT)
Baseflow Volume: 0.00 (AC-FT)
Discharge Volume: 2.26 (AC-FT)


Basin Model [Basin 200] Current Run [10yr-24hr]
DMA-2
Summary Results for Subbasin "DMA-2"
Project: 537-03 Simulation Run: 10yr-24hr
Subbasin: DMA-2
Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 12:00
Compute Time: 19Dec2019, 03:47:46
Basin Model: Basin 200
Meteorologic Model: 10yr-24hr
Control Specifications: 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge: 57.37 (CFS)
Precipitation Volume: 8.50 (AC-FT)
Loss Volume: 1.83 (AC-FT)
Excess Volume: 6.66 (AC-FT)
Date/Time of Peak Discharge: 01Jan2000, 16:10
Direct Runoff Volume: 6.66 (AC-FT)
Baseflow Volume: 0.00 (AC-FT)
Discharge Volume: 6.66 (AC-FT)

10-yr-24hr ONSITE RETENTION VOLUME AND PONDING DEPTH								
Basin ID	Runoff Volume from HEC-HMS (AC-FT)	Runoff Volume (CF)			SDGE Easement Area Stage-Storage			
BYPASS	2.26	98446			Elevation (ft)	Depth (ft)	Area (sf)	Volume (cf)
DMA-2 only	6.66	290110			36.0	0.0	6532	0
	TOTAL	**388555**			37.0	1.0	101060	44428
					38.0	2.0	205061	194454
	BMP-2 (BASIN 2) VOLUME							
	Basin Area (SF)	42600			Ponded Depth	1.1	ft (interpolated)	
	Basin Depth (FT)	6			**Ponded Elev**	**37.1**	**ft (interpolated)**	**-----> OK**
	Basin Surface Volume (CF)	302602						
	Soil Volume	14910						
	Gravel Volume	17040						
	Total Basin Volume	**334552**						
	Volume Leftover to Pond in SDGE Easement	**54003**						

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Oct 22 2019

Circular Culvert

Invert Elev Dn (ft)	=	27.10
Pipe Length (ft)	=	104.00
Slope (%)	=	2.22
Invert Elev Up (ft)	=	29.41
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

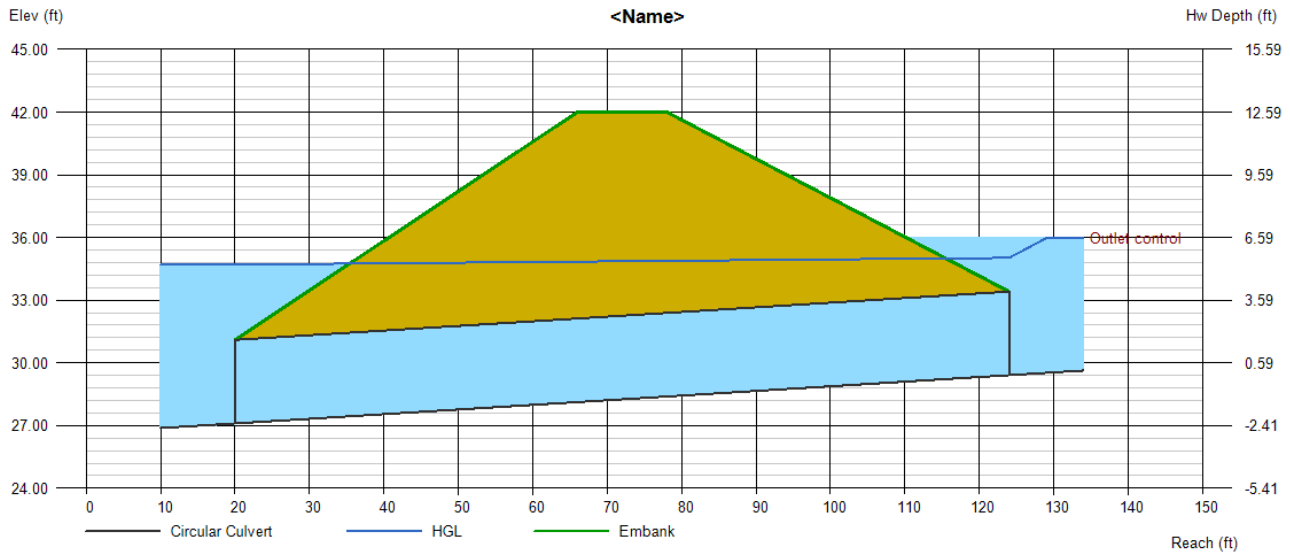
Top Elevation (ft)	=	42.00
Top Width (ft)	=	12.00
Crest Width (ft)	=	300.00

Calculations

Qmin (cfs)	=	10.00
Qmax (cfs)	=	200.00
Tailwater Elev (ft)	=	34.7

Highlighted

Qtotal (cfs)	=	80.00
Qpipe (cfs)	=	80.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.37
Veloc Up (ft/s)	=	6.37
HGL Dn (ft)	=	34.70
HGL Up (ft)	=	35.02
Hw Elev (ft)	=	35.97
Hw/D (ft)	=	1.64
Flow Regime	=	Outlet Control



APPENDIX E

Project Maps

- Existing Condition Hydrology Map
- Developed Condition Hydrology Map

Exhibit A
Hydrology Map
Existing Condition
Scale 1"=300'

Park Pond

Existing Double 96" RCP with flapgates

Fireside Channel (Section Varies)

7.23ac

SDG&E Corridor

San Luis Rey River

9.76ac

27

9.72ac

Discharge Point 2
Existing 48" RCP with flapgate
Q100=68.2 cfs
A=64.1 ac

5.15ac

25

23

Master Drainage Facility AD
(Triple 8ft x 4ft RCB)

29

21

20

0.92ac

7.67ac

10

1.39ac

13.69ac

9.99ac

11

16.75ac

Fireside Road

Middle Pond

Foussat Road

14.57ac

Existing 24" RCP

3.27ac

5.90ac

Mission Road

13

Discharge Point 1
60" RCP Outfall to Middle Pond
Q100=50.0 cfs
A=49.0 ac

15

4.75ac

17

2.36ac

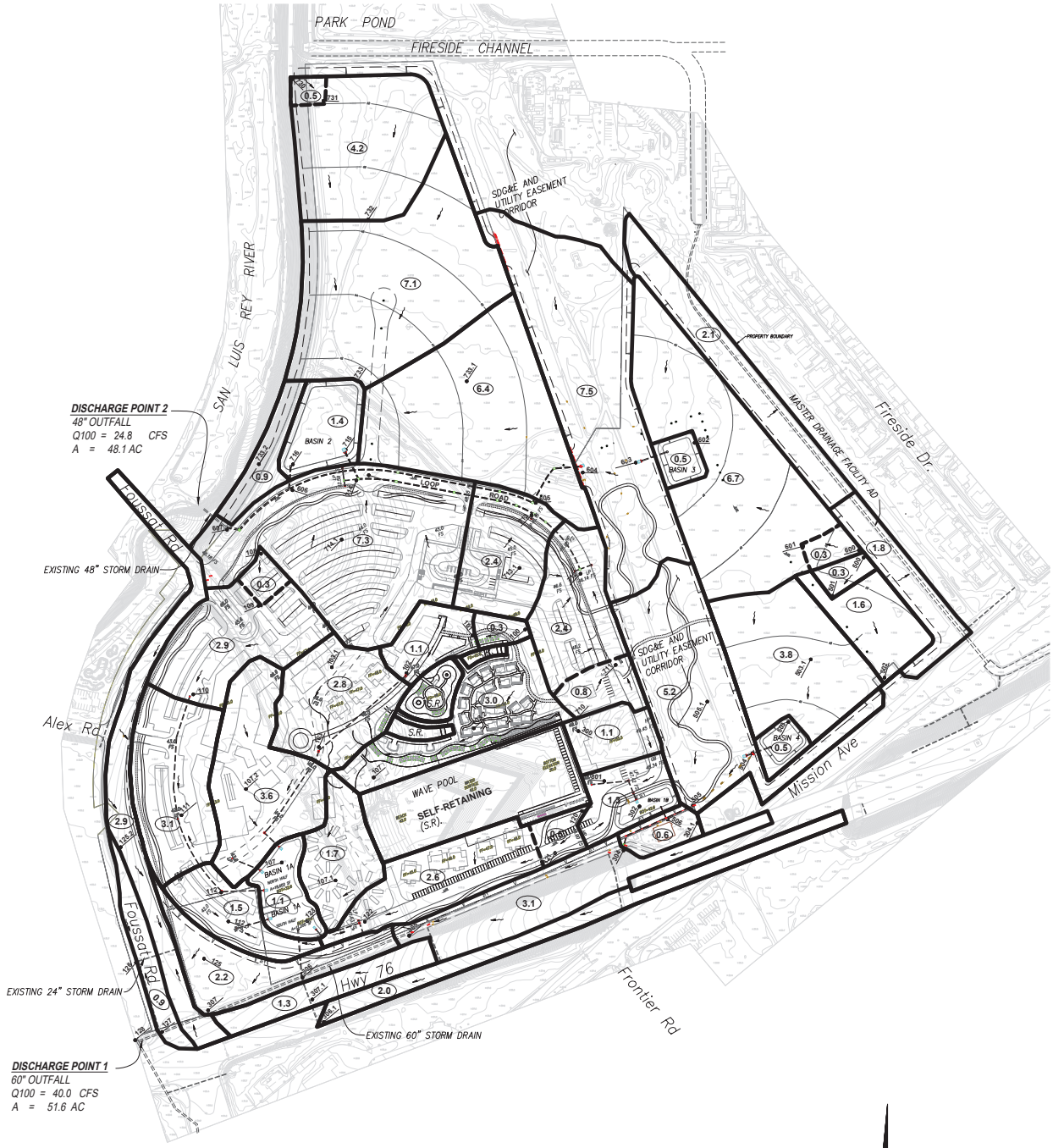
Highway 76

19

18

Existing 60" RCP

N



LEGEND

- SUBAREA BASIN BOUNDARY
- INITIAL AREA BOUNDARY
- FLOW DIRECTION
- 100.0 — RATIONAL METHOD NODE
- 0.08 — AREA (AC)
- 610 — PROPOSED CONTOUR
- 610 — EXISTING CONTOUR

N

150 75 0 150 300 450

SCALE: 1"=150'

DATE: DECEMBER 19, 2019

TORY R. WALKER ENGINEERING
RELIABLE SOLUTIONS IN WATER RESOURCES
122 CIVIC CENTER DR, STE 206, VISTA, CA 92084 · 760-414-9212

OCEAN KAMP

DEVELOPED CONDITION HYDROLOGY MAP

ATTACHMENT 6
Geotechnical and Groundwater Investigation Report

This is the cover sheet for Attachment 6.

GEOTECHNICAL EVALUATION

Zephyr Investors, LLC
Proposed "Zephyr Oceanside" Commercial/Retail and Residential Development
Highway 76 and North Foussat Road
City of Oceanside, County of San Diego, California

September 19, 2018

EEI Project ZEP-72676.4

Corporate Office: 2195 Faraday Ave., Suite K, Carlsbad, CA 92008-7207 * Ph: 760-431-3747 www.eeitiger.com
Camarillo * Carlsbad * Pleasanton * Sacramento * Reno

GEOTECHNICAL EVALUATION

Prepared for:

Mr. Jim McMenamin
Senior Vice President, Forward Planning
Zephyr Investors, LLC
700 Second Street
Encinitas, California 92024

Subject Property Location:

Proposed "Zephyr Oceanside" Commercial and Residential Development
Highway 76 and North Foussat Road
City of Oceanside, County of San Diego, California

Prepared by:

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Jeffrey P. Blake
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Principal Geologist

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Carlsbad, California 92008-7207

EEI Project ZEP-72676.4

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this Geotechnical Evaluation is to provide preliminary geotechnical information to Zephyr Investments, LLC ("Client") regarding the subject property in the City of Oceanside, San Diego County, California. The information gathered in this evaluation is intended to provide the Client with an understanding of the physical conditions of site-specific subsurface soils, groundwater, and the regional geologic setting which could affect the cost or design of the proposed development at the property (**Figure 1** -Site Vicinity Map, **Figure 2**-Aerial Site Map).

This Geotechnical Evaluation has been conducted in general accordance with accepted geotechnical engineering principles and in general conformance with the approved proposal and cost estimate for the project by EEI, dated February 7, 2018.

EEI conducted onsite field exploration on August 20, 21 and 31, 2018 that included twelve (12) CPT soundings which were advanced within the property to evaluate liquefaction potential of onsite soils, and the drilling and sampling of six (6) hollow-stem auger geotechnical borings within proposed infiltration basins at the subject property in order to perform infiltration testing. This Geotechnical Evaluation has been prepared for the sole use of Zephyr Investments, LLC. Other parties, without the express written consent of EEI and Zephyr Investments, LLC should not rely upon this Geotechnical Evaluation.

1.2 Project Description

Based on conceptual information provided by the Client (ktgy, 2017), we understand that the current proposed development we understand that the current proposed development will consist of both commercial/retail and residential development. Approximately 300,000 square feet of commercial/retail development, paved parking and drive areas, and other associated improvements are planned within the southwest portion of the 87.5-acre subject property. A residential development with approximately 1,000 units is proposed in the remaining portion of the property, along with related improvements. We also understand that grading for the proposed site is expected to include the placement of fill to raise the existing grades up to approximately 7 feet to achieve proposed finish grades (excluding any remedial grading) and will include the placement of significant quantities of import fill.

1.3 Scope of Services

The scope of our services included:

- A review of readily available data pertinent to the subject property, including published and unpublished geotechnical/geologic reports/maps, and soils data for the area (**References**).

- Conducting a geotechnical reconnaissance of the subject property and nearby vicinity.

- Coordination with Underground Service Alert (USA) to identify the presence of underground utilities for clearance of proposed boring locations.

- Subsurface exploration including the advancement of twelve (12) CPT soundings placed across the property to depths of 50 to 75 feet bgs. Drilling, logging, and sampling of six (6) small diameter exploratory borings in readily accessible areas of the subject property to depths of approximately 6 feet to 8 feet below the ground surface (bgs) within proposed infiltration basins for percolation testing. The approximate locations of each of our borings and percolation tests are presented on **Figure 3** (Geotechnical Map).

- An evaluation of seismicity and geologic hazards including an evaluation of faulting and liquefaction potential.

- Completion of laboratory testing of representative earth materials encountered onsite to ascertain their pertinent soils engineering properties (**Appendix B & B-1**).

- The preparation of this report which presents our preliminary findings, conclusions, and recommendations.

2.0 BACKGROUND

2.1 Subject Property Description

Based on the information provided by the Client, our previous work on the subject property, and a review of the GoogleEarth™ online aerial photography resources, the overall property consists of an approximately 87.5-acre parcel that is located near the northeast corner of the intersection of Highway 76 and North Foussat Road in Oceanside, California. The property is bounded by the San Luis Rey River levee to the northwest, a residential development to the east, Highway 76 and Mission Avenue to the south, and Foussat Road and the Oceanside Municipal Airport to the west. An approximate 18- to 20-foot high rip rap armored levee bounds the north subject property boundary, and apparently was built in the early 1990s adjacent to the San Luis Rey River to mitigate flooding of the property.

The majority of the subject property has not previously been developed. An old drive-in movie theater complex is located in the west central portion of the property, which we understand houses a weekly swap meet. Asphalt concrete pavement covers the movie theater area along with areas covered with gravel. There are a few storage units at the property. This area also includes a portion of the former Foussat Road alignment and portions of vacant lands on either side of the former street. The vacant lots are currently covered with native weeds and grasses that appear to be mowed on a regular basis, while the surface of the former Foussat Road consists of a flexible pavement section. Overhead electric transmission lines are located within the property, as well as underground gas and water lines and reportedly four (4) water wells.

The center of the subject property is approximately situated at 33.2221° north latitude and 117.3415° west longitude (GoogleEarth®, 2018).

2.2 Previous Geotechnical Work

Several prior geotechnical evaluation draft reports have been prepared for proposed developments on the subject site. One report by Eberhart/United dated March 2005 was not a draft report. EEI obtained and reviewed these documents and we present a brief summary of the reports and their general findings here.

Eberhart/United performed a preliminary geotechnical engineering study in 2005 and a draft feasibility study in 2006 consisting of subsurface exploration and laboratory testing. During their subsurface exploration Eberhart/United drilled 9 exploratory borings and advanced 8 CPTs to maximum depths of 50 feet bgs across the property. Eberhart/United found that the site was underlain by alluvial deposits consisting of poorly graded medium-grained sand with trace silt. They encountered groundwater at depths ranging from 7 to 17 feet bgs. Eberhart/United determined that the site is not located within an Alquist-Priolo Earthquake Fault Zone and that there is no evidence of active faulting in the subject site. The site is also not susceptible to slope instability, flooding, soil expansion, tsunamis, or seiches. Eberhart/United did state that the site is potentially susceptible to approximately 1-inch to 3-inches of seismically-induced settlement and liquefaction due to a high groundwater level (at grade).

EEI conducted subsurface exploration and prepared a draft Geotechnical Evaluation in 2008 for a proposed commercial/retail development in the southwestern portion of the subject property. Our subsurface exploration consisted of drilling 21 exploratory borings across the property to depths of 11.5 to 51.5 feet bgs. During our exploration we encountered Quaternary-aged alluvial deposits consisting of fine to coarse-grained sand, silty sand, and sandy silts which are underlain by layers of clayey-sand and clayey silts. Groundwater was encountered at depths ranging from 10 to 15 feet bgs. We concluded that the site is potentially susceptible to liquefaction and seismically-induced settlements ranging from 6- to 9-inches with differential settlement ranging from 3- to 4-inches, based on SPT data from Hollow Stem Auger borings. Static settlements of less than 1-inch were estimated for proposed building loads and planned raised site grades. To mitigate the estimated seismic settlement, we recommended the use of a conventional shallow foundation system that is structurally tied together with grade beams and a structural mat foundation, or alternatively, the use of ground improvement to reduce the susceptibility to liquefaction of the underlying soils. Ground improvement options provided in the report include rammed aggregate piers, vibro-replacement, compaction grouting and deep dynamic compaction.

Group Delta conducted subsurface exploration and prepared a draft Preliminary Geotechnical Report in 2015. Their subsurface exploration consisted of drilling 4 exploratory borings and 8 CPTs across the site to depths of 101 feet bgs. Group Delta described the onsite alluvial soils as consisting of mixtures of sand, silt, and clay. They encountered groundwater at depths of 24 to 28 feet bgs. Group Delta concluded that the site is potentially susceptible to liquefaction and seismically-induced settlements on the order of 2 to 8-inch based on data from both borings and CPT Soundings. Group Delta indicated that lateral spreading displacements of up to 3 feet are possible adjacent to the San Luis Rey river levee along the western side of the property and that a setback of at-least 100 feet is necessary for any proposed structures.

Available Boring logs, CPT soundings and laboratory data from these geotechnical evaluations are included in the Appendices herein.

2.3 Topography

The subject property is located in the 7.5-minute San Luis Rey Topographic Quadrangle (USGS, 2015). The property is relatively flat lying with elevation ranging from 30 to 40 feet above sea level (USGS, 2015).

3.0 FIELD EXPLORATION, SUBSURFACE CONDITIONS AND LABORATORY TESTING

3.1 Field Exploration

Field work for our Geotechnical Evaluation was conducted on August 20, 21, and 29, 2018. A total of six (6) hollow-stem auger borings and twelve (12) CPT soundings were advanced at the subject property in readily accessible areas. Boring depths ranged from approximately 6 to 8 feet bgs and were logged under the supervision of a Registered Professional Engineer and Certified Engineering Geologist at EEI. CPT soundings were advanced to depths of 50 and 75 feet. The approximate locations of the borings, percolation tests, and soundings are shown on **Figure 3**.

A truck mounted B-53 hollow-stem auger (HSA) drill rig was used to advance borings B-1/P-1 through B-6/P-6. A CPT rig was used to advance CPT-1 through CPT-12 soundings. Blow count (N) values were determined utilizing a 140-pound hammer, falling 30-inches onto a Standard Penetration Test (SPT) split-spoon sampler and a Modified California split-tube sampler.

The blows per 6-inch increment required to advance the 18-inch long SPT and 18-inch long Modified California split-tube samplers were measured at various depth intervals (varying between 2 to 8 feet), or at changes in lithology, recorded on the boring logs, and are presented in **Appendix A** (Soil Classification Chart and Boring Logs). Energy-corrected SPT N_{60} values are also presented on the borings logs.

Relatively "undisturbed" samples were collected in a 2.42-inch (inside diameter) California Modified split-tube sampler for visual examination and laboratory testing. The soils were classified in accordance with the Unified Soil Classification System (ASTM, 2015). Representative bulk samples were also collected for appropriate laboratory testing.

3.2 Laboratory Testing

Selected samples obtained from our borings were tested to evaluate pertinent soil classification and engineering properties and enable development of geotechnical conclusions and recommendations. The laboratory tests consisted of:

- Moisture Content and Dry Density
- #200 Sieve Wash

Laboratory testing was conducted during the Eberhart/United (2006), EEI (2008), and Group Delta (2015). Laboratory tests from these draft reports consisted of:

- Moisture Content and Dry Density
- #200 Sieve Wash
- Direct Shear
- Expansion Index
- Consolidation
- Corrosion
- Sand Equivalent
- Atterberg Limits
- R-Value

The results of the laboratory tests from this report, and brief explanations of test procedures, are presented in **Appendix B**. The results of the laboratory tests from the Eberhart/United (2005), EEI (2008), and Group Delta (2015) draft reports are included in **Appendix B-1**. The laboratory results from the Eberhart/United (2006) report were not provided to us and are not included within **Appendix B-1**. It should be understood that the results provided in **Appendices B & B-1** are based upon pre-development conditions. Verification testing is recommended at the conclusion of grading on samples collected at or near finish grade.

4.0 GEOLOGIC SETTING AND SUBSURFACE CONDITIONS

4.1 Geologic Setting

Regionally, the subject property lies within the Peninsular Ranges Geomorphic Province of southern California. This province consists of a series of ranges separated by northwest trending valleys; sub parallel to branches of the San Andreas Fault (CGS, 2002). The Peninsular Ranges geomorphic province, one of the largest geomorphic units in western North America, extends from the Transverse Ranges geomorphic province and the Los Angeles Basin, south to Baja California. It is bound on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province. The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks (CGS, 2002). Major fault zones and subordinate fault zones found in the Peninsular Ranges Province typically trend in a northwest-southeast direction. Regional geologic maps of the subject property and vicinity (Kennedy & Tan, 2007) indicate the property is underlain by late Pleistocene to Holocene Young Alluvial Flood Plain deposits (map symbol Qya). These deposits consist of poorly sorted sands, gravels, silts and clay that were deposited by the San Luis Rey river.

4.2 Subsurface Conditions

The subsurface materials encountered in our exploratory borings consisted of Quaternary alluvial flood plain deposits. A brief description of the subsurface conditions is provided in the following section. Detailed descriptions of the subsurface conditions are provided on the boring logs included in **Appendix A & A-1**.

Quaternary Alluvial Flood Plain Deposits – Alluvial flood plain deposits were encountered in all of our exploratory borings to maximum depths of 8 feet bgs, and within the CPTs to maximum depths of 75 feet bgs. These alluvial deposits consist of interbedded layers of fine to medium-grained sand, silty sand, sandy/clayey silt, and low plasticity clay. These materials were observed to be typically moist and medium dense at the time of our subsurface exploration. The prior subsurface explorations from EEI (2008) and Group Delta (2015) found that the alluvial deposits generally consisted interbedded layers of fine to medium-grained sand, silty sand, sandy/clayey silt, and low plasticity clay that ranged from moist to wet, and loose to medium dense to dense to the maximum explored depths of 101 feet.

Minor amounts of artificial fill that appeared to be derived from the alluvial materials were encountered in one of our borings B-10 (EEI, 2008) and were about 3 to 5 feet thick. Other areas underlain by fill should be anticipated on the site associated with existing site improvements and utility trench backfill.

4.3 Groundwater

Groundwater was not encountered in any of our recent HSA borings at the time of drilling to maximum depths of 8 feet bgs. The CPT soundings estimated groundwater at depths of 11 to 20 feet bgs based on pore water dissipation information with the shallowest depths occurring in the southwestern part of the study area. Based upon information provided in the referenced geotechnical reports on the subject property (Eberhart/United, 2005, 2006; EEI, 2008; Group Delta, 2015), groundwater was encountered at depths ranging from 7 to 28 feet bgs at the time of drilling. Eberhart/United indicated groundwater levels at time of drilling was 7 feet to 17 feet bgs but indicated post drilling groundwater levels that stabilized to depths of 15 to 35 feet (Eberhart/United 2005/2006). Groundwater was encountered at depths ranging from 10 and 15 feet bgs during our previous Geotechnical subsurface exploration (EEI, 2008). Groundwater was encountered at depths ranging from 24 to 28 feet bgs during Group Delta's Geotechnical subsurface explorations (Group Delta, 2015).

The groundwater surface in the general vicinity of the site appears to be related to a large extent to the nearby San Luis Rey River and can be expected to vary in response to fluctuations in water flow within the river, the distance of the site from the river and other factors. Review of well data contained in California Department of Water Resources' electronic groundwater level database (DWR, 2018) indicates that during January and February of 1966, measurements in two (2) wells near the site showed groundwater to be at depths of between 18 and 24 feet below ground surface (bgs). Other data released by the California Depart of Water Resources (DWR, 1967) indicated measured depths to groundwater to range from 26 feet to 50 feet below ground surface between 1952 and 1964. Our review of a previous geotechnical evaluation conducted in the vicinity of the site encountered groundwater at depths between 7 and 17 feet below the existing ground surface (Leighton, 1992). Our review of groundwater data published by Izbicki (1985) reveals that measured groundwater levels were approximately 5 to 7.5 feet below ground surface in the vicinity for the year 1982-1983. The data suggests that groundwater has been present at or below a depth of 10 feet for about the last 40 years. This appears to be consistent with the adjacent San Luis Rey river bed at about an elevation of 28 msl to 32 msl. Overall groundwater flow is anticipated to be westward toward the Pacific Ocean.

It should be noted that variations in groundwater may result from fluctuations in the ground surface topography, subsurface stratification, precipitation, irrigation and other factors that may not be currently evident. In general, groundwater is often expected to follow the direction of surface topography. Based on topography, local groundwater flow is expected to be in a westerly direction.

5.0 GEOLOGIC HAZARDS

5.1 California Building Code Seismic Design Parameters

EEI utilized seismic design criteria provided in the CBC (2016) and ASCE 7-10. Final selection of the appropriate seismic design coefficients should be made by the structural consultant based on the local laws and ordinances, expected building response, and desired level of conservatism. The site coefficients and adjusted maximum considered earthquake spectral response accelerations in accordance with the 2016 California Building Code are presented in **Table 1**.

TABLE 1 2016 CBC Seismic Parameters and Peak Ground Acceleration	
Parameter	**Value**
Site Coordinates	Latitude 33.22208° Longitude -117.34154°
Mapped Spectral Acceleration Value at Short Period: $\mathbf{S_s}$	1.089g
Mapped Spectral Acceleration Value at 1-Second Period: $\mathbf{S_1}$	0.421g
Site Classification	D
Short Period Site Coefficient: $\mathbf{F_a}$	1.064
1-Second Period Site Coefficient: $\mathbf{F_v}$	1.579
Design Spectral Response Acceleration at Short Periods: $\mathbf{S_{DS}}$	0.773g
Design Spectral Response Acceleration at 1-Second Period: $\mathbf{S_{D1}}$	0.443g
Peak Ground Acceleration adjusted for Site Class Effects: $\mathbf{PGA_M}$	0.450g

5.2 Faulting and Surface Rupture

The subject property is located within an area of California known to contain a number of active and potentially active faults. There are no known active faults crossing the property (Jennings and Bryant, 2010) and the property is not within a State of California Earthquake Fault Zone (Hart and Bryant, 1997; CDMG, 2000). The closest known active fault is the Newport-Inglewood Fault Zone, located offshore approximately 6.85 miles west of the property (USGS, 2008). Therefore, the potential for surface rupture at the property is considered low. Three of the closest faults along with their distance from the property and Maximum Magnitude are shown in **Table 2.**

TABLE 2 Nearby Active Faults		
Fault	**Distance in Miles (Kilometers)[1]**	**Maximum Magnitude[1]**
Newport-Inglewood (Offshore)	6.85 (11.02)	7.5
Rose Canyon	8.36 (13.45)	6.9
Elsinore	20.92 (33.67)	7.8

1. USGS Online Fault Search (2008)

5.3 Landslides and Slope Stability

The subject property and surrounding areas are generally relatively flat. As a result, we consider the potential for landslides or slope instabilities to occur at the property to be negligible.

5.4 Liquefaction Potential and Lateral Spreading

Liquefaction occurs when loose, saturated, generally cohesionless fine sands and non-plastic silts are subjected to strong ground shaking. The soils lose shear strength and become liquid; potentially

resulting in large total and differential ground surface settlements as well as possible lateral spreading during an earthquake. Seismically induced settlement can occur in response to liquefaction of saturated loose granular soils, as well as the reorientation of soil particles during strong shaking of loose, unsaturated sands.

Groundwater was not encountered in any of the recent exploratory HSA borings to the maximum explored depths of 8 feet bgs. The CPT soundings estimated groundwater at depths of 11 to 20 feet bgs, based on pore water dissipation. The previous subsurface explorations by Eberhart United (2005/2006) EEI (2008) and Group Delta (2015) encountered groundwater at depths ranging from 10 to 35 feet bgs. We have used a groundwater level of 10 feet below the existing ground surface for our analysis.

Our evaluation of the site's susceptibility to liquefaction was performed in accordance with the procedure recommended by The National Center for Earthquake Engineering Research (NCEER- 1998, and Youd, et al., 2001). The liquefaction potential was estimated using the CLiq computer program (Geologismiki, 2015), which incorporates the CPT data from CPT-1 through CPT-12. Our evaluation was based on the site class adjusted peak ground acceleration PGA_m of 0.450g, as presented in Table 1**.** Deaggregation of the probabilistic ground motion at the subject property was performed using the USGS 2008 interactive webpage which estimates the modal magnitude for a given probabilistic seismic ground motion. A 2% probability of exceedance in 50 years (2,475 year return period) was utilized. Results of our seismic hazard deaggregation yielded a modal magnitude of 6.72, which is the magnitude used in our seismic settlement analysis. Our evaluation was performed on the data from all twelve of the CPT soundings. The results (**Appendix C**), of our calculations indicate that during a design level earthquake along a nearby fault, the sand and silt layers encountered in CPT-1 through CPT-12 at various depths between the existing surface and 50 feet below existing grade are susceptible to liquefaction. Based on our evaluation, we estimate the total vertical seismic-induced settlement to range from 1-inch to 6-inches and differential seismic-induced settlements to range from 0.6 to 4-inches across a 50-foot span. Individual CPT results, as well as a chart summarizing the overall settlement in each CPT are included in **Appendix C – Seismic Settlement Analysis.**

This information is supported by previous liquefaction analyses conducted by Eberhart/United (2006), EEI (2008), and Group Delta (2015). The specific data from the Eberhart/United (2006) report was not made available to us, however Eberhart/United reported in their 2005 report and their 2006 draft report that onsite alluvial soils had a potential for 1- to 2-inches of vertical settlement and a potential for 2-inches of differential settlement over a distance of 100 to 200 feet. EEI (Draft 2008) conducted liquefaction analyses on two (2) HSA borings in the southern/southwestern part of the study area (borings B-1 and B-21; see **Figure 3** for locations). The liquefaction potential was estimated using the LiquefyPro computer program (CivilTech, 2003), which incorporates Tokimatsu and Seed's procedure (1987). EEI (2008) found that the onsite alluvial soils had the potential for 6 to 9-inches of vertical settlement and 3 to 5-inches of differential settlement, based solely on SPT data from Hollow Stem Auger borings. Group Delta (Draft 2015) found that vertical settlement varied from 2 to 4-inches, based on CPT data, with up to 8-inches based on SPT data from borings, with the highest settlements occurring in the central and western part of the property.

It is our opinion that the higher settlements that can be attributed to the Hollow Stem Auger (HSA) and rotary wash borings is because HSA borings tend to overestimate the settlements as compared to CPT Soundings which provide a continuous profile (CPT data for every one (1) vertical foot, versus more than a foot to five foot boring sampling intervals). Therefore, it is our opinion that the results of the CLiq liquefaction and seismically induced settlement analyses utilizing the CPT sounding data is considered to be more reliable and accurate.

Cyclic mobility is a liquefaction phenomenon, triggered by cyclic loading, occurring in soil deposits with static shear stresses lower than the soil strength. Deformations due to cyclic mobility develop incrementally because of static and dynamic stresses that exist during an earthquake. Lateral spreading, a common result of cyclic mobility can occur on gently sloping ground close to rivers and lakes and the movement of liquefied soil downslope towards a free face slope condition such as the adjacent San Luis Rey River levee along the western portion of the subject site. These conditions generally do not exist on the majority of the subject property, given the distance of the majority of the planned subject development structures from the San Luis Rey River, and that the site is anticipated to be relatively level in its as-graded configuration. However, our evaluation of the site's susceptibility to lateral spreading was performed for the western portion of the site in accordance with the procedure by Youd, Hansen and Bartlett, 2002 for prediction of lateral spread displacement (Youd, Hansen and Bartlett, 2002). Our analysis incorporates data from CPT-5, CPT-11, and CPT-12 and indicates that the potential slope movements could range on the order of approximately 1-1/2 to 3 feet as a result of lateral spreading (**Appendix C**). Our results generally concur with Group Delta's (2015) findings that the onsite alluvial soils adjacent to the levee are potentially susceptible to 1 to 3-feet of lateral spreading. Conceptual site plans provided (ktgy, 2017) indicate an approximately 80 to 100 foot wide buffer or landscape area runs parallel to the top of the levee and therefore a setback of approximately 100 feet will be present for the proposed buildings. It is our opinion that this setback distance should be adequate along with the recommendations provided herein to mitigate the effect of lateral spreading towards the river.

5.5 Tsunamis, Flooding and Seiches

EEI reviewed the CGS Tsunami Inundation Map for the Oceanside/San Luis Rey quadrangles and determined that the subject property is not located within a Tsunami Evacuation Area; therefore, damage due to tsunamis is considered low (CGS, 2009).

EEI reviewed the Federal Emergency Management Agency (FEMA, 2012) Flood Insurance Rate Map (FIRM) panel 06073C0752H to determine if the subject property was located within an area designated as a Flood Hazard Zone. The property is within Zone A99 described as an area that is to be protected from a 1% annual chance flood event by a Federal flood protection system; therefore, the damage due to flooding is considered low.

Seiches are periodic oscillations in large bodies of water such as lakes, harbors, bays, or reservoirs. The subject property is not located immediately adjacent to any lakes or confined bodies of water; therefore, the potential for a seiche to affect the site is considered low.

5.6 Expansive Soil

Laboratory test results from the EEI (2008) draft report indicate the near surface onsite soils have a very low expansion potential. The expansion potential of these materials is not considered to pose a hazard for the proposed development.

6.0 CONCLUSIONS

Based on our field exploration, laboratory testing and engineering and geologic analysis, it is our opinion that the subject property is suitable for the proposed development project from a geotechnical engineering and geologic viewpoint; however, there are existing geotechnical conditions associated

with the property that will warrant mitigation and/or consideration during planning stages. The predominant geological considerations at this site include the presence of a relatively shallow ground water surface, unconsolidated alluvial soils, and the site's susceptibility to intense ground shaking due to a nearby seismic event. Based on these conditions, the primary geotechnical constraints to the proposed construction include seismically-induced liquefaction. If site plans and/or the proposed building locations are revised, additional field studies may be warranted to address proposed site-specific conditions. The main geotechnical conclusions for the project are presented in the following text.

- A total of six (6) exploratory HSA borings were advanced within the subject property during this evaluation. HSA boring depths ranged from 6 to 8 feet bgs, and percolation tests were conducted in order to ascertain the infiltration potential of onsite soils. Twelve (12) CPT soundings were advanced to maximum depths of 50 to 75 feet bgs. The property is underlain by Quaternary-aged alluvial flood plain deposits consisting of sand, silt, and clay mixtures.

- Native earth materials appear to be suitable for use as structural fill provided they are moisture conditioned (as needed), meet EEI's recommendations for size (**Section 7.4**), and are properly compacted.

- Groundwater was not encountered in any of our HSA borings to the maximum explored depth of 8 feet bgs during this evaluation. The CPT soundings estimated groundwater at depths ranging from 11 to 20 feet bgs based on pore water dissipation. Previous site exploration by EEI (2008) and others as discussed and referenced herein encountered groundwater at depths of 10 to 35 feet bgs.

- Standard heavy-duty grading equipment is anticipated to excavate the alluvial deposits.

- The subject property is located within an area of southern California recognized as having a number of active and potentially-active faults located nearby. Our review indicates that there are no known active faults mapped as crossing the property and the property is not located within an Earthquake Fault Zone.

- Based on EEI's evaluation, Earth materials underlying the subject property are considered potentially susceptible to significant amounts of seismic settlement. Localized zones within the earth materials underlying the site of the proposed commercial development appear to be susceptible to liquefaction, with associated total and differential seismic settlements estimated to be 1- to 6-inches and 0.6 to 4-inches, respectively. The potential lateral spreading in the western part of the site along the levee ranges from 1-1/2 to 3 feet. It is our opinion that a 100 foot setback distance should be adequate along with the recommendations provided herein to mitigate the effect of lateral spreading towards the river.

- The onsite soils are predominantly sands and silty sands and in general are anticipated to have a very low to low expansion potential (EI ≤ 50). It should be noted, however, that localized clayey soils could potentially be expansive (EI > 50), and should be further evaluated during future studies or during earthwork when the proposed building pads are near finish grade.

- The existing upper portions of alluvial deposits and any existing fill are variable in density and are considered potentially compressible. As such, they are considered unsuitable for the support of settlement-sensitive structures or additional fill in their current condition. Therefore, these materials should be removed and recompacted in those areas to receive additional fill, proposed buildings and other settlement-sensitive improvements. Based on the results of our subsurface exploration, we anticipate that these removals need to extend up to approximately 7 feet below existing site grades.

- A conventional shallow foundation system in conjunction with a concrete slab-on-grade floor appears to be suitable for support of the proposed residential buildings.

7.0 RECOMMENDATIONS

The recommendations presented herein should be incorporated into the planning and design phases of development. Guidelines for site preparation, earthwork, and onsite improvements are provided in the following sections. Our recommendations include alternative measures to mitigate the effects of seismically induced liquefaction. These include the use of a conventional foundation system that is structurally tied together with reinforced concrete grade beams, a reinforced concrete structural mat foundation and post tensioned slab foundation to support the proposed buildings. As another alternative, soil improvement involving densification of the soils at depth can be performed to reduce the soils' susceptibility to liquefaction so that a conventional foundation system without grade beams (as described above) can be used for building support. However, it is our understanding that recommendations for ground improvement options are not desired and are not considered economically feasible. As such, we are providing recommendations for special foundation systems to mitigate the effects of seismically induced liquefaction. If Zephyr desires geotechnical recommendations for ground improvement options, we would be pleased to provide them upon request. These measures are discussed in the following sections.

7.1 General

Grading should conform to the guidelines presented in the 2016 California Building Code (CBC, 2016), as well as the requirements of the City of Oceanside. Additionally, general Earthwork and Grading Guidelines are provided herein as **Appendix E**.

During earthwork construction, removals and reprocessing of soft or unsuitable fill and alluvial materials, as well as general grading procedures of the contractor should be observed and the fill placed should be selectively tested by representatives of the geotechnical engineer, EEI. If any unusual or unexpected conditions are exposed in the field, they should be reviewed by the geotechnical engineer and if warranted, modified and/or additional recommendations will be offered. Specific guidelines and comments pertinent to the planned development are provided herein.

The recommendations presented herein have been completed using the preliminary information provided to us regarding site development. EEI should be provided with grading and foundation plans once they are available so that we can determine if the recommendations provided in this report remain applicable.

7.2 Site Preparation and Grading

Debris and other deleterious material, such as organic soils, tree rootballs and/or environmentally impacted earth materials (if any) should be removed from the subject property prior to the start of grading. All undocumented fill/backfill encountered should be removed and recompacted. Areas to receive fill should be properly scarified and/or benched in accordance with current industry standards of practice and guidelines specified in the CBC (2016) and the requirements of the local jurisdiction.

Abandoned trenches should be properly backfilled and tested. If unanticipated subsurface improvements (utility lines, septic systems, wells, utilities, etc.) are encountered during earthwork construction, the Geotechnical Engineer should be informed and appropriate remedial recommendations would then be provided.

7.3 Remedial Earthwork

Remedial grading for the proposed residential building pads and for pavement and hardscape areas is provided in the following sections. Unless noted otherwise, fill should be moisture conditioned to at least the optimum moisture content and compacted to at least 90 percent of the maximum dry density (based on ASTM D1557).

Building Pads and other Settlement Sensitive Structures: The surficial soils comprised of fill and the upper portions of the alluvial deposits vary in density and are considered potentially compressible. As such, these materials are considered unsuitable for the support of settlement-sensitive structures or additional fill in their current condition.

Based on this information, we recommend the over-excavation and re-compaction (remedial grading) of the materials within the proposed grading limits of the building pads and other settlement sensitive structures. These removals should extend to a minimum of 7 feet below the existing ground surface or 24-inches below the bottom of foundations, whichever is deeper. The remedial earthwork should encompass the entire building pad area and extend laterally at least 10 feet beyond the proposed building footprints, as well as at least five (5) feet outside the edge of entryways and canopies, loading docks, drive-through approaches and other appurtenances attached to the main building. The limits of any over-excavation should be further evaluated once a precise grading plan for the site with finish grade elevation(s) is made available. Note that vertical sides exceeding five (5) feet in depth may be prone to sloughing and may require laying back to an inclination of 1:1 (horizontal to vertical). Some locations that are close to property lines and existing improvements may require temporary shoring or slot cutting methods.

Other Settlement Sensitive Structures: Similar remedial grading should be performed below other settlement sensitive improvements such as retaining walls. If over-excavations for improvements are not performed in these areas, these improvements may be subject to settlement.

Additionally, removal and recompaction of the upper 24-inches of subgrade in proposed pavement and hardscape areas is also recommended. The over-excavation should extend at least 5 feet outside paved or hardscape areas.

7.4 Fill Material and Placement

Fill materials should be compacted to at least 90 percent of the maximum dry density (based on ASTM D1557). Unless noted otherwise, fill should be moisture conditioned to at least 2 percent above the optimum moisture content and compacted to at least 90 percent of the maximum dry density (based on ASTM D1557). Fill material should be free of organic matter (less than 3 percent organics by weight) and other deleterious material. Fill material should not contain rocks greater than 6-inches in maximum dimension, organic debris and other deleterious materials. Rock fragments exceeding 6-inches in one dimension should be segregated and exported from the subject property or utilized for landscaping.

Shallow Foundations with Slab on Grade: Fill within 4 feet of pad grade should consist of low expansion potential material (EI < 50). The low-expansion potential material should extend at least 5 feet beyond the building perimeter.

Hardscape: Fill within 2 feet of hardscape subgrade should consist of low-expansive material (EI < 50). The low-expansion potential material should extend at least 2 feet beyond the hardscape.

For Import soils: The earthwork contractor should ensure that all proposed fill materials are approved by the Geotechnical Engineer prior to use. Representative soil samples should be made available for testing at least ten (10) working days prior to hauling to the property to allow for laboratory tests.

Those areas to receive fill or surface improvements should be scarified at least 6-inches; moisture conditioned to at least 2 percent over optimum moisture content and re-compacted to at least 90 percent of the maximum dry density (based on ASTM D1557). The subgrade should be thoroughly and uniformly moistened prior to placing concrete.

7.5 Expansive Soil

The onsite soils are anticipated to possess a very low expansion potential. The recommendations presented in this report reflect a low expansion potential.

7.6 Yielding Subgrade Conditions

The soils encountered at the subject property can exhibit "pumping" or yielding if they become saturated. This can often occur in response to periods of significant precipitation, such as during the winter rainy season. If this occurs and in order to help stabilize the yielding subgrade soils within the bottom of the removal areas, the contractor can consider the placement of stabilization fabric or geo-grid over the yielding areas, depending on the relative severity. Mirafi 600X (or approved equivalent) stabilization fabric may be used for areas with low to moderate yielding conditions.

Geo-grid such as Tensar TX-5 may be used for areas with moderate to severe yielding conditions. Uniform sized, ¾- to 2-inch crushed rock should be placed over the stabilization fabric or geo-grid. A 6- to 12-inch thick section of crushed rock will typically be necessary to stabilize yielding ground.

If significant voids are present in the crushed gravel, a filter fabric should be placed over the crushed gravel to prevent migration of fines into the gravel and subsequent settlement of the overlying fill. Fill soils, which should be placed and compacted in accordance with the recommendations presented herein, should then be placed over the fabric or geo-grid until design finish grades are reached. The

crushed gravel and stabilization fabric or geo-grid should extend at least 5 feet laterally beyond the limits of the yielding areas. These operations should be performed under the observation and testing of a representative of EEI in order to evaluate the effectiveness of these measures and to provide additional recommendations for mitigation, as necessary.

7.7 Shrinkage and Bulking

Several factors will impact earthwork balancing on the subject property, including shrinkage, bulking, subsidence, trench spoils from utilities and footing excavations, and final pavement section thickness as well as the accuracy of topography. Shrinkage, bulking and subsidence are primarily dependent upon the degree of compactive effort achieved during construction. Shrinkage, bulking and subsidence should be considered by the project civil engineer relative to final site balancing. It is recommended that the site development be planned to include an area that could be raised or lowered to accommodate final site balancing. We estimate the existing surficial soils subject to removal and recompaction will shrink approximately 10 to 15 percent. Reprocessing of removal bottoms is anticipated to result in a general subsidence of approximately 0.1 feet. The estimates of shrinkage and subsidence are intended as an aid for project engineers in determining earthwork quantities. However, these estimates should be used with some caution since they are not absolute values. Contingencies should be made for balancing earthwork quantities based on actual shrinkage and subsidence that occurs during the grading process.

7.8 Temporary Site Excavations

Based on the results of our subsurface exploration, we anticipate that excavations can generally be accomplished by conventional heavy-duty earth moving equipment in good working condition. However, excavations may encounter localized harder, cemented zones that may require air hammer attachments to excavators, or specialized excavation equipment. Excavations in the onsite materials could generate oversize materials. Oversize materials should be placed in accordance with **Section 7.5** and the Earthwork and Grading Guidelines.

Temporary excavations within the onsite materials (considered to be a Type C soil per OSHA guidelines) should be stable at 1.5H:1V inclinations for short durations during construction, and where cuts do not exceed 15 feet in height or penetrate into groundwater. Some sloughing of surface soils should be anticipated. Temporary excavations 4 feet deep or less can be made vertically.

Groundwater was encountered at a depth of approximately 10 feet bgs during previous subsurface exploration at the subject site. The presence of groundwater could impact construction of deeper underground utilities that require excavation below the groundwater level. Excavations below groundwater may require dewatering and may require stabilization prior to placement of bedding for piping. If excavations for utilities will extend below groundwater, specific recommendations should be provided by a qualified consultant or specialty contractor for dewatering.

The faces of temporary slopes should be inspected daily by the contractor's Competent Person before personnel are allowed to enter the excavation. Any zones of potential instability, sloughing or raveling should be brought to the attention of the Engineer and corrective action implemented before personnel begin working in the excavation.

Excavated soils should not be stockpiled behind temporary excavations within a distance equal to the depth of the excavation. EEI should be notified if other surcharge loads are anticipated so that lateral load criteria can be developed for the specific situation. If temporary slopes are to be maintained during the rainy season, berms are recommended along the tops of slopes to prevent runoff water from entering the excavation and eroding the slope faces.

8.0 FOUNDATION RECOMMENDATIONS

8.1 General

In the event that plans concerning the proposed building structures are revised in the project design and/or location or loading conditions of the planned structures are made, conclusions and recommendations contained in this report should not be considered valid unless they are reviewed, revised and/or approved in writing by EEI. As discussed in section 5.4 the site is susceptible to liquefaction. Although ground improvement or deep soil improvement can also be performed to mitigate the effects of liquefaction at the site, when performed properly, soil improvement can be expected to increase the site's resistance to liquefaction to the point where special foundation systems are not warranted. However, it is our understanding that recommendations for ground improvement options are not desired and are not considered economically feasible. As such, we are providing recommendations for special foundation systems. If Zephyr desires geotechnical recommendations for ground improvement options, we would be pleased to provide them upon request.

8.2 Preliminary Foundation Design

As discussed in section 5.4 the site is susceptible to liquefaction. To mitigate the effects of liquefaction conditions, along with the recommended remedial earthwork in section 7.4, we are including three (3) alternative foundation systems to mitigate the effects of seismically induced liquefaction. We recommend the proposed retail and residential structures be supported by a foundation system consisting of 1) a structural slab with grade beams, 2) a reinforced concrete structural mat foundation (mat slab), or 3) a post-tensioned slab. Other foundation systems, such as drilled piers and driven piles can also be used for building support and based on our geotechnical evaluation, along with our review of pertinent geotechnical literature; such foundations systems may not be economically feasible for structural support at the subject site. As such, we are not providing recommendations for ground improvement or the design and construction of deep foundations herein. If Zephyr desires geotechnical recommendations for deep foundations, we would be pleased to provide them upon request.

The following design parameters assume that the minimum recommended remedial grading will be performed, and that foundations for the proposed residential/retail buildings will consist of shallow stiffened foundations with a slab on grade. The foundation recommendations provided herein are based on the soil materials within 36-inches of foundation level possessing a low expansion potential (EI<50). Recommendations by the project's design-structural engineer or architect may exceed the following minimum recommendations.

The intent of the seismic design provisions of the California Building Code is to reduce the potential for structural damage to levels such that collapse will not occur, given a design level earthquake. It should be understood, however, that some structural damage could occur that could require considerable repair prior to reoccupation or the resumption of normal operations within the building(s).

In light of this, we recommend that the project structural engineer evaluate whether the seismically induced ground shaking, liquefaction, and dynamic settlements estimated herein are of a magnitude to induce structural collapse of the planned structures supported on shallow foundation systems that are stiffened. If the structural engineer determines that the planned structures are at risk for structural collapse due to seismically induced ground shaking and/or ground deformations, if they are supported by this type of foundation system, then the foundation design should be further revised to incorporate additional grade beams/"stiffeners" to help increase its rigidity to the point where it can adequately tolerate ground displacements without collapse.

In preparation for foundation construction, the earthwork contractor should ensure that the site has been prepared as recommended, and that field density tests have been performed to adequately document the relative compaction of structural fill. Foundation design recommendations for the proposed structure is provided in the following sections of this report.

8.2.1 Alternative 1 – Conventional Shallow Foundations with Grade Beams

For proposed three- to four-story wood frame residential buildings and retail/commercial buildings conventional continuous and/or isolated shallow spread footings should bear entirely on compacted fill with remedial grading as described in previous sections of this report. Foundations should be constructed with an embedment of at least 24-inches below finish grade and a minimum width of 24-inches. Isolated footings should have a minimum width of 24-inches. An allowable bearing capacity of 2,000 pounds per square foot (psf) can be used for footings extending at least 24-inches below lowest adjacent finished grade. The allowable bearing may be increased by 750 psf for each additional 12-inches of embedment up to a maximum bearing of 3,000 psf. The bearing value can be increased by ⅓ when considering the total of all loads, including wind or seismic forces.

Based on the prevailing geotechnical conditions encountered during our geotechnical evaluation as described herein, we recommend that foundations be reinforced with at least two (2) No. 4 bars, one (1) placed at the top of the footing and one (1) placed at the bottom.

The recommendations for footings sizes and reinforcement are considered minimums and are not intended to supersede the design of the project structural engineer.

To help resist the effects of seismically-induced liquefaction and settlement of the soils that underlie the site, we recommend that the foundations supporting the proposed buildings be structurally interconnected through the use of reinforced concrete grade beams. These grade beams can provide added rigidity to the foundation system and can help the foundation system behave as a structural unit to span areas of settlement, while helping to reduce the potential for structural collapse.

8.2.2 Alternative 2 – Mat Foundations

A rigid mat foundation may be used for the support of the buildings at the site, provided the mat foundation is bearing within fill soils that are properly placed and compacted in accordance with the recommendations contained herein. When properly designed and constructed, a structural mat foundation system can be expected to support high structural loads and provide relatively uniform settlement across a structure, while being able to "bridge" over local areas of

dynamic settlement, resulting in differential settlements that should be within structural settlement criteria. Mat foundations should be properly reinforced to form a relatively rigid structural unit in accordance with the structural engineers design. For designing a mat foundation, we recommend using an uncorrected modulus of subgrade reaction of 100 tons per cubic foot (tcf). For large foundations, the modulus is typically reduced by 75 percent (i.e., to 25 tcf). The mat foundation may also be designed for a maximum bearing pressure of 1,500 psf with a one third increase for transient loadings. Mat foundations should be reinforced in accordance with structural considerations.

If the buildings experience seismically induced settlements that result in the structures being significantly out-of-plumb, the buildings could be subsequently re-leveled by pressure grouting or other methods in conjunction with other earthquake repairs.

Based on the above information, we recommend that the project structural engineer evaluate whether a mat foundation system can be economically constructed to tolerate seismically induced ground shaking, liquefaction, and dynamic settlements estimated herein without structural collapse. If the structural engineer determines that mat foundations cannot be feasibly constructed for the seismic conditions at the site, then consideration should be given for the use of another foundation type for building support or the implementation of ground improvement methods.

8.2.3 Alternative 3 – Post Tensioned Foundations

Perimeter edge beams for the post-tensioned slab should have a minimum effective width of 12 inches and be founded at a minimum depth of 12 inches below the lowest adjacent final ground surface. Interior beams may be founded at a minimum depth of 12 inches below the bottom of the finished floor slabs. Provided site grading is performed in accordance with the recommendations provided herein, a bearing value of 1,500 pounds per square foot (psf) may be used for continuous beams on post-tensioned slab systems. The beams should have a minimum effective width of 12 inches and founded at a minimum of 12 inches below the lowest adjacent grade. Recommended allowable bearing values include both dead and live loads, and may be increased by one-third for wind and seismic forces.

Based on the guidelines provided in the "Design of Post-Tensioned Slabs-on-Ground" 3rd Edition by Post-Tensioning Institute, the em and ym values for expansive soil conditions are summarized below. These values also consider the estimated potential differential settlement due to seismic settlement.

TABLE 3
Geotechnical Parameters for Post Tensioned Slab Design

Expansion Potential	Center Lift e_m	Edge Lift e_m	Center Lift y_m	Edge Lift y_m
Very Low to Low (EI = 0 – 50)	9.0 ft.	4.7 ft.	1.29 in.	1.89 in.

8.3 Lateral loads

Lateral loads will be resisted by friction between the bottoms of foundations and passive pressure on the faces of footings and other structural elements below grade. An allowable passive pressure of 300 psf per foot of depth can be used for the portion of the foundation below grade. An allowable coefficient of friction of 0.30 can be used. The passive pressure can be increased by ⅓ when considering the total of all loads, including wind or seismic forces. The upper one-foot of soil should not be relied on for passive support unless the ground is covered with pavements or slabs.

8.4 Settlement

Settlement estimates for foundations are as follows:

- Seismic Total Settlement: 6- inches
- Seismic Differential Settlement: 4-inches over a distance of 40 feet.
- Static Total Settlement: Less than 1-inch
- Static Differential Settlement: Less than ½-inch over a distance of 40 feet

8.5 Footing Setbacks

Footings adjacent to unlined drainage swales or underground utilities (if any) should be deepened to a minimum of 6-inches below the invert of the adjacent unlined swale or utilities. This distance is measured from the footing face at the bearing elevation. Footings for structures adjacent to retaining walls should be deepened so as to extend below a 1:1 projection from the heel of the wall. Alternatively, walls may be designed to accommodate structural loads from buildings or appurtenances.

8.6 Conventional Retaining Walls

8.6.1 Foundations

The recommendations provided in the conventional foundation section of this report are also applicable to conventional retaining walls.

8.6.2 Lateral Earth Pressure

The following parameters are based on the use of low-expansion potential backfill materials within a 1:1 (H:V) line projected from the heel of the retaining wall.

The active earth pressure for the design of unrestrained earth retaining structures with level backfills can be taken as equivalent to the pressure of a fluid weighing 40 pcf. The at-rest earth pressure for the design of restrained earth retaining structures with level backfills can be taken

as equivalent to the pressure of a fluid weighing 60 pcf. The above values assume a granular and drained backfill condition. Higher lateral earth pressures would apply if walls retain expansive clay soils. An additional 20 pcf should be added to these values for walls with a 2:1 (H:V) sloping backfill. An increase in earth pressure equivalent to an additional 2 feet of retained soil can be used to account for surcharge loads from light traffic. The above values do not include a factor of safety. Appropriate factors of safety should be incorporated into the design. Surcharge due to other loading within an approximate 1½:1 (H:V) projection from the back of the wall will increase the lateral pressures provided above and should be incorporated into the wall design.

Retaining walls should be designed to resist hydrostatic pressures or be provided with a back-drain to reduce the accumulation of hydrostatic pressures. Back-drains may consist of a two-foot wide zone of ¾-inch crushed rock. The back-drain should be separated from the adjacent soils using a non-woven filter fabric, such as Mirafi 140N or equivalent. Weep holes should be provided or a perforated pipe (Schedule 40 PVC) should be installed at the base of the back-drain and sloped to discharge to a suitable storm drain facility. As an alternative, a geo-composite drainage system such as Miradrain 6000 or equivalent placed behind the wall and connected to a suitable storm drain facility can be used. The project architect should provide waterproofing specifications and details.

8.6.3 Seismic Earth Pressure

Where required, seismic earth pressures can be taken as equivalent to the pressure of a fluid weighing 44 pounds per cubic foot (pcf) for flexible walls and 79 pcf for stiff walls. These values are for level backfill conditions and do not include a factor of safety. Sloping backfill will increase wall pressures. Appropriate factors of safety should be incorporated into the design. The seismic pressure is in addition to the un-factored static active pressures. The allowable passive pressure and bearing capacity can be increased by ⅓ in determining the stability of the wall.

8.7 Interior Slabs-on-Grade

The project structural engineer should design the interior concrete slab-on-grade floor. We recommend that building slabs be at least 5-inches in thickness and that consideration be given to the slab being reinforced with No. 3 bars spaced 18-inches on center, each way, and placed at slab mid-height, or the slab reinforcement in accordance with the structural engineer's design. Subgrade materials should not be allowed to desiccate between grading and the construction of the concrete slabs. The floor slab subgrade should be thoroughly and uniformly moistened prior to placing concrete.

A moisture vapor retarder/barrier should be placed beneath slabs where moisture sensitive floor coverings will be installed. Typically, plastic is used as a vapor retardant. If plastic is used, a minimum 10-mil is recommended. The plastic should comply with ASTM E1745. Plastic installation should comply with ASTM E1643.

Current construction practice typically includes placement of a 2-inch thick sand cushion between the bottom of the concrete slab and the moisture vapor retarder/barrier. This cushion can provide some protection to the vapor retarder/barrier during construction and may assist in reducing the potential for edge curling in the slab during curing. However, the sand layer also provides a source of moisture vapor to the underside of the slab that can increase the time required to reduce moisture vapor emissions to limits acceptable for the type of floor covering placed on top of the slab. The slab can be placed directly on the vapor retarder/barrier. The floor covering manufacturer should be contacted to determine the volume of moisture vapor allowable and any treatment needed to reduce moisture vapor emissions to acceptable limits for the particular type of floor covering installed. The project team should determine the appropriate treatment for the specific application.

8.8 Exterior Slabs-on-Grade (Hardscape)

The top 24-inches of soil below exterior concrete slabs-on-grade should have an expansion index of 50 or less. Exterior slabs should have a minimum thickness of 4-inches and consideration given to be reinforced with at least No. 3 bars at 24-inches on center each way. Slabs should be provided with weakened plane joints. Joints should be placed in accordance with the American Concrete Institute (ACI) guidelines. Proper control joints should be provided to reduce the potential for damage resulting from shrinkage. Subgrade materials should not be allowed to desiccate between grading and the construction of the concrete slabs. The floor slab subgrade should be thoroughly and uniformly moistened prior to placing concrete.

All dedicated exterior flatwork should conform to standards provided by the governing agency including section composition, supporting material thickness and any requirements for reinforcing steel. Concrete mix proportions and construction techniques, including the addition of water and improper curing, can adversely affect the finished quality of the concrete and result in cracking and spalling of the slab. We recommend that all placement and curing be performed in accordance with procedures outlined by the American Concrete Institute and/or Portland Cement Association. Special consideration should be given to concrete placed and cured during hot or cold weather conditions.

8.9 Corrosivity

Seven samples of the onsite soils were tested during previous subsurface explorations to provide a preliminary indication of the corrosion potential of the onsite soils (Eberhart-United, 2006; EEI, 2008; Group Delta, 2015). The test results are presented in **Appendix B-1**. A brief discussion of the corrosion test results is provided in the following section.

- The samples tested had soluble sulfate concentrations of 0.002 to 0.01 percent, which indicates the samples have a negligible sulfate corrosion potential relative to concrete.

- It should be noted that soluble sulfate in the irrigation water supply, and/or the use of fertilizer may cause the sulfate content in the surficial soils to increase with time. This may result in a higher sulfate exposure than that indicated by the test results reported herein. Studies have shown that the use of improved cements in the concrete, and a low water-cement ratio will improve the resistance of the concrete to sulfate exposure.

- The samples tested had chloride concentrations of 0.001 to 0.01 percent, which indicates the samples have a negligible chloride corrosion potential relative to metal.

- The samples tested had minimum resistivities of 5,470 to 9,000 ohm-cm, which indicates the samples are moderately corrosive to ferrous metals.

- The samples tested had pH of 7.1 to 7.7, which indicates the samples are neutral to slightly alkaline.

Additional testing should be performed after grading to evaluate the as-graded corrosion potential of the onsite soils. We are not corrosion engineers. A corrosion consultant should be retained to provide corrosion control recommendations if deemed necessary.

9.0 PRELIMINARY PAVEMENT DESIGN RECOMMENDATIONS

Deleterious material, excessively wet or dry pockets, concentrated zones of oversized rock fragments, and any other unsuitable yielding materials encountered during grading should be removed. Once compacted fill and/or native soils are brought to the proposed pavement subgrade elevations, the subgrade should be proof-rolled in order to check for a uniform firm and unyielding surface. Representatives of the project Geotechnical Engineer should observe all grading and fill placement.

The upper 12-inches of pavement subgrade soils should be scarified; moisture conditioned to at least optimum moisture content and compacted to at least 95 percent of the laboratory standard (ASTM D1557). If loose or yielding materials are encountered during subgrade preparation, evaluation should be performed by EEI. Aggregate base materials should be properly prepared (i.e., processed and moisture conditioned) and compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557. Aggregate base materials should conform to Caltrans specifications for Class 2 aggregate base.

All pavement section changes should be properly transitioned. Although not anticipated, if adverse conditions are encountered during the preparation of subgrade materials, special construction methods may need to be employed. A representative of the project Geotechnical Engineer should be present for the preparation of subgrade and aggregate base.

For design purposes we have assumed a Traffic Index (TI) of 5.0 for the drive areas and entrance aprons at the subject property. This assumed TI should be verified as necessary by the Civil Engineer or Traffic Engineer. We have assumed a preliminary R-Value of 20. The modulus of subgrade reaction (K-Value) was estimated at 80 pounds per square inch per inch (psi/in) for an R-Value of 20 (Caltrans, 1974). Pavement design was calculated for the parking lot structural section requirements for asphaltic concrete in accordance with the guidelines presented in the Caltrans Highway Design Manual. Rigid pavement sections were evaluated in general accordance with ACI 330R-08, based on an average daily truck traffic value of 10.

TABLE 4
Preliminary Pavement Design Recommendations

Traffic Index (TI) / Intended Use	Pavement Surface	Aggregate Base Material (1)
5.0 – Parking/Drive Areas	4.0-inches Asphalt Concrete	5.0-inches
Concrete Pavement - Cars and Trucks	5.0-inches Portland Cement Concrete (2)	6.0-inches
Concrete Pavement Trash Truck Pads/Trash Enclosure	6-inches Portland Cement Concrete (2)	6.0-inches

(1) R-Value of 78 for Caltrans Class 2 aggregate base
(2) Reinforcement and control joints placed in accordance with the structural engineer's requirements

The recommended pavement sections provided in **Table 4** are intended as a minimum guideline. If thinner or highly variable pavement sections are constructed, increased maintenance and repair could be expected. If the actual ADT (average daily traffic), ADTT (average daily truck traffic), or traffic index (TI) increases beyond our assumed values, increased maintenance and repair could be required for the pavement section. Final pavement design should be verified by testing of soils exposed at subgrade after grading has been completed. Thicker pavement sections could result if R-Value testing indicates lower values.

10.0 DEVELOPMENT RECOMMENDATIONS

10.1 Landscape Maintenance and Planting

Water is known to decrease the physical strength of earth materials, significantly reducing stability by high moisture conditions. Surface drainage away from foundations and graded slopes should be maintained. Only the volume and frequency of irrigation necessary to sustain plant life should be applied.

Consideration should be given to selecting lightweight, deep rooted types of landscape vegetation which require low irrigation that are capable of surviving the local climate. From a soils engineering viewpoint, "leaching" of the onsite soils is not recommended for establishing landscaping. If landscape soils are processed for the addition of amendments, the processed soils should be re-compacted to at least 90 percent relative compaction (based on ASTM D1557).

10.2 Site Drainage

Positive site drainage should be maintained at all times. Drainage should not flow uncontrolled over slopes. Runoff should be channeled away from slopes and structures and not allowed to pond and/or seep uncontrolled into the ground. Pad drainage should be directed toward an acceptable outlet. Consideration should be given to eliminating open bottom planters directly adjacent to proposed structures for a minimum distance of 10 feet. As an alternative, closed-bottom type planters could be utilized, with a properly designed drain outlet placed in the bottom of the planter.

Final surface grades around structures should be designed to collect and direct surface water away from structures and toward appropriate drainage facilities. The ground around the structure should be graded so that surface water flows rapidly away from the structure without ponding. In general, we recommend that the ground adjacent to the structure slope away at a gradient of at least 2 percent. Densely vegetated areas where runoff can be impaired should have a minimum gradient of at least 5 percent within the first 5 feet from the structure. Roof gutters with downspouts that discharge directly into a closed drainage system are recommended on structures. Drainage patterns established at the time of fine grading should be maintained throughout the life of the proposed structures.

10.3 Site Runoff Considerations - Stormwater Disposal Systems

It is our understanding that the Client is considering that runoff generated from the facilities to be disposed of in engineered subsurface features onsite. We performed percolation testing in order to provide an indication of the infiltration characteristics of the onsite materials. Our testing and findings are summarized in the following sections.

10.3.1 Percolation Testing

Following the drilling of exploratory borings B-1/P-1 through B-6/P-6 a 3-inch diameter perforated polyvinyl chloride (PVC) pipe was placed in the hole and gravel was placed around the pipe. The test holes were presoaked in general accordance with the City of Oceanside BMP guidelines (City of Oceanside, 2016). These tests were performed at depths of 6 to 8 feet below existing site grades. If 3 to 7 feet of additional fill is placed, this should be taken into consideration for analyzing change in depths of infiltration. Also, the validity of these values

depends on the type of fill placed and the proposed depth of the infiltration basin. Additional testing may be required after grading to confirm these values are valid for infiltration purposes.

Percolation testing was performed until consistent results were obtained. The results were used to calculate the pre-adjusted percolation rate for the test hole. Upon conclusion of testing, the perforated pipe was removed from the test hole and the test hole was backfilled.

We note that a soil profile's percolation rate is not the same as its infiltration rate. Therefore, the measured/calculated field percolation rate was converted to an estimated infiltration rate utilizing a reduction factor determined using the Porchet method. Additionally, as indicated in the County of San Diego BMP guidelines (County of San Diego, 2016) and City of Oceanside BMP Guidelines (2016), a feasibility factor of safety of 2.0 is should be applied to the measured infiltration rates to account for remaining uncertainty and long-term deterioration that cannot be technically mitigated. The following **Table 5** presents the measured percolation rate and corresponding infiltration rate calculated for the test hole.

TABLE 5
Summary of Percolation Testing

Location	Depth (ft.)	Pre-Adjusted Percolation Rate (in/hr)	Infiltration Rate* (in/hr)
B-1/P-1	~ 8	22.56	4.95/2.48*
B-2/P-2	~ 6	42.72	2.44/1.22*
B-3/P-3	~ 8	31.34	3.75/1.88*
B-4/P-4	~ 5	39.60	2.57/1.29*
B-5/P-5	~ 6	40.32	2.58/1.29*
B-6/P-6	~ 8	32.64	3.98/1.99*

*Feasibility factor of safety of 2.0 is included

10.3.2 Summary of Findings

The County of San Diego/Oceanside BMP guidelines indicate that onsite storm-water disposal systems can be designed for "Full-Infiltration" for subsurface materials with corrected infiltration rates equal to or greater than 0.5-inches per hour, and for "Partial Infiltration" for corrected infiltration rates less than 0.5-inches per hour. Per the City of Oceanside/ County of San Diego's BMP guidelines, the on-site soils in the areas tested are suitable for direct storm water infiltration. However, because of existing geological hazards including, the potential shallow level of groundwater, the liquefaction settlement/lateral displacement potential, and the proposed grade increase of 3 to 7 feet across the subject site, direct infiltration of stormwater is not recommended.

We provide the following conclusions regarding the percolation test results:

- It is our opinion that the percolation characteristics at the tested depths and locations are generally representative of the site conditions in the vicinity of the test holes. Percolation testing was performed within alluvial flood plain deposits consisting mostly of silty sand/sandy silt with minor clay layers.

- As discussed in the County of San Diego/City of Oceanside BMP guidelines for percolation testing, the bottom of the borings where the percolation tests are performed should be at approximately the same depth of the invert of the proposed infiltration facility. The project civil engineer should determine if the tests performed meet this requirement.

- As discussed in the County of San Diego/City of Oceanside BMP guidelines, a correction factor should be applied to the measured infiltration rates to account for soil assessment method, soil type, soil variability, depth to groundwater, level of pretreatment, redundancy, and compaction during construction. The project civil engineer should determine the appropriate design-level factor of safety for the proposed disposal system.

Design of the stormwater disposal system should be in accordance with the City of Oceanside BMP Guidelines/County of San Diego guidelines. The completed form I-8 of the San Diego Region Model BMP Design Manual is included as **Appendix D**.

10.3.3 Structure Setback from Retention Devices

We recommend that storm-water disposal systems be situated at least three times their depth, or a minimum of 15 feet (whichever is greater), from the outside bottom edge of structural foundations. Structural foundations include (but are not limited to) buildings, loading docks, retaining walls, and screen walls. The invert of storm-water infiltration should be outside a 1:1 (H:V) plane projected from the bottom of adjacent foundations.

Stormwater disposal systems should be checked and maintained on regular intervals. Stormwater devices including bio-swales that are located closer than 10 feet from any foundations/footings should be lined with an impermeable membrane to reduce the potential for saturation of foundation soils. Foundations may also need to be deepened.

Storm water infiltration should not be located near utility lines where the introduction of storm water could cause damage to utilities or settlement of trench backfill.

10.4 Additional Site Improvements

Recommendations for additional grading can be provided upon request. If in the future, additional property improvements are planned for the subject property, recommendations concerning the design and construction of improvements would be provided upon request.

10.5 Utility Trench Backfill

Fill around the pipe should be placed in accordance with details shown on the drawings and should be placed in layers not to exceed 8-inches loose (unless otherwise approved by the geotechnical engineer) and compacted to at least 90 percent of the maximum dry density as determined in accordance with ASTM D1557 (Modified Proctor). The geotechnical engineer should approve all backfill material.

Select material should be used when called for on the drawings, or when recommended by the geotechnical engineer. Care should be taken during backfill and compaction operations to maintain alignment and prevent damage to the joints. The backfill should be kept free from oversized material, chunks of highly plastic clay, or other unsuitable or deleterious material. Backfill soils should be non-

expansive, non-corrosive, and compatible with native earth materials. Backfill materials and testing should be in accordance with the CBC (2016), and the requirements of the local governing jurisdiction. Pipe backfill areas should be graded and maintained in such a condition that erosion or saturation will not damage the pipe bedding or backfill. Flooding trench backfill is not recommended. Heavy equipment should not be operated over any pipe until it has been properly backfilled with a minimum of 2 to 3 feet of cover. The utility trench should be systematically backfilled to allow maximum time for natural settlement. Backfill should not occur over porous, wet, or spongy subgrade surfaces. Should these conditions exist, the areas should be removed, replaced and recompacted.

11.0 PLAN REVIEW

Once detailed grading and foundation plans are available, they should be submitted to EEI for review and comment, to reduce the potential for discrepancies between plans and recommendations presented herein. If conditions found differ substantially from those stated; appropriate recommendations will be provided. Additional field studies may be warranted.

12.0 LIMITATIONS

This Geotechnical Evaluation has been conducted in accordance with generally accepted geotechnical engineering principles and practices. Findings provided herein have been derived in accordance with current standards of practice, and no warranty is expressed or implied. Standards of practice are subject to change with time. This report has been prepared for the sole use of Zephyr Partners, LLC (Client), within a reasonable time from its authorization.

Subject property conditions, land use (both onsite and offsite), or other factors may change as a result of manmade influences, and additional work may be required with the passage of time. This Geotechnical Evaluation should not be relied upon by other parties without the express written consent of EEI and the Client; therefore, any use or reliance upon this Geotechnical Evaluation by a party other than the Client should be solely at the risk of such third party and without legal recourse against EEI, its employees, officers, or directors, regardless of whether the action in which recovery of damages is brought or based upon contract, tort, statue, or otherwise. The Client has the responsibility to see that all parties to the project, including the designer, contractor, subcontractor, and building official, etc. are aware of this report in its complete form. This report contains information that may be used in the preparation of contract specifications; however, the report is not designed as a specification document, and may not contain sufficient information for use without additional assessment. EEI assumes no responsibility or liability for work or testing performed by others. In addition, this report may be subject to review by the controlling authorities.

13.0 REFERENCES

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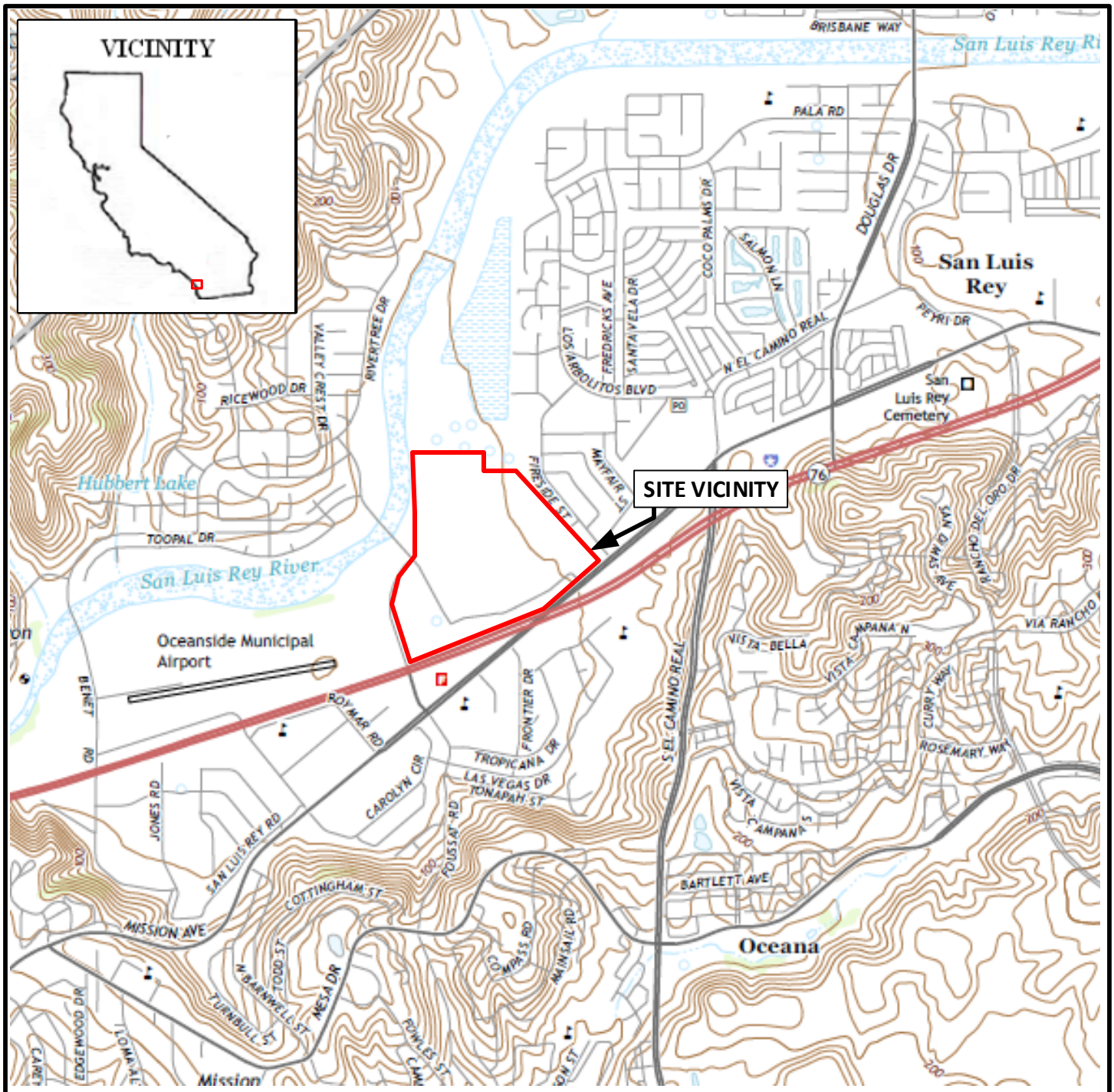
FIGURES



Map Source: USGS San Luis Rey 7.5-minute quadrangle, 2015

LEGEND

N

Scale: 1" = 2,000 ft

0 2,000 ft 4,000 ft

Note: All Locations Are Approximate

SITE VICINITY MAP

Zephyr Partners

Pavilion at Oceanside

Highway 76 and North Foussat Road, Oceanside CA

EEI Project No. ZEP-72676.4

Created August 2018

EEI Engineering Solutions

FIGURE 1

N

Scale: 1" = 450'

0 450 FT 900 FT

Note: All Locations Are Approximate

AERIAL MAP

Zephyr Partners

Pavilion at Oceanside
Highway 76 and North Foussat Road, Oceanside CA
EEI Project No. ZEP-72676.4
Created August 2018

EEI Engineering Solutions

FIGURE 2

Source: Google Earth, 2016

LEGEND

- Approximate Locations of Percolation Tests (EEI, 2018)
- Approximate Locations of CPTs (EEI, 2018)
- Approximate Boring Locations (EEI, 2008)
- Approximate Boring Locations (Group Delta, 2015)
- Approximate CPT Locations (Group Delta, 2015)

N

0 450 FT 900 FT

Scale: 1" = 450'

Note: All Locations Are Approximate

FIELD EXPLORATION MAP

Zephyr Partners

Pavilion at Oceanside
Highway 76 and North Foussat Road, Oceanside CA
EEI Project No. ZEP-72676.4
Created August 2018

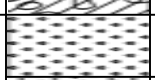
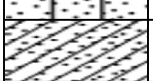
EEI Engineering Solutions

FIGURE 3

Source: Google Earth, 2016

APPENDIX A
SOIL CLASSIFICATION CHART AND BORING LOGS

UNIFIED SOIL CLASSIFICATION (ASTM D-2487-98)

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE)	GRAVEL AND GRAVELLY SOILS (GREATER THAN 50% OF COARSE FRACTION PASSING NO. 4 SEIVE)	CLEAN GRAVELS (LESS THAN 5% PASSING #200 Sieve)		GW	WELL-GRADED GRAVELS, GRAVEL- SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES
		GRAVELS WITH FINES (GREATER THAN 12% PASSING #200 Sieve)		GM	SILTY-GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY-GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS (GREATER THAN 50% OF COARSE FRACTION PASSING NO. 4 SEIVE)	CLEAN SANDS (LESS THAN 5% PASSING #200 Sieve)		SW	WELL-GRADED SANDS,GRAVELLY-SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY-SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (GREATER THAN 12% PASSING #200 Sieve)		SM	SILTY-SANDS
				SC	CLAYEY-SANDS
FINE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE)	SILTS AND CLAYS	Low Plasticity (LIQUID LIMIT LESS THAN 50)		ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC CLAYS WITH LOW PLASTICITY
	SILTS AND CLAYS	High Plasticity (LIQUID LIMIT GREATER THAN 50)		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR VOCANIC ASH
				CH	INORGANIC CLAYS WITH HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS

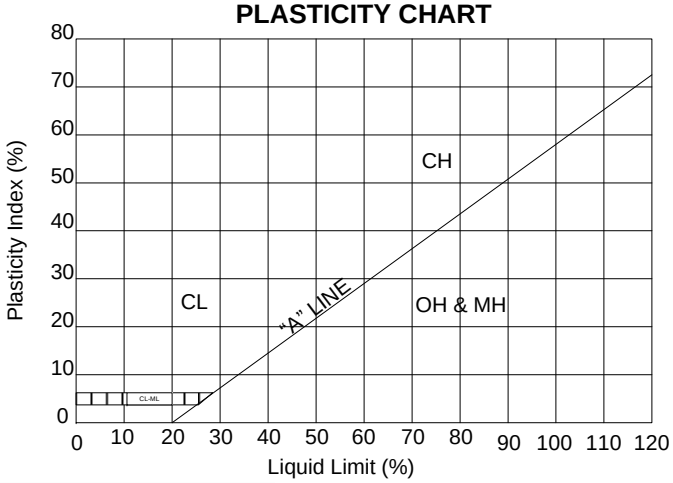
SAMPLER TYPES

- SPT
- Modified California (2.5" I.D.)
- Bulk
- Rock Core
- Shelby Tube
- Water Level

OTHER TESTS

ATT – Atterberg Limit (Plasticity Index)
CD – Consolidated Drained Triaxial
CON – Consolidation
COR – Corrosivity
DS – Direct Shear
EI – Expansion Index
MAX – Maximum Density
RV – R-Value
SA – Sieve Analysis
-#200 - Percent Passing #200 Sieve
TV – Torvane Shear
UU – Unconsolidated Undrained Triaxial

PLASTICITY CHART



PENETRATION RESISTANCE (Recorded As Blows/Foot)					
SAND & GRAVEL			SILT & CLAY		
Relative Density	Blows/Foot* N_{60}		Consistency	Blows/Foot* N_{60}	Strength**(KSF)
Very Loose	0-4		Very Soft	0 - 2	0 – 0.5
Loose	4-10		Soft	2 - 4	0.5 – 1.0
Medium Dense	10-30		Medium Stiff	4 - 8	1.0 – 2.0
Dense	30-50		Stiff	8 - 15	2.0 – 4.0
Very Dense	Over 50		Very Stiff	15 - 30	4.0 – 8.0
			Hard	Over 30	Over 8.0

* Number of blows of 140LB hammer falling 30 inches to drive a 2 inch O.D. (1-3/8 inch I.D.) split barrel sampler the last 12 inches of an 18-inch drive (ASTM-1586 Standard Penetration Test)

** Undrained shear strength in kips/sq. ft. As determined by laboratory testing or approximated by the standard penetration test, pocket penetrometer, torvane, or visual observation

BORING NUMBER B1

CLIENT Zephyr Oceanside Investments, LLC
PROJECT NAME Pavilion at Oceanside
PROJECT NUMBER ZEP-72676.4
PROJECT LOCATION North of Hwy. 76 and Mission Ave., Oceanside CA
DATE STARTED 8/31/18 **COMPLETED** 8/31/18
GROUND ELEVATION **BORING DIAMETER** 8"
EQUIPMENT / RIG B-53 truck mounted rill rig
HAMMER EFFICIENCY (%) 86
METHOD 8" Hollow Stem Auger 140 lbs Auto Hammer
SPT CORRECTION 1.43 **CAL CORRECTION** 0.79
LOGGED BY WAP **CHECKED BY** JB
GROUNDWATER DEPTH (ft) Not Encountered
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS SYMBOL	SAMPLE TYPE	PENETRATION RESISTANCE (blows/6-inches)	SPT N60	POCKET PEN (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (PI:LL)	FINES CONTENT (%)	OTHER TESTS
0		**ALLUVIUM**										
1		SILTY SAND, brown, fine to medium-grained, dry, loose										
2												
3				MC	2 5 10	12		2	98			
4			SM									
5		@ 5' Becomes damp and medium dense						5	94			
6				MC	7 9 14	18						
7		@ 6.5' Becomes moist		MC BULK	7 12 15	21		7 10	106		50.7	#200
8												

Total depth: 8'
No groundwater encountered
Backfilled

BORING NUMBER B2

CLIENT Zephyr Oceanside Investments, LLC
PROJECT NAME Pavilion at Oceanside
PROJECT NUMBER ZEP-72676.4
PROJECT LOCATION North of Hwy. 76 and Mission Ave., Oceanside CA
DATE STARTED 8/31/18 **COMPLETED** 8/31/18
GROUND ELEVATION **BORING DIAMETER** 8"
EQUIPMENT / RIG B-53 truck mounted rill rig
HAMMER EFFICIENCY (%) 86
METHOD 8" Hollow Stem Auger 140 lbs Auto Hammer
SPT CORRECTION 1.43 **CAL CORRECTION** 0.79
LOGGED BY WAP **CHECKED BY** JB
GROUNDWATER DEPTH (ft) Not Encountered
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS SYMBOL	SAMPLE TYPE	PENETRATION RESISTANCE (blows/6-inches)	SPT N60	POCKET PEN (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (PI:LL)	FINES CONTENT (%)	OTHER TESTS
0		**ALLUVIUM**										
1		SILTY SAND, brown, fine to medium-grained, dry, medium dense										
2			SM	MC	9 11 15	20		2	105			
3												
4		@ 4' Becomes damp		MC	6 9 13	17		3	105			
5				BULK							4.6	#200
6								2				

Total depth: 6'
No groundwater encountered
Backfilled

BORING NUMBER B3

CLIENT Zephyr Oceanside Investments, LLC
PROJECT NAME Pavilion at Oceanside
PROJECT NUMBER ZEP-72676.4
PROJECT LOCATION North of Hwy. 76 and Mission Ave., Oceanside CA
DATE STARTED 8/31/18 **COMPLETED** 8/31/18
GROUND ELEVATION **BORING DIAMETER** 8"
EQUIPMENT / RIG B-53 truck mounted rill rig
HAMMER EFFICIENCY (%) 86
METHOD 8" Hollow Stem Auger 140 lbs Auto Hammer
SPT CORRECTION 1.43 **CAL CORRECTION** 0.79
LOGGED BY WAP **CHECKED BY** JB
GROUNDWATER DEPTH (ft) Not Encountered
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS SYMBOL	SAMPLE TYPE	PENETRATION RESISTANCE (blows/6-inches)	SPT N60	POCKET PEN (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (PI:LL)	FINES CONTENT (%)	OTHER TESTS
0		**ALLUVIUM**										
1		SILTY SAND, brown, fine to medium-grained, dry, loose, trace rootlets										
2				BULK				2	99			
3			SM	MC	4 5 5	8						
4												
5		@ 5' Becomes damp and medium dense						5	100			
6				MC	5 7 9	13						
7		@ 6.5' SILTY SAND, tan to gray, fine to medium-grained, trace coarse-grained sand, damp, loose	SM	MC	5 7 8	12		4	96			
8				BULK				5			11.7	#200

Total depth: 8'
No groundwater encountered
Backfilled

BORING NUMBER B4

CLIENT Zephyr Oceanside Investments, LLC
PROJECT NAME Pavilion at Oceanside
PROJECT NUMBER ZEP-72676.4
PROJECT LOCATION North of Hwy. 76 and Mission Ave., Oceanside CA
DATE STARTED 8/31/18 **COMPLETED** 8/31/18
GROUND ELEVATION **BORING DIAMETER** 8"
EQUIPMENT / RIG B-53 truck mounted rill rig
HAMMER EFFICIENCY (%) 86
METHOD 8" Hollow Stem Auger 140 lbs Auto Hammer
SPT CORRECTION 1.43 **CAL CORRECTION** 0.79
LOGGED BY WAP **CHECKED BY** JB
GROUNDWATER DEPTH (ft) Not Encountered
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS SYMBOL	SAMPLE TYPE	PENETRATION RESISTANCE (blows/6-inches)	SPT N60	POCKET PEN (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (PI:LL)	FINES CONTENT (%)	OTHER TESTS
0		**ALLUVIUM**										
1		SILTY SAND, gray, fine-grained, damp, loose										
2			SM	MC	3 6 6	9		2	92			
3												
4				MC	4 7 6	10		2	96			
5				BULK								
6								2	95			

Total depth: 6'
No groundwater encountered
Backfilled

BORING NUMBER B5

CLIENT Zephyr Oceanside Investments, LLC
PROJECT NAME Pavilion at Oceanside
PROJECT NUMBER ZEP-72676.4
PROJECT LOCATION North of Hwy. 76 and Mission Ave., Oceanside CA
DATE STARTED 8/31/18 **COMPLETED** 8/31/18
GROUND ELEVATION **BORING DIAMETER** 8"
EQUIPMENT / RIG B-53 truck mounted rill rig
HAMMER EFFICIENCY (%) 86
METHOD 8" Hollow Stem Auger 140 lbs Auto Hammer
SPT CORRECTION 1.43 **CAL CORRECTION** 0.79
LOGGED BY WAP **CHECKED BY** JB
GROUNDWATER DEPTH (ft) Not Encountered
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS SYMBOL	SAMPLE TYPE	PENETRATION RESISTANCE (blows/6-inches)	SPT N60	POCKET PEN (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (PI:LL)	FINES CONTENT (%)	OTHER TESTS
0												
1		**ALLUVIUM**										
2		SILTY SAND, brown, fine-grained, dry, medium dense	SM	MC	6 8 8	13		3	96			
3												
4		@ 4' SILTY SAND, tan to gray, fine to medium-grained, damp to moist, loose	SM	MC	4 6 6	9		2	91			
5				BULK				2			1.8	#200
6												

Total depth: 6'
No groundwater encountered
Backfilled

BORING NUMBER B6

CLIENT Zephyr Oceanside Investments, LLC
PROJECT NAME Pavilion at Oceanside
PROJECT NUMBER ZEP-72676.4
PROJECT LOCATION North of Hwy. 76 and Mission Ave., Oceanside CA
DATE STARTED 8/31/18 **COMPLETED** 8/31/18
GROUND ELEVATION **BORING DIAMETER** 8"
EQUIPMENT / RIG B-53 truck mounted rill rig
HAMMER EFFICIENCY (%) 86
METHOD 8" Hollow Stem Auger 140 lbs Auto Hammer
SPT CORRECTION 1.43 **CAL CORRECTION** 0.79
LOGGED BY WAP **CHECKED BY** JB
GROUNDWATER DEPTH (ft) Not Encountered
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS SYMBOL	SAMPLE TYPE	PENETRATION RESISTANCE (blows/6-inches)	SPT N60	POCKET PEN (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (PI:LL)	FINES CONTENT (%)	OTHER TESTS
0		**ALLUVIUM**										
1		SILTY SAND, tan to brown, fine to medium-grained, damp, medium dense										
2				BULK				2	102			
3			SM	MC	4 7 12	15						
4												
5		@ 5' Becomes loose						3	96			
6				MC	4 6 9	12						
7								2	101			
8		@ 7' SILTY SAND and SANDY SILT, brown, fine to medium-grained, moist, loose/stiff	SM	MC BULK	3 5 10	12		18			43.2	#200

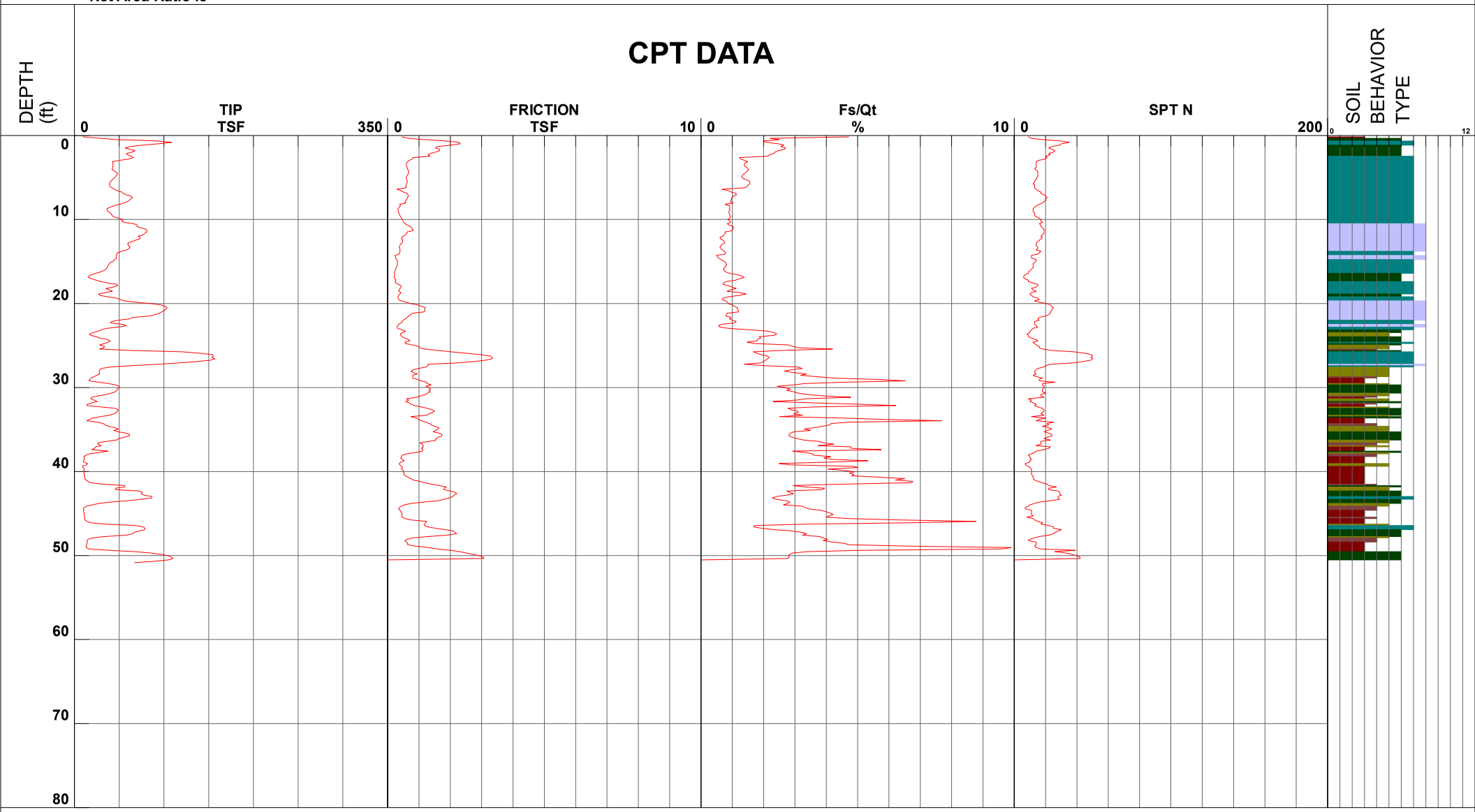
Total depth: 8'
No groundwater encountered
Backfilled

EEI Engineering Solutions

Project	Oceanside Pavillion	Operator	BH AS	Filename	SDF(136).cpt
Job Number	ZEP-72676.4	Cone Number	DDG1448	GPS	
Hole Number	CPT-01	Date and Time	8/21/2018 11:04:41 AM	Maximum Depth	50.85 ft
EST GW Depth During Test		11.40 ft			

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

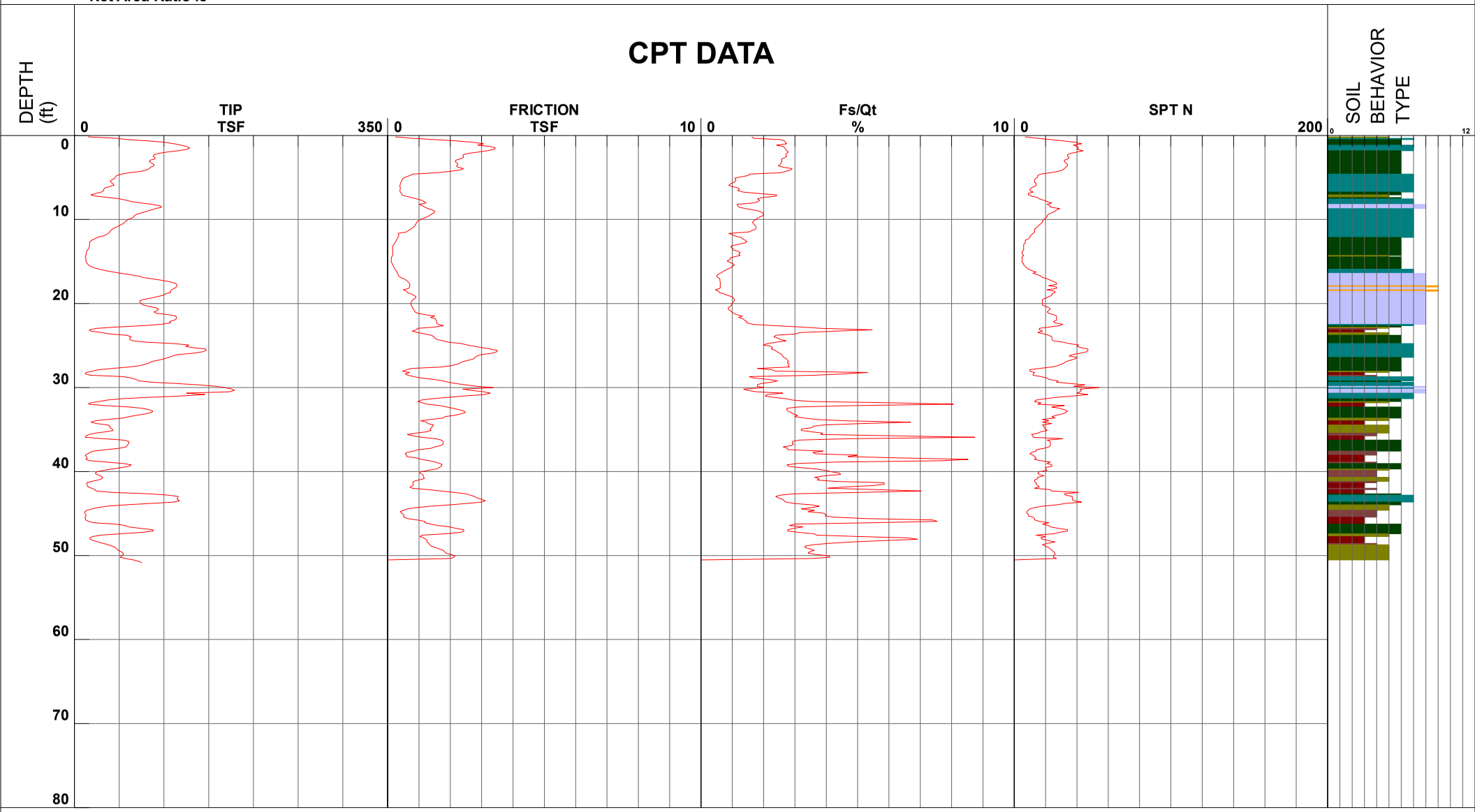
S*Soil behavior type and SPT based on data from UBC-1983

EEI Engineering Solutions

Project	Oceanside Pavillion	Operator	BH AS	Filename	SDF(137).cpt
Job Number	ZEP-72676.4	Cone Number	DDG1448	GPS	
Hole Number	CPT-02	Date and Time	8/21/2018 11:54:25 AM	Maximum Depth	50.85 ft
EST GW Depth During Test		12.80 ft			

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

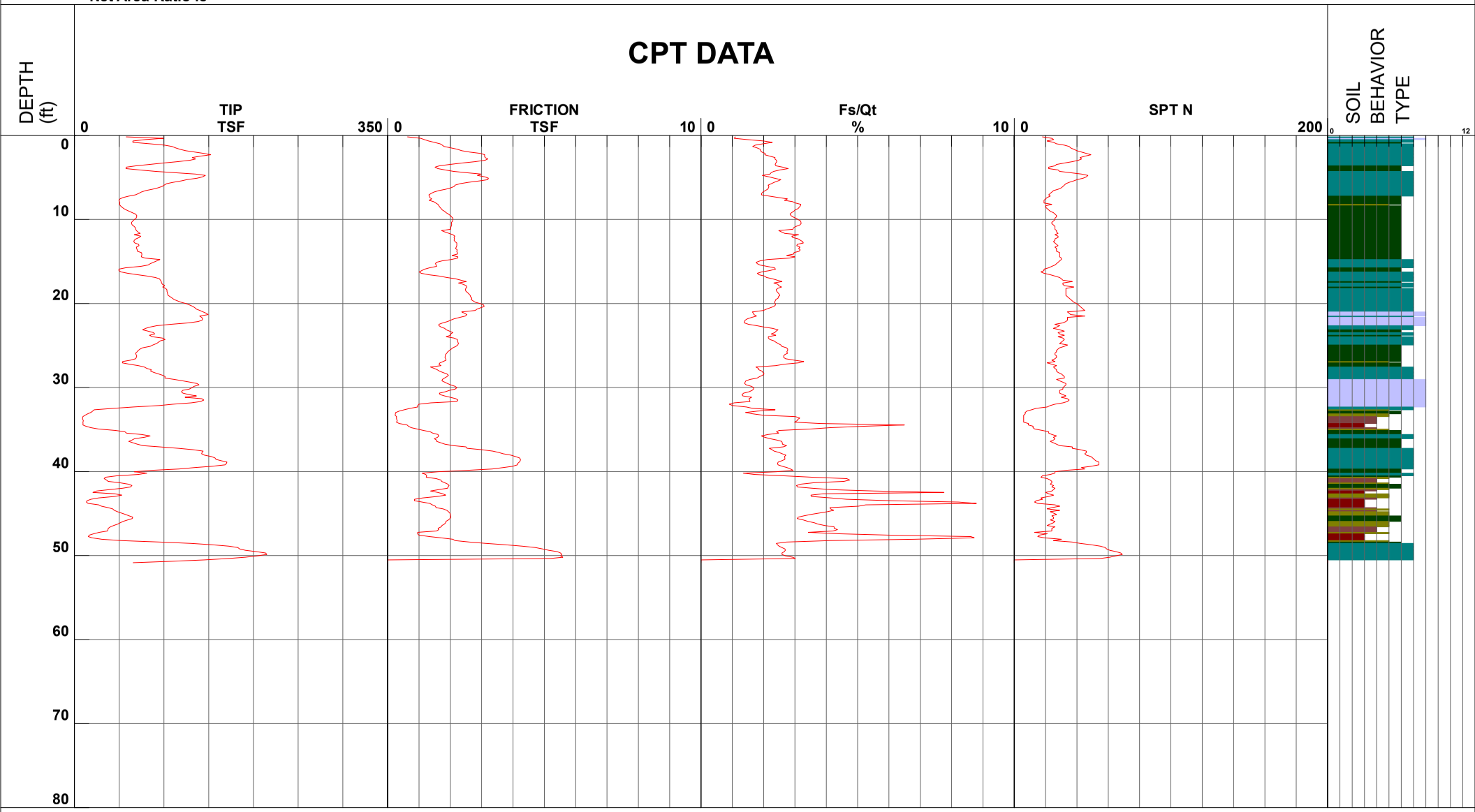
S*Soil behavior type and SPT based on data from UBC-1983

EEI Engineering Solutions

Project	Oceanside Pavillion	Operator	BH AS	Filename	SDF(133).cpt
Job Number	ZEP-72676.4	Cone Number	DDG1448	GPS	
Hole Number	CPT-03	Date and Time	8/21/2018 8:18:48 AM	Maximum Depth	50.85 ft
EST GW Depth During Test		19.40 ft			

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

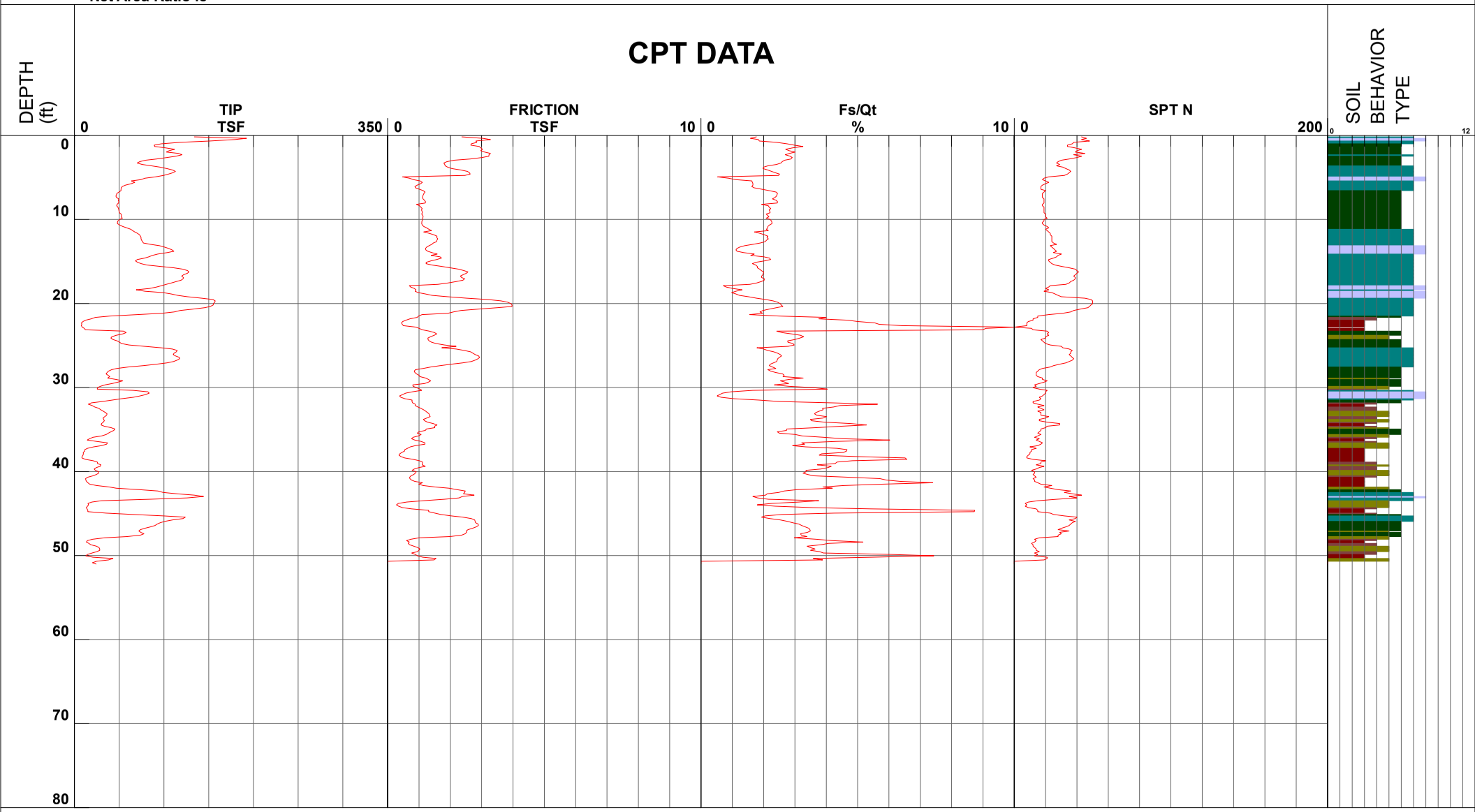
S*Soil behavior type and SPT based on data from UBC-1983

EEI Engineering Solutions

Project	Oceanside Pavillion	Operator	BH AS	Filename	SDF(135).cpt
Job Number	ZEP-72676.4	Cone Number	DDG1448	GPS	
Hole Number	CPT-04	Date and Time	8/21/2018 10:08:38 AM	Maximum Depth	51.02 ft
EST GW Depth During Test		12.50 ft			

Net Area Ratio .8

CPT DATA



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2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

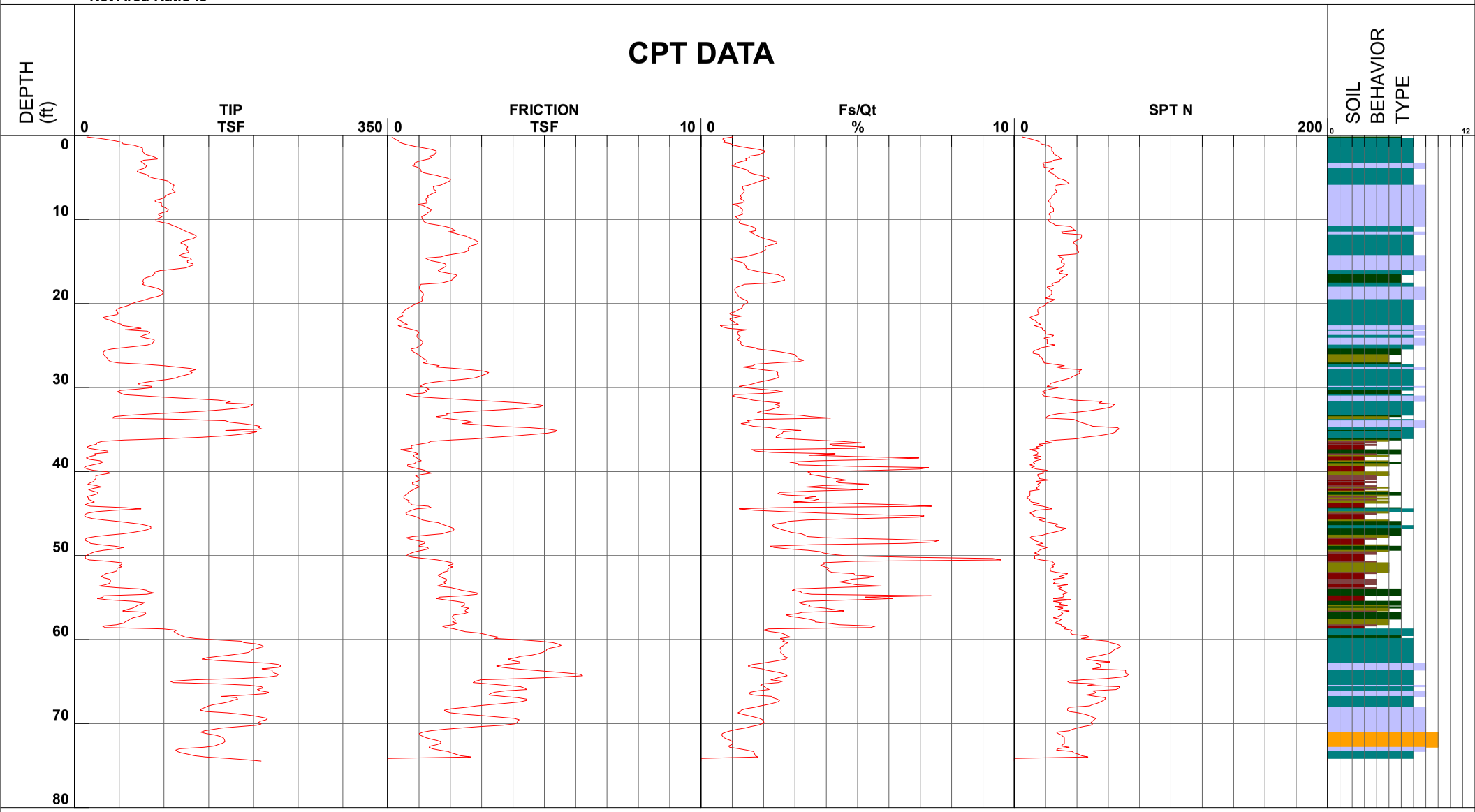
S*Soil behavior type and SPT based on data from UBC-1983

EEI Engineering Solutions

Project	Oceanside Pavillion	Operator	BH AS	Filename	SDF(138).cpt
Job Number	ZEP-72676.4	Cone Number	DDG1448	GPS	
Hole Number	CPT-05	Date and Time	8/21/2018 12:42:29 PM	Maximum Depth	74.47 ft
EST GW Depth During Test		15.00 ft			

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

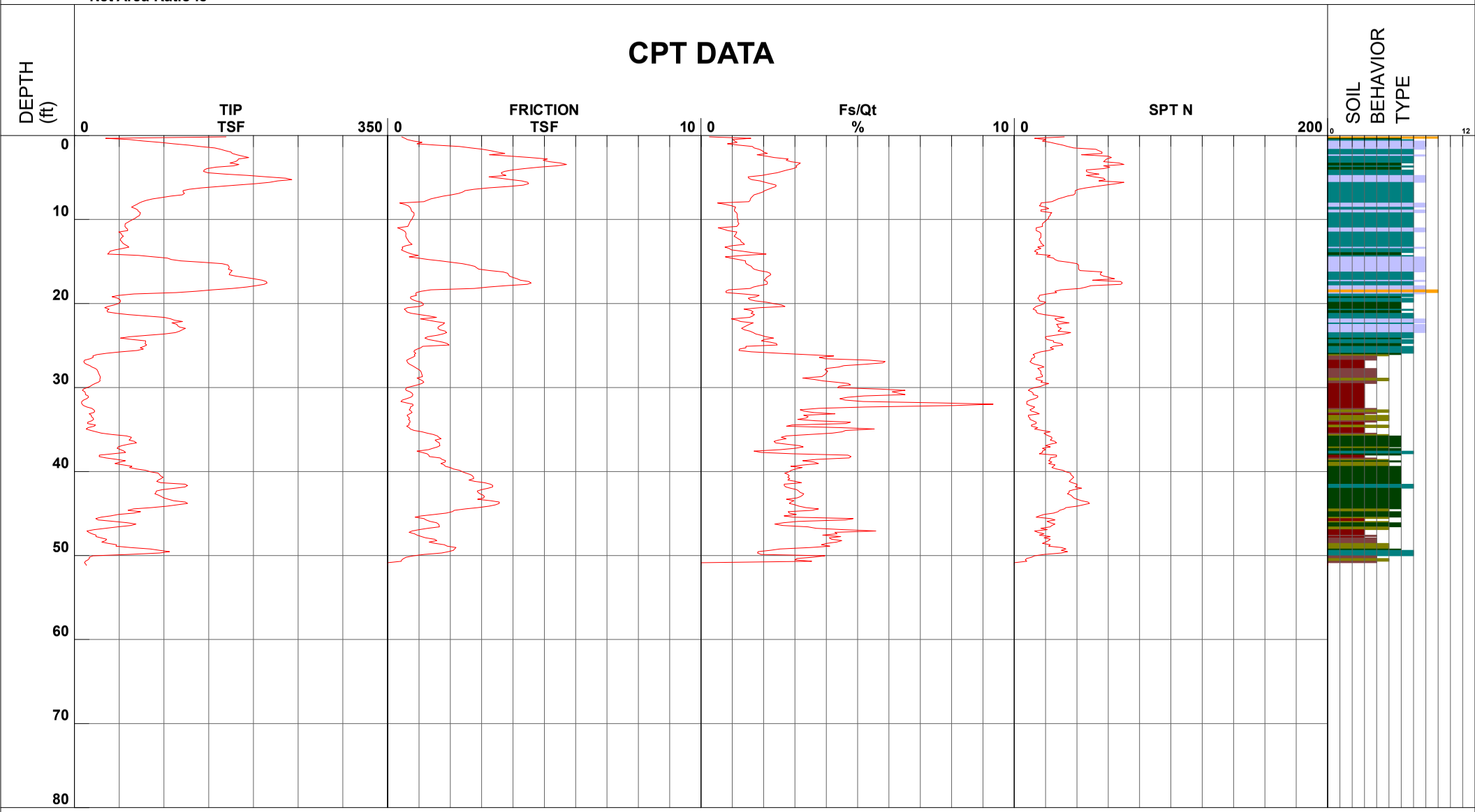
S*Soil behavior type and SPT based on data from UBC-1983

EEI Engineering Solutions

Project	Oceanside Pavillion	Operator	BH AS	Filename	SDF(134).cpt
Job Number	ZEP-72676.4	Cone Number	DDG1448	GPS	
Hole Number	CPT-06	Date and Time	8/21/2018 9:10:41 AM	Maximum Depth	51.18 ft
EST GW Depth During Test		17.10 ft			

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

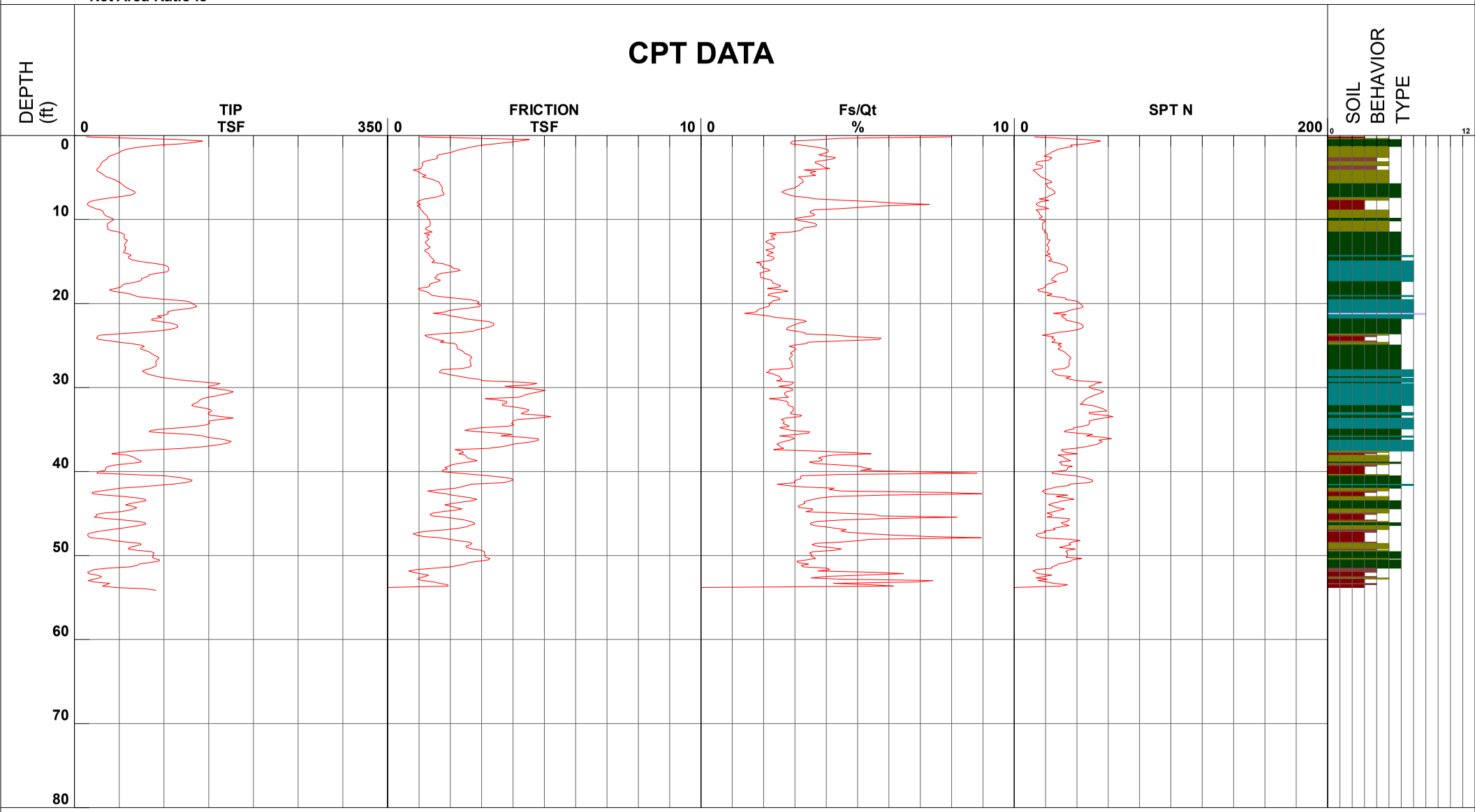
S*Soil behavior type and SPT based on data from UBC-1983

EEI Engineering Solutions

Project	Oceanside Pavillion	Operator	RC AS	Filename	SDF(130).cpt
Job Number	ZEP-72676.4	Cone Number	DDG1448	GPS	
Hole Number	CPT-07	Date and Time	8/20/2018 11:52:15 AM	Maximum Depth	54.13 ft
EST GW Depth During Test		19.90 ft			

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

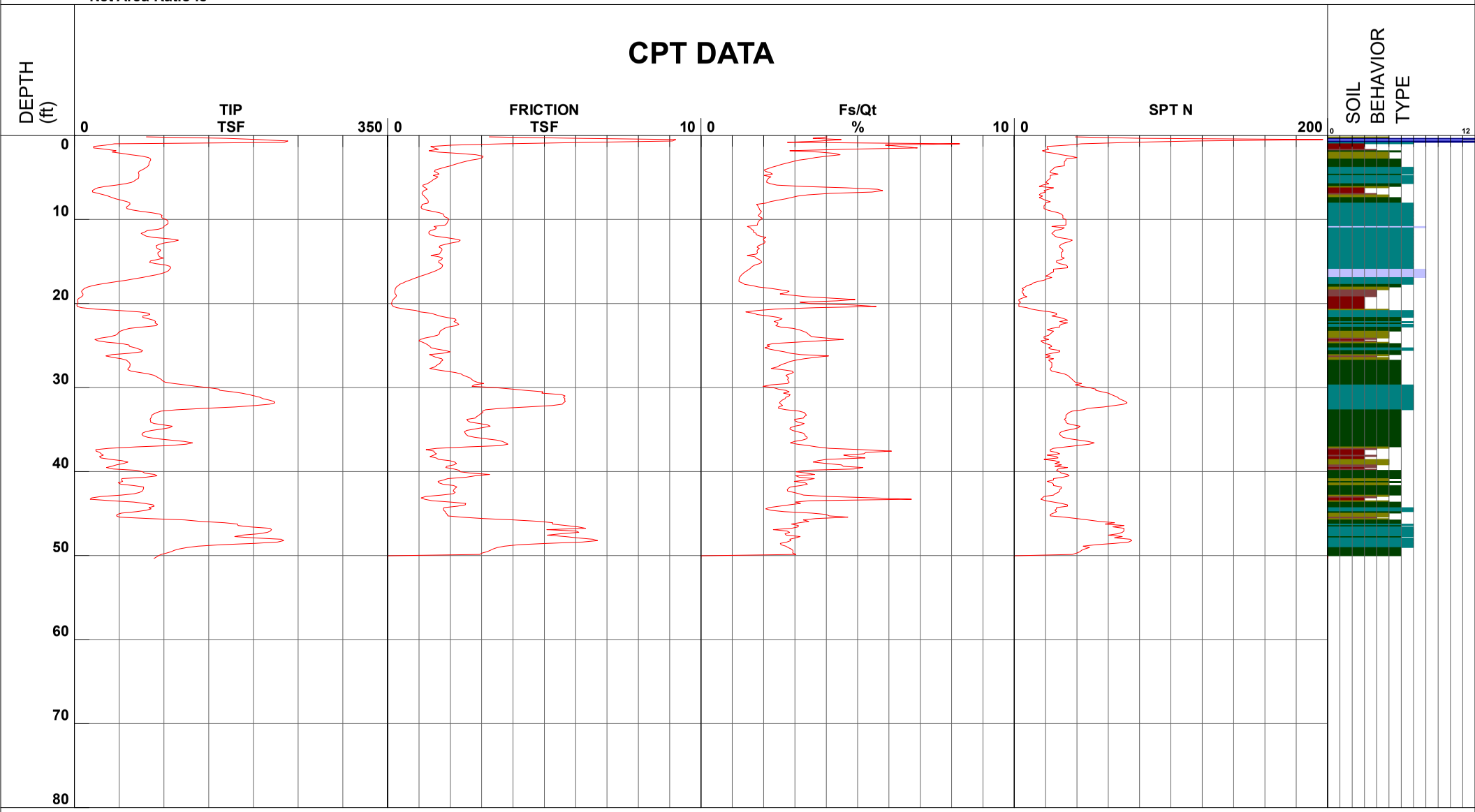
S*Soil behavior type and SPT based on data from UBC-1983

EEI Engineering Solutions

Project	Oceanside Pavillion	Operator	RC AS	Filename	SDF(127).cpt
Job Number	ZEP-72676.4	Cone Number	DDG1448	GPS	
Hole Number	CPT-08	Date and Time	8/20/2018 8:12:01 AM	Maximum Depth	50.36 ft
EST GW Depth During Test		19.00 ft			

Net Area Ratio .8

CPT DATA



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3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

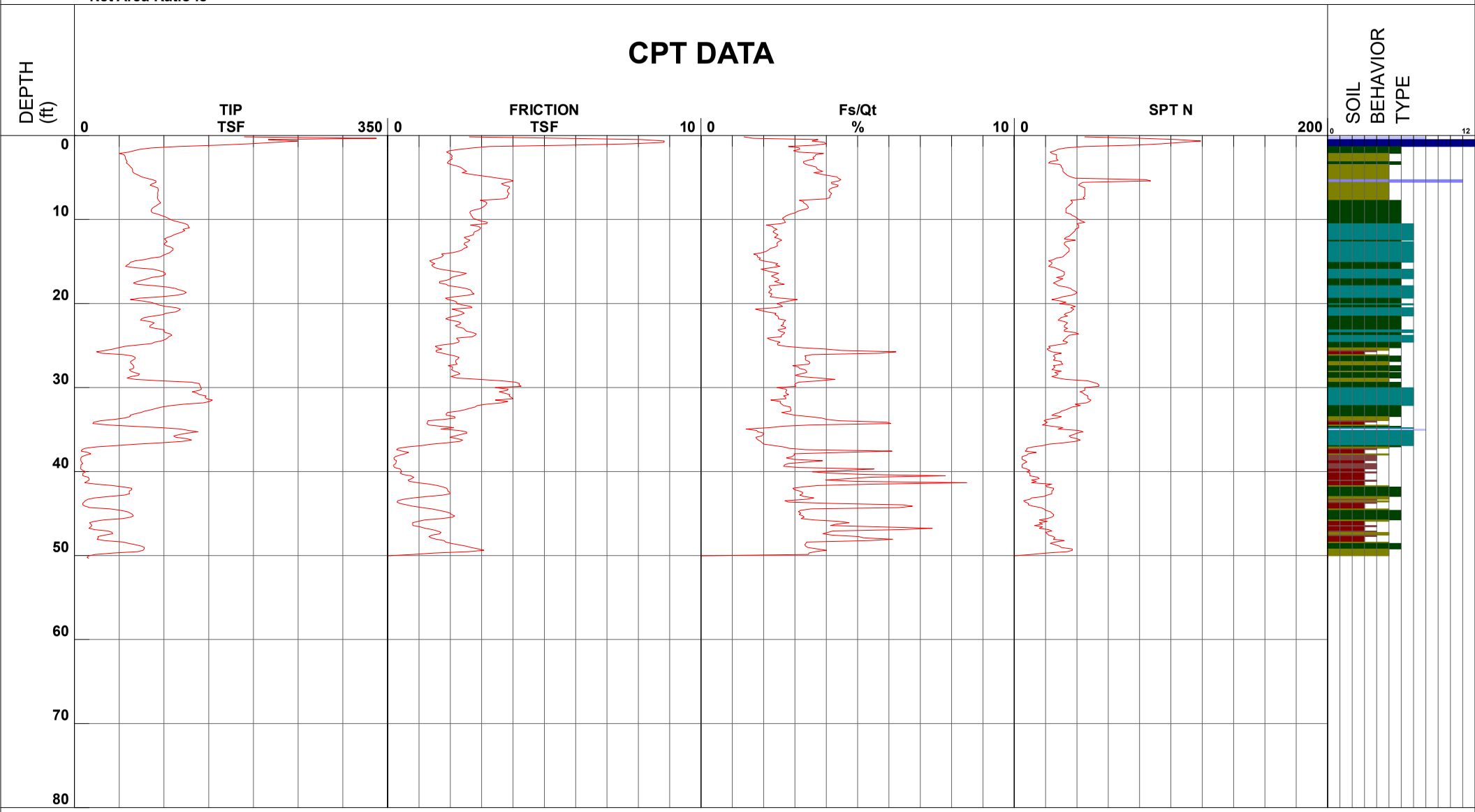
S*Soil behavior type and SPT based on data from UBC-1983

EEI Engineering Solutions

Project	Oceanside Pavillion	Operator	RC AS	Filename	SDF(128).cpt
Job Number	ZEP-72676.4	Cone Number	DDG1448	GPS	
Hole Number	CPT-09	Date and Time	8/20/2018 8:55:22 AM	Maximum Depth	50.36 ft
EST GW Depth During Test		17.20 ft			

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

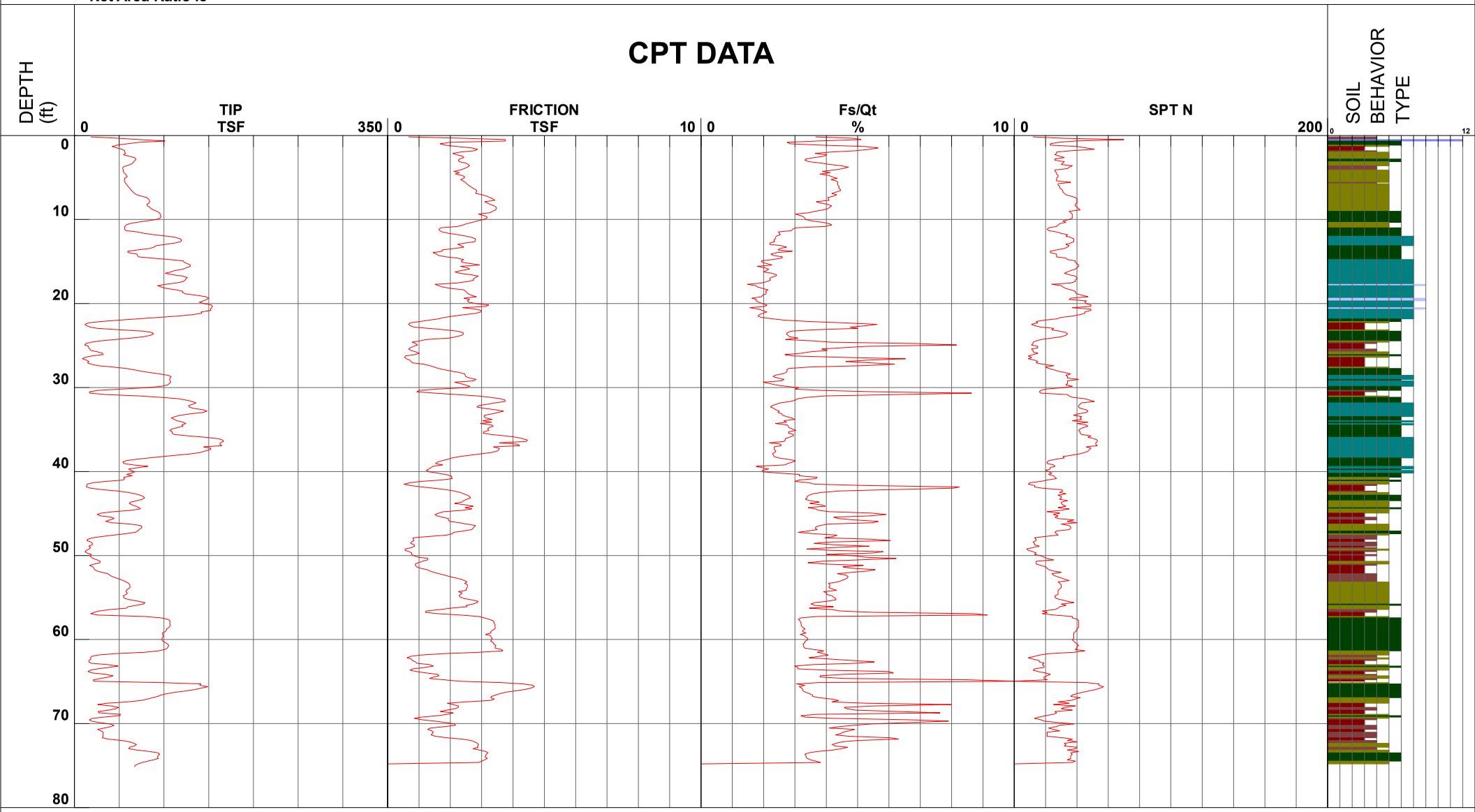
S*Soil behavior type and SPT based on data from UBC-1983

EEI Engineering Solutions

Project	Oceanside Pavillion	Operator	RC AS	Filename	SDF(129).cpt
Job Number	ZEP-72676.4	Cone Number	DDG1448	GPS	
Hole Number	CPT-10	Date and Time	8/20/2018 9:50:27 AM	Maximum Depth	75.13 ft
EST GW Depth During Test		16.80 ft			

Net Area Ratio .8

CPT DATA



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3 - clay
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5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

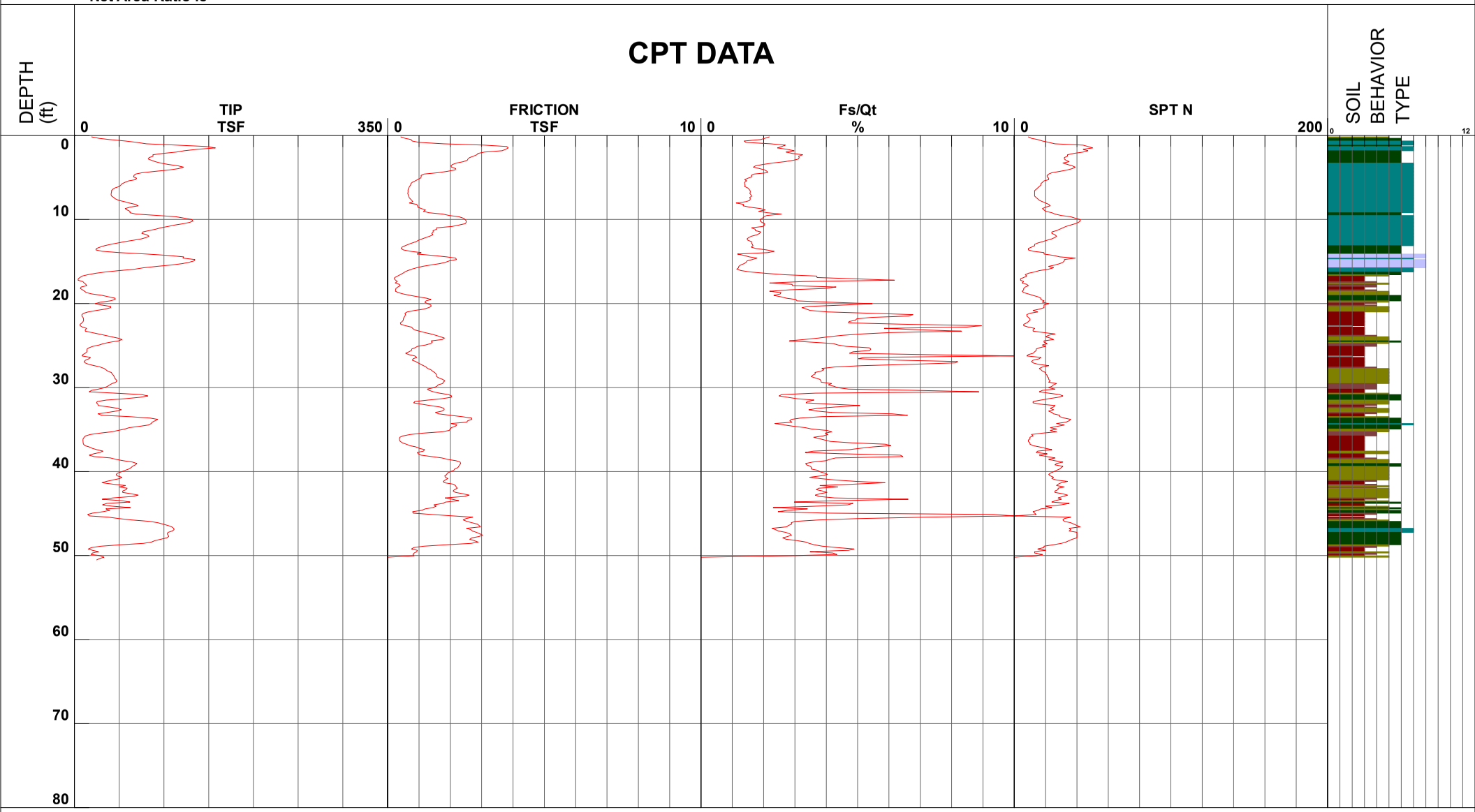
S*Soil behavior type and SPT based on data from UBC-1983

EEI Engineering Solutions

Project	Oceanside Pavillion	Operator	RC AS	Filename	SDF(131).cpt
Job Number	ZEP-72676.4	Cone Number	DDG1448	GPS	
Hole Number	CPT-11	Date and Time	8/20/2018 12:44:00 PM	Maximum Depth	50.52 ft
EST GW Depth During Test		13.90 ft			

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

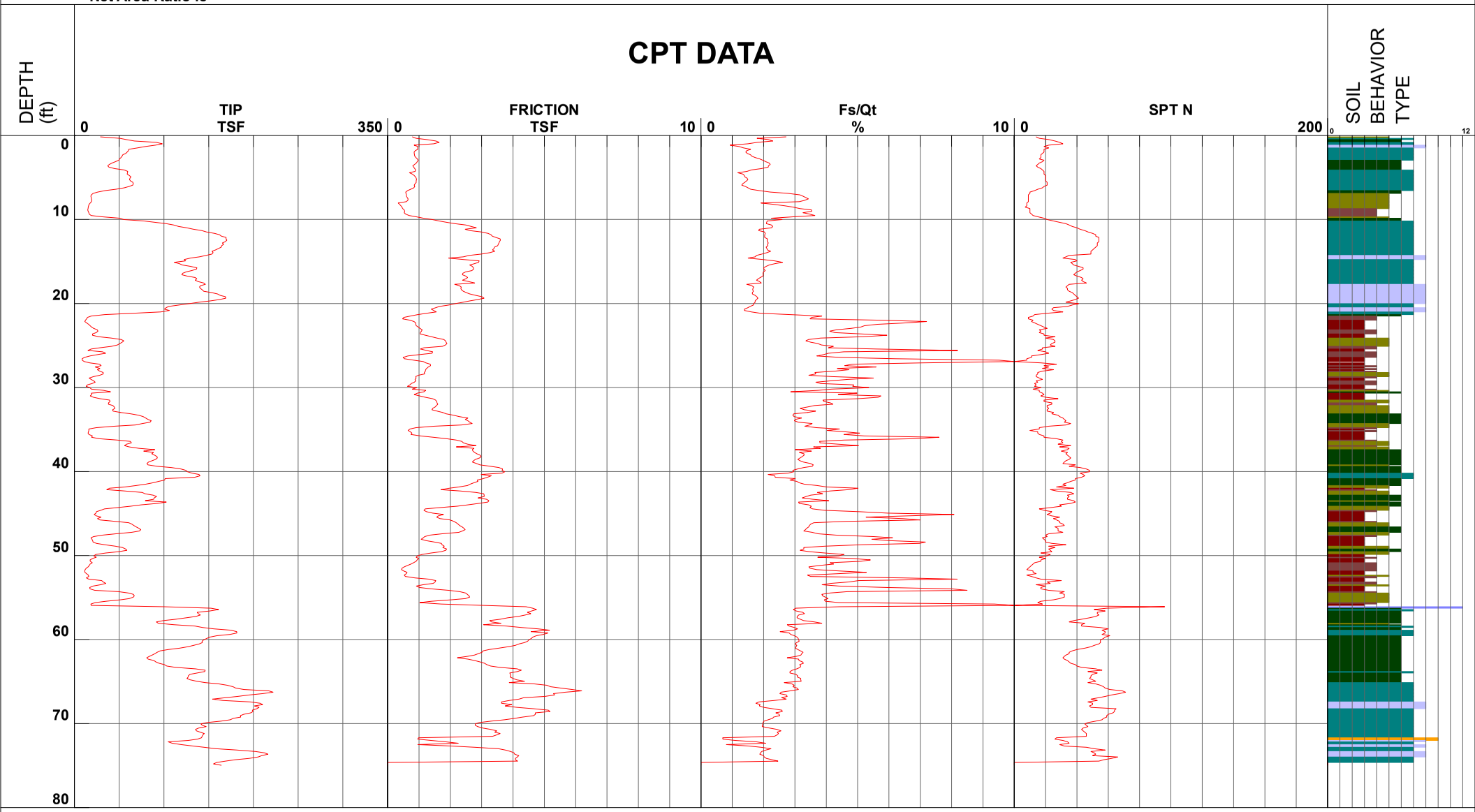
S*Soil behavior type and SPT based on data from UBC-1983

EEI Engineering Solutions

Project	Oceanside Pavillion	Operator	RC AS	Filename	SDF(132).cpt
Job Number	ZEP-72676.4	Cone Number	DDG1448	GPS	
Hole Number	CPT-12	Date and Time	8/20/2018 1:35:27 PM	Maximum Depth	74.97 ft
EST GW Depth During Test		16.50 ft			

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

S*Soil behavior type and SPT based on data from UBC-1983

APPENDIX A-1
EEI (2008) AND GROUP DELTA (2015) BORING LOGS

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

	Number: B-01	
Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 1 of 2	
Location: Foussat Road and HWY 76, Oceanside, CA 92058		
Date Started: 8/26/2008	**Date Finished:** 8/26/2008	
EEI Rep: TK	**Project Number:** THO-70810	**Drill Rig/Sampling Method:** Hollow Stem Auger, B61; Autohammer, 140 pounds at 30-inch drop
Borehole Diameter: 8"		

SAMPLE LOG | **BOREHOLE LOG**

Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1			**ALLUVIUM**
	SPT	2 3 4			3			@ 2.5' SILTY-SAND, brown, fine to medium grained sand, minor silt, dry, loose
	MC	3 3 4	94.0	11.1	5			@ 5' SILTY-SAND, brown, fine to medium grained sand, minor silt, dry, loose
	SPT	2 2 2			8			@ 7.5' SILTY-SAND, slightly moist, loose
	MC	2 4 7	100.9	20.8	10			@ 10' SILTY-SAND, slightly moist, loose
	SPT	3 4 6			13	SM		@ 12.5' SILTY-SAND, brownish-gray, moist, medium dense
	SPT	3 5 7			15			@ 15' SILTY-SAND, saturated, medium dense
	SPT	2 2 3			20			@ 20' SILTY-SAND, saturated, loose
	SPT	2 2 2			25			@ 25' SANDY-SILT, gray, fine grained sand, saturated, loose
	SPT	2 3 7			30	ML		@ 30' SANDY-SILT, gray, fine grained sand, saturated, loose to medium dense

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

		Number: B-01
	Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 2 of 2
Date Started: 8/26/2008	**Date Finished:** 8/26/2008	**Location:** Foussat Road and HWY 76, Oceanside, CA 92058
EEI Rep: TK	**Project Number:** THO-70810	**Drill Rig/Sampling Method:** Hollow Stem Auger, B61; Autohammer, 140 pounds at 30-inch drop
		Borehole Diameter: 8"

SAMPLE LOG | **BOREHOLE LOG**

Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
	SPT	4 7 10			36			@ 25' SANDY-SILT, gray, fine grained sand, saturated, loose
					37			@ 35' SANDY-SILT, brown, fine to medium grained sand, saturated, medium dense
					38			
					39			
	SPT	2 2 3			40	ML		@ 40' dark gray, minor clay
					41			
					42			
					43			
					44			
	SPT	3 3 4			45			@ 45' CLAYEY-SAND, dark gray, saturated, loose
					46			
					47	SC		
					48			
					49			@ 50' dark gray, fine grained sand, minor clay, saturated, medium dense
	SPT	3 9 4			50			
					51			
					52			
					53			Total Boring Depth = 50' Groundwater encountered at approximately 15' MC = Modified California sample SPT = Standard Penetration Test sample
					54			
					55			Hole backfilled with bentonite grout 8/26/08.
					56			
					57			
					58			
					59			
					60			
					61			
					62			
					63			
					64			
					65			
					66			
					67			
					68			
					69			

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

		Number: B-02
	Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 1 of 1
Date Started: 8/26/2008	**Date Finished:** 8/26/2008	**Location:** Foussat Road and HWY 76, Oceanside, CA 92058
EEI Rep: TK	**Project Number:** THO-70810	**Drill Rig/Sampling Method:** Hollow Stem Auger, B61; Autohammer, 140 pounds at 30-inch drop
		Borehole Diameter: 8"

SAMPLE LOG						BOREHOLE LOG		
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1			**ALLUVIUM**
	SPT	3 4 5			3			@ 2.5' SILTY-SAND, dark brown, minor silt, dry, loose, no odor or staining
	MC	3 4 5	91.5	12.7	6	SM		@ 5' SILTY-SAND, dark brown, moist, loose
	SPT	2 2 3			8			@ 7.5' SILTY-SAND, moist, loose
	MC	2 4 5	85.2	30.2	11			@ 10' SILTY-SAND, medium to fine grained sand, moist, loose
	SPT	2 4 6			13			@ 12.5' POORLY-GRADED SAND, brownish-gray, medium to coarse grained sand, minor silt, saturated, medium dense
	SPT	4 7 18			16	SP		@ 15' SAND, brownish-gray, medium to coarse grained sand, minor silt, saturated, medium dense, no odor or staining
					20			@ 20' SAND, brownish-gray, medium to coarse grained sand, minor silt, saturated, loose, no odor or staining
					23			Total Boring Depth = 20' Groundwater encountered at approximately 12.5' MC = Modified California sample SPT = Standard Penetration Test sample Hole backfilled with native soil and bentonite chips 8/26/08.

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

		Number: B-03
	Client: Thomas Enterprises - The Pavillion at Oceanside	Sheet: 1 of 1
	Location: Foussat Road and HWY 76, Oceanside, CA 92058	
Date Started: 8/26/2008	Date Finished: 8/26/2008	
EEI Rep: TK	Project Number: THO-70810	Drill Rig/Sampling Method: Hollow Stem Auger, B61, Autohammer, 140 pounds at 30-inch drop
		Borehole Diameter: 8"

SAMPLE LOG						BOREHOLE LOG		
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1			ALLUVIUM
	SPT	2 2 3			3			@ 2.5' SILTY-SAND, dark brown, fine to medium grained sand, minor silt, slightly moist, loose
	MC	3 4 5	101.5	2.7	6	SM		@ 5' SAND, dark brown, medium to coarse grained sand, minor silt, slightly moist, loose
	SPT	1 2 3			8			@ 7.5' SILTY-SAND, dark brown, medium to coarse grained sand, moist, loose
	MC	3 2 3	82.9	31.0	10			@ 10' SILTY-SAND, dark brown, medium to coarse grained sand, moist, very loose
	SPT	3 4 6			13			@ 12.5' SAND, brown, medium to coarse grained sand, minor silt, saturated, medium dense
	SPT	4 6 6			15	SP		@ 15' SAND, medium to coarse grained sand, minor silt, saturated, medium dense
					19			@ 20' SAND, medium to coarse grained sand, saturated, medium dense
	SPT	7 11 15			20			Total Boring Depth = 20'
								Groundwater encountered at approximately 12.5'
								MC = Modified California sample
								SPT = Standard Penetration Test sample
								Hole backfilled with native soil and bentonite 8/26/08.

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

	Number: B-04	
Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 1 of 1	
Location: Foussat Road and HWY 76, Oceanside, CA 92058		
Date Started: 8/26/2008	**Date Finished:** 8/26/2008	
EEI Rep: TK	**Project Number:** THO-70810	**Drill Rig/Sampling Method:** Hollow Stem Auger, B61; Autohammer, 140 pounds at 30-inch drop
Borehole Diameter: 8"		

SAMPLE LOG | **BOREHOLE LOG**

Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth in Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1			**ALLUVIUM**
	SPT	1 2 2			2 3 4			@ 2.5' SILTY-SAND, dark brown, fine to medium grained sand, dry, loose
	MC	3 4 5	92.6	3.1	5 6 7	SM		@ 5' SILTY-SAND, dark brown, fine to medium grained sand, slightly moist, loose
	SPT	2 2 3			8 9			@ 7.5' SILTY-SAND, dark brown, fine to medium grained sand, slightly-moist, loose
	MC	2 3 4	83.5	36.1	10 11 12	SP		@ 10' SAND, dark brown, coarse grained sand, minor silt, moist, loose
	SPT	2 4 4			13 14			@ 12.5' SAND, dark brown, coarse grained sand, minor silt, moist to saturated, loose
	SPT	2 3 4			15 16 17 18 19			@ 15' SAND, dark brown, coarse grained sand, minor silt, saturated, loose
					20			@ 20' SAND, dark brown, coarse grained sand, minor silt, saturated, loose
	SPT	1 2 3			21 22 23 24 25 26 27 28 29 30 31 32 33 34			Total Boring Depth = 20' Groundwater encountered at approximately 13' MC = Modified California sample SPT = Standard Penetration Test sample Hole backfilled with native soil and bentonite 8/26/08.

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

		Number: B-05
	Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 1 of 1
	Location: Foussat Road and HWY 76, Oceanside, CA 92058	
Date Started: 8/26/2008	**Date Finished:** 8/26/2008	
EEI Rep: TK	**Project Number:** THO-70810	**Drill Rig/Sampling Method:** Hollow Stem Auger, B61; Autohammer, 140 pounds at 30-inch drop
		Borehole Diameter: 8"

SAMPLE LOG | **BOREHOLE LOG**

Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1			**ALLUVIUM**
	SPT	3 3 4			3			@ 2.5' SILTY-SAND, brown, fine to medium grained sand, minor silt, dry, loose
	MC	4 8 11	92.7	3.6	6	SM		@ 5' SILTY-SAND, brown, fine to medium grained sand, minor silt, slightly moist, loose
	SPT	4 3 4			8			@ 7.5' SILTY-SAND, brown, fine to medium grained sand, minor silt, moist, loose
	MC	3 5 6	88.5	20.4	10			@ 10' SILTY-SAND, brown, fine to medium grained sand, minor silt, moist, loose
	SPT	2 2 4			13			
	SPT	3 6 9			16	SP		@ 15' SAND, brown, coarse grained sand, saturated, medium dense
					19			@ 20' SAND, brown, coarse grained sand, saturated, loose
	SPT	2 3 3			20			
					22			Total Boring Depth = 20' Groundwater encountered at approximately 12.5' MC = Modified California sample SPT = Standard Penetration Test sample
					25			Hole backfilled with native soil and bentonite 8/26/08.

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

Number: B-06	
Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 1 of 1
Location: Foussat Road and HWY 76, Oceanside, CA 92058	
Date Started: 8/26/2008	**Date Finished:** 8/26/2008
EEI Rep: TK	**Project Number:** THO-70810
Drill Rig/Sampling Method: Hollow Stem Auger, B61; Autohammer, 140 pounds at 30-inch drop	**Borehole Diameter:** 8"

SAMPLE LOG | **BOREHOLE LOG**

Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1			**ALLUVIUM**
	SPT	2 3 3			3			@ 2.5' SILTY-SAND, brown, minor silt, dry, loose
	MC	3 4 5	97.2	6.3	5	SM		@ 5' SILTY-SAND, brown, minor silt, slightly moist, loose
	SPT	3 3 4			8			@ 7.5' SILTY-SAND, brown, moist, loose
	MC	4 5 7	89.3	12.4	10			@ 10' SILTY-SAND, brown, moist, loose
	SPT	1 2 2			13			@ 12.5' SAND, brown, coarse grained, very moist to saturated, loose
	SPT	3 5 6			15	SP		@ 15' SAND, brown, coarse grained, saturated
					19			@ 20' SAND, brown, coarse grained, saturated, medium dense
	SPT	5 11 13			20			Total Boring Depth = 20' Groundwater encountered at approximately 13' MC = Modified California sample SPT = Standard Penetration Test sample Hole backfilled with native soil and bentonite 8/26/08.

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

	Number: B-07	
Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 1 of 1	
Location: Foussat Road and HWY 76, Oceanside, CA 92058		
Date Started: 8/26/2008	**Date Finished:** 8/26/2008	
EEI Rep: TK	**Project Number:** THO-70810	**Drill Rig/Sampling Method:** Hollow Stem Auger, B61; Autohammer, 140 pounds at 30-inch drop
Borehole Diameter: 8"		

SAMPLE LOG | **BOREHOLE LOG**

Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1			**ALLUVIUM**
	SPT	2 2 4			3			@ 2.5' SILTY-SAND, brown, fine to coarse grained sand, dry, loose
	MC	5 8 9		1.4	5			@ 5' SILTY-SAND, brown, fine to coarse grained sand, slightly moist, loose
	SPT	2 2 4			8	SM		@ 7.5' SILTY-SAND, brown, coarse grained sand, moist, loose
	MC	2 7 4	90.6	1.8	10			@ 10' SILTY-SAND, brown, coarse grained sand, moist, loose
	SPT	3 4 7			13			@ 12.5' SAND, brown, medium to coarse grained,, very moist to saturated, medium dense
	SPT	1 1 1			15	SP		@ 15' becomes very loose
					19			@ 20' becomes very loose
	SPT	3 3 5			20			Total Boring Depth = 20' Groundwater encountered at approximately 13' MC = Modified California sample SPT = Standard Penetration Test sample Hole backfilled with native soil and bentonite 8/26/08.

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

		Number: B-08
	Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 1 of 1
	Location: Foussat Road and HWY 76, Oceanside, CA 92058	
Date Started: 8/26/2008	**Date Finished:** 8/26/2008	
EEI Rep: TK	**Project Number:** THO-70810	**Drill Rig/Sampling Method:** Hollow Stem Auger, B61; Autohammer, 140 pounds at 30-inch drop
		Borehole Diameter: 8"

SAMPLE LOG						BOREHOLE LOG		
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
						ASPHALT		@ 0-2.5" ASPHALT
					1			**ALLUVIUM**
	SPT	3 3 4			2 3 4			@ 2.5' SILTY-SAND, brown, fine to coarse grained sand, dry, loose
	MC	3 4 8	96.2	3.8	5 6 7	SM		@ 5' SILTY-SAND, brown, medium to coarse grained sand, slightly moist, loose
	SPT	2 3 5			8 9			@ 7.5' SILTY-SAND, brown, medium to coarse grained sand, moist, loose
	MC	4 6 6	92.5	10.5	10 11 12			@ 10' SILTY-SAND, brown, coarse grained sand, moist, loose
	SPT	2 4 4			13 14	SW		@ 12.5' SAND, brown, coarse grained sand, very moist to moist, loose
	SPT	4 5 7			15 16 17 18 19			@ 15' SAND, brown, coarse grained sand, saturated, medium dense @ 20' SAND, brown, coarse grained sand, saturated, medium dense
	SPT	5 9 10			20 21 22 23 24 25 26 27 28 29 30 31 32 33 34			Total Boring Depth = 20' Groundwater encountered at approximately 15' MC = Modified California sample SPT = Standard Penetration Test sample Hole backfilled with native soil and bentonite 8/26/08.

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

Number: B-09	
Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 1 of 1
Location: Foussat Road and HWY 76, Oceanside, CA 92058	
Date Started: 8/26/2008	**Date Finished:** 8/26/2008
EEI Rep: TK	**Project Number:** THO-70810
Drill Rig/Sampling Method: Hollow Stem Auger, B61; Autohammer, 140 pounds at 30-inch drop	**Borehole Diameter:** 8"

SAMPLE LOG | **BOREHOLE LOG**

Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
						ASPHALT		@ 0-2.5" ASPHALT
					1			**ALLUVIUM**
					2			
	SPT	1 2 2			3			@ 2.5' SILTY-SAND, dark brown, fine grained sand, slightly moist, loose
					4			
	MC	2 4 5	89.3	13.6	5			@ 5' SILTY-SAND, dark brown, fine grained sand, slightly moist, loose
					6	SM		
					7			
	SPT	2 2 2			8			@ 7.5' SILTY-SAND, dark brown, fine grained sand, slightly moist, loose
					9			
	MC	2 3 5	81.9	33.9	10			@ 10' SILTY-SAND, dark brown, fine grained sand, moist, loose
					11			
					12			
	SPT	2 2 4			13			@ 12.5 SAND, dark brown, medium to coarse grained sand, minor silt, saturated, loose
					14			
	SPT	3 3 6			15			@ 15' SAND, dark brown, medium to coarse grained sand, minor silt, saturated, loose
					16	SP		
					17			
					18			
					19			
					20			@ 20' SAND, dark brown, medium to coarse grained sand, minor silt, saturated, medium dense
	SPT	4 7 9			21			
					22			
					23			Total Boring Depth = 20'
					24			Groundwater encountered at approximately 13'
					25			MC = Modified California sample
					26			SPT = Standard Penetration Test sample
					27			
					28			Hole backfilled with native soil and bentonite 8/26/08.
					29			
					30			
					31			
					32			
					33			
					34			

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

Number: B-10	
Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 1 of 1
Location: Foussat Road and HWY 76, Oceanside, CA 92058	
Date Started: 8/27/2008	**Date Finished:** 8/27/2008
EEI Rep: TK	**Project Number:** THO-70810
Drill Rig/Sampling Method: Hollow Stem Auger, B61, Autohammer, 140 pounds at 30-inch drop	**Borehole Diameter:** 8"

SAMPLE LOG | **BOREHOLE LOG**

Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
1					1			**FILL**
	SPT	3 4 5			2 3 4	SM		@ 2.5' SILTY-SAND, brownish-red, fine to coarse grained sand, minor clay, slightly moist, possible non-native
	MC	5 6 8	111.4	8.6	5			**ALLUVIUM**
					6 7	SM		@ 5' SILTY-SAND, dark brown, fine to coarse grained sand, minor clay, slightly moist, loose
	SPT	3 4 6			8 9			@ 7.5' SILTY-SAND, dark brown, fine to coarse grained sand, minor clay, slightly moist, medium dense
					10			@ 10' SILTY-SAND, dark brown, fine to coarse grained sand, moist to saturated, loose
	MC	3 4 5			11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34			Total Boring Depth = 10' Groundwater encountered at approximately 10' MC = Modified California sample SPT = Standard Penetration Test sample Hole backfilled with native soil and bentonite 8/27/08.

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

Number: B-11

Sheet: 1 of 1

Client: Thomas Enterprises - The Pavillion at Oceanside

Location: Foussat Road and HWY 76, Oceanside, CA 92058

Date Started:	Date Finished:	EEI Rep:	Project Number:	Drill Rig/Sampling Method:	Borehole Diameter:
8/27/2008	8/27/2008	TK	THO-70810	Hollow Stem Auger, B61 Autohammer, 140 pounds at 30-inch drop	8"

SAMPLE LOG | **BOREHOLE LOG**

Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth in Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1			**ALLUVIUM**
	SPT	7 6 4			3			@ 2.5' SILTY-SAND, reddish-brown, fine to medium grained sand, minor clay, dry, medium dense
	MC	4 5 5	88.3	2.5	5	SM		@ 5' SILTY-SAND, brown, fine to medium grained sand, minor silt, slightly moist, loose
	SPT	1 2 2			8			@ 7.5' SILTY-SAND, brown, fine to medium grained sand, moist, loose
					9			@ 10' SILTY-SAND, brown, fine to coarse grained sand, moist to saturated, loose
	MC	3 5 6			10			
					11			Total Boring Depth = 10'
					12			Groundwater encountered at approximately 10'
					13			MC = Modified California sample
					14			SPT = Standard Penetration Test sample
					15			Hole backfilled with native soil and bentonite 8/27/08.
					16			
					17			
					18			
					19			
					20			
					21			
					22			
					23			
					24			
					25			
					26			
					27			
					28			
					29			
					30			
					31			
					32			
					33			
					34			

BOREHOLE LOG

Number: B-12

Sheet: 1 of 1

Client: Thomas Enterprises - The Pavillion at Oceanside

Location: Foussat Road and HWY 76, Oceanside, CA 92058

Date Started:	Date Finished:	EEI Rep:	Project Number:	Drill Rig/Sampling Method:	Borehole Diameter:
8/27/2008	8/27/2008	TK	THO-70810	Hollow Stem Auger, B61 Autohammer, 140 pounds at 30-inch drop	8"

SAMPLE LOG | **BOREHOLE LOG**

Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1			**ALLUVIUM**
					2			
	SPT	1 2 2			3			@ 2.5' SILTY-SAND, dark brown, minor clay, dry, loose
					4			
	MC	3 4 4	91.3	4.9	5	SM		@ 5' SILTY-SAND, dark brown, slightly moist, loose
					6			
					7			
	SPT	2 3 3			8			@ 7.5' SILTY-SAND, minor clay, moist to saturated, loose
					9			
					10			@ 10' SILTY-SAND, minor clay, moist to saturated, loose
	MC	4 4 8			11			
					12			
					13			Total Boring Depth = 10'
					14			Groundwater encountered at approximately 10'
					15			MC = Modified California sample SPT = Standard Penetration Test sample Hole backfilled with native soil and bentonite 8/27/08.
					16			
					17			
					18			
					19			
					20			
					21			
					22			
					23			
					24			
					25			
					26			
					27			
					28			
					29			
					30			
					31			
					32			
					33			
					34			

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

Number: B-13	
Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 1 of 1
Location: Foussat Road and HWY 76, Oceanside, CA 92058	
Date Started: 8/27/2008	**Date Finished:** 8/27/2008
EEI Rep: TK	**Project Number:** THO-70810
Drill Rig/Sampling Method: Hollow Stem Auger, B61; Autohammer, 140 pounds at 30-inch drop	**Borehole Diameter:** 8"

SAMPLE LOG | **BOREHOLE LOG**

Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1			**ALLUVIUM**
	SPT	2 3 4			3			@ 2.5' SILTY-SAND, brown, fine to medium grained sand, dry, loose
	MC	3 4 5	73.4	25.5	5	SM		@ 5' SILTY-SAND, brown, fine to medium grained sand, moist, loose
	SPT	1 1 2			8			@ 7.5' SILTY-SAND, brown, fine to medium grained sand, moist to saturated, very loose
					9			@ 10' SILTY-SAND, brown, medium to coarse grained sand, saturated, loose
	MC	3 4 7			10			
					11			
					12			Total Boring Depth = 10'
					13			Groundwater encountered at approximately 10'
					14			MC = Modified California sample
					15			SPT = Standard Penetration Test sample
					16			Hole backfilled with native soil and bentonite 8/27/08.
					17			
					18			
					19			
					20			
					21			
					22			
					23			
					24			
					25			
					26			
					27			
					28			
					29			
					30			
					31			
					32			
					33			
					34			

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

Number: B-14	
Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 1 of 1
Location: Foussat Road and HWY 76, Oceanside, CA 92058	
Date Started: 8/27/2008	**Date Finished:** 8/27/2008
EEI Rep: TK	**Project Number:** THO-70810
Drill Rig/Sampling Method: Hollow Stem Auger, B61; Autohammer, 140 pounds at 30-inch drop	**Borehole Diameter:** 8"

SAMPLE LOG | **BOREHOLE LOG**

Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
2					1			**ALLUVIUM**
					2			
	SPT	4 5 5			3			@ 2.5' SILTY-SAND, brown, fine to medium grained sand, dry, medium dense
					4			
	MC	3 4 6	96.5	17.4	5	SM		@ 5' SILTY-SAND, brown, fine to medium grained sand, slightly moist, loose
					6			
					7			
	SPT	3 3 5			8			@ 7.5' SILTY-SAND, brown, fine to coarse grained sand, moist, loose
					9			
					10		▽	@ 10' SILTY-SAND, brown, fine to coarse grained sand, saturated, loose
	MC	4 8 8			11			
					12			
					13			Total Boring Depth = 10'
					14			Groundwater encountered at approximately 10'
					15			MC = Modified California sample SPT = Standard Penetration Test sample Hole backfilled with native soil and bentonite 8/27/08.
					16			
					17			
					18			
					19			
					20			
					21			
					22			
					23			
					24			
					25			
					26			
					27			
					28			
					29			
					30			
					31			
					32			
					33			
					34			

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

Number: B-15	
Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 1 of 1
Location: Foussat Road and HWY 76, Oceanside, CA 92058	
Date Started: 8/27/2008	**Date Finished:** 8/27/2008
EEI Rep: TK	**Project Number:** THO-70810
Drill Rig/Sampling Method: Hollow Stem Auger, B61; Autohammer, 140 pounds at 30-inch drop	**Borehole Diameter:** 8"

SAMPLE LOG | **BOREHOLE LOG**

Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
						ASPHALT		@ 0-1" ASPHALT
					1			**ALLUVIUM**
	SPT	1 1 2			2 3 4			@ 2.5' SILTY-SAND, dark brown, fine to medium grained sand, slightly moist, very loose
	MC	3 6 6	86.3	1.3	5 6 7			@ 5' SILTY-SAND, dark brown, fine to medium grained sand, slightly moist, loose
	SPT	2 2 2			8 9	SM		@ 7.5' SILTY-SAND, light brown, moist, loose
	MC	4 4 8	94.5	11.2	10 11 12			@ 10' SILTY-SAND, light brown, moist, loose
	SPT	2 3 3			13 14		▽	@ 12.5' SILTY-SAND, light brown, moist to saturated, loose
	SPT	1 1 1			15 16 17 18 19	SP		@ 15' SAND, brown, fine to medium grained sand, saturated, very loose @ 20' SAND, brown, fine to medium grained sand, saturated, medium dense
	SPT	3 3 7			20 21 22 23 24 25 26 27 28 29 30 31 32 33 34			Total Boring Depth = 20' Groundwater encountered at approximately 13' MC = Modified California sample SPT = Standard Penetration Test sample Hole backfilled with native soil and bentonite 8/27/08.

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

	Number: B-16	
Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 1 of 1	
Location: Foussat Road and HWY 76, Oceanside, CA 92058		
Date Started: 8/27/2008	**Date Finished:** 8/27/2008	
EEI Rep: TK	**Project Number:** THO-70810	**Drill Rig/Sampling Method:** Hollow Stem Auger, B61; Autohammer, 140 pounds at 30-inch drop
Borehole Diameter: 8"		

SAMPLE LOG						BOREHOLE LOG		
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
						ASPHALT		@ 0-2.5" ASPHALT
					1			**ALLUVIUM**
	SPT	3 4 4			2 3 4			@ 2.5' SILTY-SAND, brown, fine to coarse grained sand, slightly moist, loose
	MC	3 4 6	92.5	2.1	5 6 7			@ 5' SILTY-SAND, brown, fine to coarse grained sand, slightly moist, loose
	SPT	3 4 6			8 9	SM		@ 7.5' SILTY-SAND, brown, fine to coarse grained sand, slightly moist, medium dense
	MC	3 3 4	115.6	2.2	10 11 12			@ 10' SILTY-SAND, brown, fine to coarse grained sand, slightly moist, loose
	SPT	1 2 2			13 14		▽	@ 12.5' SILTY-SAND, brown, fine to coarse grained sand, minor clay, moist to saturated, loose
	SPT	2 2 3			15 16 17 18 19	SP		@ 15' SAND, brown, fine to coarse grained sand, minor clay, saturated, loose @ 20' SAND, brown, fine to coarse grained sand, minor clay, saturated, loose
	SPT	5 5 4			20 21 22 23 24 25 26 27 28 29 30 31 32 33 34			Total Boring Depth = 20' Groundwater encountered at approximately 13' MC = Modified California sample SPT = Standard Penetration Test sample Hole backfilled with native soil and bentonite 8/27/08.

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

	Client: Thomas Enterprises - The Pavillion at Oceanside	**Number:** B-17
		Sheet: 1 of 1
Location: Foussat Road and HWY 76, Oceanside, CA 92058		
Date Started: 8/27/2008	**Date Finished:** 8/27/2008	
EEI Rep: TK	**Project Number:** THO-70810	**Drill Rig/Sampling Method:** Hollow Stem Auger, B61; Autohammer, 140 pounds at 30-inch drop
		Borehole Diameter: 8"

SAMPLE LOG						BOREHOLE LOG		
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
						ASPHALT		@ 0-2" ASPHALT
3					1			**ALLUVIUM**
	SPT	1 1 2			2			
					3			@ 2.5' SILTY-SAND, dark brown, fine to medium grained sand, slightly moist, very loose
	MC	3 4 5	79.7	17.3	4			
					5			@ 5' SILTY-SAND, dark brown, fine to coarse grained sand, slightly moist, loose
					6	SM		
	SPT	3 4 5			7			
					8			@ 7.5' SANDY-SILT, dark brown, fine grained sand, moist, loose
					9			
	MC	2 3 5	87.1	27.5	10			@ 10' SANDY-SILT, dark brown, fine grained sand, very moist, loose
					11			
					12			
	SPT	2 5 7			13			@ 12.5' SAND, fine to coarse grained sand, minor silt, saturated, medium dense
					14			
	SPT	3 3 6			15			@ 15' SAND, fine to coarse grained sand, saturated, loose
					16	SP		
					17			
					18			
					19			
					20			@ 20' SAND, fine to coarse grained sand, saturated, medium dense
	SPT	4 5 6			21			
					22			
					23			Total Boring Depth = 20'
					24			Groundwater encountered at approximately 12.5'
					25			MC = Modified California sample
					26			SPT = Standard Penetration Test sample
					27			
					28			Hole backfilled with native soil and bentonite 8/27/08.
					29			
					30			
					31			
					32			
					33			
					34			

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

Number: B-18	
Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 1 of 1
Location: Foussat Road and HWY 76, Oceanside, CA 92058	
Date Started: 8/27/2008	**Date Finished:** 8/27/2008
EEI Rep: TK	**Project Number:** THO-70810
Drill Rig/Sampling Method: Hollow Stem Auger, B61; Autohammer, 140 pounds at 30-inch drop	**Borehole Diameter:** 8"

SAMPLE LOG						BOREHOLE LOG		
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
4					0 ASPHALT			@ 0-2" ASPHALT
					1			**ALLUVIUM**
	SPT	1 2 2			2 3 4	SM		@ 2.5' SILTY-SAND, dark brown, fine to medium grained sand, slightly moist, loose
	MC	2 4 6	87.8	15.0	5 6 7			@ 5' SILTY-SAND, dark brown, fine to medium grained sand, slightly moist, loose
	SPT	2 2 3			8 9	ML		@ 7.5' SANDY-SILT, dark brown, fine grained sand, slightly moist, loose
	MC	2 3 4	82.3	37.3	10 11 12			@ 10' SANDY-SILT, dark brown, fine grained sand, moist, loose
	SPT	2 3 3			13 14	SP		@ 12.5' SAND, light brown, fine to coarse grained sand, saturated, loose
	SPT	1 2 3			15 16 17 18 19			@ 15' SAND, light brown, fine to coarse grained sand, saturated, loose @ 20' SAND, light brown, fine to coarse grained sand, saturated, medium dense
	SPT	2 3 9			20 21 22 23 24 25 26 27 28 29 30 31 32 33 34			Total Boring Depth = 20' Groundwater encountered at approximately 13' MC = Modified California sample SPT = Standard Penetration Test sample Hole backfilled with native soil and bentonite 8/27/08.

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

Number:	B-19
Client:	Thomas Enterprises - The Pavillion at Oceanside
Sheet:	1 of 1
Location:	Foussat Road and HWY 76 Oceanside, CA 92058
Date Started:	8/27/2008
Date Finished:	8/27/2008
EEI Rep:	TK
Project Number:	THO-70810
Drill Rig/Sampling Method:	Hollow Stem Auger, B61 Autohammer, 140 pounds at 30-inch drop
Borehole Diameter:	8"

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1			**ALLUVIUM**
					2			
	SPT	2 3 4			3			@ 2.5' SILTY-SAND, dark brown, fine to medium grained sand, moist, loose
					4			
	MC	3 3 4	97.7	23.1	5	SM		@ 5' SAND, dark brown, fine to medium grained sand, minor silt, moist, loose
					6			
					7			
	SPT	3 3 4			8			@ 7.5' SAND, dark brown, fine to medium grained sand, moist, loose
					9			
					10			@ 10' SAND, dark brown, fine to medium grained sand, saturated, medium dense
	MC	4 8 12			11			
					12			
					13			Total Boring Depth = 10'
					14			Groundwater encountered at approximately 10'
					15			MC = Modified California sample SPT = Standard Penetration Test sample
					16			
					17			Hole backfilled with native soil and bentonite 8/27/08.
					18			
					19			
					20			
					21			
					22			
					23			
					24			
					25			
					26			
					27			
					28			
					29			
					30			
					31			
					32			
					33			
					34			

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

		Number: B-20
	Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 1 of 1
	Location: Foussat Road and HWY 76, Oceanside, CA 92058	
Date Started: 8/29/2008	**Date Finished:** 8/29/2008	
EEI Rep: TK	**Project Number:** THO-70810	**Drill Rig/Sampling Method:** Hollow Stem Auger, B53; Autohammer, 140 pounds at 30-inch drop
		Borehole Diameter: 8"

SAMPLE LOG						BOREHOLE LOG		
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
						ASPHALT		@ 0-2" ASPHALT
					1			**ALLUVIUM**
	SPT	6 10 11			2			
					3			@ 2.5' SILTY-SAND, brown, fine to medium grained sand, dry, medium dense
					4			
	MC	8 11 14	106.0	5.0	5			
					6			@ 5' SILTY-SAND, brown, fine to medium grained sand, slightly moist, medium dense
					7			
	SPT	3 3 5			8	SM		@ 7.5' SILTY-SAND, brown, fine to medium grained sand, slightly moist, loose
					9			
	MC	7 10 11	92.7	2.2	10			@ 10' SILTY-SAND, brown, coarse grained sand, moist, medium dense
					11			
					12			
	SPT	3 3 5			13			@ 12.5' SILTY-SAND, brown, coarse grained sand, moist to saturated, loose
					14			
					15			
	SPT	3 3 4			16			@ 15' SAND, brownish-gray, medium to coarse grained sand, saturated, loose
					17	SP		
					18			
					19			@ 20' SAND, brownish-gray, coarse grained sand, saturated, medium dense
					20			
	SPT	5 8 10			21			
					22			
					23			Total Boring Depth = 20'
					24			Groundwater encountered at approximately 13.5'
					25			MC = Modified California sample
					26			SPT = Standard Penetration Test sample
					27			
					28			Hole backfilled with native soil and bentonite 8/29/08.
					29			
					30			
					31			
					32			
					33			
					34			

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

	Number: B-21	
Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 1 of 2	
Location: Foussat Road and HWY 76, Oceanside, CA 92058		
Date Started: 8/29/2008	**Date Finished:** 8/29/2008	
EEI Rep: TK	**Project Number:** THO-70810	**Drill Rig/Sampling Method:** Hollow Stem Auger, B53, Autohammer, 140 pounds at 30-inch drop
Borehole Diameter: 8"		

SAMPLE LOG						BOREHOLE LOG		
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth in Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
						ASPHALT		@ 0-2" ASPHALT
					1			ALLUVIUM
	SPT	7 7 9			2 3			@ 2.5' SILTY-SAND, brown, dry, medium dense
	MC	7 8 11	98.3	4.3	4 5 6	SM		@ 5' SILTY-SAND, brown, slightly moist, medium dense
	SPT	5 5 8			7 8 9			@ 7.5' SILTY-SAND, brown, coarse grained sand, moist, medium dense
	MC	5 13 15	92.0	13.3	10 11 12			@ 10' SAND, gray, coarse grained sand, moist, medium dense
	SPT	3 4 5			13 14			@ 12.5' SAND, gray, fine to medium grained sand, moist to saturated, loose
	SPT	3 6 8			15 16 17 18 19			@ 15' SAND, gray, @ 15' fine to medium grained sand, saturated, medium dense
	SPT	4 7 8			20 21 22 23 24	SP		@ 20' SAND, gray, fine to coarse grained sand, minor silt, saturated, medium dense
	SPT	5 9 9			25 26 27 28 29			@ 25' SAND, gray, fine to coarse grained sand, minor silt, saturated, medium dense
	SPT	3 4 7			30 31 32 33 34	SM		@ 30' SILTY-SAND, gray, fine to coarse grained sand, saturated, medium dense

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BOREHOLE LOG

EEI Geotechnical & Environmental Solutions

	Number: B-21	
Client: Thomas Enterprises - The Pavillion at Oceanside	**Sheet:** 2 of 2	
Location: Foussat Road and HWY 76, Oceanside, CA 92058		
Date Started: 8/29/2008	**Date Finished:** 8/29/2008	
EEI Rep: TK	**Project Number:** THO-70810	**Drill Rig/Sampling Method:** Hollow Stem Auger, B53; Autohammer, 140 pounds at 30-inch drop
		Borehole Diameter: 8"

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
	SPT	7 14 16			36 37 38 39 40	SW		@ 35' SAND, gray, fine to coarse grained sand, minor clay, saturated, dense
	SPT	5 8 9			40 41 42 43 44 45	SM		@ 40' SILTY-SAND, gray, minor clay, saturated, medium dense
	SPT	3 2 3			45 46 47 48 49 50	CL		@ 45' CLAYEY-SILT, gray, some fine grained sand, saturated, firm @ 50' CLAYEY-SILT, gray, some fine grained sand, saturated, very stiff
	SPT	7 12 19			51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69			Total Boring Depth = 50' Groundwater encountered at approximately 13' MC = Modified California sample SPT = Standard Penetration Test sample Hole backfilled with native soil and bentonite 8/29/08.

BOREHOLE LOG THO-70810-FOUSSAT76-BORINGLOGS.GPJ EEI.GDT 9/8/08

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Riverplace	IR630	**B-101**

SITE LOCATION	START	FINISH	SHEET NO.
Oceanside, CA (See Figure 2)	6/24/2015	6/24/2015	1 of 4

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
C&L Drilling	Mayhew 1000	Rotary Wash	Sathis/Grace	Kul

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi), %	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	71	4.875	81.5	37.5	▽ NM / *NM* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	BACKFILL METHOD	
SPT (1.4"), CAL (2.4")	N60* = 1.18 Nspt = 0.79 Ncal	Bentonite chips	▼ 27.0 / *10.5* AFTER DRILLING 6/24/2015

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-1	8 8 16	24	19			3.3	104					SILTY SAND (SM); medium dense; brown; moist; mostly fine to medium SAND; some fines, nonplastic.
	35														
			S-2	7 9 11	20	24									
5			R-3	7 14 20	34	27			4.8	106		#200			61% SAND; 39% fines
	30														
			S-4	9 15 19	34	40									Dense.
10			R-5	5 9 11	20	16			1.8	100					Poorly-graded SAND (SP); medium dense; pale brown; moist; mostly fine to medium SAND; trace fines; nonplastic; trace iron oxidation staining.
	25														
			S-6	5 7 7	14	17									Slightly micaceous.
15			R-7	5 10 13	23	18			3.5	103		#200			96% SAND; 4% fines
	20														
			S-8	7 10 10	20	24									
20			R-9	8 12 17	29	23			5.5	96					Mostly fine SAND; few medium SAND.
	15														

GDC_LOG_BORING_2013 IR 630 RIVERPLACE OCEANSIDE.GPJ GDC2013.GDT 7/9/15

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THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-2 a

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Riverplace	IR630	**B-101**

SITE LOCATION	START	FINISH	SHEET NO.
Oceanside, CA (See Figure 2)	6/24/2015	6/24/2015	2 of 4

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
C&L Drilling	Mayhew 1000	Rotary Wash	Sathis/Grace	Kul

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi), %	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	71	4.875	81.5	37.5	▽ NM / *NM* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	BACKFILL METHOD	
SPT (1.4"), CAL (2.4")	N60* = 1.18 Nspt = 0.79 Ncal	Bentonite chips	▼ 27.0 / *10.5* 6/24/2015 AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			S-10	7 8 8	16	19									SILTY SAND (SM); medium dense; gray; moist; mostly fine to medium SAND; little fines; nonplastic; slightly micaceous.
	10														
30			R-11	9 9 15	24	19			23.8	98					
	5														
35			S-12	8 8 9	17	20									Dark gray.
	0														
40			R-13	10 20 22	42	33			25.4	100					Poorly-graded SAND (SP); dense; light gray; wet; mostly fine to medium SAND; trace fines; nonplastic; slightly micaceous.
	-5														
45			S-14	0 3 5	8	9			38.5		39:14	#200			SANDY SILT/SANDY lean CLAY (ML/CL); medium stiff; dark gray; wet; mostly fines; some fine SAND; low to medium plasticity; PP=0.5 tsf; micaceous; trace seashell fragments. 61% fines; 38% SAND; 1% seashell fragments
	-10														

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FIGURE
A-2 b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Riverplace	IR630	**B-101**

SITE LOCATION	START	FINISH	SHEET NO.
Oceanside, CA (See Figure 2)	6/24/2015	6/24/2015	3 of 4

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
C&L Drilling	Mayhew 1000	Rotary Wash	Sathis/Grace	Kul

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi), %	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	71	4.875	81.5	37.5	▽ NM / *NM* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	BACKFILL METHOD	
SPT (1.4"), CAL (2.4")	N60* = 1.18 Nspt = 0.79 Ncal	Bentonite chips	▼ 27.0 / *10.5* AFTER DRILLING 6/24/2015

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-15-2	3	20	16									*(SANDY SILT/SANDY lean CLAY (ML/CL), continued.)*
			R-15-1	7 13					27.1	98					SILTY SAND (SM); medium dense; light gray; wet; mostly fine to medium SAND; little fines; nonplastic.
	-15														
55			S-16	2 6 10	16	19									Dark gray; mostly fine SAND; few medium SAND; trace organics.
	-20														
60			R-17	9 24 26	50	40			22.8	105					Poorly-graded SAND with SILT (SP-SM); dense; gray; wet; mostly fine to medium SAND; few fines; nonplastic.
	-25														
65			S-18	2 5 10	15	18									SANDY SILT (ML); medium stiff; dark gray; wet; mostly fines; some fine SAND; low plasticity; PP=0.5 tsf; slightly micaceous.
	-30														
70			R-19	6 8 13	21	17									PP=0.5 tsf.
	-35														

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FIGURE
A-2 c

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Riverplace	IR630	**B-101**

SITE LOCATION	START	FINISH	SHEET NO.
Oceanside, CA (See Figure 2)	6/24/2015	6/24/2015	4 of 4

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
C&L Drilling	Mayhew 1000	Rotary Wash	Sathis/Grace	Kul

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi), %	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	71	4.875	81.5	37.5	▽ NM / *NM* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	BACKFILL METHOD	
SPT (1.4"), CAL (2.4")	N60* = 1.18 Nspt = 0.79 Ncal	Bentonite chips	▼ 27.0 / *10.5* 6/24/2015 AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			S-20	3 8 11	19	22									SILTY SAND (SM); medium dense; dark gray; wet; mostly fine SAND; some fines; nonplastic; slightly micaceous.
80	-40														
			R-21	16 21 32	53	42									Poorly-graded SAND with SILT (SP-SM); dense; light gray; wet; mostly fine to medium SAND; few fines; nonplastic.
															Bottom of borehole at 81.5 feet. Boring terminated at planned depth.
85	-45														This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
	-50														
90															
	-55														
95															
	-60														

GDC_LOG_BORING_2013 IR 630 RIVERPLACE OCEANSIDE.GPJ GDC2013.GDT 7/9/15

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FIGURE
A-2 d

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Riverplace	IR630	**B-102**

SITE LOCATION	START	FINISH	SHEET NO.
Oceanside, CA (See Figure 2)	6/24/2015	6/24/2015	1 of 3

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
C&L Drilling	Mayhew 1000	Rotary Wash	Sathis/Grace	Kul

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi), %	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	71	4.875	56.5	40.0	▽ NM / *NM* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	BACKFILL METHOD	
SPT (1.4"), CAL (2.4")	N60* = 1.18 Nspt = 0.79 Ncal	Bentonite chips	▼ 27.0 / *13.0* 6/24/2015 AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
															Poorly-graded SAND with SILT (SP-SM); dense; light grayish brown; moist; mostly fine to medium SAND; few fines; nonplastic; slightly micaceous.
			R-1	14 27 33	60	48			6.0	112					
5	35		S-2	8 10 8	18	21									Medium dense; grayish brown.
			R-3	3 5 8	13	10			6.5	104		#200			Loose to medium dense. 92% SAND; 8% fines
10	30		S-4	2 3 6	9	11									Medium dense.
			R-5	4 6 9	15	12			15.2	102		SW			Mostly fine SAND.
15	25		S-6	4 6 7	13	15									Mostly fine to medium SAND.
			R-7	7 12 15	27	21			12.8	102					Poorly-graded SAND (SP); medium dense; pale brown; moist; mostly fine to medium SAND; trace fines; nonplastic; slightly micaceous.
20	20		S-8	6 7 5	12	14									Few coarse SAND.

GDC_LOG_BORING_2013 IR 630 RIVERPLACE OCEANSIDE.GPJ GDC2013.GDT 7/9/15

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FIGURE
A-3 a

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Riverplace	IR630	**B-102**

SITE LOCATION	START	FINISH	SHEET NO.
Oceanside, CA (See Figure 2)	6/24/2015	6/24/2015	2 of 3

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
C&L Drilling	Mayhew 1000	Rotary Wash	Sathis/Grace	Kul

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi), %	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	71	4.875	56.5	40.0	▽ NM / *NM* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	BACKFILL METHOD	
SPT (1.4"), CAL (2.4")	N60* = 1.18 Nspt = 0.79 Ncal	Bentonite chips	▼ 27.0 / *13.0* 6/24/2015 AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-9	10 16 20	36	29			3.6	104					*(Poorly-graded SAND (SP), continued.)* No coarse SAND.
30	10		S-10	4 4 4	8	9			25.3			#200			SILTY SAND (SM); loose; gray; wet; mostly fine SAND; some fines; nonplastic; slightly micaceous. 71% SAND; 29% fines
35	5		R-11	7 10 13	23	18			28.0	95					Medium dense.
40	0		S-12	0 1 7	8	9			34.3		39:14	#200			SANDY SILT/SANDY lean CLAY (ML/CL); medium stiff; dark gray; moist; nearly equal portions of fines and fine SAND; low plasticity; PP=0.5 tsf; slightly micaceous. 51% fines; 49% SAND
45	-5		R-13	14 20 22	42	33			22.7	104					SILTY SAND (SM); dense; light gray; wet; mostly fine to medium sand; little fines; nonplastic; slightly micaceous.

GDC_LOG_BORING_2013 IR 630 RIVERPLACE OCEANSIDE.GPJ GDC2013.GDT 7/9/15

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FIGURE
A-3 b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Riverplace	IR630	**B-102**

SITE LOCATION	START	FINISH	SHEET NO.
Oceanside, CA (See Figure 2)	6/24/2015	6/24/2015	3 of 3

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
C&L Drilling	Mayhew 1000	Rotary Wash	Sathis/Grace	Kul

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi), %	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	71	4.875	56.5	40.0	▽ NM / *NM* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	BACKFILL METHOD	
SPT (1.4"), CAL (2.4")	N60* = 1.18 Nspt = 0.79 Ncal	Bentonite chips	▼ 27.0 / *13.0* 6/24/2015 AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			S-14	6 10 10	20	24									*(SILTY SAND (SM), continued.)* Medium dense; gray; mostly fine SAND.
55	-15		R-15	7 13 18	31	25									
															Bottom of borehole at 56.5 feet. Boring terminated at planned depth. This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
60	-20														
65	-25														
70	-30														

GDC_LOG_BORING_2013 IR 630 RIVERPLACE OCEANSIDE.GPJ GDC2013.GDT 7/9/15

GROUP DELTA CONSULTANTS
32 Mauchly, Suite B
Irvine, CA 92618

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FIGURE
A-3 c

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Riverplace	IR630	**B-103**

SITE LOCATION	START	FINISH	SHEET NO.
Oceanside, CA (See Figure 2)	6/24/2015	6/24/2015	1 of 3

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
C&L Drilling	Mayhew 1000	Rotary Wash	Sathis/Grace	Kul

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi), %	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	71	4.875	61.5	35.5	▽ NM / *NM* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	BACKFILL METHOD	
SPT (1.4"), CAL (2.4")	N60* = 1.18 Nspt = 0.79 Ncal	Bentonite chips	▼ 24.0 / *11.5* AFTER DRILLING 6/24/2015

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
0	35														SILTY SAND (SM); brown; moist; mostly fine to medium SAND; little fines; nonplastic.
			R-1	3 6 6	12	10						CR			Poorly-graded SAND with SILT (SP-SM); loose to medium dense; pale brown; moist; mostly fine to medium SAND; few fines; nonplastic.
5	30		S-2	3 4 5	9	11									Medium dense.
			R-3	3 7 9	16	13			8.5	96					Slightly micaceous.
10	25		S-4	5 6 6	12	14									
15	20		R-5	5 7 8	15	12			9.6	99		PA DS			92% SAND; 8% fines
20	15		S-6	6 9 7	16	19									

GDC_LOG_BORING_2013 IR 630 RIVERPLACE OCEANSIDE.GPJ GDC2013.GDT 7/9/15

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FIGURE
A-4 a

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Riverplace	IR630	**B-103**

SITE LOCATION	START	FINISH	SHEET NO.
Oceanside, CA (See Figure 2)	6/24/2015	6/24/2015	2 of 3

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
C&L Drilling	Mayhew 1000	Rotary Wash	Sathis/Grace	Kul

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi), %	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	71	4.875	61.5	35.5	▽ NM / *NM* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	BACKFILL METHOD	
SPT (1.4"), CAL (2.4")	N60* = 1.18 Nspt = 0.79 Ncal	Bentonite chips	▼ 24.0 / *11.5* 6/24/2015 AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
	10		R-7	1 3 3	6	5			29.5	95					SANDY SILT (ML); medium stiff; gray; moist; mostly fines; some fine SAND; low plasticity; PP=0.5 tsf; slightly micaceous; trace organics.
30	5		S-8	2 3 5	8	9									SILTY SAND (SM); loose; gray; wet; mostly fine sand; some fines; nonplastic; slightly micaceous.
35	0		R-9	5 7 10	17	13			25.7	97					Medium dense.
40	-5		S-10	0 3 5	8	9									Loose; dark gray.
45	-10		R-11	6 8 10	18	14			34.7	88	0:0	#200			61% SAND; 39% fines

GDC_LOG_BORING_2013 IR 630 RIVERPLACE OCEANSIDE.GPJ GDC2013.GDT 7/9/15

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FIGURE
A-4 b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Riverplace	IR630	**B-103**

SITE LOCATION	START	FINISH	SHEET NO.
Oceanside, CA (See Figure 2)	6/24/2015	6/24/2015	3 of 3

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
C&L Drilling	Mayhew 1000	Rotary Wash	Sathis/Grace	Kul

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi), %	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	71	4.875	61.5	35.5	▽ NM / *NM* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	BACKFILL METHOD	
SPT (1.4"), CAL (2.4")	N60* = 1.18 Nspt = 0.79 Ncal	Bentonite chips	▼ 24.0 / *11.5* 6/24/2015 AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
	-15		S-12	0 6 11	17	20									SANDY SILT (ML); medium stiff; dark gray; moist; mostly fines; some fine SAND; low plasticity; PP=0.5 tsf.
55	-20		R-13	4 7 9	16	13									PP=0.5 tsf.
60	-25		S-14	4 4 6	10	12									PP=0.5 tsf.
															Bottom of borehole at 61.5 feet. Boring terminated at planned depth.
65	-30														This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
70	-35														

GDC_LOG_BORING_2013 IR 630 RIVERPLACE OCEANSIDE.GPJ GDC2013.GDT 7/9/15

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FIGURE
A-4 c

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Riverplace	IR630	**B-104**

SITE LOCATION	START	FINISH	SHEET NO.
Oceanside, CA (See Figure 2)	6/23/2015	6/23/2015	1 of 3

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
C&L Drilling	Mayhew 1000	Rotary Wash	Sathis/Grace	Kul

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi), %	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	71	4.875	71.5	37.0	▽ NM / *NM* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	BACKFILL METHOD	
SPT (1.4"), CAL (2.4")	N60* = 1.18 Nspt = 0.79 Ncal	Bentonite chips	▼ 24.0 / *13.0* 6/24/2015 AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
															SILTY SAND (SM); brown; moist; mostly fine to medium SAND; little fines; nonplastic.
	35														Poorly-graded SAND with SILT (SP-SM); medium dense; brown; moist; mostly fine to medium SAND; few fines; nonplastic.
			R-1	5 8 10	18	14			2.4	103					
5															Loose.
			S-2	2 3 4	7	8									
	30														
			R-3	4 5 8	13	10			10.2	96		#200			Loose to medium dense. 95% SAND; 5% fines
10															Medium dense; yellowish brown; trace iron oxidation staining.
			S-4	3 6 8	14	17									
	25														
			R-5	5 11 13	24	19			4.6	98		PA			Olive brown; slightly micaceous. 95% SAND; 5% fines
15															
			S-6	5 8 13	21	25									
	20														
			R-7	9 18 20	38	30			4.3	100					Medium dense to dense; light yellowish brown.
20															Medium dense.
			S-8	5 7 8	15	18									
	15														

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FIGURE
A-5 a

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Riverplace	IR630	**B-104**

SITE LOCATION	START	FINISH	SHEET NO.
Oceanside, CA (See Figure 2)	6/23/2015	6/23/2015	2 of 3

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
C&L Drilling	Mayhew 1000	Rotary Wash	Sathis/Grace	Kul

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi), %	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	71	4.875	71.5	37.0	▽ NM / *NM* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	BACKFILL METHOD	
SPT (1.4"), CAL (2.4")	N60* = 1.18 Nspt = 0.79 Ncal	Bentonite chips	▼ 24.0 / *13.0* 6/24/2015 AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-9	0 2 3	5	4			28.8	91					SANDY SILT (ML); soft; dark gray; moist to wet; mostly fines; some fine SAND; low plasticity; PP=0.5 tsf; micaceous.
	10														
30			S-10	2 4 6	10	12			31.4		30:5	#200			Medium stiff; trace fine GRAVEL; PP=0.5 tsf. 63% fines; 36% SAND; 1% GRAVEL
	5														
35			R-11	3 6 9	15	12			31.8	90					No GRAVEL; PP=0.5 tsf.
	0														
40			S-12	4 11 13	24	28			27.3			#200			SILTY SAND (SM); medium dense; dark gray; wet; nearly equal portions of fine SAND and fines; low plasticity; micaceous. 51% SAND; 49% fines
	-5														
45			R-13	15 22 30	52	41			21.6	99					Poorly-graded SAND with SILT (SP-SM); dense; grayish brown; wet; mostly fine to medium SAND; few fines; nonplastic.
	-10														

GDC_LOG_BORING_2013 IR 630 RIVERPLACE OCEANSIDE.GPJ GDC2013.GDT 7/9/15

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FIGURE
A-5 b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Riverplace	IR630	**B-104**

SITE LOCATION	START	FINISH	SHEET NO.
Oceanside, CA (See Figure 2)	6/23/2015	6/23/2015	3 of 3

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
C&L Drilling	Mayhew 1000	Rotary Wash	Sathis/Grace	Kul

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi), %	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	71	4.875	71.5	37.0	▽ NM / *NM* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	BACKFILL METHOD	
SPT (1.4"), CAL (2.4")	N60* = 1.18 Nspt = 0.79 Ncal	Bentonite chips	▼ 24.0 / *13.0* 6/24/2015 AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			S-14	6 19 25	44	52									*(Poorly-graded SAND with SILT (SP-SM), continued.)* Very dense.
	-15														
55			R-15	15 25 33	58	46									Dense.
	-20														
60			S-16	8 12 13	25	30									SILTY SAND (SM); medium dense to dense; gray; wet; mostly fine SAND; some fines; nonplastic.
	-25														
65			S-17	10 15 16	31	37									Dense.
	-30														
70			S-18	15 23 25	48	57									Poorly graded SAND with SILT (SP-SM); very dense; light gray; wet; mostly fine to medium SAND; few fines; nonplastic.
	-35														Bottom of borehole at 71.5 feet. Boring terminated at planned depth.

This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).

GDC_LOG_BORING_2013 IR 630 RIVERPLACE OCEANSIDE.GPJ GDC2013.GDT 7/9/15

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FIGURE
A-5 c

APPENDIX B
LABORATORY TEST DATA

GRAIN SIZE DISTIBUTION - PASSING #200 SIEVE

ASTM METHOD D422

Boring No.	B-1	B-2	B-3	B-5	B-6		
Depth	7	6	7	6	7		ft
Total Sample Weight	98.2	108.9	108.7	116.9	100.6		gm
Retained on #200 Sieve	48.4	103.9	96.0	114.8	57.1		gm
Passing #200 Sieve	49.8	5.0	12.7	2.1	43.5		gm
Fines Content	**50.7**	**4.6**	**11.7**	**1.8**	**43.2**		%

Boring No.							
Depth							ft
Total Sample Weight							gm
Retained on #200 Sieve							gm
Passing #200 Sieve							gm
Fines Content							%

Boring No.							
Depth							ft
Total Sample Weight							gm
Retained on #200 Sieve							gm
Passing #200 Sieve							gm
Fines Content							%

EEI Engineering Solutions

2195 Faraday Avenue, Suite K, Carlsbad, CA 92008

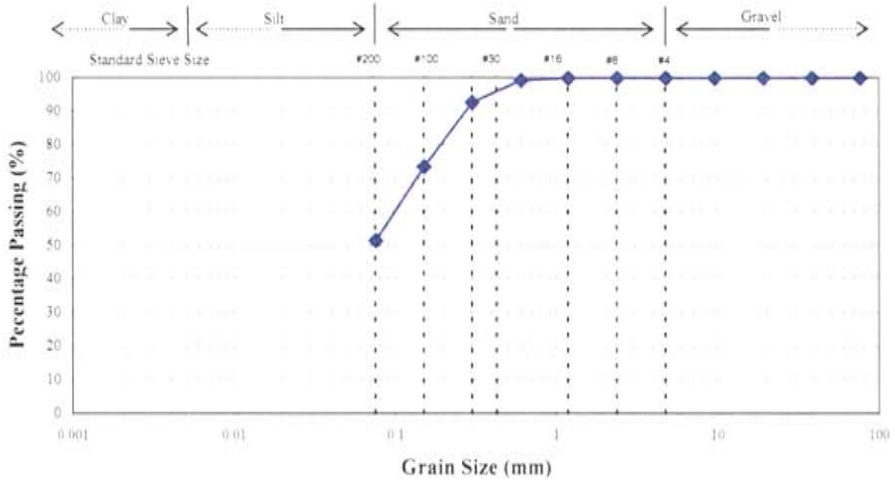
Client:	Zephyr Partners
Project Name:	Oceanside
Project Number:	ZEP-72676.4
Date:	9/5/18
Tested by:	B D
Reviewed by:	

APPENDIX B-1
EEI (2008) AND GROUP DELTA (2015) LABORATORY TEST DATA

PARTICLE-SIZE ANALYSIS OF SOILS
ASTM METHOD D 422 (SIEVE ANALYSIS)

Sample :	B1@25ft		D10 (mm)	na
Total Weight (g)	164.8		D30 (mm)	na
Dry Weight (g)	121.6		D60 (mm)	0.10
Wet Sieve Weight (g)	60.1		Cu	na
Initial Moisture (%)	35.5		Cc	na

According to ASTM D 2487 Unified Soil Classification System (USCS) and ASTM D 422 (Standard Test Method for Particle-Size Analysis) test method results, soil sample B1 at 25 feet is classified as Sandy silt (**ML**).



Sieve Size (in)	Sieve Size (mm)	Cumulative Weight of dry soil (gm)	Percent Retained (%)	Percent Passing (%)
3"	76.2		0.0	100.0
1.5"	38.1		0.0	100.0
3/4"	19.05		0.0	100.0
3/8"	9.53		0.0	100.0
#4	4.75		0.0	100.0
#8	2.36		0.0	100.0
#16	1.18		0.0	100.0
#30	0.6	0.8	0.7	99.3
#50	0.3	8.8	7.2	92.8
#100	0.15	32.1	26.4	73.6
#200	0.075	58.9	48.4	51.6

EEI Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad CA 92008

Client: Thomas Enterprises

Project Name: Oceanside, CA

Job Number: THO-70810

Date: 9-4-08

Boring Number: B1

Location: 25 feet

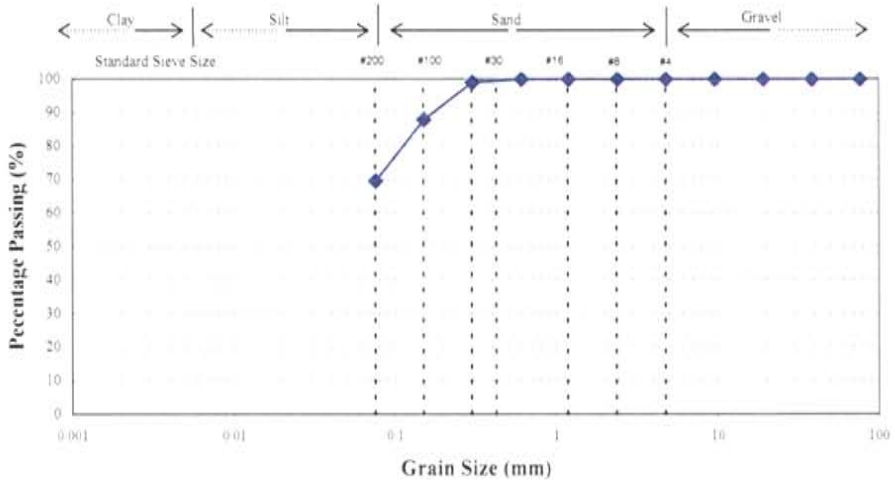
Soil Description: Sandy silt, ML

Tested by: AW

PARTICLE-SIZE ANALYSIS OF SOILS
ASTM METHOD D 422 (SIEVE ANALYSIS)

Sample :	B1@40ft		D10 (mm)	na
Total Weight (g)	134.6		D30 (mm)	na
Dry Weight (g)	102.4		D60 (mm)	na
Wet Sieve Weight (g)	32.9		Cu	na
Initial Moisture (%)	31.4		Cc	na

According to ASTM D 2487 Unified Soil Classification System (USCS) and ASTM D 422 (Standard Test Method for Particle-Size Analysis) test method results, soil sample B1 at 40 feet is classified as Sandy silt (**ML**).



Sieve Size (in)	Sieve Size (mm)	Cumulative Weight of dry soil (gm)	Percent Retained (%)	Percent Passing (%)
3"	76.2		0.0	100.0
1.5"	38.1		0.0	100.0
3/4"	19.05		0.0	100.0
3/8"	9.53		0.0	100.0
#4	4.75		0.0	100.0
#8	2.36		0.0	100.0
#16	1.18		0.0	100.0
#30	0.6		0.0	100.0
#50	0.3	1.0	1.0	99.0
#100	0.15	12.3	12.0	88.0
#200	0.075	31.1	30.4	69.6

EEI
Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad CA 92008

Client: Thomas Enterprises

Project Name: Oceanside, CA

Job Number: THO-70810

Date: 9-4-08

Boring Number: B1

Location: 40 feet

Soil Description: Sandy silt, ML

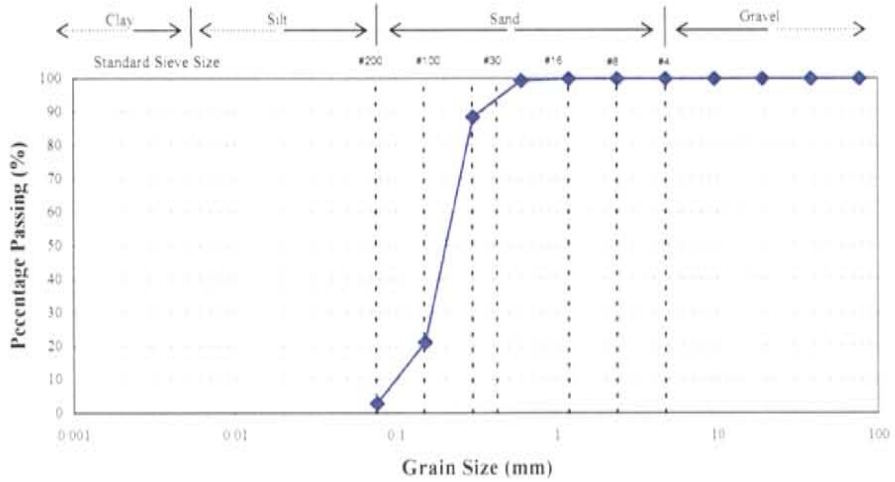
Tested by: AW

PARTICLE-SIZE ANALYSIS OF SOILS
ASTM METHOD D 422 (SIEVE ANALYSIS)

Sample :	B21@12.5ft
Total Weight (g)	188.9
Dry Weight (g)	145.5
Wet Sieve Weight (g)	141.3
Initial Moisture (%)	29.8

D10 (mm)	0.10
D30 (mm)	0.15
D60 (mm)	0.22
Cu	2.20
Cc	1.02

According to ASTM D 2487 Unified Soil Classification System (USCS) and ASTM D 422 (Standard Test Method for Particle-Size Analysis) test method results, soil sample B21 at 12.5 feet is classified as Poorly graded sand (**SP**).



Sieve Size (in)	Sieve Size (mm)	Cumulative Weight of dry soil (gm)	Percent Retained (%)	Percent Passing (%)
3"	76.2		0.0	100.0
1.5"	38.1		0.0	100.0
3/4"	19.05		0.0	100.0
3/8"	9.53		0.0	100.0
#4	4.75		0.0	100.0
#8	2.36		0.0	100.0
#16	1.18		0.0	100.0
#30	0.6	0.8	0.5	99.5
#50	0.3	16.7	11.5	88.5
#100	0.15	114.6	78.8	21.2
#200	0.075	141.2	97.0	3.0

EEI
Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad CA 92008

Client: Thomas Enterprises

Project Name: Oceanside, CA

Job Number: THO-70810

Date: 9-4-08

Boring Number: B21

Location: 12.5 feet

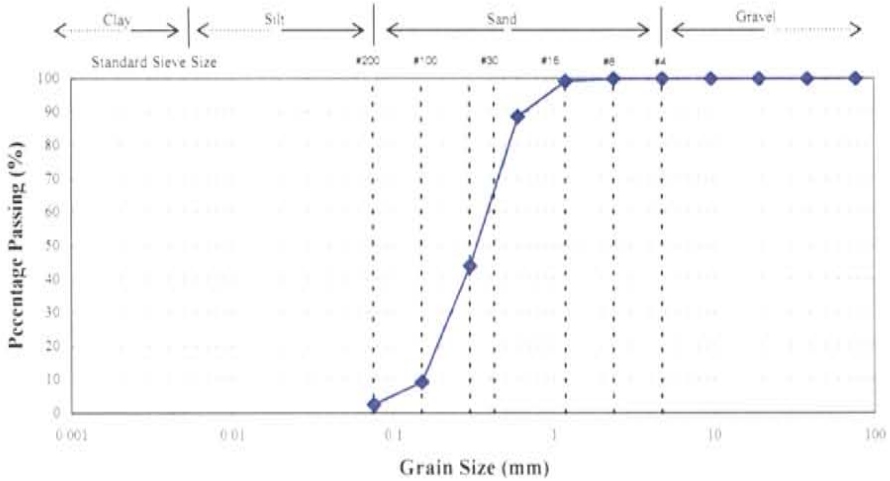
Soil Description: Poorly graded sand, SP

Tested by: AW

PARTICLE-SIZE ANALYSIS OF SOILS
ASTM METHOD D 422 (SIEVE ANALYSIS)

Sample :	B21@20ft		D10 (mm)	0.15
Total Weight (g)	115.8		D30 (mm)	0.23
Dry Weight (g)	90.8		D60 (mm)	0.39
Wet Sieve Weight (g)	88.5		Cu	2.60
Initial Moisture (%)	27.5		Cc	0.90

According to ASTM D 2487 Unified Soil Classification System (USCS) and ASTM D 422 (Standard Test Method for Particle-Size Analysis) test method results, soil sample B21 at 20 feet is classified as Poorly graded sand (**SP**).



Sieve Size (in)	Sieve Size (mm)	Cumulative Weight of dry soil (gm)	Percent Retained (%)	Percent Passing (%)
3"	76.2		0.0	100.0
1.5"	38.1		0.0	100.0
3/4"	19.05		0.0	100.0
3/8"	9.53		0.0	100.0
#4	4.75		0.0	100.0
#8	2.36		0.0	100.0
#16	1.18	0.7	0.8	99.2
#30	0.6	10.2	11.2	88.8
#50	0.3	50.8	55.9	44.1
#100	0.15	82.3	90.6	9.4
#200	0.075	88.4	97.4	2.6

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Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad CA 92008

Client: Thomas Enterprises

Project Name: Oceanside, CA

Job Number: THO-70810

Date: 9-4-08

Boring Number: B21

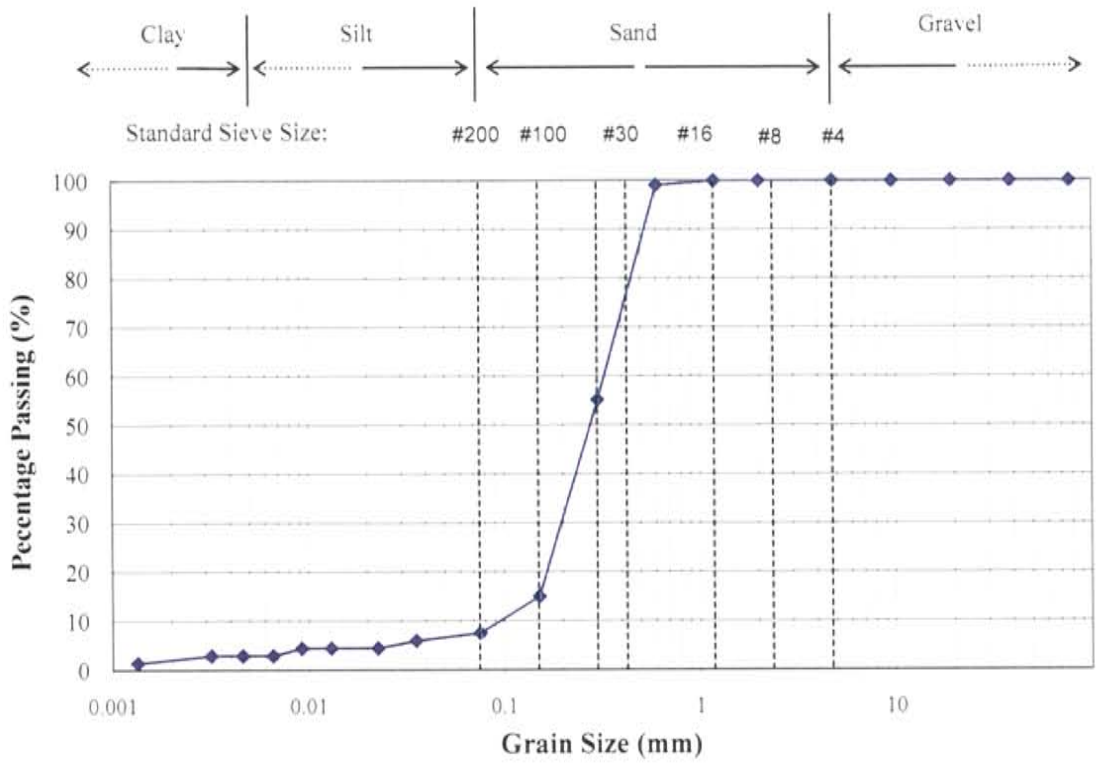
Location: 20 feet

Soil Description: Poorly graded sand, SP

Tested by: AW

PARTICLE-SIZE ANALYSIS OF SOILS
ASTM METHOD D 422 (HYDROMETER CURVE)

Sample :	B21@35ft



According to ASTM D 2487 Unified Soil Classification System (USCS) and ASTM D 422 (Standard Test Method for Particle-Size Analysis) test method results, soil sample B21 at 35 feet is classified as a Poorly graded sand with silt (**SP-SM**).

D_{10} (mm)	**0.095**
D_{30} (mm)	**0.19**
D_{60} (mm)	**0.33**
C_u	**3.47**
C_c	**1.15**

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5845 Avenida Encinas, Suite 128 Carlsbad, CA 92008

Client: Thomas Enterprises
Project Name: Oceanside, CA
Job Number:THO-70810
Date: 9-8-08
Boring Number: B21
Location: 35 feet
Soil Description: Poorly graded sand with silt, SP-SM
Tested by: AW

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX

ASTM METHOD D 4318

	Sample: B1@40ft			
	One Point Liquid Limit		Plastic Limit	
Test Number	1		1	2
Container Number	10	30	16	14
Weight of Container (g)	13.88	13.98	13.88	13.6
Wet Weight of Soil and Container (g)	41.28	40.12	17.71	19.44
Dry Weight of Soil and Container (g)	34.3	32.8	16.81	17.93
Number of Blows	20	9		
Moisture Content (%)	34.5	38.9	30.7	34.9

Liquid Limit =	**34**
Plastic Limit =	**33**
Plasticity Index =	**1**

Classification of fine-grained portion of soils = ML

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2195 Faraday Avenue, Suite K, Carlsbad, CA 92008

Client: Thomas Enterprises

Project Name: Oceanside, CA

Job Number: THO-70810

Date: 9-5-08

Boring Number: B1

Location: 40 feet

Soil Description: Silt, ML

Tested by: AW

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX

ASTM METHOD D 4318

	Sample: B21@35ft			
	One Point Liquid Limit		Plastic Limit	
Test Number	1		1	2
Container Number	21	32	non-plastic	non-plastic
Weight of Container (g)	13.97	13.85		
Wet Weight of Soil and Container (g)	46.38	42.18		
Dry Weight of Soil and Container (g)	41.1	36.19		
Number of Blows	12	3		
Moisture Content (%)	19.3	26.8	na	na

Liquid Limit =	**19**
Plastic Limit =	**na**
Plasticity Index =	**na**

Classification of fine-grained portion of soils = ML

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2195 Faraday Avenue, Suite K, Carlsbad, CA 92008

Client: Thomas Enterprises

Project Name: Oceanside, CA

Job Number: THO-70810

Date: 9-5-08

Boring Number: B21

Location: 35 feet

Soil Description: Silt, ML

Tested by: AW

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX

ASTM METHOD D 4318

	Sample: B21@45ft			
	One Point Liquid Limit		Plastic Limit	
Test Number	1		1	2
Container Number	C	D	A	B
Weight of Container (g)	13.7	13.78	13.82	13.89
Wet Weight of Soil and Container (g)	35.13	38.87	22.18	20.77
Dry Weight of Soil and Container (g)	28.7	31.61	20.21	19.01
Number of Blows	9	12		
Moisture Content (%)	42.8	40.7	30.8	34.4

Liquid Limit =	**38**
Plastic Limit =	**33**
Plasticity Index =	**5**

Classification of fine-grained portion of soils = ML

EEI Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad, CA 92008

Client: Thomas Enterprises

Project Name: Oceanside, CA

Job Number: THO-70810

Date: 9-5-08

Boring Number: B21

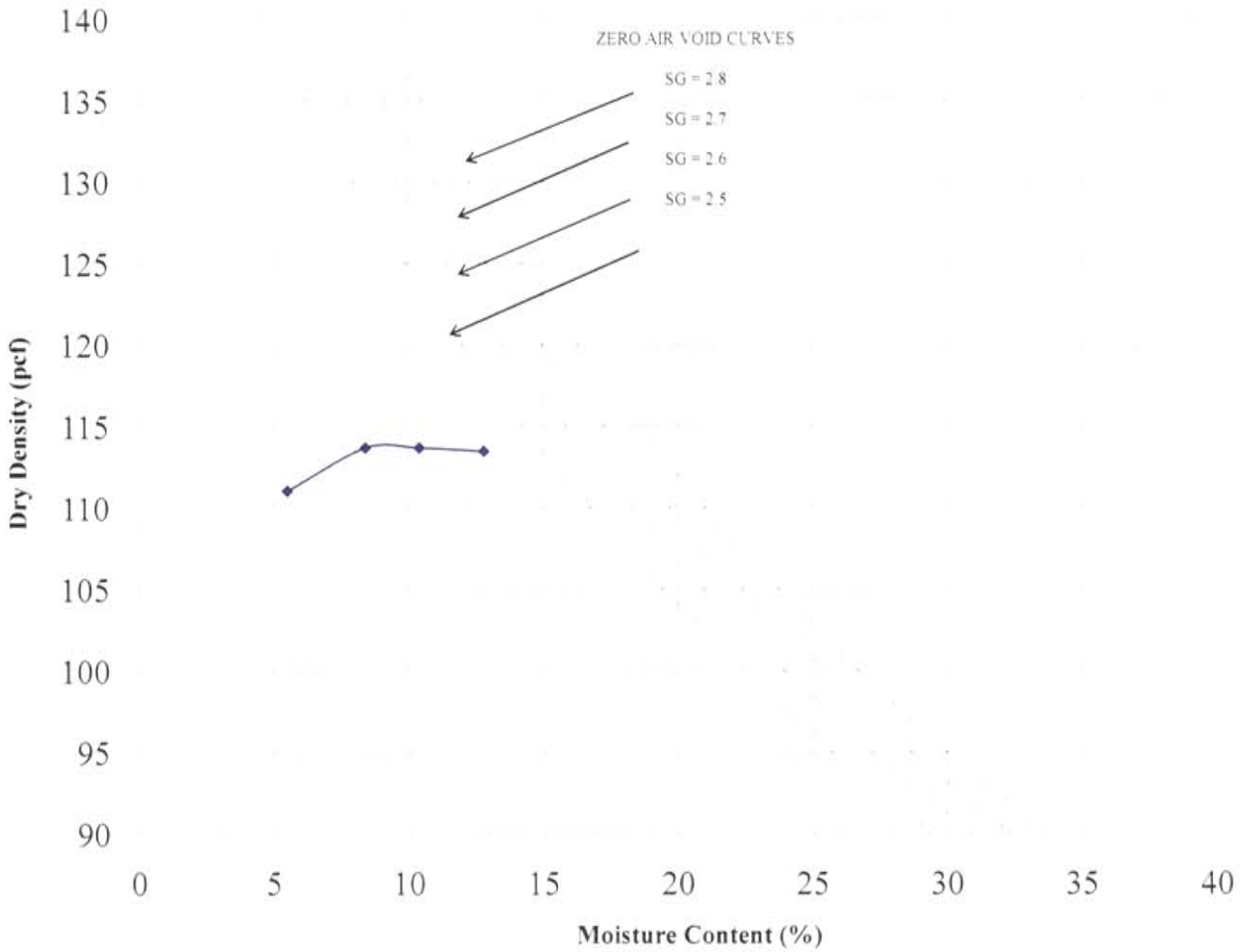
Location: 45 feet

Soil Description: Silt, ML

Tested by: AW

LABORATORY COMPACTION ASTM D 1557

Sample	1	2	3	4
Mold and wet soil (lbs.)	13.140	13.342	13.418	13.516
Mold (lbs.)	9.250	9.250	9.250	9.250
Wet Soil (lbs.)	3.890	4.092	4.168	4.266
Wet Density (pcf)	117.17	123.25	125.54	128.03
Moisture (%)	**5.5**	**8.4**	**10.4**	**12.8**
Dry Density (pcf)	**111.1**	**113.7**	**113.7**	**113.5**



Maximum density 114pcf @ 9% moisture

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2195 Faraday, Suite K, Carlsbad, CA 92008

Client: Thomas Enterprises

Project Name: Oceanside, CA

Procedure: Method A

Job Number: THO-70810

Date: 9-5-08

Boring Number: B18

Location: 0-2 feet

Soil Description: Silty sand, SM

Tested by: AW

DIRECT SHEAR TEST ASTM D 3080

Job Data	
Job No.:	THO-70810
Client:	Thomas Enterprises
Date:	9/8/08
Sample Data	
Sample:	B18@0-2ft
Remolded To:	to 90% of max
Remarks:	Soaked Before Placing in Shear Box
Soil Description:	Silty sand, SM

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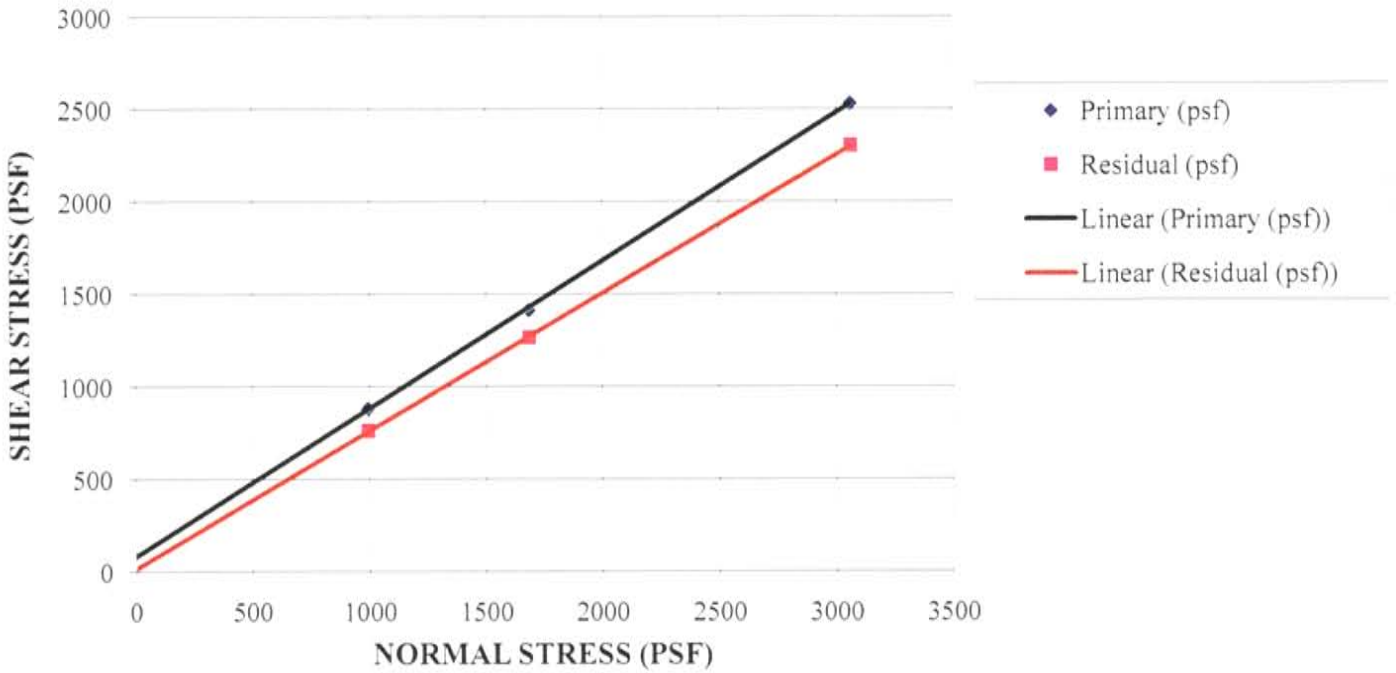
SHEAR TEST DIAGRAM



Test Results	Phi		Cohesion	
Primary (psf)	39	degrees	82	psf
Residual (psf)	37	degrees	19	psf

Average Initial Moisture	9.0%
Average Dry Density	101.8 pcf
Average Final Moisture	20.2%

EXPANSION INDEX TEST

ASTM METHOD D 4829

Sample: B18@0-2ft

Moisture Content of Initial Sample		% Saturation of Re-molded Sample		Moisture Content of Final Sample	
Tare No. -		Wt. of Soil and Ring (g) -	551.5	Wt. of Soil and Ring (g) -	600.7
Wet Weight and Tare (g) -	174.2	Ring Weight (g) -	189.1	Ring Weight (g) -	189.1
Dry Weight and Tare (g) -	157.0	Wet Weight of Soil (g) -	362.4	Wet Weight of Soil (g) -	411.6
Tare Weight (g) -	31.0	Dry Weight of Soil (g) -	318.9	Dry Weight of Soil (g) -	318.9
Water Loss (g) -	17.2	Volume of Ring (ft^3) -	0.0073	Weight of Water (g) -	92.7
Dry Weight (g) -	126.1	Dry Density (pcf) -	96.3	*Final Moisture (%)*	*29.1*
Initial Moisture (%) -	*13.6*	*Initital Saturation (%) -*	*49.2*	*Final Saturation (%) -*	*104.7*

Expansion Test - UBC (144 PSF)				
	Date	Time	Reading	
Add Weight	9/2/2008	16:20	0.000	
10 Minutes		16:30	0.000	Initial Reading
Add Water		16:50	0.000	
	9/3/2008	17:05	0.000	
		17:26	0.000	Final Reading

EImeasured	=	0
EI_{50}	=	**0**

Expansion Index, EI_{50}	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
>130	Very High

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2195 Faraday Avenue, Suite K, Carlsbad, CA 92008

Client: Thomas Enterprises

Project Name: Oceanside, CA

Job Number: THO-70810

Date: 9-3-08

Boring Number: B18

Depth: 0-2 feet

Soil Description: Silty sand, SM

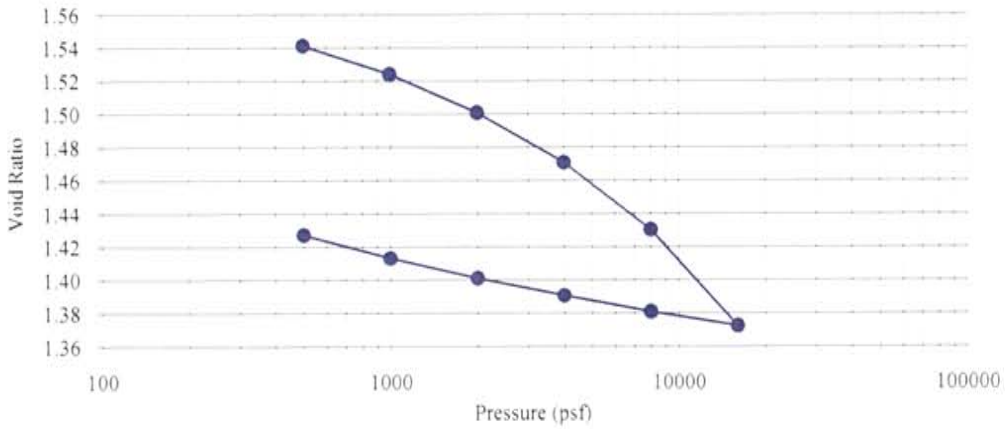
Tested by: AW

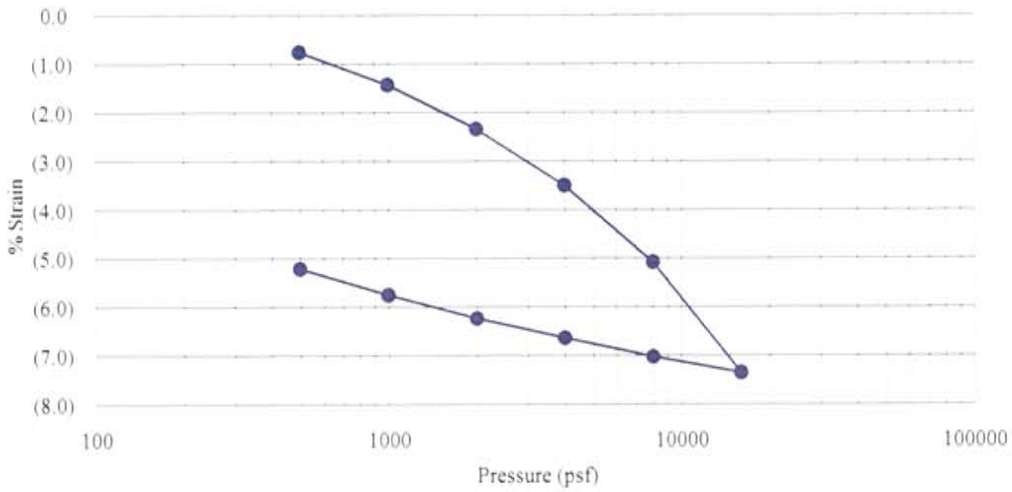
CONSOLIDATION-SWELL TEST ASTM D 2435

Job Data
Job No.: THO-70810
Client: Thomas Enterprises
Project Name: Oceanside, CA
Date: 9-8-08
Sample Data
Sample: B4@10ft
Sample Type: cal mod
Remarks: inundated at 2ksf
Soil Description: Silty sand, SM

EEI Geotechnical & Environmental Solutions

2195 Faraday, Suite K, Carlsbad, CA 92008





Swell Pressure:	1986	psf
Percent Swell:	0.0%	
Comp. Index (Cc):	0.193	
Consol. Index (Cr):	0.036	

Specimen Diameter:	2.418	in.
Specimen Height:	1.00	in.
Overburden Pressure (Po):	835	psf
Preconsol. Pressure (Pp):	n/a	psf

	Initial	Final
Moisture Content:	36.1%	34.0%
Void Ratio:	1.541	1.427
Saturation:	n/a	65%
Dry Density (pcf):	65.8	70.3

CONSOLIDATION-SWELL TEST ASTM D 2435

Job Data
Job No.: THO-70810
Client: Thomas Enterprises
Project Name: Oceanside, CA
Date: 9-8-08
Sample Data
Sample: B16@10ft
Sample Type: cal mod
Remarks: inundated at 2ksf
Soil Description: Silty sand, SM

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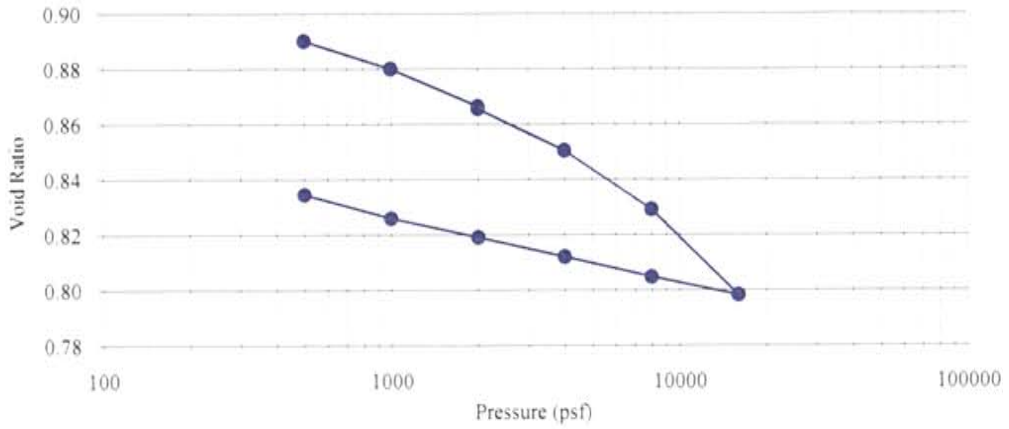
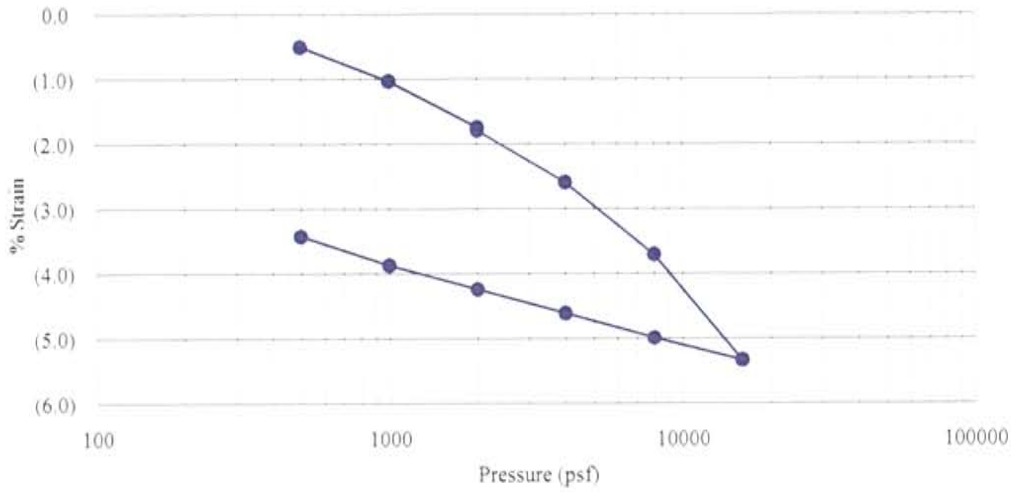




Swell Pressure:	1986	psf
Percent Swell:	-0.1%	
Comp. Index (Cc):	0.103	
Consol. Index (Cr):	0.024	

Specimen Diameter:	2.418	in.
Specimen Height:	1.00	in.
Overburden Pressure (Po):	1156	psf
Preconsol. Pressure (Pp):	n/a	psf

	Initial	Final
Moisture Content:	2.8%	31.2%
Void Ratio:	0.890	0.835
Saturation:	n/a	61%
Dry Density (pcf):	88.7	71.4

Table 1 - Laboratory Tests on Soil Samples

EEI
Oceanside, CA
Your #THO-70810, SA #08-1039LAB
3-Sep-08

Sample ID			B21 @ 2.5' SM/SP
Resistivity		**Units**	
as-received		ohm-cm	40,000
minimum		ohm-cm	9,200
pH			7.7
Electrical			
Conductivity		mS/cm	0.10
Chemical Analyses			
Cations			
calcium	Ca^{2-}	mg/kg	63
magnesium	Mg^{2-}	mg/kg	8.7
sodium	Na^{1-}	mg/kg	14
potassium	K^{1-}	mg/kg	10
Anions			
carbonate	CO_3^{2-}	mg/kg	ND
bicarbonate	HCO_3^{1-}	mg/kg	165
flouride	F^{1-}	mg/kg	1.9
chloride	Cl^{1-}	mg/kg	2.5
sulfate	SO_4^{2-}	mg/kg	24
phosphate	PO_4^{3-}	mg/kg	3.2
Other Tests			
ammonium	NH_4^{1-}	mg/kg	1.2
nitrate	NO_3^{1-}	mg/kg	ND
sulfide	S^{2-}	qual	Negative
Redox		mV	372

Minimum resistivity per CTM 643

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.
Redox = oxidation-reduction potential in millivolts
ND = not detected
na = not analyzed

R - VALUE DATA SHEET

P.N. THO-70810
Oceanside, CA

PROJECT NUMBER 35787 BORING NUMBER: B-14 @ 0'-2'

SAMPLE DESCRIPTION: Brown Sand

Item	SPECIMEN		
	a	b	c
Mold Number	1	3	4
Water added, grams	170	130	115
Initial Test Water, %	14.8	11.5	10.2
Compact Gage Pressure,psi	350	350	350
Exudation Pressure, psi	129	314	489
Height Sample, Inches	2.58	2.48	2.60
Gross Weight Mold, grams	2978	2945	2980
Tare Weight Mold, grams	1965	1977	1977
Sample Wet Weight, grams	1013	968	1003
Expansion, Inches x 10exp-4	0	0	0
Stability 2,000 lbs (160psi)	17 / 34	13 / 26	11 / 25
Turns Displacement	5.01	4.96	4.91
R-Value Uncorrected	65	72	73
R-Value Corrected	67	72	75
Dry Density, pcf	103.6	106.1	106.0
	DESIGN CALCULATION DATA		
Traffic Index Assumed:	4.0	4.0	4.0
G.E. by Stability	0.34	0.29	0.26
G. E. by Expansion	0.00	0.00	0.00

Equilibrium R-Value 71 by EXUDATION

Examined & Checked: 9 /4/ 08

REMARKS:
Gf = 1.25
0.0% Retained on the 3/4" Sieve.
Free Drainage.

REGISTERED PROFESSIONAL ENGINEER STEVEN R. MARVIN 30659 EXP 3/31/10 STATE OF CALIFORNIA

Steven R. Marvin, RCE 30659

The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301.

LaBelle • Marvin

R-VALUE GRAPHICAL PRESENTATION

PROJECT NO. 35787
P.N. THO-70810

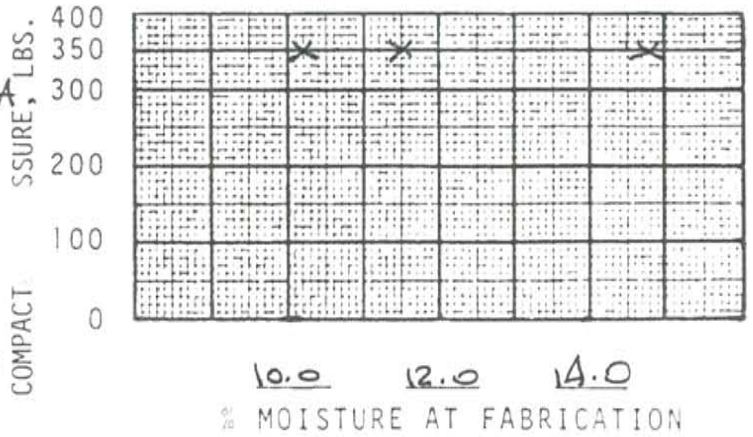
BORING NO. B-14 @ 0'-2' Oceanside, CA.
Thomas Ent.

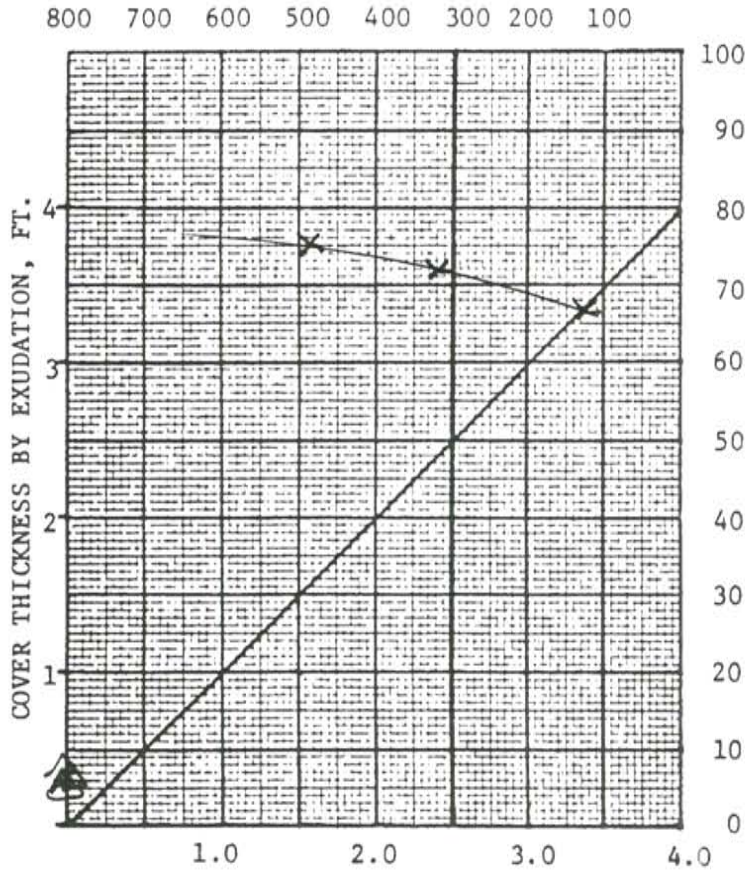
DATE 9-4-08

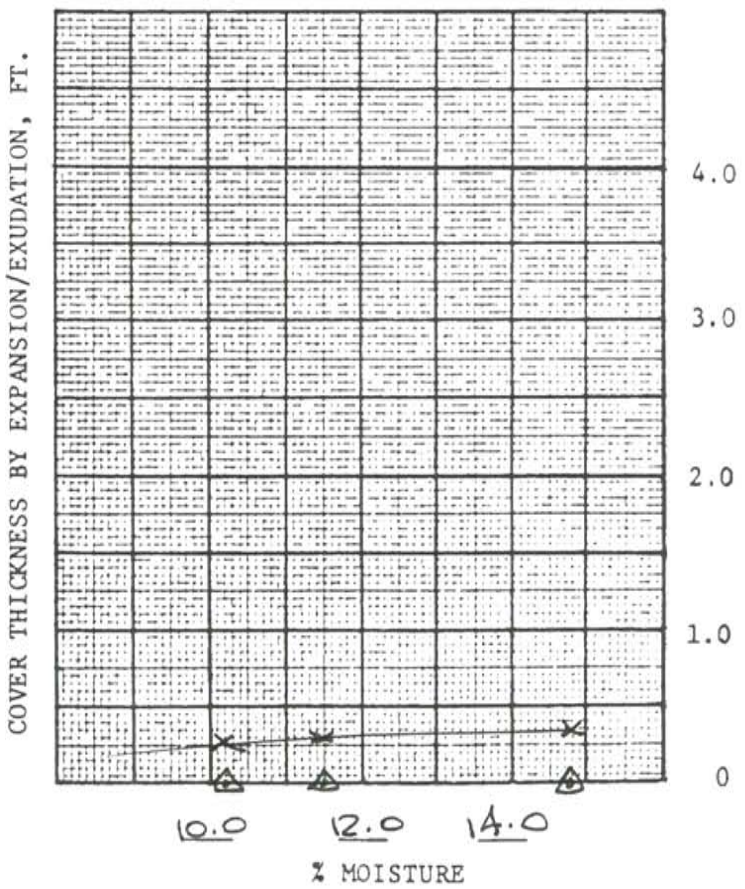
TRAFFIC INDEX Assume 4.0

R-VALUE BY EXUDATION 71

R-VALUE BY EXPANSION ~~2~~







R-VALUE vs. EXUD. PRES.

T by EXUDATION

EXUD. T vs. EXPAN. T

T by EXPANSION

REMARKS

GF=1.25

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PROFESSIONAL PAVEMENT ENGINEERING

APPENDIX B
LABORATORY TESTING

B.1 General

The laboratory testing was performed using appropriate American Society for Testing and Materials (ASTM) standards and Caltrans Test Methods (CTM).

Modified California drive samples, Standard Penetration Test (SPT) drive samples, and bulk samples collected during the field exploration were sealed in the field to reduce moisture loss. The samples of subsurface soils were then transported to the laboratory for further examination and testing. Tests were performed on selected samples as an aid in classifying the earth materials and to evaluate their physical properties. Laboratory testing for this investigation included:

- Soil Classification: USCS (ASTM D 2487) and Visual Manual (ASTM D 2488);
- Moisture Content (ASTM D 2216) and Dry Unit Weight (ASTM D 2937);
- Atterberg Limits (ASTM D 4318);
- Grain Size Distribution (ASTM D 422) and Percent Passing #200 Sieve (ASTM D 1140);
- Direct Shear (ASTM D 3080);
- Swell/Collapse Potential (ASTM D 4546); and
- Soil Corrosivity:
    - pH (CTM 643);
    - Water-Soluble Sulfate (ASTM D 516);
    - Water-Soluble Chloride (Ion-Specific Probe, ASTM D 512);
    - Minimum Electrical Resistivity (CTM 643)

A summary of laboratory test results is presented in Table B-1. A brief description of the laboratory testing program with test results is presented below.

B.2 Soil Classification

The subsurface soils were visually and manually classified in the field in accordance with the Unified Soil Classification System (USCS) following ASTM D 2488; soil classifications were modified as necessary based on testing in the laboratory in accordance with ASTM D 2487. The details of the soil classification system and boring records showing the classifications are presented in Appendix A.

B.3 Moisture Content and Dry Unit Weight

The in-situ moisture content of selected SPT, and Modified California Ring samples was measured by oven drying in accordance with ASTM D 2216. Selected Modified California Ring samples were trimmed flush in the brass/steel rings and their wet weight was

measured. After drying, the dry weight of each sample, and volume and weight of the metal containers were measured. The moisture content and dry density were calculated in accordance with ASTM D 2216 and D 2937, respectively. Results of these tests are presented in Table B-1 and included in the boring records in Appendix A.

B.4 Atterberg Limits

Characterization of the fine-grained fractions of soils was evaluated using the Atterberg Limits. This test includes Liquid Limit and Plastic Limit tests to determine the Plasticity Index in accordance with ASTM D 4318. Results of these tests are presented on the boring records in Appendix A, are summarized in Table B-1, and are plotted on a Plasticity Chart in Figure B-1 of this appendix.

B.5 Grain Size Distribution and Percent Passing No. 200 Sieve

Selected soil samples were dried, weighed, and soaked in water until individual soil particles were separated, and then washed on the No. 200 sieve. The percentage of fines (soil passing No.200 sieve) was measured in accordance with ASTM D 1140. The washed fraction retained on the No.200 sieve was then screened on a No.4 sieve, and the fraction retained on No.4 was weighed to measure the percentage of gravel. Then, the washed material retained on No.200 sieve was shaken through a standard stack of sieves in accordance with ASTM D 422 to evaluate the grain size distribution. The results of grain size distribution tests are plotted in Figure B-2 of this appendix. The relative proportions (or percentages) by dry weight of gravel (retained on No.4 sieve), sand (passing No.4 sieve and retained on No.200 sieve), and fines (passing No.200 sieve) are included in the boring records in Appendix A and are summarized in Table B-1.

B.6 Direct Shear Test

To evaluate the drained shear strength parameters, direct shear tests were performed on selected soil samples in accordance with ASTM D 3080. After the initial weight and volume were measured, the sample was placed in the direct shear apparatus, and a selected normal load was applied. The sample was inundated or kept at field moisture, allowed to consolidate under the selected normal load, and then sheared to failure. Shear rate was selected to maintain drained conditions. Shear stress, and vertical and horizontal sample displacements were recorded throughout the test. The process was repeated on additional samples of the same soil material at two different normal loads. Direct shear test results are presented in Figure B-3.

B.7 One Dimensional Swell/Collapse Test

One Dimensional Swell/Collapse tests were performed in general accordance with ASTM D 4546. One dimensional swell/collapse test results are presented in Figure B-4.

B.8 Soil Corrosivity

Tests were performed to evaluate corrosion potential of selected soil samples on concrete and ferrous metals. Corrosivity testing included minimum electrical resistivity and soil pH (CTM 643), water-soluble chlorides (ASTM D 512), and water-soluble sulfates (ASTM D 516). The test results are presented in Figures B-5a through 5c.

B.9 List of Attached Table and Figures

The following table and figures are attached:

List of Table

Table B-1	Summary of Laboratory Test Results

List of Figures

Figure B-1	Atterberg Limit Test Results
Figure B-2	Grain Size Distribution Test Results
Figure B-3	Direct Shear Test Results
Figure B-4	Swell/Collapse Test Result
Figures B-5a through B-5c	Corrosion Test Results

Boring No.	Sample No.	Depth (ft)	Sample Type	USCS Group Symbol	SPT N*60 (blows/ft)	Undrained Shear Strength, Su (ksf)			Moisture Content (%)	Dry Unit Weight (pcf)	Total Unit Wt (pcf)	Atterberg Limits			Grain Size Distribution (%) by dry weight			Other Tests
						Pocket Pen.	Mini Vane	UU Test				LL	PL	PI	Gravel	Sand	Fines	
B-101	R-1	1.0	MC	SM	19				3.3	104	107							
B-101	S-2	3.0	SPT	SM	24													
B-101	R-3	5.0	MC	SM	27				4.8	106	111				0	61	39	#200
B-101	S-4	7.5	SPT	SM	40													
B-101	R-5	10.0	MC	SP	16				1.8	100	102							
B-101	S-6	12.5	SPT	SP	17													
B-101	R-7	15.0	MC	SP	18				3.5	103	107				0	96	4	#200
B-101	S-8	17.5	SPT	SP	24													
B-101	R-9	20.0	MC	SP	23				5.5	96	101							
B-101	S-10	25.0	SPT	SM	19													
B-101	R-11	30.0	MC	SM	19				23.8	98	121							
B-101	S-12	35.0	SPT	SM	20													
B-101	R-13	40.0	MC	SP	33				25.4	100	125							
B-101	S-14	45.0	SPT	ML/CL	9	0.5			38.5			39	25	14	1	38	61	#200
B-101	R-15	50.0	MC	(ML/CL)&SM	16													
B-101	R-15-2	50.5	MC	ML/CL														
B-101	R-15-1	51.3	MC	SM					27.1	98	125							
B-101	S-16	55.0	SPT	SM	19													
B-101	R-17	60.0	MC	SP-SM	40				22.8	105	129							
B-101	S-18	65.0	SPT	ML	18	0.5												
B-101	R-19	70.0	MC	ML	17	0.5												
B-101	S-20	75.0	SPT	SM	22													
B-101	R-21	80.0	MC	SP-SM	42													
B-102	R-1	2.5	MC	SP-SM	48				6.0	112	119							
B-102	S-2	5.0	SPT	SP-SM	21													
B-102	R-3	7.5	MC	SP-SM	10				6.5	104	111				0	92	8	#200
B-102	S-4	10.0	SPT	SP-SM	11													
B-102	R-5	12.5	MC	SP-SM	12				15.2	102	118							SW
B-102	S-6	15.0	SPT	SP-SM	15													
B-102	R-7	17.5	MC	SP	21				12.8	102	115							

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TABLE B-1: Summary of Laboratory Results

Project: Riverplace

Location: Oceanside, California

Number: IR630

GDC TABLE B-1 (2015) IR 630 RIVERPLACE OCEANSIDE.GPJ GDC2013.GDT 7/7/15

Boring No.	Sample No.	Depth (ft)	Sample Type	USCS Group Symbol	SPT N*60 (blows/ft)	Undrained Shear Strength, Su (ksf)			Moisture Content (%)	Dry Unit Weight (pcf)	Total Unit Wt (pcf)	Atterberg Limits			Grain Size Distribution (%) by dry weight			Other Tests
						Pocket Pen.	Mini Vane	UU Test				LL	PL	PI	Gravel	Sand	Fines	
B-102	S-8	20.0	SPT	SP	14													
B-102	R-9	25.0	MC	SP	29				3.6	104	108							
B-102	S-10	30.0	SPT	SM	9				25.3						0	71	29	#200
B-102	R-11	35.0	MC	SM	18				28.0	95	122							
B-102	S-12	40.0	SPT	ML/CL	9	0.5			34.3			39	25	14	0	49	51	#200
B-102	R-13	45.0	MC	SM	33				22.7	104	128							
B-102	S-14	50.0	SPT	SM	24													
B-102	R-15	55.0	MC	SM	25													
B-103	R-1	2.5	MC	SP-SM	10													CR
B-103	S-2	5.0	SPT	SP-SM	11													
B-103	R-3	7.5	MC	SP-SM	13				8.5	96	104							
B-103	S-4	10.0	SPT	SP-SM	14													
B-103	R-5	15.0	MC	SP-SM	12				9.6	99	109				0	92	8	PA,DS
B-103	S-6	20.0	SPT	SP-SM	19													
B-103	R-7	25.0	MC	ML	5	0.5			29.5	95	123							
B-103	S-8	30.0	SPT	SM	9													
B-103	R-9	35.0	MC	SM	13				25.7	97	122							
B-103	S-10	40.0	SPT	SM	9													
B-103	R-11	45.0	MC	SM	14				34.7	88	119	0	0	0	0	61	39	#200
B-103	S-12	50.0	SPT	ML	20	0.5												
B-103	R-13	55.0	MC	ML	13	0.5												
B-103	S-14	60.0	SPT	ML	12	0.5												
B-104	R-1	2.5	MC	SP-SM	14				2.4	103	105							
B-104	S-2	5.0	SPT	SP-SM	8													
B-104	R-3	7.5	MC	SP-SM	10				10.2	96	106				0	95	5	#200
B-104	S-4	10.0	SPT	SP-SM	17													
B-104	R-5	12.5	MC	SP-SM	19				4.6	98	103				0	95	5	PA
B-104	S-6	15.0	SPT	SP-SM	25													
B-104	R-7	17.5	MC	SP-SM	30				4.3	100	104							
B-104	S-8	20.0	SPT	SP-SM	18													

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TABLE B-1: Summary of Laboratory Results

Project: Riverplace
Location: Oceanside, California
Number: IR630

GDC_TABLE B-1 (2015) IR 630 RIVERPLACE OCEANSIDE.GPJ GDC2013.GDT 7/7/15

Boring No.	Sample No.	Depth (ft)	Sample Type	USCS Group Symbol	SPT N*60 (blows/ft)	Undrained Shear Strength, Su (ksf)			Moisture Content (%)	Dry Unit Weight (pcf)	Total Unit Wt (pcf)	Atterberg Limits			Grain Size Distribution (%) by dry weight			Other Tests
						Pocket Pen.	Mini Vane	UU Test				LL	PL	PI	Gravel	Sand	Fines	
B-104	R-9	25.0	MC	ML	4	0.25			28.8	91	117							
B-104	S-10	30.0	SPT	ML	12	0.5			31.4			30	25	5	1	36	63	#200
B-104	R-11	35.0	MC	ML	12	0.5			31.8	90	119							
B-104	S-12	40.0	SPT	SM	28				27.3						0	51	49	#200
B-104	R-13	45.0	MC	SP-SM	41				21.6	99	120							
B-104	S-14	50.0	SPT	SP-SM	52													
B-104	R-15	55.0	MC	SP-SM	46													
B-104	S-16	60.0	SPT	SM	30													
B-104	S-17	65.0	SPT	SM	37													
B-104	S-18	70.0	SPT	SP-SM	57													

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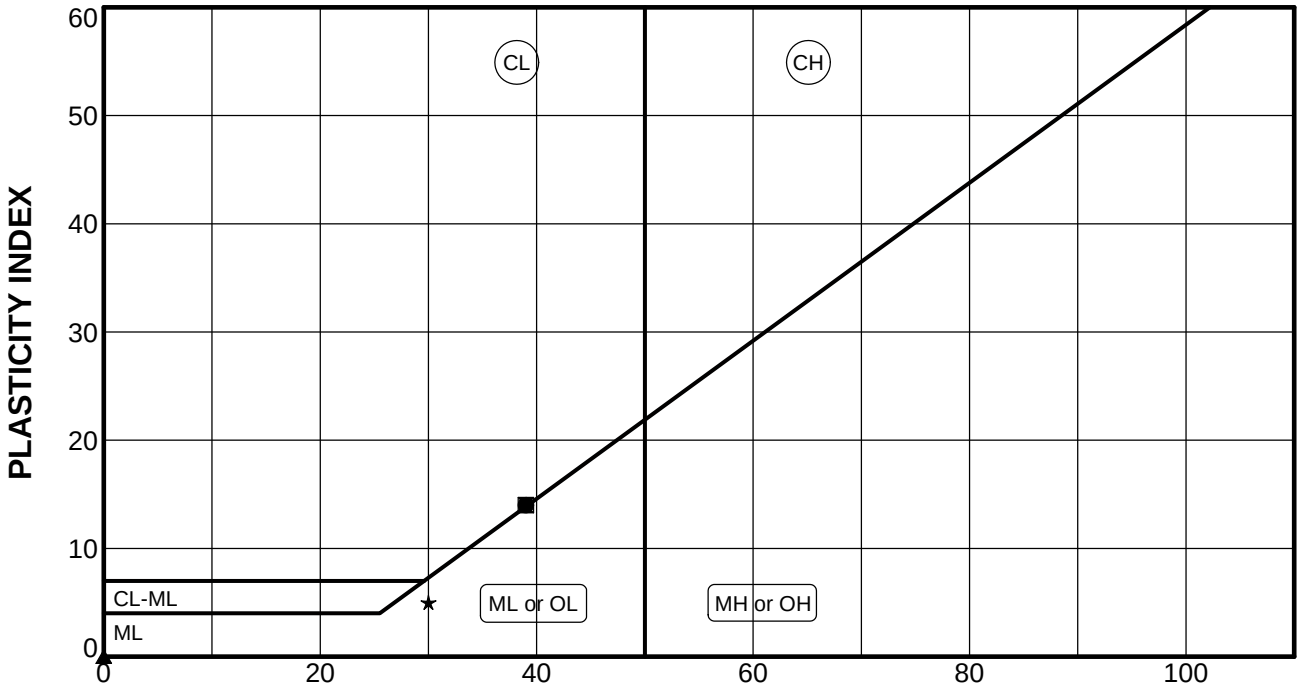
TABLE B-1: Summary of Laboratory Results

Project: Riverplace

Location: Oceanside, California

Number: IR630

GDC TABLE B-1 (2015) IR 630 RIVERPLACE OCEANSIDE.GPJ GDC2013.GDT 7/7/15



SYMBOL	BORING	DEPTH (ft)	LL	PL	PI	LI	w%	USCS CLASSIFICATION
●	**B-101**	**45.0**	**39**	**25**	**14**	**0.93**	**39**	**ML/CL) SANDY SILT/SANDY lean CLAY**
⊠	**B-102**	**40.0**	**39**	**25**	**14**	**0.64**	**34**	**ML/CL) SANDY SILT/SANDY lean CLAY**
▲	**B-103**	**45.0**	**NP**	**NP**	**NP**		**35**	**(SM) SILTY SAND**
★	**B-104**	**30.0**	**30**	**25**	**5**	**1.20**	**31**	**(ML) SANDY SILT**

GDC ATTERBERG APP E IR 630 RIVERPLACE OCEANSIDE.GPJ GDC WLOG.GDT 7/7/15

GROUP DELTA

ATTERBERG LIMITS

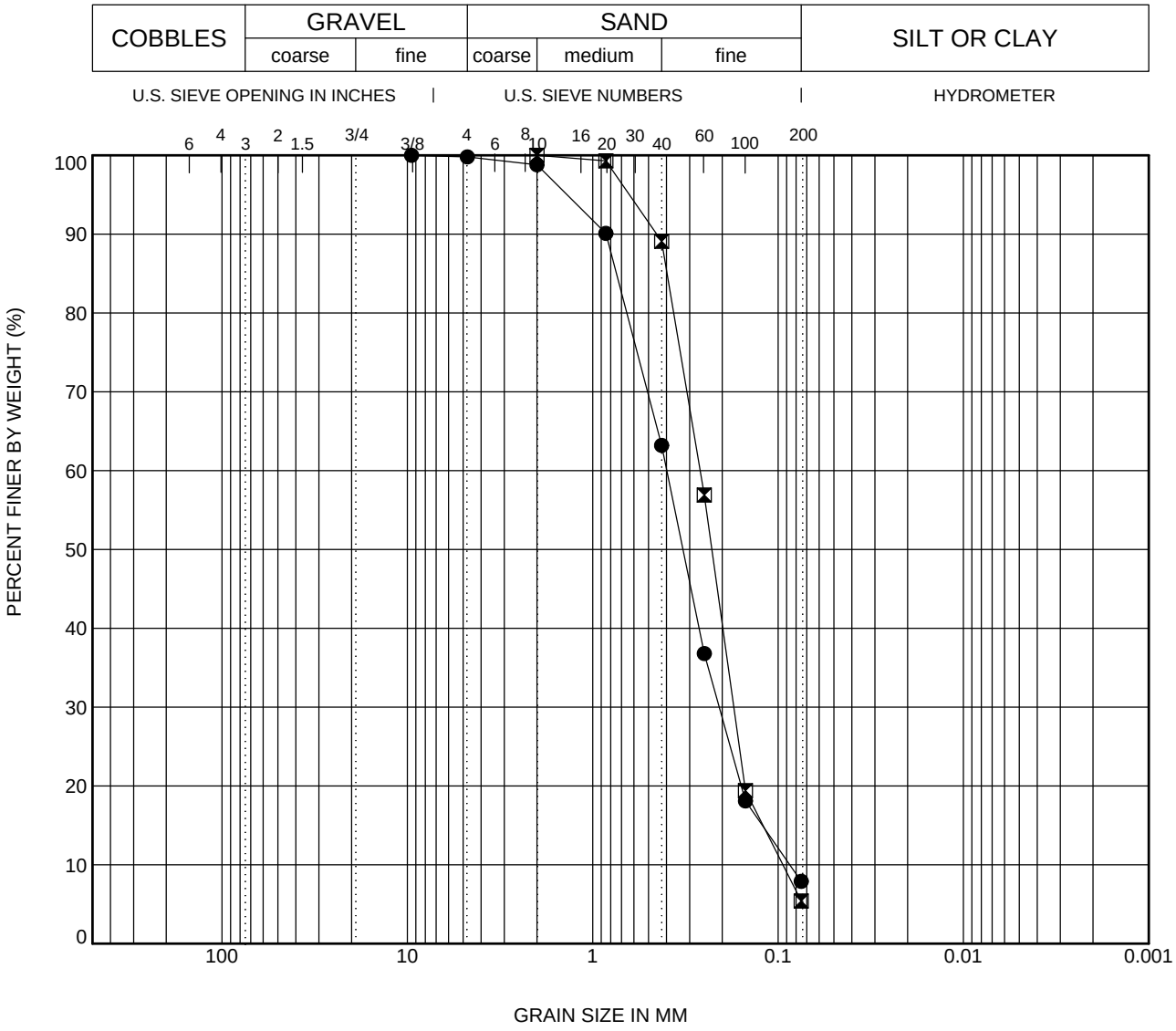
Group Delta Consultants, Inc.

Project: Riverplace

Location: Oceanside, California

Number: IR630

Figure B-1



SYMBOL	BORING	DEPTH (ft)	USCS CLASSIFICATION
●	**B-103**	**15.0**	**(SP-SM) Poorly-graded SAND with SILT**
⊠	**B-104**	**12.5**	**(SP-SM) Poorly-graded SAND with SILT**

SYMBOL	BORING	DEPTH (ft)	D100	D60	D30	D10	LL	PL	PI	Cc	Cu
●	**B-103**	**15.0**	**9.5**	**0.399**	**0.208**	**0.087**				**1.25**	**4.61**
⊠	**B-104**	**12.5**	**2**	**0.263**	**0.173**	**0.094**				**1.21**	**2.79**

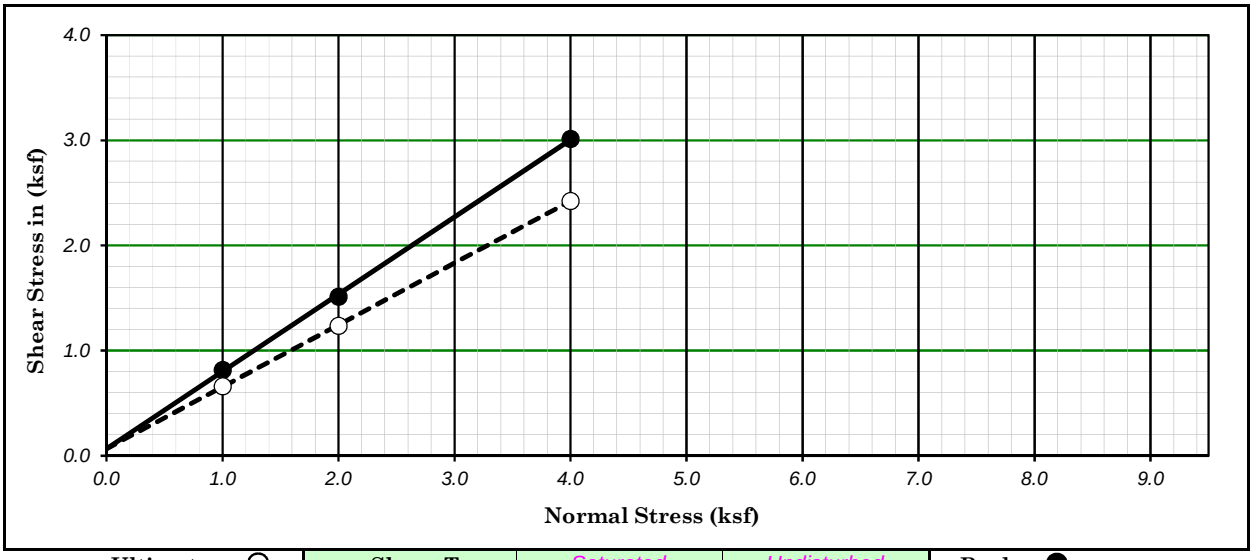
GDC GRAIN SIZE APP E IR 630 RIVERPLACE OCEANSIDE.GPJ GDC WLOG.GDT 7/7/15

GRAIN SIZE DISTRIBUTION
(ASTM D 422)

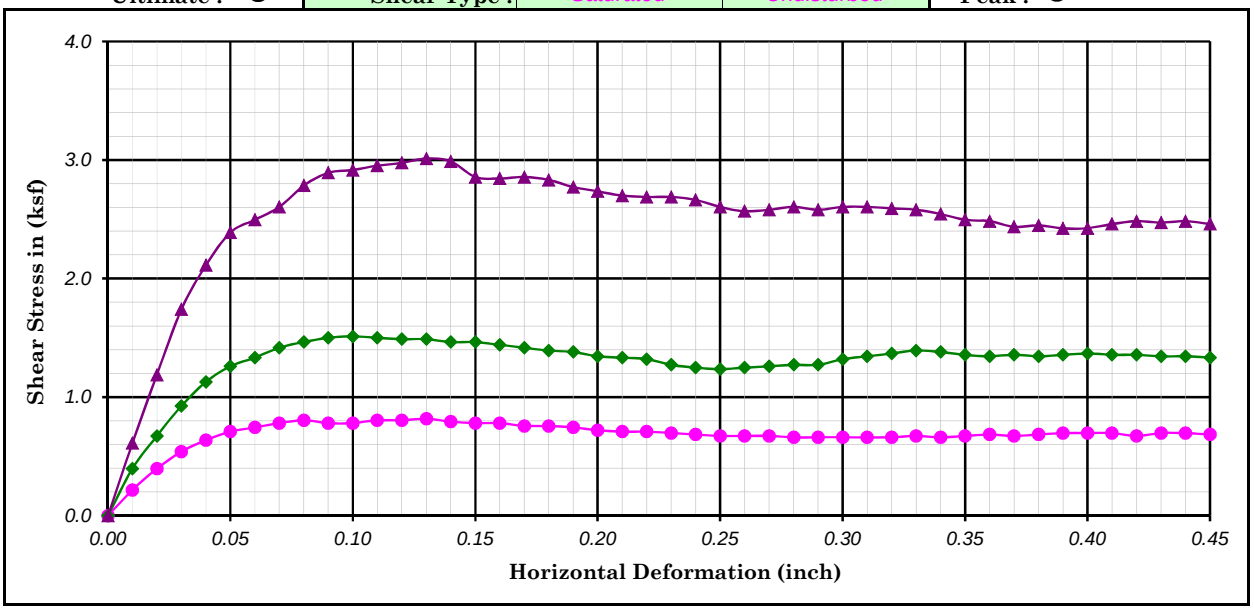
Group Delta Consultants, Inc.

Project: Riverplace
Location: Oceanside, California
Number: IR630

Figure B-2



Ultimate : ○ | Shear Type : Saturated | Undisturbed | Peak : ●



Boring No. : B-103		Strength Intercept (C) :	0.07	(ksf)	Peak	0.07	(ksf)	Ultimate
Sample No. : R5			3.16	(kPa)		3.16	(kPa)	
Depth (ft/m) : 16.0	4.88	Friction Angle (ϕ) :	36.30	Degree		30.49	Degree	
Description : Pale brown Poorly-graded Sand with Silt					Shear Rate (inch/minute) :		0.025	

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	25.02	99.18	15.61	0.70	1.00	47.88	0.82	39.07	0.66	31.60
◆	26.27	100.27	15.78	0.68	2.00	95.76	1.51	72.39	1.24	59.18
▲	23.28	102.03	16.06	0.65	4.00	191.52	3.01	144.21	2.42	116.06

GROUP DELTA

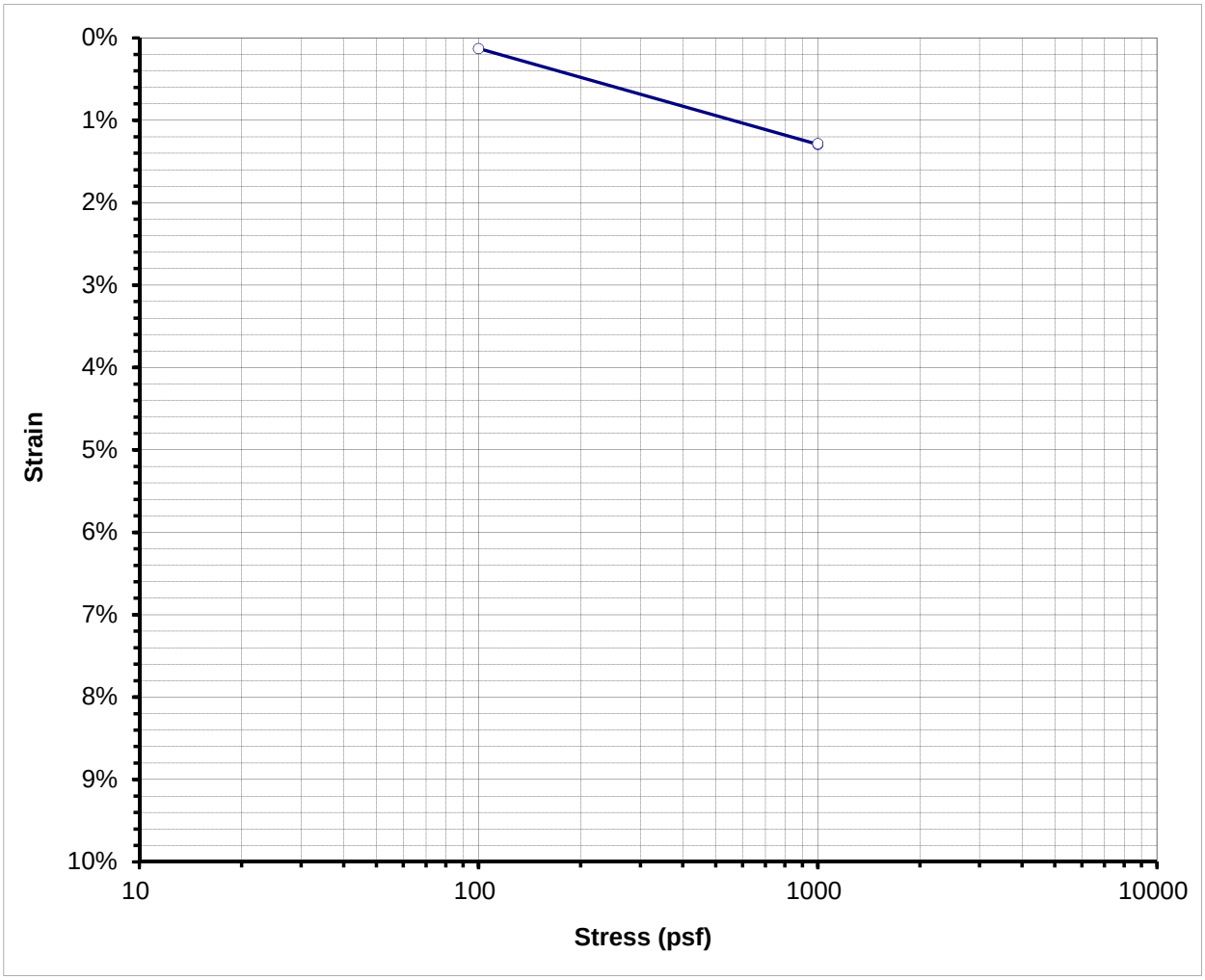
River Place, Oceanside

Project No. : IR 630 **Date :** 07/03/15

DIRECT SHEAR TEST
(ASTM D 3080)

Figure B-3

ONE DIMENSIONAL SWELL/SETTLEMENT TEST RESULTS
ASTM D 4546



Boring No.	B-102	Sample Depth	13.5
Sample No.	R5	USCS	SP-SM

BEFORE TEST

Initial Moisture Content:	27.8%	
Initial Dry Unit Wt:	91.2	pcf
Initial Total Unit Wt.:	116.5	pcf
Initial Void Ratio:	0.8484	
Initial Degree of Saturation:	88.6%	

AFTER TEST

Final Moisture Content:	30.8%	
Final Dry Unit Wt:	91.2	pcf
Final Total Unit Wt.:	119.2	pcf
Final Void Ratio:	0.8484	
Final Degree of Saturation:	98.1%	

Water Added at: 1000 psf

ATTERBERG LIMITS					
LL=	Nonplastic	PL=	Nonplastic	PI=	Nonplastic

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	0.13%	0.8460
1000	1.29%	0.8245
1000	1.28%	0.8246
0	0.00%	0.8484

Assumed Specific Gravity of Solids, Gs: 2.70

PROJECT NUMBER: IR 630	PROJECT NAME: River Place, Oceanside

GROUP DELTA

Figure B-4

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9245 Activity Road, Suite 103, San Diego, CA 92126

STANDARD TEST METHOD FOR pH AND RESISTIVITY (CTM 643)

REV 9-22-10

PROJECT: ***River Place, Oceanside*** SAMPLE DESCRIPTION:

PROJECT NO.: ***IR 630*** ***B-103 / R-1 @ 2.5-4'***

TESTED BY: ***JANK***

SAMPLED BY: ***Sathis***

DATE: ***7/6/2015***

CHECKED BY: ***DLR*** DATE: ***July 7, 2015***

pH OF SAMPLE

TEST RESULT		
	7.09	**pH**

RESISTIVITY OF SAMPLE

SAMPLE WEIGHT		
	300	gm.

TRIAL NO.	WATER ADDED (ml)	RESISTANCE (ohm)
1	***50***	***16,000***
2	***60***	***12,000***
3	***70***	***10,000***
4	***80***	***9,000***
5	***90***	***9,000***
6		
7		
8		
9		
10		

BOX CONSTANTS [CM]: SMALL (.5.5), MEDIUM (0.432), LARGE (6.458)

RESISTIVITY

A) BOX CONSTANT (SMALL, MEDIUM OR LARGE)	***0.505***	**CM**
B) LOW RESISTANCE X BOX CONSTANT (A)	***4545***	**OHM-CM**
C) TEMPERATURE AT MINIMUM RESISTIVITY	***23.7***	**^{0}C**
D) CORRECTED RESISTIVITY FOR 15.5 ^{0}C	***5477***	**OHM-CM**

Figure B-5a

GROUP DELTA
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STANDARD METHOD FOR DETERMINING SOLUBLE SULFATE CONTENT OF SOILS (Modified ASTM D516)

REV 9-22-10

PROJECT: ***River Place, Oceanside*** SAMPLED BY: ***Sathis*** TESTED BY: ***JANK***

PROJECT NO.: ***IR 630*** CHECKED BY: ***DLR*** DATE: ***7/7/2015***

DESCRIPTION: ***Soil Extraction - SO.3233***

SULFATE DETERMINATION	***B-103***													
A) SAMPLE I.D.	BLANK	***R-1 @ 2.5-4'***			BLANK		BLANK		BLANK		BLANK		BLANK	
B) DILUTION FACTOR	***20:1***	***20:1***												
C) BLANK ABSORPTION	***0***	***0***												
D) ABSORPTION @ 30 S	***0.005***	***0.017***												
E) ABSORPTION @ 60 S	***0.005***	***0.015***												
F) ABSORPTION @ 90 S	***0.005***	***0.014***												
G) ABSORPTION @ 120 S	***0.005***	***0.013***												
H) ABSORPTION @ 150 S	***0.005***	***0.012***												
I) ABSORPTION @ 180 S	***0.005***	***0.011***												
J) ABSORPTION @ 210 S	***0.005***	***0.011***												
K) ABSORPTION @ 240 S	***0.005***	***0.010***												
L) MAX. ABSORPTION	***0.005***	***0.012***												
M) CHART CONCENTRATION [PPM]		***0***												
N) SULFATE (M*B/10,000) [%]		***< 0.01***												

Figure B-5b

GROUP DELTA
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STANDARD METHOD FOR DETERMINING SOLUBLE CHLORIDE CONTENT OF SOILS (ION PROBE 9617BN) (ASTM D512)

REV 9-30-10

PROJECT: ***River Place, Oceanside*** SAMPLED BY: ***Sathis*** TESTED BY: ***JANK***

PROJECT NO.: ***IR 630*** CHECKED BY: ***DLR*** TEST DATE: ***7/7/2015***

DESCRIPTION: ***Soil Extraction B-103, SO-3233***

CHLORIDE DETERMINATION	***B-103***	
A) SAMPLE I.D.	***R-1 @ 2.5-4'***	
B) INITIAL DILUTION	***10:1***	
C) INITIAL VOLUME [ML]	***50.0***	
D) ISA SOLUTION [ML]	***2.0***	
E) WATER ADDED [ML]	***48.0***	
F) DILUTION (B*(C+D+E)/C)	***20.0***	
G) ION PROBE READING	***0.62***	
H) CONC. (G*F) [PPM]	***12.4***	
I) CHLORIDE (H/10,000) [%]	***< 0.01***	

CHLORIDE DETERMINATION											
A) SAMPLE I.D.											
B) INITIAL DILUTION											
C) INITIAL VOLUME [ML]											
D) ISA SOLUTION [ML]											
E) WATER ADDED [ML]											
F) DILUTION (B*(C+D+E)/C)											
G) ION PROBE READING											
H) CONC. (G*F) [PPM]											
I) CHLORIDE (H/10,000) [%]											

CHLORIDE DETERMINATION											
A) SAMPLE I.D.											
B) INITIAL DILUTION											
C) INITIAL VOLUME [ML]											
D) ISA SOLUTION [ML]											
E) WATER ADDED [ML]											
F) DILUTION (B*(C+D+E)/C)											
G) ION PROBE READING											
H) CONC. (G*F) [PPM]											
I) CHLORIDE (H/10,000) [%]											

Figure B-5c