Appendix G2

Stormwater Quality Management Plan

(D24-00006)

CITY OF OCEANSIDE
ENGINEERING DIVISION

PRIORITY DEVELOPMENT PROJECT

STORM WATER QUALITY MANAGEMENT PLAN

FOR

OLIVE PARK APARTMENTS

ENGINEER OF WORK

Alisa Vialpando – RCE 47945 Exp: 12/31/2025

PREPARED FOR:

CAPSTONE EQUITIES

5455 WILSHIRE BLVD, SUITE 1012

LOS ANGELES, CALIFORNIA 90036

TELEPHONE NUMBER: (310) 666-6860

PREPARED BY:

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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.

Applicable elements of SWQMP were update in accordance with the January 2022 city of Oceanside BMP Design Manual.

Template Date: February 16, 2016

Assembled By:

Quick Reference Guide

Item	Project Information
Project Name	Olive Park Apartments
Application Number(s)	D24-00006
Project Address	College Boulevard and Olive Drive, Oceanside, CA 92056
Total Parcel Area	1,894,822 sq. ft.
Project Description	The proposed project will develop a single pad designated for two building structures, accommodating a total of 282 apartment units, complete with courtyards. The development plan includes private driveways, sidewalks, landscaping, and parking spaces, alongside the necessary infrastructure and utilities typical for such a development. This infrastructure will consist of a dual storm drain system comprising pipes, inlets, catch basins, brow ditches, and cleanouts. To facilitate access to the site from College Blvd, the existing access road northeast of the site will be paved and improved as a gated emergency-only ingress/egress road. A new connection to the cul-de-sac on Olive Drive, east of the site, is proposed.
Proposed Disturbed Area	439,208 sq. ft.
Created or Replaced Impervious	252,571 sq. ft.
Project Hydrologic Unit Watershed	☐ Santa Maria ☐ San Luis Rey ☒ Carlsbad
Required to implement HMP	☒ Yes ☐ No

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CERTIFICATION PAGE

Project Name: Olive Park Apartments
Permit Application Number: D24-00006

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.

Alisa S. Vialpando
____

Alisa Vialpando, RCE 47945, Exp. 12/31/25

Alisa Vialpando_________________________________

Print Name

Hunsaker & Associates San Diego, Inc. ____________________

Company

10/07/2024___________________________

Date

Engineer's Seal:

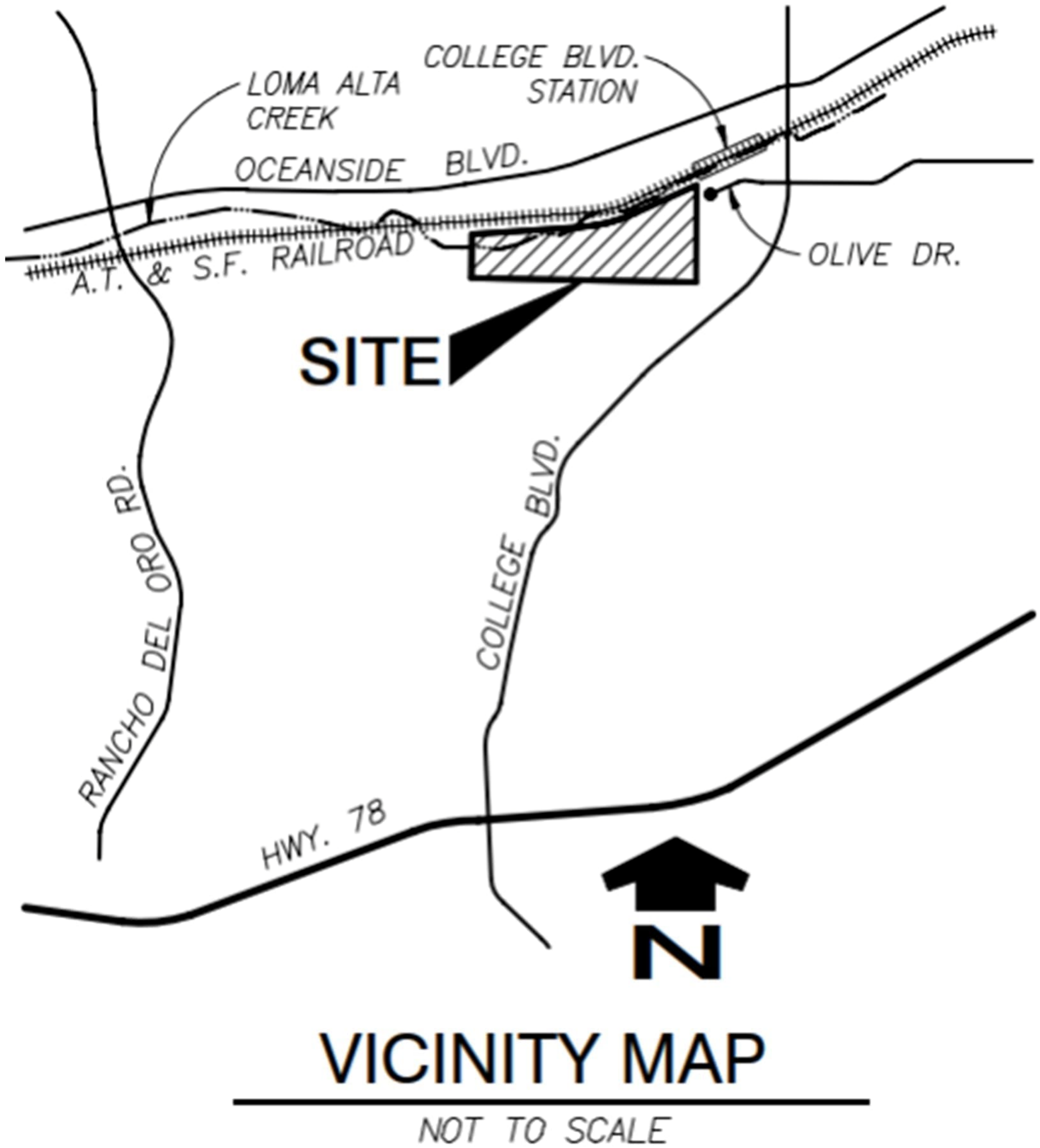
REGISTERED PROFESSIONAL ENGINEER
ALISA S. VIALPANDO
No. 47945
CIVIL
STATE OF CALIFORNIA

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	02/27/2024	☒ Preliminary Design/ Planning/ CEQA ☐ Final Design	SWQMP Initial Submittal
2	[08/07/2024]	☒ Preliminary Design/ Planning/ CEQA ☐ Final Design	Address City Comments
3	[10/08/2024]	☒ Preliminary Design/ Planning/ CEQA ☐ Final Design	Address City Comments
4	[MM/DD/YY]	☐ Preliminary Design/ Planning/ CEQA ☐ Final Design	Click here to enter text.

Placeholder – **Project Vicinity Map**



<table>
<tr><th colspan="2">Applicability of Permanent, Post-Construction
Storm Water BMP Requirements
(Storm Water Intake Form for all Development Permit Applications)</th><th>Form I-1</th></tr>
<tr><td colspan="3">Project Identification</td></tr>
<tr><td colspan="3">Project Name: Olive Park Apartments</td></tr>
<tr><td colspan="2">Permit Application Number: D24-00006</td><td>Date: 10/07/2024</td></tr>
<tr><td colspan="3">Determination of Requirements</td></tr>
<tr><td colspan="3">The purpose of this form is to identify permanent, post-construction requirements that apply to the project. This form serves as a short <u>summary</u> 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.</td></tr>
<tr><td>Step</td><td>Answer</td><td>Progression</td></tr>
<tr><td rowspan="2">Step 1: Is the project a "development project"?
See Section 1.3 of the manual for guidance.</td><td>☒Yes</td><td>Go to Step 2.</td></tr>
<tr><td>☐No</td><td>Stop.
Permanent BMP requirements do not apply. No SWQMP will be required. Provide discussion below.</td></tr>
<tr><td colspan="3">Discussion / justification if the project is <u>not</u> a "development project" (e.g., the project includes only interior remodels within an existing building):</td></tr>
<tr><td rowspan="3">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.</td><td>☐Standard Project</td><td>Stop.
Standard Project requirements apply, including Standard Project SWQMP.</td></tr>
<tr><td>☒PDP</td><td>PDP requirements apply, including PDP SWQMP.
Go to Step 3.</td></tr>
<tr><td>☐ Exception to PDP definitions</td><td>Stop.
Standard Project requirements apply. Provide discussion and list any additional requirements below. Prepare Standard Project SWQMP.</td></tr>
<tr><td colspan="3">Discussion / justification, and additional requirements for exceptions to PDP definitions, if applicable:</td></tr>
</table>

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*):		
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:		
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: No Critical Coarse Sediment Yield Areas (CCSYA) are located within or upstream of the project's disturbed area according to the WMAA map. There is a CCSYA within the site's boundary, but it is situated to the west of the project and will not be impacted.		

Project Type Determination Checklist				Form I-2
Project Information				
Project Name: Olive Park Apartments				
Permit Application Number: D24-00006				
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: _252,571_____ ft² (__5.80______) 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.	

<table>
<tr><th colspan="4">Form I-2 Page 2 of 2</th></tr>
<tr><td>Yes
☐</td><td>No
☒</td><td>(d)</td><td>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.</td></tr>
<tr><td>Yes
☐</td><td>No
☒</td><td>(e)</td><td>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.</td></tr>
<tr><td>Yes
☒</td><td>No
☐</td><td>(f)</td><td>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.</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td colspan="4">The following is for redevelopment PDPs only:

The area of existing (pre-project) impervious area at the project site is: ________ ft² (A)
The total proposed newly created or replaced impervious area is: ________ ft² (B)
Percent impervious surface created or replaced (A/B)*100: _______%
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</td></tr>
</table>

Site Information Checklist For PDPs	Form I-3B (PDPs)

Project Summary Information	
Project Name	Olive Park Apartments
Project Address	College Boulevard and Olive Drive, Oceanside, CA 92056
Assessor's Parcel Number(s)	162-111-04-00
Permit Application Number	D24-00006
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)	_43.50_______ Acres (__1,894,822 __ Square Feet)
Area to be disturbed by the project (Project Area)	__10.08___ Acres (__439,208______ Square Feet)
Project Proposed Impervious Area (subset of Project Area)	__5.80______ Acres (___252,571___ Square Feet)
Project Proposed Pervious Area (subset of Project Area)	___4.28_____ Acres (__186,637 Square Feet)
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 site is situated on slopes descending northwest towards Loma Alta Creek, which borders the northern edge of the site. The topographical contours show an increase in gradient from north to south. The creek, characterized by a gentle gradient, flows westward in a meandering pattern and features vertically incised embankments, with heights reaching up to 10 feet at certain points along its edges. A fill berm, constructed as part of railroad enhancements, is present along the site's northeast boundary. In the southeast corner, a level and graded pad has been prepared for the construction of a residential development along Wooster Drive.
Existing Land Cover Includes (select all that apply): ☒Vegetative Cover ☒Non-Vegetated Pervious Areas ☐Impervious Areas Description / Additional Information: The existing pervious area consists of vacant undeveloped area, vegetative cover and slopes. Vegetation across the site varies significantly with the topography, including flat, intermediate, and steep slopes. In areas with flat slopes, the vegetation primarily consists of hydric (water-seeking) species, such as rushes and marsh-type plants, with several eucalyptus trees also dotting these areas. The intermediate slopes, which have undergone disking, are home to sparse, xeric (dry) vegetation. Meanwhile, the areas with steep slopes boast dense coverage of vegetation, including species like mustard, sage, and cactus.
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

According to the geotechnical report prepared by Geocon in March 2024, groundwater was not detected within the proposed development area. However, it was encountered at a depth of approximately 7 to 13 feet below the existing ground surface, which is roughly 1 to 5 feet above mean sea level, on the western portion of the property that is not designated for development.

Form I-3B Page 3 of 10
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 site is situated on slopes descending northwest towards Loma Alta Creek, which borders the northern edge of the site. The topographical contours show an increase in gradient from north to south. The creek, characterized by a gentle gradient, flows westward in a meandering pattern and features vertically incised embankments, with heights reaching up to 10 feet at certain points along its edges. A fill berm, constructed as part of railroad enhancements, is present along the site's northeast boundary. In the southeast corner, a level and graded pad has been prepared for the construction of a residential development along Wooster Drive. The site's elevation ranges from approximately 185 feet above Mean Sea Level (MSL) at the northwest corner, near Loma Alta Creek, to 464 feet MSL at the graded pad. The proposed development occupies the northeastern corner of the site, with the remaining area left undeveloped. The drainage study focuses on the eastern watersheds affected by the development, covering approximately 29.9 acres. This includes 5.0 acres of an offsite area along the eastern boundary, consisting of both the southeastern slope that drains through a brow ditch along the eastern boundary of the site, moving northward, and water from an existing development channeled via the Olive Drive curb and gutter system into the same brow ditch. This ditch enters the site from its northeastern corner. Furthermore, the drainage area under consideration incorporates 2.80 acres of the offsite northeastern section, where the proposed emergency-only ingress/egress road from College Boulevard will be situated. The onsite drainage flows north towards the railway lines (part of the Loma Alta Creek Floodway), merging with the offsite flows mentioned earlier. It then moves westward through the undisturbed project boundary towards Loma Alta Creek's existing natural channel. This channel crosses under the railway line within the site and continues west to discharge into the Pacific Ocean at the mouth of Loma Alta Creek. Refer to Appendix 4 in the Preliminary Drainage Study for Olive Park Apartments, prepared by Hunsaker and Associates SD and dated October 2024, for calculations regarding peak runoff under existing conditions.

Description of Proposed Site Development and Drainage Patterns
Project Description / Proposed Land Use and/or Activities: The proposed project will develop a single pad designated for two building structures, accommodating a total of 282 apartment units, complete with courtyards. The development plan includes private driveways, sidewalks, landscaping, and parking spaces, alongside the necessary infrastructure and utilities typical for such a development. This infrastructure will include a dual storm drain system, comprising pipes, inlets, catch basins, brow ditches, and cleanouts. One component of this dual system is designed to collect and convey the onsite 100-year runoff through the project area to the proposed underground storage facilities. These facilities will provide attenuation and direct the runoff to the proposed structural pollutant control Best Management Practices (BMPs) to meet water quality requirements. The second component, the bypass storm drain system, aims to capture and convey the offsite flows along with a portion of the onsite flows from the undisturbed slopes directly to the existing northern channel. To facilitate access to the site from College Blvd, the existing access road northeast of the site will be paved and improved as a gated emergency-only ingress/egress road. A new connection to the cul-de-sac on Olive Drive, east of the site, is proposed.
List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features): Building rooftops, roadways, sidewalks, walkways, parking, patios and other hardscapes areas.
List/describe proposed pervious features of the project (e.g., landscape areas): Landscaped areas, Decomposed granite, resilient surface areas on the playground, and artificial turf in the podium courtyard and the dog run.
Does the project include grading and changes to site topography? ☒Yes ☐No Description / Additional Information: Grading will be performed onsite to accommodate the buildings and ensure the positive drainage. Existing drainage patterns will be maintained.

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

☒Yes

☐No

Description / Additional Information:

The project introduces a new storm drain system, featuring inlets throughout the site designed to efficiently capture onsite runoff. This water is then conveyed through storm drain pipes to underground storage facilities, which designed to handle anticipated designed captured volumes and regulate the flow into downstream biofiltration BMPs before reaching the Loma Alta Creek to the north. Specifically, runoff from two designated areas, DMA1 and DMA2, is directed to these underground facilities. These facilities provide additional storage and flow control to comply with Hydromodification Management Plan (HMP) and peak flow requirements.

To effectively manage runoff, the project includes brow ditches and catch basins to collect water from both offsite and undisturbed onsite areas, channeling it via proposed separate bypass storm drain system or brow ditches to discharge points along the northern boundary of the site without mixing with untreated onsite flows. Furthermore, the eastern section of the emergency-only ingress/egress road route (DMA 4) is engineered to slope towards one flow-based proprietary biofiltration unit appropriately sized to fulfill water quality standards. The unit will then route flows to an underground storage facility sized to addressed hydromodification. The majority of this road route route (DMA 3), which slopes southwest, features a proprietary flow-based biofiltration Best Management Practice (BMP) that treats runoff before it discharges into the creek. Additionally, the underground storage facility for DMA 2 (HMP 2) is specifically designed to over-detain flows for DMA 3 that are not routed to a storage unit, ensuring compliance with HMP requirements at the points of compliance (POCs).

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 Refuse areas are situated within the buildings; the western building has its refuse area underground within the garage, while the eastern building features a designated trash room within the building itself. ☐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 site drains to Loma Alta Creek, then to Loma Alta Slough and ultimately to Pacifica Ocean Shoreline at Loma Alta Creek mouth.		
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
Loma Alta Creek	Benthic Community Effects, Bifenthrin, Cyfluthrin, Cyhalothrin, Lambda, Indicator Bacteria, Nitrogen, Phosphorus, Pyrethroids, Selenium, Toxicity	N/A
Loma Alta Slough	Eutrophic, Indicator Bacteria	Phosphorus (Alternative TMDL – Addressed by regional MS4 permit per Carlsbad WMA WQIP)
Pacific Ocean Shoreline, Loma Alta HSA, at Loma Alta Creek mouth	Indicator Bacteria, Trash	N/A

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): SWMM Analysis is performed to show compliance with hydromodification requirements.
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: No Critical Coarse Sediment Yield Areas (CCSYA) are located within or upstream of the project's disturbed area according to the WMAA map. There is a CCSYA within the site's boundary, but it is situated to the west of the project and will not be impacted.

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. Three points of compliance (POCs) were analyzed for the proposed project. The first POC (POC3), located at the northeast end of the emergency-only ingress/egress road near College Blvd (offsite), currently receives runoff from a dirt-compacted access road in existing conditions. In the proposed condition, the road will be improved, surfaced, and superelevated towards one proprietary biofiltration unit to address water quality requirements that will route the flows into an underground storage facility (HMP4) to address hydromodification requirements. The second POC (POC2), situated at the easterly end of the onsite improvements, receives flow from DMA 2 after routing through the underground storage facility (HMP2) and the downstream MWS unit, along with treated flow from DMA 3 that was routed through the flow-based MWS unit and commingled with bypassed flow south of the EVA. The third POC (POC1), located at the westerly end of the onsite improvements, receives flow from POC2 and runoff from DMA 1 that is directed through another underground storage facility (HMP1) and a volume-based MWS unit, which then discharges directly into Loma Alta Creek. Runoff from the southern slopes is also directed through brow ditches to POC1. Due to grading, the area directed to POC1 has increased compared to existing conditions. Continuous simulation has been provided for POC1 and POC2 to verify that the proposed facilities have adequate storage and outlet structures to meet HMP requirements.

Form I-3B Page 10 of 10
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. LOMA Alta Creek crosses through the site on its western portion. The project disturbed area will be outside of the flood way and flood plain of the creek.
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. The proposed curb and sidewalk on Olive Drive, serving as the entrance to the project, are meticulously designed to align seamlessly with the existing curb and sidewalk at the Olive Drive cul-de-sac. New storm drain inlets, strategically positioned on-site west of the cul-de-sac, are intended to capture runoff from this new entrance and direct it to the proposed storage facility and MWS unit (HMP2 and BF-3-2), preventing it from mixing with the offsite runoff on Olive Drive. Additionally, another inlet is planned for the existing offsite Olive Drive cul-de-sac to effectively capture runoff from the existing road and route it through a separate, proposed storm drain system directly to POC2. Overlying and resurfacing at this connection are expected to ensure a flawless and integrated transition at the cul-de-sac.

<table>
<tr><td colspan="4">Source Control BMP Checklist
for All Development Projects
(Standard Projects and PDPs)</td><td colspan="2">Form I-4</td></tr>
<tr><td colspan="6">Project Identification</td></tr>
<tr><td colspan="6">Project Name: Olive Park Apartments</td></tr>
<tr><td colspan="6">Permit Application Number: D24-00006</td></tr>
<tr><td colspan="6">Source Control BMPs</td></tr>
<tr><td colspan="6">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.</td></tr>
<tr><td colspan="3">Source Control Requirement</td><td colspan="3">Implemented?</td></tr>
<tr><td colspan="3">SC-1 Prevention of Illicit Discharges into the MS4</td><td>☒ Yes</td><td>☐ No</td><td>☐ N/A</td></tr>
<tr><td colspan="6">Discussion / justification if SC-1 not implemented:
All proposed impervious surfaces are strategically designed to drain into adjacent landscaped areas where feasible. This setup facilitates the dispersion of non-stormwater discharges into the landscaping for infiltration. Efficient irrigation practices will be employed as well. Additionally, BMPs outlined under SC-6 will help prevent illicit discharges. Please refer to the information provided below for further details.</td></tr>
<tr><td colspan="3">SC-2 Storm Drain Stenciling or Signage</td><td>☒ Yes</td><td>☐ No</td><td>☐ N/A</td></tr>
<tr><td colspan="6">Discussion / justification if SC-2 not implemented:
•Locations of inlets are shown on exhibits.
• Placards will be provided for all storm water drain inlets and catch basins within the project area with prohibitive dumping language (E.G. “NO DUMPING – I LIVE DOWNSTREAM”). See DMA maps.
• Maintain and periodically repaint or replace inlet markings.
• Provide storm water pollution prevention information to new owners, lessees, or operations.</td></tr>
<tr><td colspan="3">SC-3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal</td><td>☐ Yes</td><td>☐ No</td><td>☒ N/A</td></tr>
<tr><td colspan="6">Discussion / justification if SC-3 not implemented:
There’s no “Outdoor Materials Storage Areas” contemplated for this project.</td></tr>
</table>

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: There's no "Materials Stored in Outdoor Work Areas" contemplated for this project.			
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: Trash storage areas are situated within the buildings; the western building has its trash storage area underground within the garage, while the eastern building features a designated trash room within the building itself.			

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 all "No" answers shown above.

• SC-6A: All onsite storm drain inlets to be marked with legend "NO DUMPING, FLOWS TO BAY", or similar.

• SC-6B: The "Interior floor drains and elevator shaft sump pumps" will be plumbed to sanitary sewer.

• SC-6C: The "Interior parking garages" parking garage floor drains will be plumbed to the sanitary sewer.

• SC-6D1: To discourage the entry of pests and meet the source control requirements for future indoor and structural pest control in the proposed building design, some or all of the following key features could be considered:

1-Seal Openings: Ensure that all potential entry points for pests are properly sealed. This includes gaps around doors, windows, utility penetrations, and vents. Use weatherstripping, door sweeps, and caulking to seal any openings. 2-Ventilation: Install appropriate mesh screens on vents, windows, and other openings to prevent insects and rodents from entering while still allowing for proper ventilation. 3-Landscaping: Maintain a clear separation between landscaping and the building structure. Keep vegetation trimmed away from the building to reduce potential pathways for pests to enter. 4-Trash Management: Implement a proper waste management system with sealed trash bins inside the building and regular disposal to prevent pests from being attracted to food sources. 5-Drainage: Ensure proper drainage to prevent water accumulation, which can attract pests like mosquitoes and rodents. Regularly inspect and maintain gutters, downspouts, and drains to prevent blockages.6-Structural Integrity: Maintain the structural integrity of the building by regularly inspecting and repairing any cracks or gaps in walls, foundations, and roofs, as these can serve as entry points for pests. 7-Pest-Resistant Materials: Use pest-resistant building materials, such as concrete, metal, or treated wood, for vulnerable areas like the foundation and exterior walls.and\or 8-Integrated Pest Management (IPM): Incorporate an Integrated Pest Management program for ongoing pest prevention and control. This approach combines various methods, such as inspections, monitoring, and targeted treatments, to minimize the use of pesticides.

• SC-6D2: Final landscape plans will accomplish all the following:

o Preserve existing drought tolerant trees, shrubs, and ground cover to the maximum extent possible.

o Landscaping designed to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to storm water pollution.

o Where landscaped areas are used to retain or detain storm water, use plants that are tolerant of periodic saturated soil conditions.

o Use pest-resistant plants, especially adjacent to hardscape.

o Ensure successful establishment, appropriate selection of plants to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.

• SC-6E: There’s no “Pools, spas, ponds, decorative fountains, and other water features” contemplated for this project.
• SC-6F: There’s no “Food Service” contemplated for this project.
• SC-6G: There’s no “Refuse areas” contemplated for this project.
• SC-6H: There’s no “Industrial processes” contemplated for this project.
• SC-6I: There’s no “Outdoor storage of equipment or materials” contemplated for this project.
• SC-6J: There’s no “Vehicle and equipment cleaning” contemplated for this project.
• SC-6K: There’s no “Vehicle/equipment repair and maintenance” contemplated for this project.
• SC-6L: There’s no “Fuel dispensing areas” contemplated for this project.
• SC-6M: There’s no “Loading Docks” contemplated for this project.
• SC-6N: Fire sprinkler test water" is planned for this project and will be connected to the sewer system.
• SC-6O: Final architect’s and engineer’s plans will accomplish all the following:
o Boiler drain lines will be directly or indirectly connected to the sanitary sewer system and
will not discharge to the storm drain system.
o Rooftop mounted equipment with potential to produce pollutants will be roofed and/or
have secondary containment.
o Roofing, gutters, and trim made won't be made of copper or other unprotected metals that
may leach
into runoff.
• SC-6P: Plazas, sidewalks, and parking lots will be swept regularly to prevent the accumulation of litter and debris.

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

Project Identification

Project Name: Olive Park Apartments

Permit Application Number: D24-00006

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: Loma Alta Creek flows along the northern boundary of the site from east to west, entering the site to the west of the development area and crossing under the rail lines, extending approximately 1280 feet through the property. The project plans to disturb less than 25% of the site, carefully avoiding any encroachment into the creek's floodplain or floodway, while maintaining a buffer zone of about 430 feet from the creek's floodplain limit on site. Approximately 75% of the site to the south and west of the development will preserve its natural drainage pathways, natural swales, and permeable soils. For the disturbed areas, all runoff from the upstream slope will be captured and redirected to maintain its original flow path and discharge points into Loma Alta Creek. The site layout has been optimized to minimize the need for grading near the train tracks and floodplain.			
SD-2 Conserve Natural Areas, Soils, and Vegetation	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-2 not implemented: The proposed development is situated in the northeastern corner of the site, leaving the majority of the area undeveloped. The project aims to disturb less than 25% of the site, focusing development on the least environmentally sensitive areas and maintaining a setback from natural zones. Vegetation, soils, and natural landscapes across 75% of the site will be preserved.			
SD-3 Minimize Impervious Area	☒ Yes	☐ No	☐ N/A

Form I-5 Page 2 of 2			
Discussion / justification if SD-3 not implemented: Sidewalks, streets & parking stalls were designed with widths minimized as much as possible. Adhering to the City of Oceanside's standards, the minimum sidewalk width is 4 feet. Th proposed sidewalk width is 5 ft to accommodate the expected heavy pedestrian traffic due to the size of buildings and for public safety reasons, without unnecessarily expanding the impervious area. Similarly, for the parking layout, we've strictly followed the required dimensions of 8.5' x 18' for each stall, ensuring no additional impervious surface beyond what is essential for functionality and compliance.			
SD-4 Minimize Soil Compaction	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-4 not implemented: Proposed landscaped areas will be compacted as minimally as possible by minimizing the amount of time vehicles are spent of known landscaped areas. The goal is to ensure that soil is compacted as little as possible to create optimal conditions for plant growth. Any landscape area where compaction is needed shall be re-tilled before planting to ensure optimal growth.			
SD-5 Impervious Area Dispersion	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-5 not implemented: The Low Impact Development (LID) approach for impervious area dispersion has been implemented where feasible. Roof areas and walkways have been directed toward pervious areas before being collected and routed to the storm drain system. However, due to the large size of the building and the limited surrounding landscaped area, it is not practical to route the entire roof runoff to the landscape. While directing stormwater from impervious surfaces like the roof and sidewalks to pervious areas allows for some infiltration, the available landscaped space around the building is insufficient to handle the full volume of runoff during significant storm events. Routing all roof runoff to these areas could result in saturation, water pooling, and potential drainage issues, which would compromise the overall effectiveness of the stormwater management system. To mitigate these risks, a portion of the roof area and some sidewalk runoff will be routed to the landscaped areas, allowing for effective stormwater treatment while preventing overloading of the landscape. The remaining roof runoff will be directed to the podium, where it will be hard-piped into the storm drain system for conveyance and treatment. This solution minimizes the risks of standing water, erosion, and drainage failures in the landscaped areas while maintaining compliance with stormwater management requirements. By managing impervious area disconnection in a controlled manner, this design ensures efficient runoff management without overwhelming the landscape. Splitting the flow between the podium and the landscaped areas strikes a balance between maximizing natural infiltration and ensuring the site's drainage system can effectively handle the volume of stormwater runoff.			

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Form I-5 Page 2 of 2			
SD-6 Runoff Collection	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-6 not implemented: Small collection strategies such as earthen swales on building pads to convey the runoff from roofs through landscape before being captured by catch basins, area drain, or inlet. Decomposite granite (permeable surface) was also used in the community areas.			
SD-7 Landscaping with Native or Drought Tolerant Species	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-7 not implemented: Native and drought-tolerant species will be included in landscape design.			
SD-8 Harvesting and Using Precipitation	☐ Yes	☐ No	☒ N/A
Discussion / justification if SD-8 not implemented: 1. Maintenance Challenges: This is a multi-family residential project with limited space and no dedicated on-site personnel responsible or managing rain barrels. Harvesting the water from the barrels would require someone to perform this task within 36 hours after a rainfall event, which is not practical given the absence of such personnel on-site. The logistics of ensuring timely maintenance and water usage after every rain event would be difficult to implement effectively in this setting. 2. Limited Utility of Harvested Water: The locations where rain barrels could be installed are not within areas where the harvested water can be effectively used. There is limited landscaped area on-site that would benefit from the water, and the landscape maintenance is already accounted for through other sustainable measures. This further diminishes the practicality and utility of rain barrels in this specific project. 3. Space Constraints: The high-density nature of the development, with little open space between units, limits the available space to install and access rain barrels. This would not only make installation difficult but also impede ongoing maintenance, making the long-term management of rain barrels unrealistic. Given these technical challenges, we believe rain barrels are not a suitable BMP for this project. We proposed alternative BMPs that are more practical and effective given the project's specific characteristics, such as dispersion areas where feasible and practical.			

Summary of PDP Structural BMPs	Form I-6 (PDPs)
Project Identification	
Project Name: Olive Park Apartments	
Permit Application Number: D24-00006	
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.

The general strategy for implementing structural BMPs is outlined in the provided approach:

1- Site Analysis: The project site information has been thoroughly reviewed, revealing hydrologic soil groups of types "D", "C", and "A". Infiltration has been deemed infeasible onsite according to the Stormwater Management Investigation conducted by Geocon in August 2024. Their findings indicate that the majority of the proposed development is situated on landslide debris and materials prone to landslides. Additionally, groundwater within the alluvial deposits is less than 10 feet from the existing grade, and the development plan involves placing fills more than 5 feet deep across the entire site after removing the landslide debris. Due to these factors—proximity to groundwater, proposed fill depths, and existing geologic hazards—Geocon did not perform infiltration tests within the granitic rock or Santiago Formation. Consequently, infiltration is considered infeasible across the site.

   For the small segment of the access road that drains away from the project and is located in soil type "A", five tree wells are planned to fulfill both water quality and HMP requirements. Additionally, an alternative design featuring a vault and biofiltration basin has been developed and included for this section, to be implemented if infiltration issues arise during the final engineering phase.

   Due to the proposed land use and number of stories of the proposed building, harvest and use BMPs are deemed infeasible.

2- Self-Mitigating Area: The proposed landscaped slopes surrounding the project are designed to be isolated from the rest of the site. The flow from the majority of these slopes (specifically the southwestern slopes – SM1) will be directed through brow ditches to the point of connection (POC1), without mixing with untreated flows, thus qualifying this slope as a self-mitigating area. The flow from the southeastern self-mitigating slope will also be channeled via a brow ditch, captured by a catch basin, and then directed to POC2 through a bypass storm drain system.

3- Determining DCV for each DMA: DCV for each DMA has been determined using Worksheet B.1 (per Appendix B.1).

A. Rainfall depth has been determined to be 0.62 inch per Appendix B.1.1, as utilized in Line 1.

B. Each BMP tributary area has been delineated, which includes the slopes that will be graded and will not be bypassed. DMA area for each BMP has been labeled, and an area breakdown for each DMA per surface type has been provided. The square footage of surfaces was provided in Lines 2-9.

C. Runoff factors have been determined for each subarea within individual DMA based on the surface type, as outlined in Appendix B.1.3. These factors have been used in the "Standard Drainage Basin Input" section of the Worksheet.

D. Dispersion areas have been carefully designated to meet the minimum retention requirements. The dispersion areas have been clearly delineated on the DMA map, and the corresponding calculated areas have been filled out in the "Dispersion Area" section. Supplemental calculations using the County SSD-BMPs worksheets for these designated dispersion areas have been provided.

(Page reserved for continuation of description of general strategy for structural BMP implementation at the site)

4- Retention Requirements: Worksheet B.2 (per Appendix B.2) has been used to determine retention requirements for each DMA.

A. The evaluation confirms that the project does not propose a building over 9 stories. Therefore, a capture and use evaluating the potential for toilet/landscape use for the DCV is not required.

B. The geotechnical investigation, prepared by Geocon Inc. and dated August 2024, confirms that the proposed BMP location restricts infiltration activities due to the soil type and groundwater.

C. Considering the infeasibility of infiltration due to the identified soil type, no infiltration rate has been determined.

D. As the project falls under the category of a PDP project, the minimum retention requirements are applicable.

5- BMP Performance was determined per Appendix B.3

A. The proposed site design elements satisfied the annual retention requirements for each DMA (as determined per line 46 in worksheet B.3, and the County SSD-BMPs worksheets.

B. The proposed proprietary biofiltration BMPs "Modular Wetland System Linear" were sized per Section B.4.3 "BMPs Downstream of a storage unit" for DMA1 and DMA2. For each DMA of these Two DMAs, a CMP storage facility has been proposed to carry the required design captured volume and regulate the flows to the downstream biofiltration BMP (BF-3-1 and BF-3-2). Using of this approach is not supported by County automated worksheets, but compliance with stormwater pollutant control requirements has been demonstrated using the following steps:

a- The design of the outlet structures in the proposed underground storage facilities is aimed to fulfill both Hydromodification Management Plan (HMP) and Water Quality (WQ) requirements. The low flow orifices, crucial for controlling discharge, are specifically sized to meet these criteria. For this project, these orifices are primarily governed by the low flow HMP requirements, employing a specific fraction of the Design Capture Volume (DCV) and associated drawdown time (2 DCV in 63 hours) instead of the standard practice of treating 1.5 times the DCV within 36 hours.

To determine the necessary fraction of the Design Capture Volume (DCV) required to treat 92% of the annual runoff volume, we referred to the percent capture nomographs shown in Figure B.3-1 of the BMP manual. The low flow orifices, designed to meet the HMP requirements, direct flows to the downstream biofiltration BMPs and were verified to draw down the specified fraction of DCV within the predetermined drawdown time to achieve the 92% annual runoff volume target. The flow rate from these orifices was calculated using the orifice equation once the storage unit reaches the depth associated with the specified fraction of the DCV, allowing for precise calculation of the drawdown time.

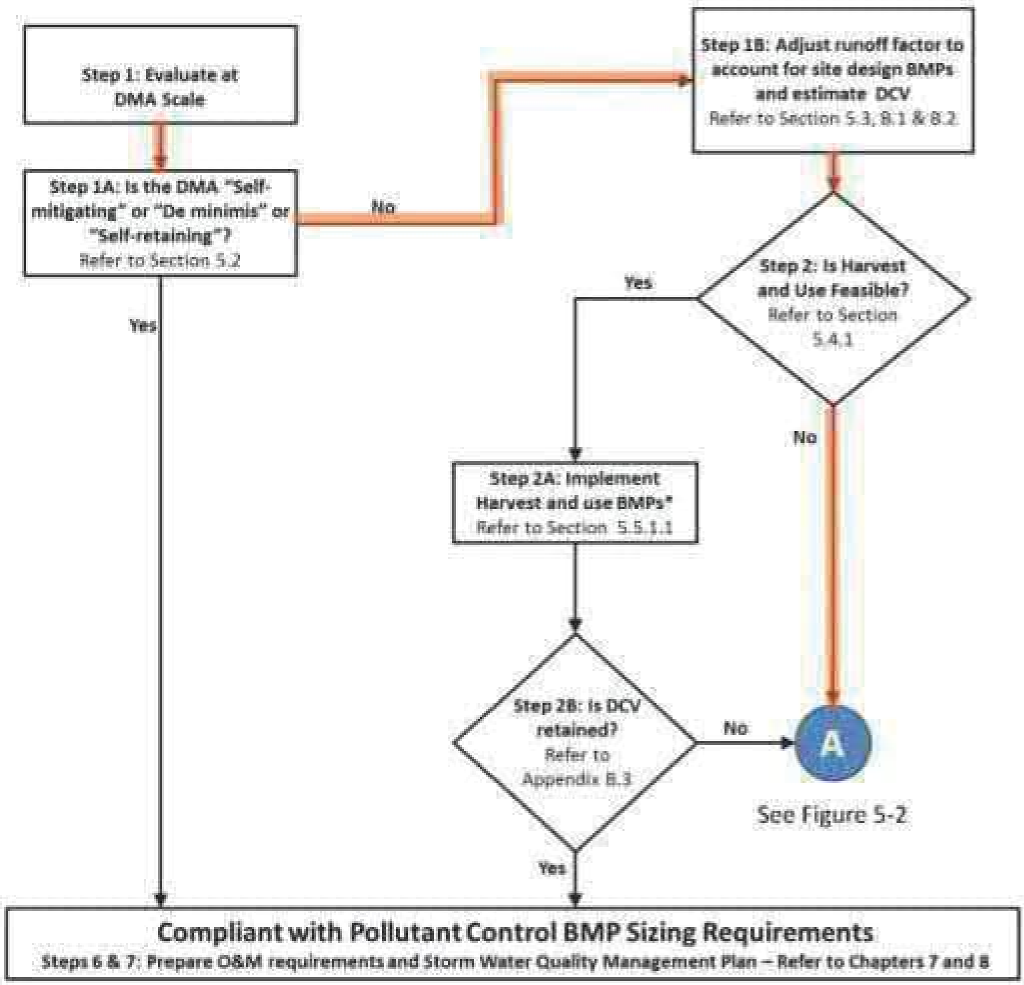
b- The proposed biofiltration BMPs are sized to manage the required volume and meet the specified drawdown time, utilizing the media filtration rate verified through manufacturer-certified testing. Additionally, a safety factor, as recommended by the manufacturer, has been incorporated to ensure reliability. This approach ensures that the MWS units are capable of treating the designated volume within the required drawdown time, with an added factor of safety for enhanced performance.

C. For DMA 3, a flow-based curb type proprietary biofiltration BMP (MWS or equivalent) is proposed to provide pollutant control treatment for this area before it enters the bypass storm drain system. From there, it continues westward to commingle with the treated and mitigated flows from HMP-2 and BF-3-2, and ultimately discharges into the Creek at POC2. HMP2 is designed to over-detain flows from DMA2 to account for the flows from DMA3 that discharge directly to the POC, ensuring compliance with hydromodification requirements at both POC1 and POC2. For sizing the flow-based proprietary biofiltration BMP-MWS unit (or equivalent), Section F.2.2 of the BMP manual was consulted. The runoff flow rate for a 0.2 inch per hour uniform intensity precipitation event was calculated by multiplying the intensity with the runoff coefficient and the area of this DMA (Q = C I A). This calculated flow rate was then increased by a factor of 1.5 to determine the design flow rate for the biofiltration system.

D. The minimum retention requirements for DMA 1 and 2 have been met through the use of dispersion areas. Additionally, extra dispersion was implemented in DMA 2 to account for the required retention volume for DMA 3.

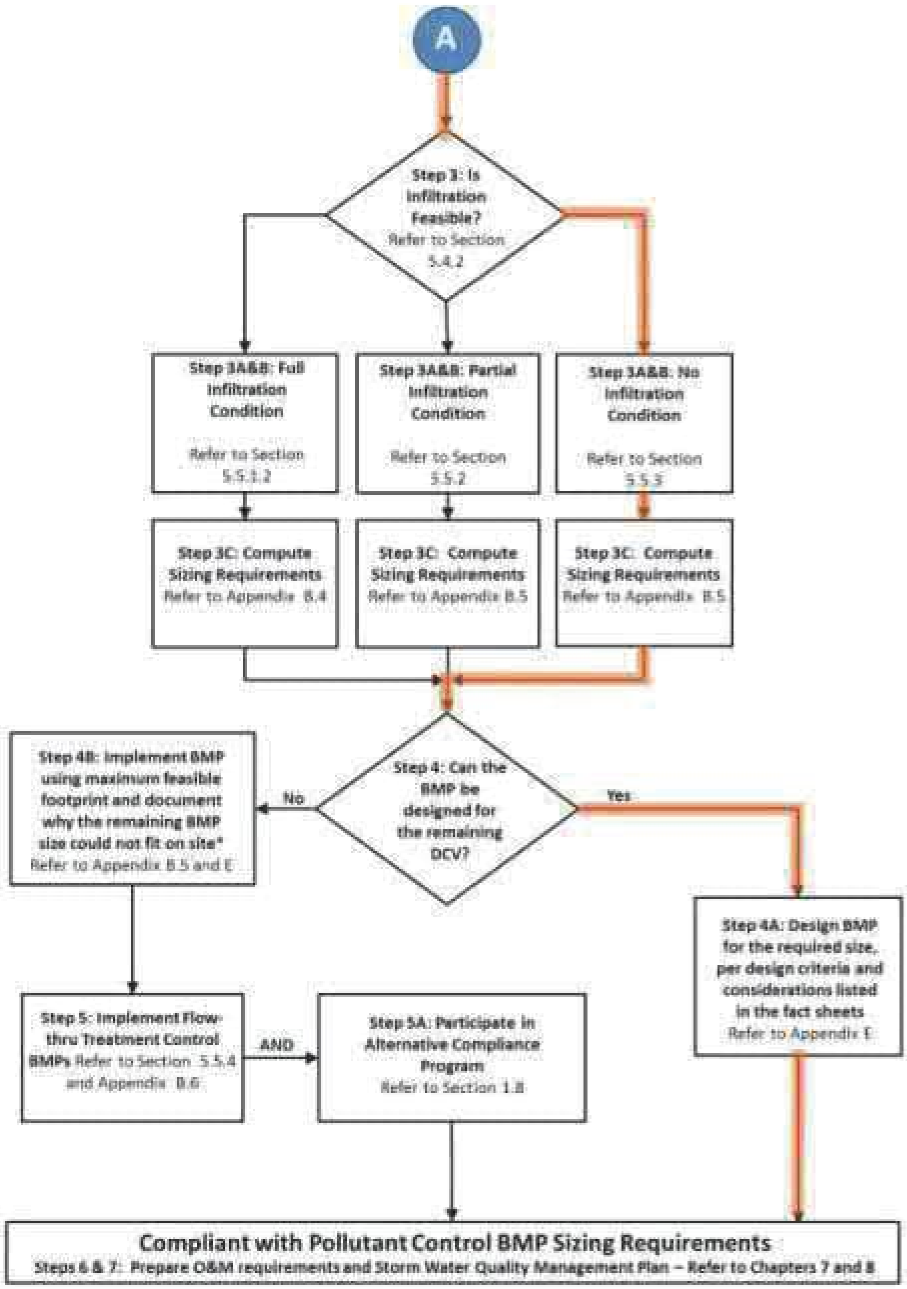
Proprietary information have been provided demonstrating that the device meets bifiltration criteria outlined in Appendix F.1.-F.2

E. DMA 4 encompasses a small segment of the EVA road, engineered to drain towards a proprietary biofiltraion MWS unit or equivalent and Underground storage facility to address HMP and WQ requirements.



* Step 2C: Project applicant has an option to also conduct feasibility analysis for infiltration and if infiltration is fully or partially feasible has an option to choose between infiltration and harvest and use BMPs. But if infiltration is not feasible and harvest and use is feasible, project applicant must implement harvest and use BMPs

FIGURE 5-1. Storm Water Pollutant Control BMP Selection Flow Chart



* Project approval at the discretion of [City Engineer]

FIGURE 5-2. Storm Water Pollutant Control BMP Selection Flow Chart

Form I-6 Page 3 of 16	
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. BF-3-1	
Construction Plan Sheet No. 8 (Tentative Map)	
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)	
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)	Alisa Vialpando, RCE. Avialpando@HunsakerSD.com
Who will be the final owner of this BMP?	Capstone Equities
Who will maintain this BMP into perpetuity?	Capstone Equities
What is the funding mechanism for maintenance?	Capstone Equities

Form I-6 Page 4 of 14
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)
Discussion (as needed): The proposed BF-3-1 is a volume-based proprietary biofiltration BMP (MWS-L-8-12) that treats runoff from DMA 1. It is situated downstream of the HMP-1 storage unit, which includes an outlet structure designed to regulate the flow to the MWS unit and control the drawdown time. Drawdown Time = 63 hours Treatment Volume (2 DCV) = 15,138 CF. To meet minimum retention requirements for DMA1, dispersion areas site design BMPs are implemented.

Form I-6 Page 5 of 16	
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. BF-3-2	
Tentative Map Sheet No. 5	
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)	
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)	Alisa Vialpando, RCE. Avialpando@HunsakerSD.com
Who will be the final owner of this BMP?	Capstone Equities
Who will maintain this BMP into perpetuity?	Capstone Equities
What is the funding mechanism for maintenance?	Capstone Equities

Form I-6 Page 6 of 14
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)
Discussion (as needed): The proposed BF-3-2 is a volume-based proprietary biofiltration BMP (MWS-L-4-8) that treats runoff from DMA 2. It is situated downstream of the HMP-2 storage unit, which includes an outlet structure designed to regulate the flow to the MWS unit and control the drawdown time. Drawdown Time = 63 hours Treatment Volume (2.0 DCV) = 6,570 CF To meet minimum retention requirements for DMA2, dispersion areas site design BMPs are implemented.

Form I-6 Page 7 of 16	
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. BF-3-3	
Tentative Map Sheet No. 5	
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)	
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)	Alisa Vialpando, RCE. Avialpando@HunsakerSD.com
Who will be the final owner of this BMP?	Capstone Equities
Who will maintain this BMP into perpetuity?	Capstone Equities
What is the funding mechanism for maintenance?	Capstone Equities

Form I-6 Page 8 of 16
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)
Discussion (as needed): The Proposed BF-3-3 is a flow based Proprietary Biofiltration BMP (MWS-L-4-13) that treats DMA 3. Required flow rate to be treated= 0.133 cfs

Form I-6 Page 9 of 16	
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. BF-3-4	
Tentative Map Sheet No. 4	
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)	
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)	Alisa Vialpando, RCE. Avialpando@HunsakerSD.com
Who will be the final owner of this BMP?	Capstone Equities
Who will maintain this BMP into perpetuity?	Capstone Equities
What is the funding mechanism for maintenance?	Capstone Equities

Form I-6 Page 10 of 16
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)
Discussion (as needed): The Proposed BF-3-4 is a flow-based Proprietary Biofiltration BMP (MWS-L-4-4) that treats DMA 3. Required flow rate to be treated= 0.016 cfs

Form I-6 Page 11 of 16	
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. HMP-1	
Construction Plan Sheet No. 8	
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)	
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)	Alisa Vialpando, RCE. Avialpando@HunsakerSD.com
Who will be the final owner of this BMP?	Capstone Equities
Who will maintain this BMP into perpetuity?	Capstone Equities
What is the funding mechanism for maintenance?	Capstone Equities

Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)
Discussion (as needed): The CMP underground storage facility features an outlet structure and is comprised of seven barrels of 84” perforated pipes, with gravel between them (40% porosity) and a 0.5-foot layer of gravel above the pipes. This system provides water quality (WQ) storage for the downstream biofiltration BMP, hydromodification storage, and flow control, and peak flow detention. Cumulative Storage= 40,273 cft. WQ ponding depth= 2.83 ft, drawdown time = 63 hrs HMP ponding depth= 5.51 ft 100 Year WSE= 6.5 ft Total depth of system 7.5 ft. Total system drawdown time= 91 hrs Outlet structure: Eight 0.5625” (9/16”) orifice to drawdown the WQ volume within 63 hrs. These orifices direct flows to the downstream MWS unit BF-3-1. Internal weir set at 2.83 ft to divert the flows associated with the volume that exceeds the required WQ volume to the bypass system. 1 X 0.5” orifice at 2.83 ft to the bypass storm drain system (bypassing MWS unit). 10X 2” orifices at 4.75 ft to the bypass storm drain system (bypassing MWS unit). 12 X 4” orifices at 5.0 ft to the bypass storm drain system (bypassing MWS unit). Wall weir length 14 ft with rim at 6.4 ft.

Form I-6 Page 13 of 16	
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. HMP-2	
Construction Plan Sheet No. 5	
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)	
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)	Alisa Vialpando, RCE. Avialpando@HunsakerSD.com
Who will be the final owner of this BMP?	Capstone Equities
Who will maintain this BMP into perpetuity?	Capstone Equities
What is the funding mechanism for maintenance?	Capstone Equities

Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)
Discussion (as needed): The CMP underground storage facility features an outlet structure and is comprised of three barrels of 90" perforated pipes, with gravel between them (40% porosity) and a 0.75-foot layer of gravel above the pipes. This system provides water quality (WQ) storage for the downstream biofiltration BMP, hydromodification storage, and flow control, and peak flow detention. Cumulative Storage= 18,273 cft. WQ ponding depth= 3.0 ft, drawdown time = 63 hrs HMP ponding depth= 6.6 ft 100 Year WSE= 7.10 ft Total depth of system 8.17 ft. Total system drawdown time= 92 hrs Outlet structure: four 0.525" orifices to drawdown the WQ volume within 63 hrs. These orifices direct flows to the downstream MWS unit BF-3-2. Internal weir set at 3.0 ft to divert the flows associated with the volume that exceeds the required WQ volume to the bypass system. 1 X 0.5" orifice at 3 ft to the bypass storm drain system (bypassing MWS unit). 4X 1" orifices at 5.50 ft to the bypass storm drain system (bypassing MWS unit). 12 X 3" orifices at 6.0 ft to the bypass storm drain system (bypassing MWS unit). Wall weir length 14 ft with rim at 7 ft.

Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. HMP-4	
Construction Plan Sheet No. 4	
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)	
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)	Alisa Vialpando, RCE. Avialpando@HunsakerSD.com
Who will be the final owner of this BMP?	Capstone Equities
Who will maintain this BMP into perpetuity?	Capstone Equities
What is the funding mechanism for maintenance?	Capstone Equities

Form I-6 Page 16 of 16
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)
Discussion (as needed): The underground storage facility features an outlet structure has been preliminarly sized to be an underground vault with a minimum HMP Volume of 98 cubic feet to address hydromodification requirements. The San Diego County BMP sizing calculator worksheet has been used to size this BMP.

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

Date Prepared: TBD	Project No.: D24-00006
Project Applicant: TBD	Phone: TBD
Project Address: TBD	
Project Engineer: TBD	Phone: TBD

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: _ TBD__ **Printed Name:** _ TBD______ **Title:** _ TBD______________ **Phone No.** _ TBD __________ 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:** _ TBD__ **Printed Name:** _ TBD______ **Title:** _ TBD______________ **Phone No.** _ TBD __________

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

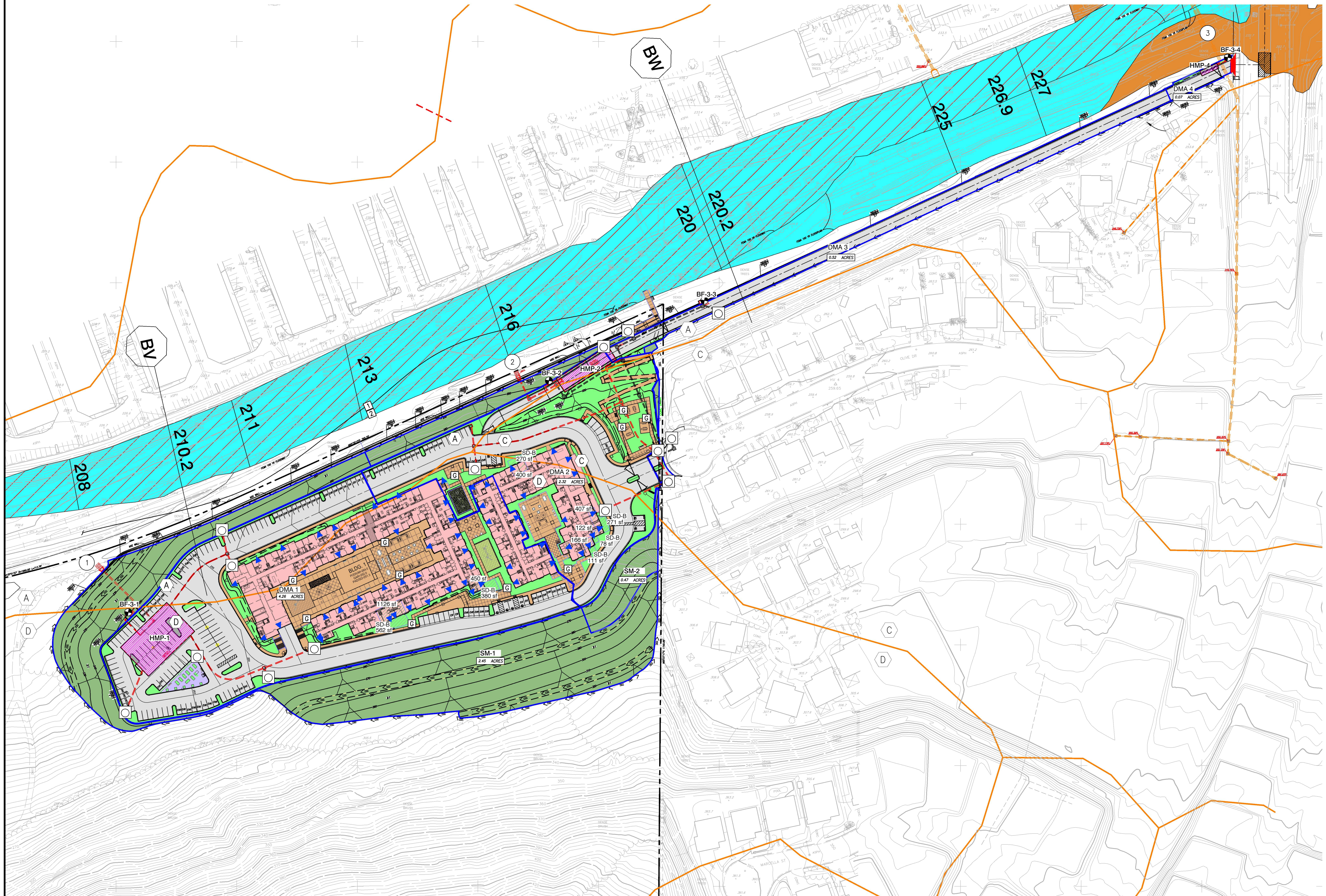
Use this checklist to ensure the required information has been included on the DMA Exhibit:

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 – **DMA Exhibit**

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



LEGEND: SYMBOL:

LEGEND	SYMBOL
PROJECT BOUNDARY	
DMA BOUNDARY	
PROPOSED STORM DRAIN	
EXISTING STORM DRAIN	
FLOW LINE	
SUBAREA ACREAGE	00.00 ACRES
DMA ICON	DMA
IMPERVIOUS - ROAD	
IMPERVIOUS - ROOF	
IMPERVIOUS - SIDEWALK\ HARDSCAPE	
PERVIOUS AREAS	
SELF-MITIGATING AREA (The proposed concrete pedestrian walkways and ramps constitute less than 5% of the self-mitigating area)	
INLET	
HYDROLOGIC SOIL TYPE	D
POINT OF COMPLIANCE	X
STRUCTURAL BMP\ MWS UNIT	
UNDERGROUND STORAGE FACILITY	
SOIL TYPE BOUNDARY	
HMP ICON	HMP
BIOFILTRATION BMP ICON	BF-3-X
PLAY GROUND (80% PERVIOUSNESS)	
DECOMPOSED GRANITE (PERVIOUSNESS)	
SELF MITIGATING ICON	SM
DISPERSION AREAS	
DE MINIMIS < 250 SFT	
100-YEAR FLOOD WAY PER FEMA FIRM	
100-YEAR FLOOD PLAIN PER FEMA FIRM\ ZONE AE	
500-YEAR FLOOD PLAIN PER FEMA FIRM\ ZONE X	
FEMA CROSS SECTION	BW 220.2
BUILDING DOWNSPOUT LOCATIONS	▲

80 0 80 160 240

SCALE 1" = 80'

NO DUMPING NO DESCARGUE BASURA CITY OF OCEANSIDE ONLY RAIN IN THE Storm Drain VA A DAR AL PLAYA DRAINS TO BEACH

NO DUMPING PLACARD FOR INLETS DETAIL

NOT TO SCALE

SITE DESIGN BMPs:

1 SD-1 MAINTAIN NATURAL HYDROLOGIC FEATURES
2 SD-2 CONSERVE NATURAL AREAS, SOILS, VEGETATION
SD-3 MINIMIZE IMPERVIOUS AREAS
SD-4 MINIMIZE SOIL COMPACTION
SD-5 IMPERVIOUS AREA DISPERSION
SD-6 RUNOFF COLLECTION
SD-7 LANDSCAPING WITH NATIVE OR DROUGHT TOLERANT SPECIES

SOURCE CONTROL BMPs:

SC-1 PREVENTION OF ILLICIT DISCHARGES TO MS4
SC-2 STORM DRAIN STENCILING OR SIGNAGE
SC-3 PROTECT OUTDOOR MATERIAL STORAGE AREAS
SC-4 PROTECT MATERIALS STORED IN OUTDOOR WORK AREAS
SC-5 PROTECT TRASH STORAGE AREAS
SC-6 ADDITIONAL BMPS BASED ON POTENTIAL SOURCES OF RUNOFF POLLUTANTS
SC-6A ON-SITE STORM DRAIN INLETS
SC-6B INTERIOR FLOOR DRAINS AND ELEVATOR SHAFT SUMP PUMPS
SC-6C INTERIOR PARKING GARAGES
SC-6D NEED FOR FUTURE INDOOR & STRUCTURAL PEST CONTROL
SC-6E LANDSCAPE/OUTDOOR PESTICIDE USE
G SC-6H REFUSE AREA
SC-6N FIRE SPRINKLER TEXT WATER
SC-6P MISCELLANEOUS DRAIN OR WASH WATER
SC-6Q PLAZAS, SIDEWALKS, AND PARKING LOTS

UNDERLYING SOIL GROUP : A,C & D
APPROXIMATE DEPTH TO GROUNDWATER 5-20'
NO CRITICAL COARSE AREAS REQUIRE PRESERVATION

NOTE: ALL DOWNSPOUTS ARE SHOWN ON THE MAP AND IN ATTACHMENT 4.

PREPARED BY:

HUNSAKER & ASSOCIATES SAN DIEGO, INC
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PH(858)558-4500 · FX(858)558-1414

DMA MAP

OLIVE PARK APARTMENTS

CITY OF OCEANSIDE, CALIFORNIA

MAP 1 OF 1

W.O.# 3785-0002

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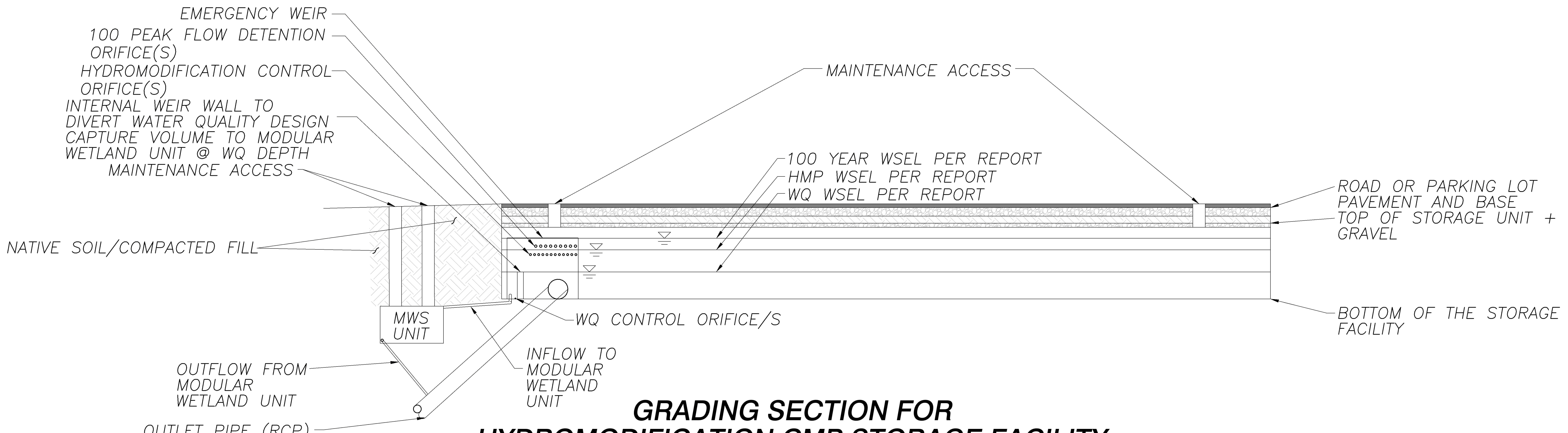
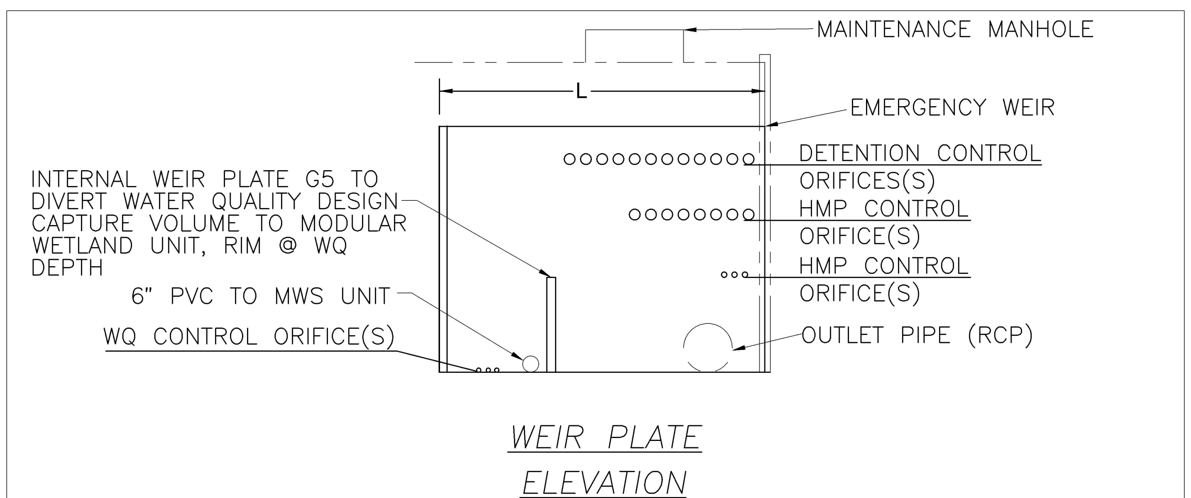


GRADING SECTION FOR HYDROMODIFICATION CMP STORAGE FACILITY

PRIVATE NOT TO SCALE



TYPICAL RISER DETAIL

NOT TO SCALE

RISER ORIFICE CONFIGURATION SUMMARY		
RISER #	RISER 1	RISER 2
WQ ORIFICE(S)	8–0.5625" @ 0	4–0.525" @ 0
WQ DEPTH	2.83'	3.00'
LOW ORIFICE(S)	1–0.5" @ 2.83'	1–0.5" @ 3.00'
MIDDLE ORIFICE(S)	10–2" @ 4.75'	1–4" @ 5.50'
TOP ORIFICE(S)	12–4" @ 5.00'	12–3" @ 6.00'
EMERGENCY RISER	3'x4' @ 6.40'	3'x4' @ 7.00'

PREPARED BY:
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CONCEPTUAL STORAGE FACILITIES & RISER DETAILS

OLIVE PARK APARTMENTS

CITY OF OCEANSIDE, CALIFORNIA

MAP 1 OF 1

W.O.# 3785-0002

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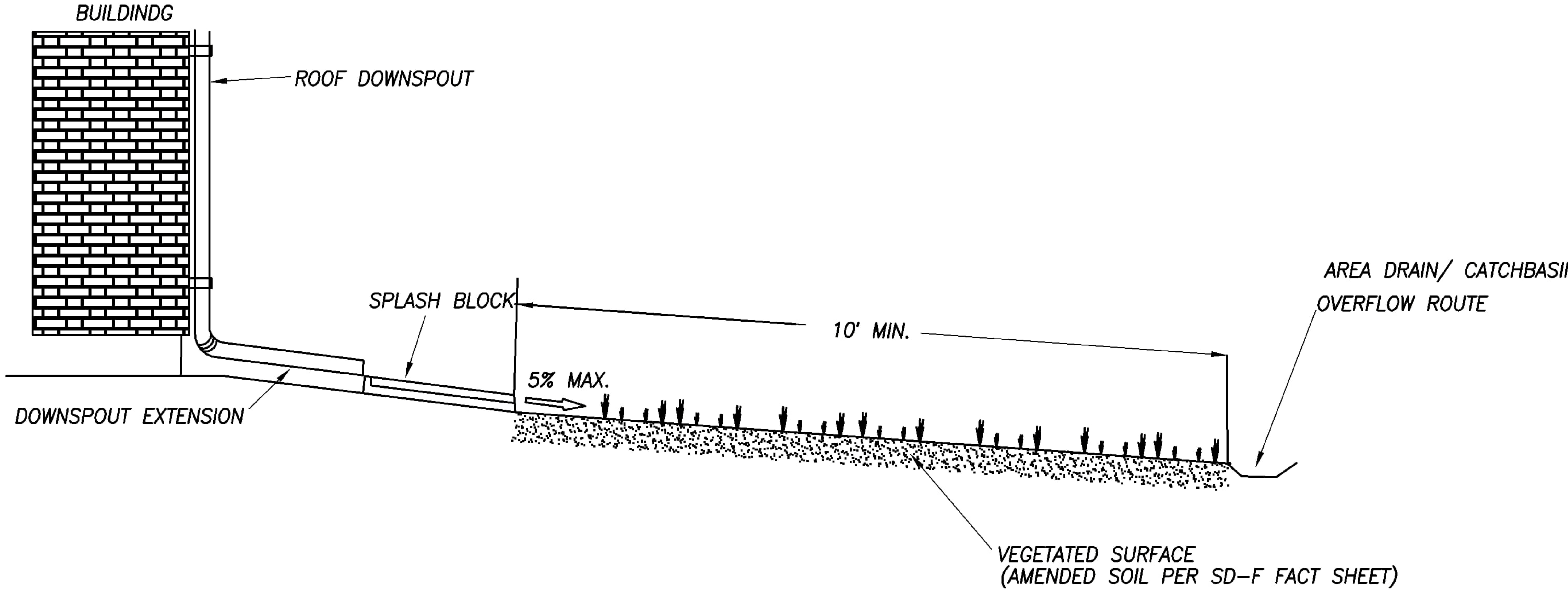

TYPICAL SECTION VIEW FOR AN IMPERVIOUS AREA DISPERSSION BMP (SD-5 PER BMPDM)

PREPARED BY:

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SURVEYING PH(858)558-4500 · FX(858)558-1414

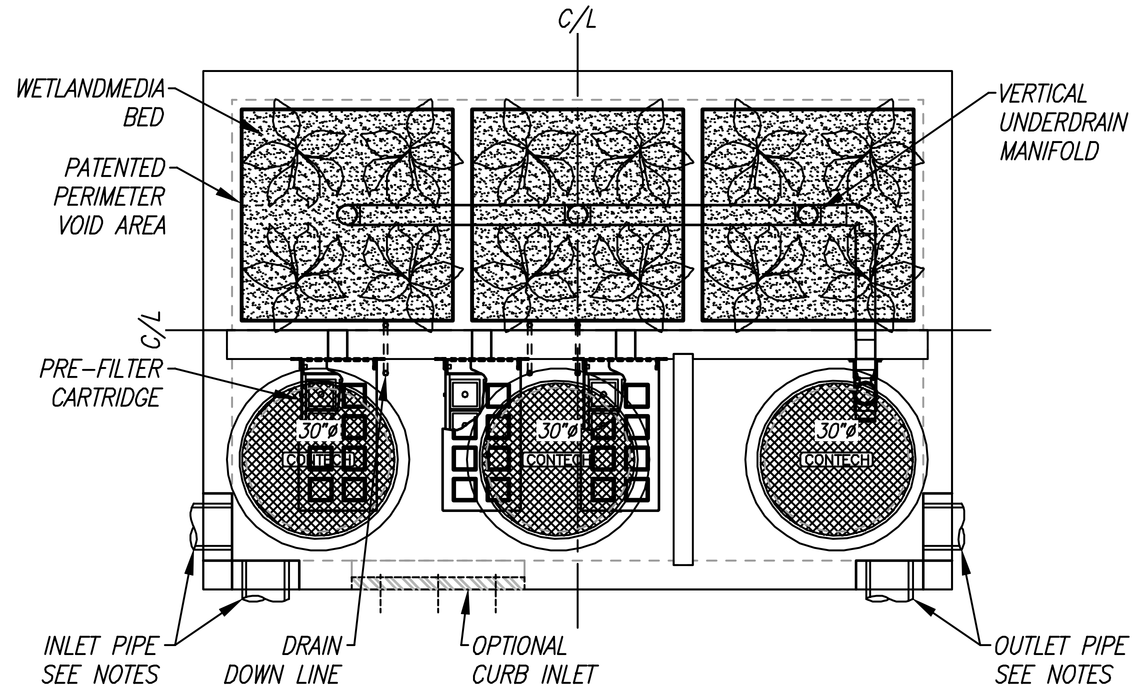
TYPICAL DETAIL EXHIBIT

DISPERSION AREAS

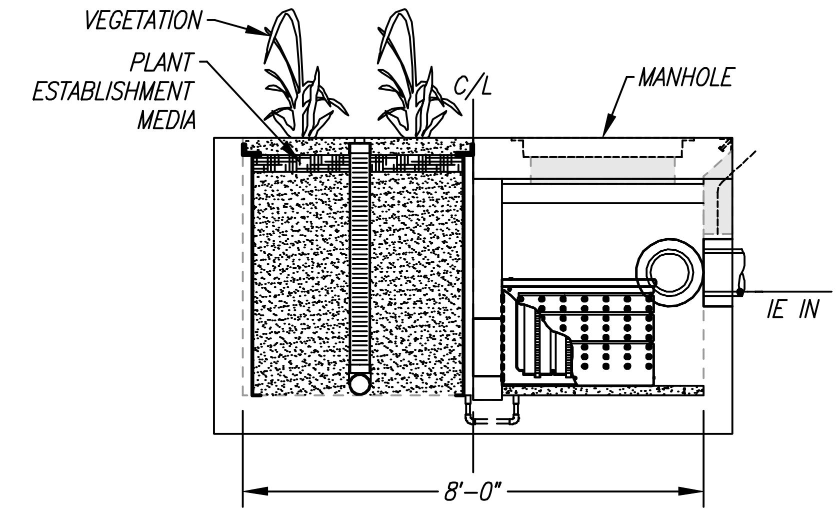
CITY OF OCEANSIDE, CALIFORNIA

SITE SPECIFIC DATA

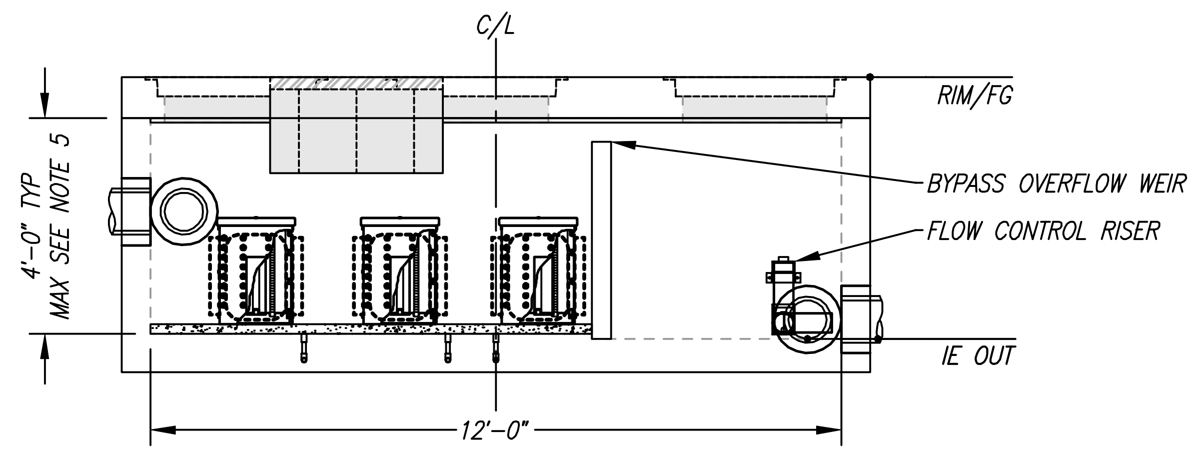
PROJECT NUMBER		TBD	
PROJECT NAME		OLIVE PARK APARTMENTS	
PROJECT LOCATION		OCEANSIDE, CA	
STRUCTURE ID		BF-3-1	
TREATMENT REQUIRED			
TREATMENT VOLUME (CFS)			15,138
PRETREATMENT LOADING RATE (GPM/SF)			TBD
WETLAND MEDIA LOADING RATE (GPM/SF)			0.26
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			N/A
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	TBD	PVC	8"
INLET PIPE 2			
OUTLET PIPE	TBD	PVC	8"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	TBD	TBD	TBD
SURFACE LOAD			
NOTES:			



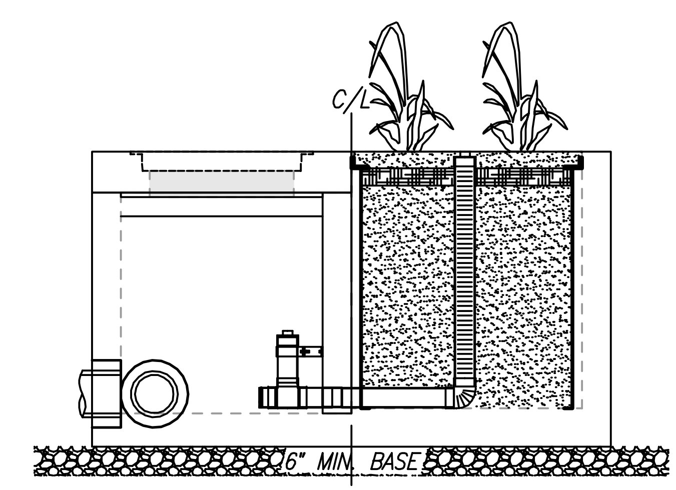
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

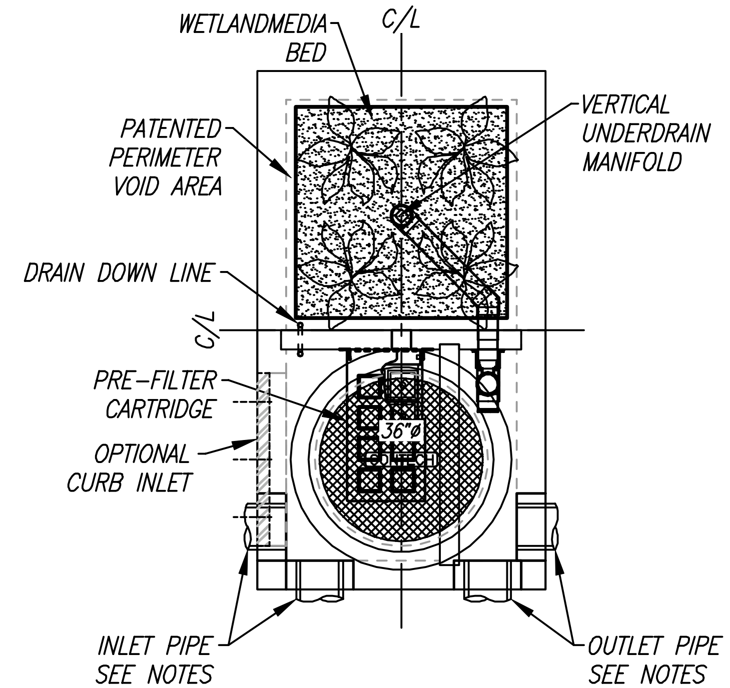
INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING PROJECT ENGINEER'S RECOMMENDED BASE SPECIFICATIONS.
3. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL.
4. CONTRACTOR RESPONSIBLE FOR CONTACTING CONTECH FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A CONTECH REPRESENTATIVE.
5. VERTICAL HEIGHT VARIES BASED ON SITE SPECIFIC REQUIREMENTS.

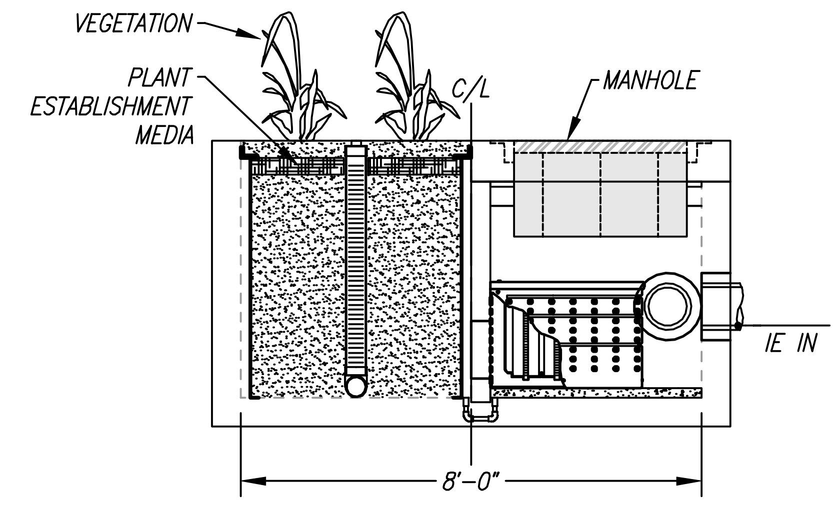
10/8/24ACGONZALEZ

MWS-L-8-12-V
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

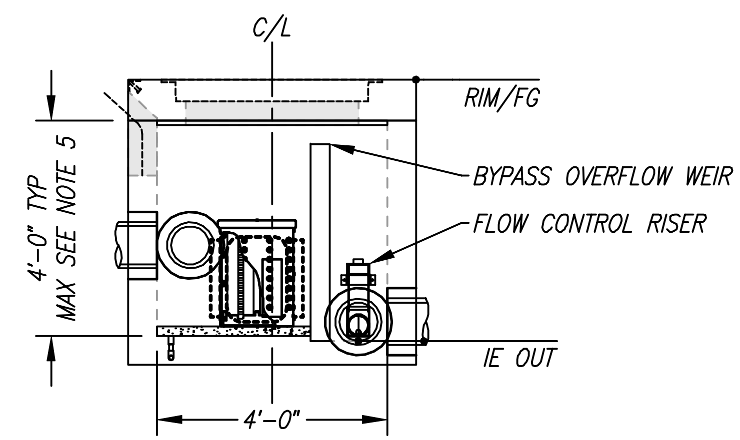
SITE SPECIFIC DATA			
PROJECT NUMBER	TBD		
PROJECT NAME	OLIVE PARK APARTMENTS		
PROJECT LOCATION	OCEANSIDE, CA		
STRUCTURE ID	BF-3-2		
TREATMENT REQUIRED			
TREATMENT VOLUME (CF)			6464
PRETREATMENT LOADING RATE (GPM/SF)			TBD
WETLAND MEDIA LOADING RATE (GPM/SF)			0.26
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			N/A
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	TBD	PVC	6"
INLET PIPE 2			
OUTLET PIPE	TBD	PVC	6"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	TBD	TBD	TBD
SURFACE LOAD			
NOTES:			



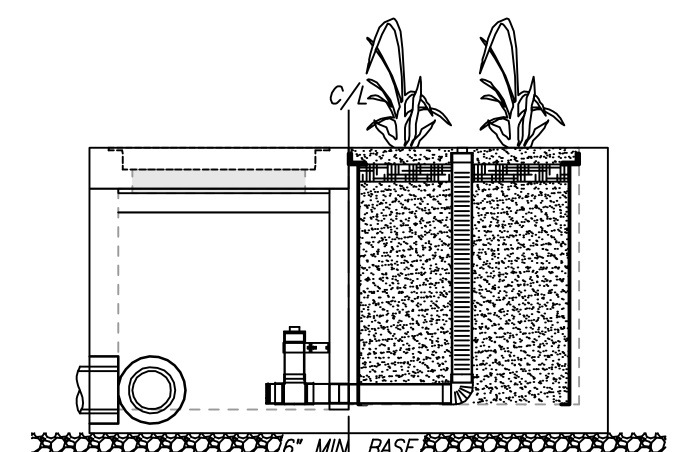
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING PROJECT ENGINEER'S RECOMMENDED BASE SPECIFICATIONS.
3. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL.
4. CONTRACTOR RESPONSIBLE FOR CONTACTING CONTECH FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A CONTECH REPRESENTATIVE.
5. VERTICAL HEIGHT VARIES BASED ON SITE SPECIFIC REQUIREMENTS.

10/8/24ACGONZALEZ

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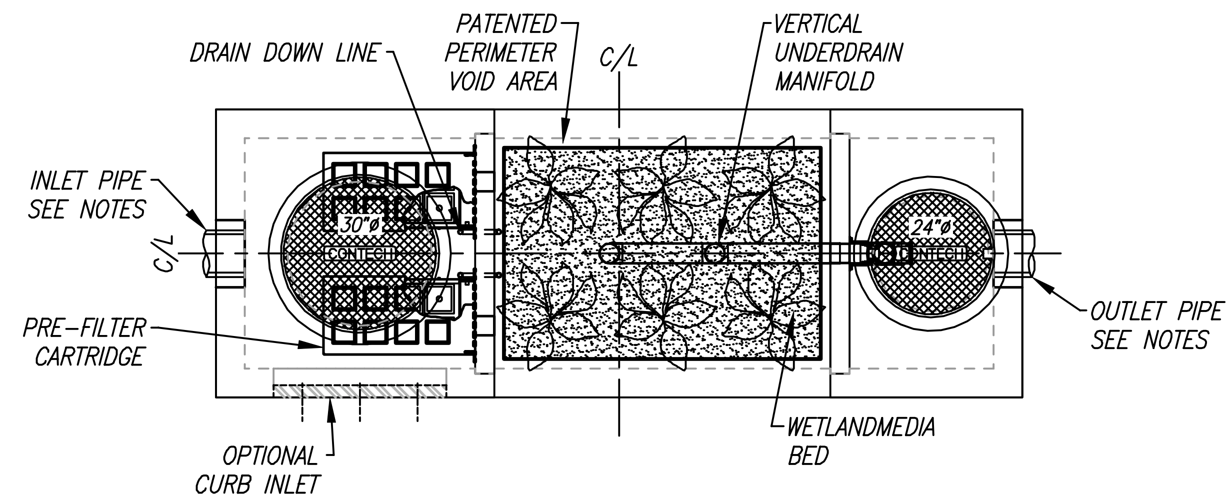
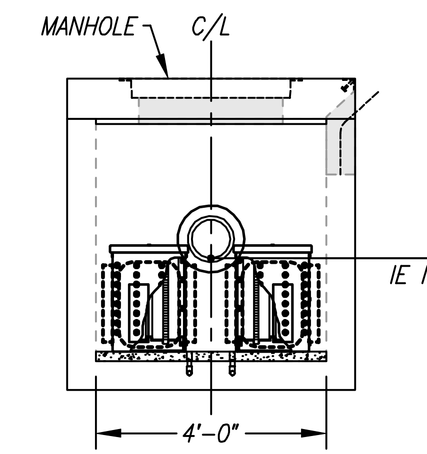
MWS-L-4-8-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

SITE SPECIFIC DATA

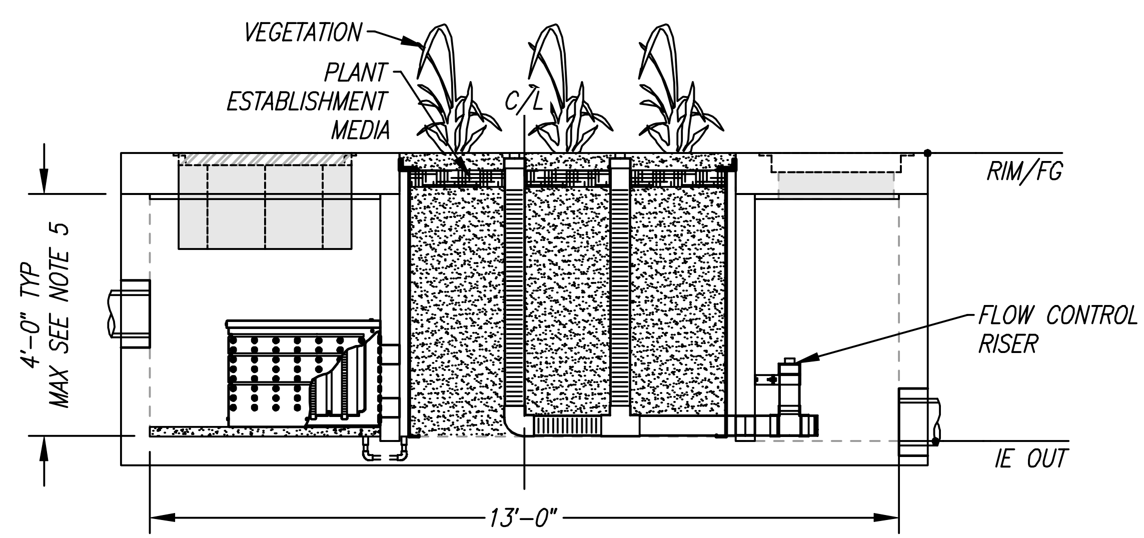
PROJECT NUMBER	TBD		
PROJECT NAME	OLIVE PARK APARTMENTS		
PROJECT LOCATION	OCEANSIDE, CA		
STRUCTURE ID	BF-3-3		
TREATMENT REQUIRED			
TREATMENT FLOW (CFS)			0.144
PRETREATMENT LOADING RATE (GPM/SF)			TBD
WETLAND MEDIA LOADING RATE (GPM/SF)			0.26
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			TBD
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE	TBD	HDPE	18"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	TBD	TBD	TBD
SURFACE LOAD			
NOTES:			



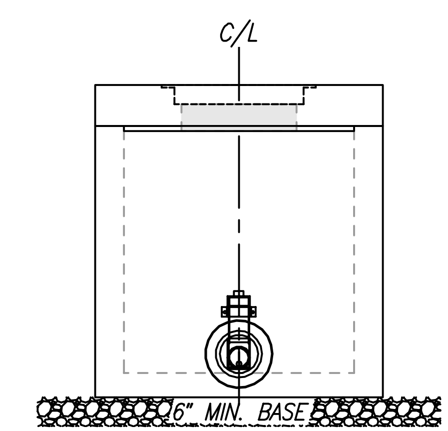
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



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INSTALLATION NOTES

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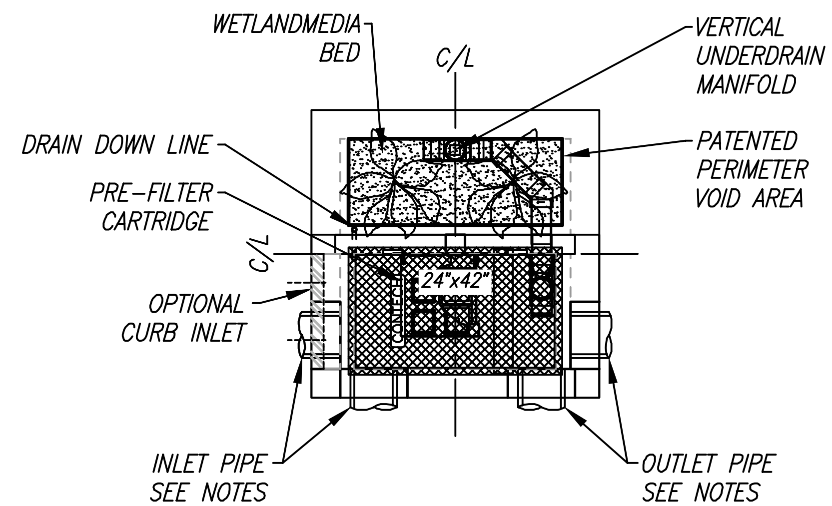
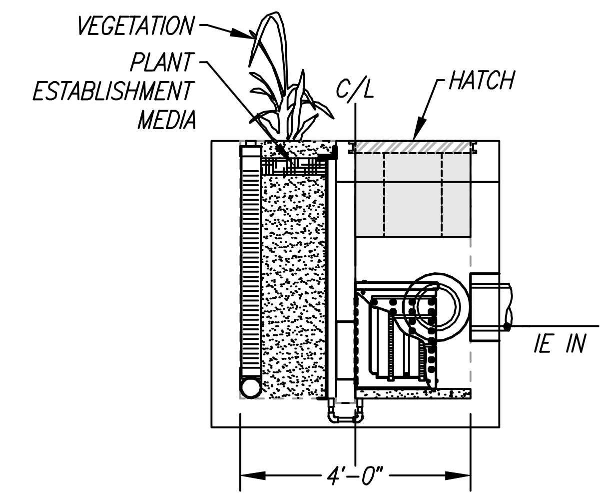
MWS-L-4-13-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

SITE SPECIFIC DATA

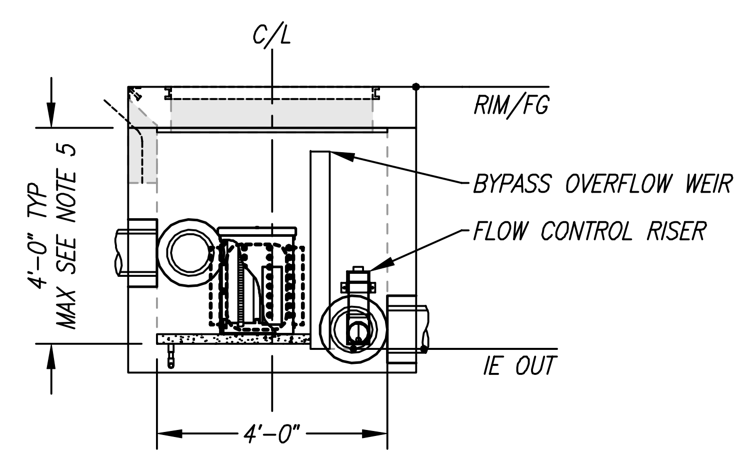
PROJECT NUMBER		TBD	
PROJECT NAME		OLIVE PARK APARTMENTS	
PROJECT LOCATION		OCEANSIDE, CA	
STRUCTURE ID		BF-3-4	
TREATMENT REQUIRED			
TREATMENT FLOW (CFS)			0.052
PRETREATMENT LOADING RATE (GPM/SF)			TBD
WETLAND MEDIA LOADING RATE (GPM/SF)			0.26
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			TBD
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE	TBD	HDPE	18"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	TBD	TBD	TBD
SURFACE LOAD			
NOTES:			



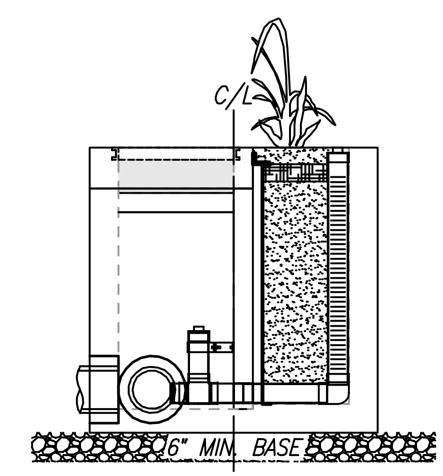
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

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5. VERTICAL HEIGHT VARIES BASED ON SITE SPECIFIC REQUIREMENTS.

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

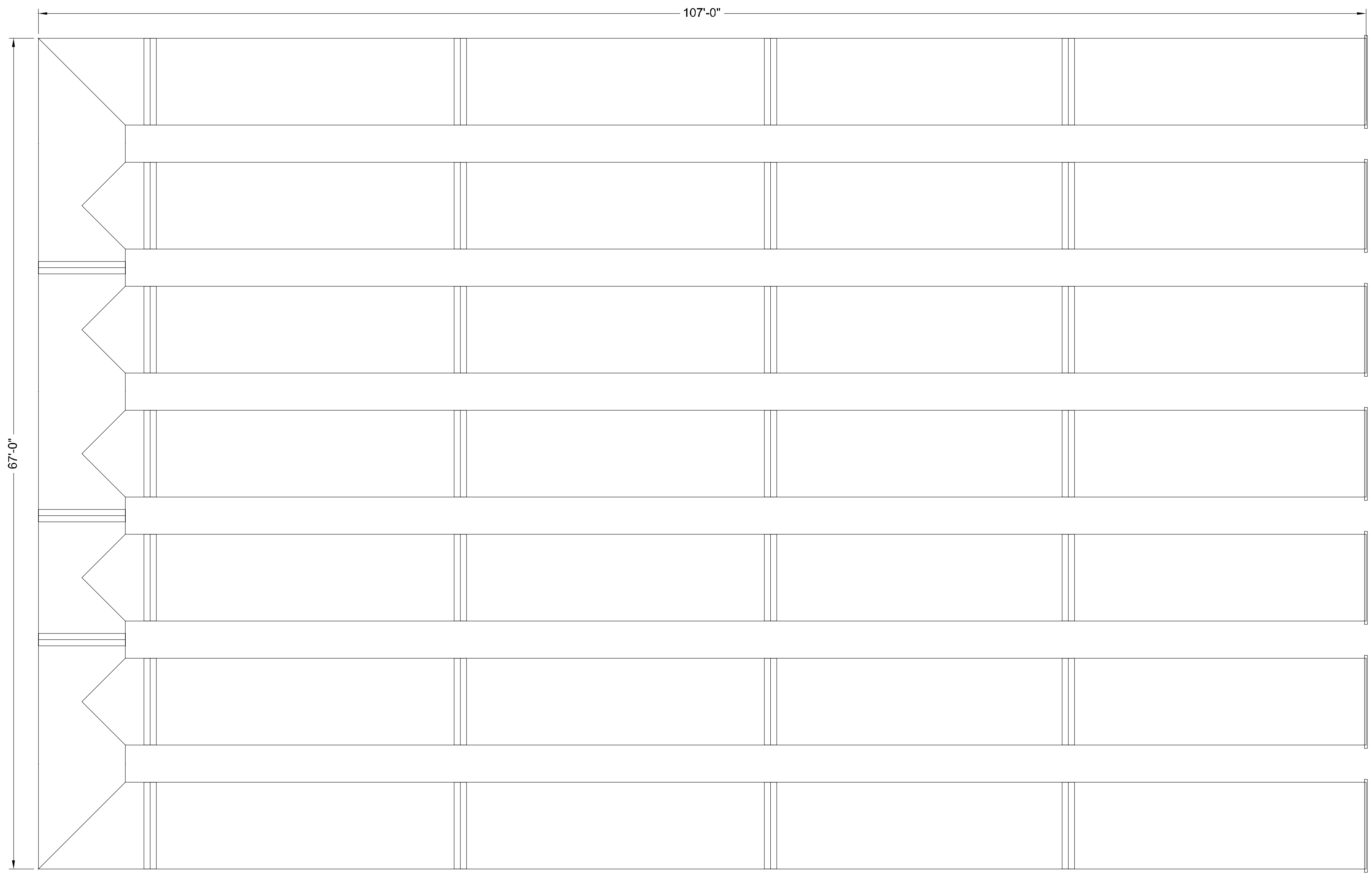
PROJECT SUMMARY

CALCULATION DETAILS
- LOADING = HS20/HS25
- APPROX. LINEAR FOOTAGE = 767 LF

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = 40,000 CF
- PIPE STORAGE VOLUME = 29,518 CF
- BACKFILL STORAGE VOLUME = 10,756 CF
- TOTAL STORAGE PROVIDED = 40,274 CF
- STONE VOID = 40%

PIPE DETAILS
- DIAMETER = 84"
- CORRUGATION = 5x1
- GAGE = 16
- COATING = ALT2
- WALL TYPE = PERFORATED
- BARREL SPACING = 36"

BACKFILL DETAILS
- WIDTH AT ENDS = 12"
- ABOVE PIPE = 6"
- WIDTH AT SIDES = 12"
- BELOW PIPE = 0"



ASSEMBLY
SCALE: 1" = 10'

NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE $2\frac{2}{3}$" x $\frac{1}{2}$" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

DATE	REVISION DESCRIPTION	BY

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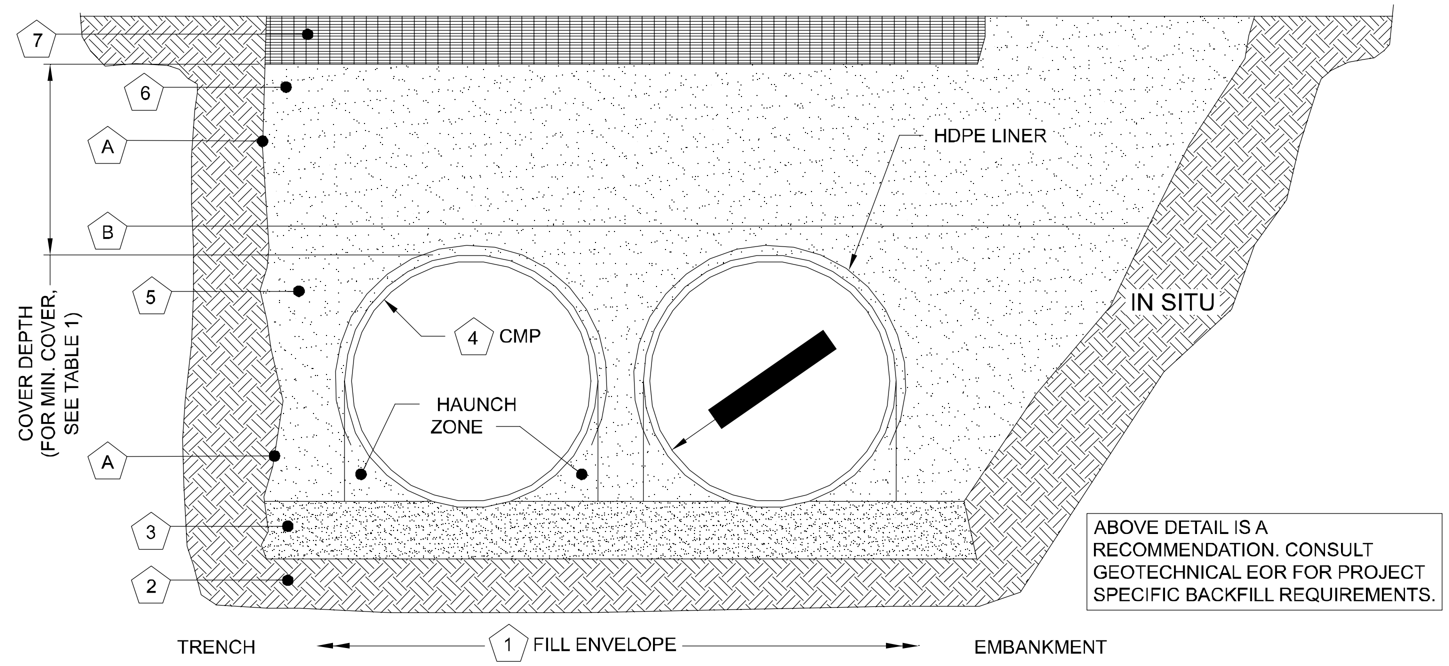
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS

CONTECH DYODS DRAWING

DYO47951 Olive Park Apartments
West Storage-1
Oceanside, CA
DETENTION SYSTEM

PROJECT No.: 33155	SEQ. No.: 47951	DATE: 8/7/2024
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		



MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT

TABLE 1:

DIAMETER, D	MIN. COVER	CORR. PROFILE
6"-10"	12"	1 1/2" x 1/4"
12"-48"	12"	2 2/3" x 1/2"
>48"-96"	12"	3" x 1", 5" x 1"
>96"	D/8	3" x 1", 5" x 1"

- STRUCTURAL BACKFILL MUST EXTEND TO LIMITS OF THE TABLE
- TOTAL HEIGHT OF COMPACTED COVER FOR CONVENTIONAL HIGHWAY LOADS IS MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT.

INSTALLATION NOTES

1. WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES.
2. OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.
3. AN HDPE MEMBRANE LINER WILL BE PLACED ON THE CROWN OF EACH PIPE TO PROVIDE AN IMPERMEABLE BARRIER AGAINST ENVIRONMENTAL CHANGES THAT MAY ADVERSELY AFFECT THE SYSTEM OVER TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL TECHNICAL DETAILS.

TABLE 2: PERFORATED STANDARD

CMP RETENTION STANDARD BACKFILL SPECIFICATIONS

	MATERIAL LOCATION	MATERIAL SPECIFICATION	DESCRIPTION
1	FILL ENVELOPE WIDTH	PER ENGINEER OF RECORD	MINIMUM TRENCH WIDTH MUST ALLOW ROOM FOR PROPER COMPACTION OF HAUNCH MATERIALS UNDER THE PIPE. THE SUGGESTED MINIMUM TRENCH WIDTH, OR EOR RECOMMENDATION: PIPE ≤ 12": D + 16" PIPE > 12": 1.5D + 12" MINIMUM EMBANKMENT WIDTH (IN FEET) FOR INITIAL FILL ENVELOPE: PIPE < 24": 3.0D PIPE 24" - 144": D + 4'0" PIPE > 144": D + 10'0"
2	FOUNDATION	**AASHTO 26.5.2** - PER ENGINEER OF RECORD	PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND FOUNDATION BROUGHT BACK TO GRADE WITH A FILL MATERIAL APPROVED BY THE ENGINEER OF RECORD.
3	BEDDING	**AASHTO M 43: 3, 357, 4, 467, 5, 56, 57**	ENGINEER OF RECORD TO DETERMINE IF BEDDING IS REQUIRED. PIPE MAY BE PLACED ON THE TRENCH BOTTOM OF A RELATIVELY LOOSE, NATIVE SUITABLE WELL GRADED GRANULAR MATERIAL THAT IS ROUGHLY SHAPED TO FIT THE BOTTOM OF THE PIPE, 2" MIN DEPTH. THE BEDDING MATERIAL MAY BE SUITABLE OPEN GRADED GRANULAR BEDDING CONFORMING TO AASHTO SOIL CLASSIFICATIONS A1, A2, OR A3 WITH MAXIMUM PARTICLE SIZE OF 3" PER AASHTO 26.3.8.1
4	CORRUGATED METAL PIPE		
5	BACKFILL	FREE-DRAINING, ANGULAR, NATURALLY OCCURRING WASHED-STONE PER **AASHTO M 43: 3, 357, 4, 467, 5, 56, 57** OR APPROVED EQUAL *	HAUNCH ZONE MATERIAL SHALL BE HAND SHOVELED OR SHOVEL SLICED INTO PLACE TO ALLOW FOR PROPER COMPACTION WITHOUT SOFT SPOTS. BACKFILL SHALL BE PLACED IN 8" +/- LOOSE LIFTS AND COMPACTED TO 90% STANDARD PROCTOR PER AASHTO T 99. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO LIFT (16") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHOULD BE ADVANCED ALONG THE LENGTH OF THE SYSTEM TO AVOID DIFFERENTIAL LOADING. WHERE CONVENTIONAL COMPACTION TESTING IS NOT PRACTICAL, THE MATERIAL SHALL BE MECHANICALLY COMPACTED UNTIL NO FURTHER YIELDING OF MATERIAL IS OBSERVED UNDER THE COMPACTOR. **IN AREAS WITH HIGH WATER TABLE FLUCTUATIONS THAT INTERACT WITH THE PIPE ZONE, CONSIDER INSTALLING A GEOTEXTILE SEPARATION LAYER TO PREVENT SOIL MIGRATION.
6	COVER MATERIAL	UP TO MIN. COVER - **AASHTO M 145: A-1, A-2, A-3** ABOVE MIN. COVER - PER ENGINEER OF RECORD	COVER MATERIAL MAY INCLUDE NON-BITUMINOUS, GRANULAR ROADBASE MATERIAL WITHIN MIN COVER LIMITS
7	RIGID OR FLEXIBLE PAVEMENT (IF APPLICABLE)	PER ENGINEER OF RECORD	FLEXIBLE PAVEMENT SHOULD NOT BE COUNTED AS PART OF THE FILL HEIGHT OVER THE CMP. FINAL BACKFILL MATERIAL SELECTION AND COMPACTION REQUIREMENTS SHALL FOLLOW THE PROJECT PLANS AND SPECIFICATIONS PER THE ENGINEER OF RECORD.
A	OPTIONAL SIDE GEOTEXTILE	NONE	GEOTEXTILE LAYER IS RECOMMENDED ON SIDES OF EXCAVATION TO PREVENT SOIL MIGRATION.
B	GEOTEXTILE BETWEEN LAYERS	NONE	IF SOIL TYPES DIFFER AT ANY POINT ABOVE PIPE INVERT, A GEOTEXTILE LAYER IS RECOMMENDED TO BE PLACED BETWEEN THE LAYERS TO PREVENT SOIL MIGRATION.

NOTES:

- FOR MULTIPLE BARREL INSTALLATIONS, THE RECOMMENDED STANDARD SPACING BETWEEN PARALLEL PIPE RUNS SHALL BE THE PIPE DIAMETER /2 BUT NO LESS THAN 12" FOR DIAMETERS <72". FOR 72" AND LARGER DIAMETERS, THE MINIMUM SPACING IS 36". CONTACT YOUR CONTECH REPRESENTATIVE FOR NONSTANDARD SPACING.

* APPROVED REGIONAL EQUIVALENTS FOR SECTION 5 INCLUDE CA-7, MIDOT 6AA, 6A, OR 5G, PROVIDED THEY MEET THE PARTICLE SIZES INDICATED.

MANUFACTURER RECOMMENDED BACKFILL

NOT TO SCALE

DATE	REVISION DESCRIPTION	BY

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CONTECH **DYODS** DRAWING

DYO47951 Olive Park Apartments
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Oceanside, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
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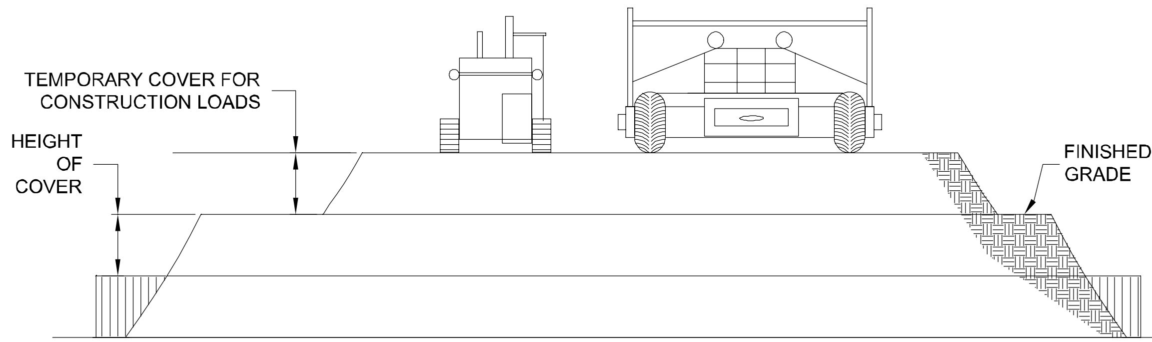

CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

PIPE
THE PIPE SHALL BE MANUFACTURED IN ACCORDANCE TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2: AASHTO M-36 OR ASTM A-760

GALVANIZED: AASHTO M-36 OR ASTM A-760

POLYMER COATED: AASHTO M-245 OR ASTM A-762

ALUMINUM: AASHTO M-196 OR ASTM B-745

HANDLING AND ASSEMBLY
SHALL BE IN ACCORDANCE WITH NCSP'S (NATIONAL CORRUGATED STEEL PIPE ASSOCIATION) FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL. SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR ALUMINUM PIPE.

INSTALLATION
SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II DIVISION II OR ASTM A-798 (FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL) OR ASTM B-788 (FOR ALUMINUM PIPE) AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.

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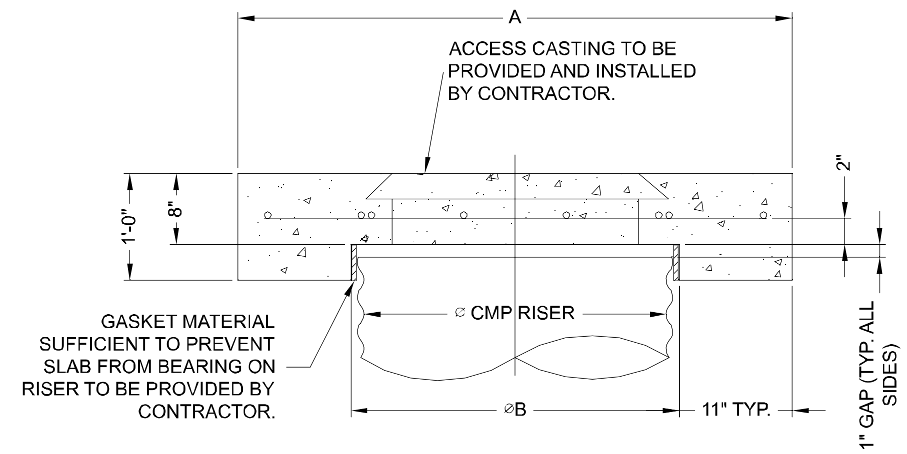
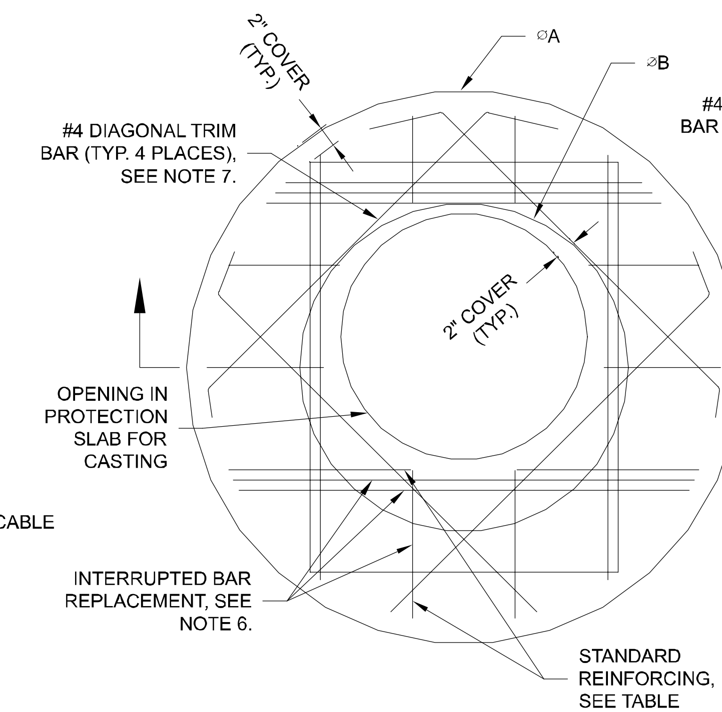


SECTION VIEW

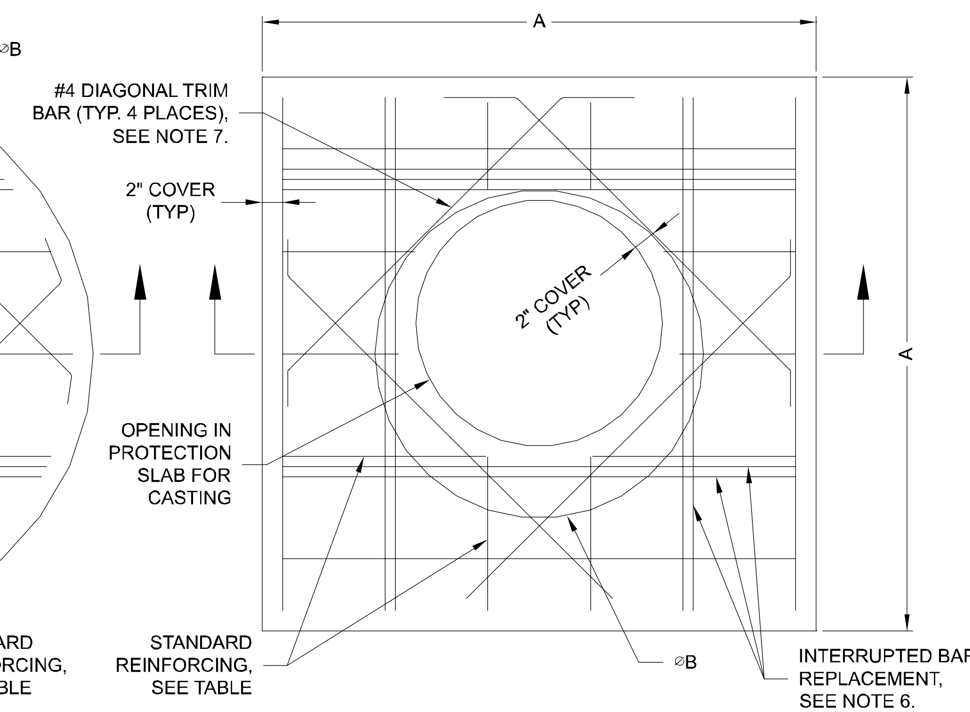
REINFORCING TABLE

⌀ CMP RISER	A	⌀ B	REINFORCING	**BEARING PRESSURE (PSF)
24"	⌀ 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	⌀ 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	⌀ 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	⌀ 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	⌀ 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 3,500 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

DATE	REVISION DESCRIPTION	BY

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CONTECH® CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO47951 Olive Park Apartments
West Storage-1
Oceanside, CA
DETENTION SYSTEM

PROJECT No.: 33155	SEQ. No.: 47951	DATE: 8/7/2024
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		

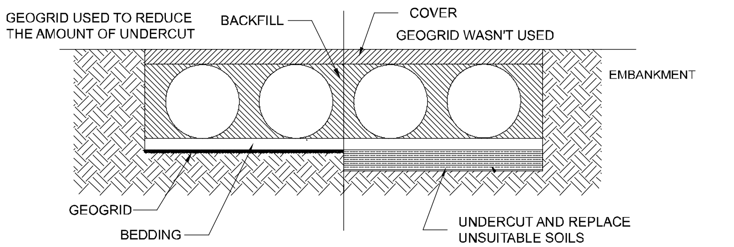
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.

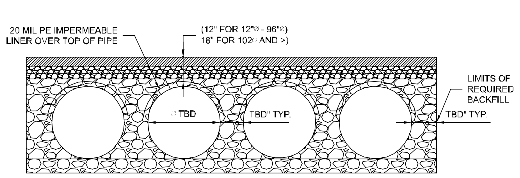


GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED, SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL SERVICE LIFE.

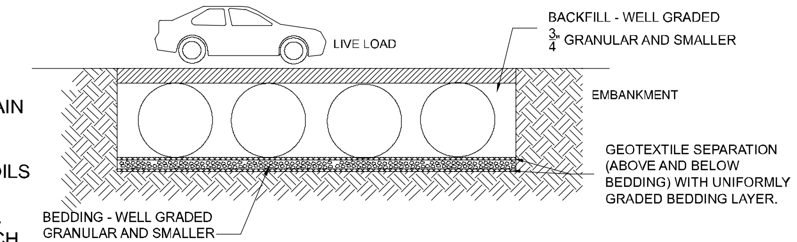
THE PROJECT'S ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.



IN-SITU TRENCH WALL

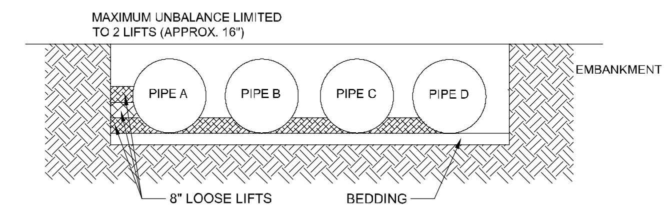
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



BACKFILL PLACEMENT

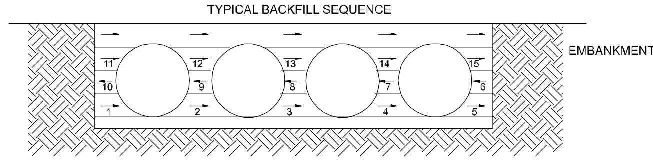
MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.



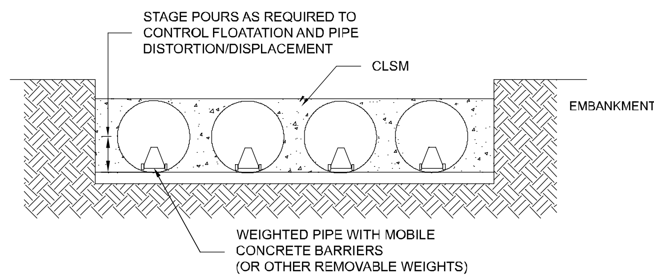
IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10-FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.

TYPICAL BACKFILL SEQUENCE



WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

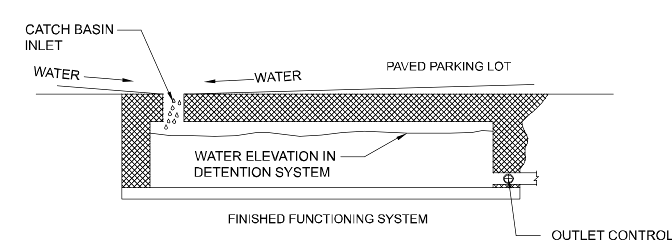


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

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CMP DETENTION SYSTEMS

CONTECH
DYODS
DRAWING

DYO47951 Olive Park Apartments
West Storage-1
Oceanside, CA
DETENTION SYSTEM

PROJECT No.: 33155	SEQ. No.: 47951	DATE: 8/7/2024
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: 1		

PROJECT SUMMARY

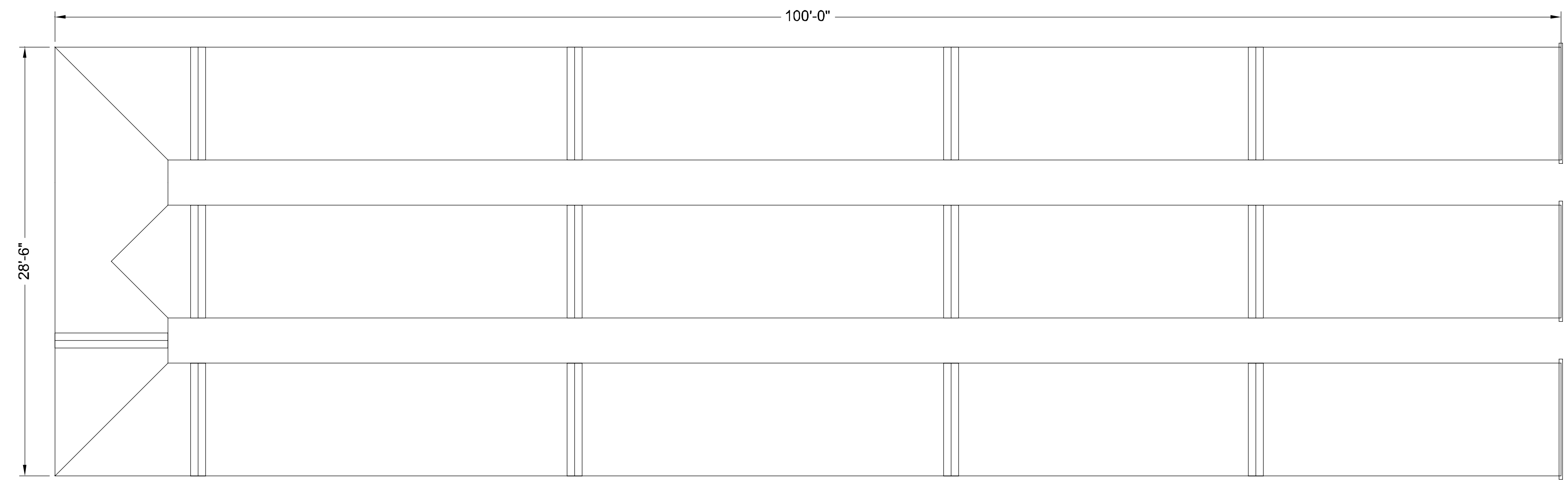
HMP-2

CALCULATION DETAILS
- LOADING = HS20/HS25
- APPROX. LINEAR FOOTAGE = 306 LF

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = N/A
- PIPE STORAGE VOLUME = 13,519 CF
- BACKFILL STORAGE VOLUME = 4,859 CF
- TOTAL STORAGE PROVIDED = 18,377 CF
- STONE VOID = 40%

PIPE DETAILS
- DIAMETER = 90"
- CORRUGATION = 5x1
- GAGE = 16
- COATING = ALT2
- WALL TYPE = PERFORATED
- BARREL SPACING = 36"

BACKFILL DETAILS
- WIDTH AT ENDS = 12"
- ABOVE PIPE = 9"
- WIDTH AT SIDES = 12"
- BELOW PIPE = 0"



ASSEMBLY
SCALE: 1" = 10'

NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE $2\frac{2}{3}$" x $\frac{1}{2}$" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

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CONTECH CMP DETENTION SYSTEMS

CONTECH
DYODS
DRAWING

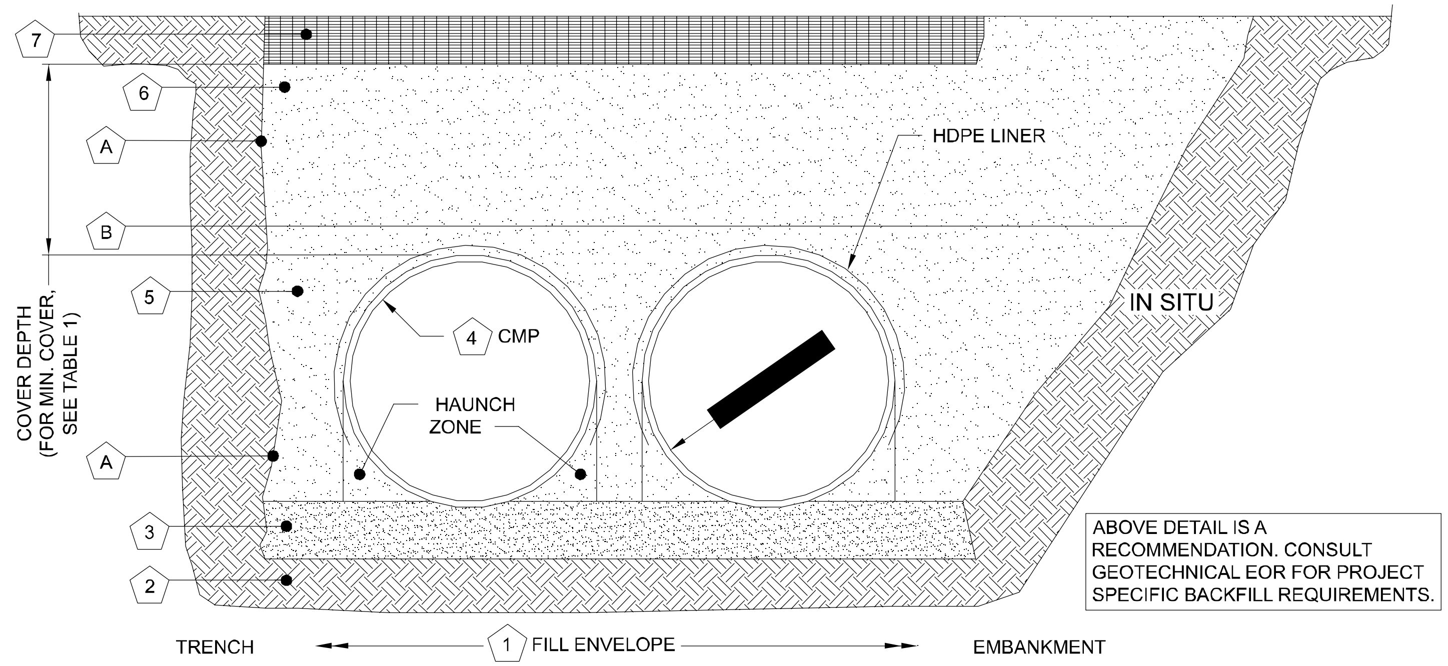
DYO47954 Olive Park Apartments
East Storage-2
Oceanside, CA
DETENTION SYSTEM

PROJECT No.: 33155	SEQ. No.: 47954	DATE: 8/7/2024
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: 1		

TABLE 1:

DIAMETER, D	MIN. COVER	CORR. PROFILE
6"-10"	12"	1 1/2" x 1/4"
12"-48"	12"	2 2/3" x 1/2"
>48"-96"	12"	3" x 1", 5" x 1"
>96"	D/8	3" x 1", 5" x 1"

- STRUCTURAL BACKFILL MUST EXTEND TO LIMITS OF THE TABLE
- TOTAL HEIGHT OF COMPACTED COVER FOR CONVENTIONAL HIGHWAY LOADS IS MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT.



MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT

INSTALLATION NOTES

1. WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES.
2. OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.
3. AN HDPE MEMBRANE LINER WILL BE PLACED ON THE CROWN OF EACH PIPE TO PROVIDE AN IMPERMEABLE BARRIER AGAINST ENVIRONMENTAL CHANGES THAT MAY ADVERSELY AFFECT THE SYSTEM OVER TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL TECHNICAL DETAILS.

TABLE 2: PERFORATED STANDARD

CMP RETENTION STANDARD BACKFILL SPECIFICATIONS

	MATERIAL LOCATION	MATERIAL SPECIFICATION	DESCRIPTION	
1	FILL ENVELOPE WIDTH	PER ENGINEER OF RECORD	MINIMUM TRENCH WIDTH MUST ALLOW ROOM FOR PROPER COMPACTION OF HAUNCH MATERIALS UNDER THE PIPE. THE SUGGESTED MINIMUM TRENCH WIDTH, OR EOR RECOMMENDATION: PIPE ≤ 12": D + 16" PIPE > 12": 1.5D + 12"	MINIMUM EMBANKMENT WIDTH (IN FEET) FOR INITIAL FILL ENVELOPE: PIPE < 24": 3.0D PIPE 24" - 144": D + 4'0" PIPE > 144": D + 10'0"
2	FOUNDATION	**AASHTO 26.5.2** - PER ENGINEER OF RECORD	PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND FOUNDATION BROUGHT BACK TO GRADE WITH A FILL MATERIAL APPROVED BY THE ENGINEER OF RECORD.	
3	BEDDING	**AASHTO M 43: 3, 357, 4, 467, 5, 56, 57**	ENGINEER OF RECORD TO DETERMINE IF BEDDING IS REQUIRED. PIPE MAY BE PLACED ON THE TRENCH BOTTOM OF A RELATIVELY LOOSE, NATIVE SUITABLE WELL GRADED GRANULAR MATERIAL THAT IS ROUGHLY SHAPED TO FIT THE BOTTOM OF THE PIPE, 2" MIN DEPTH. THE BEDDING MATERIAL MAY BE SUITABLE OPEN GRADED GRANULAR BEDDING CONFORMING TO AASHTO SOIL CLASSIFICATIONS A1, A2, OR A3 WITH MAXIMUM PARTICLE SIZE OF 3" PER AASHTO 26.3.8.1	
4	CORRUGATED METAL PIPE			
5	BACKFILL	FREE-DRAINING, ANGULAR, NATURALLY OCCURRING WASHED-STONE PER **AASHTO M 43: 3, 357, 4, 467, 5, 56, 57** OR APPROVED EQUAL *	HAUNCH ZONE MATERIAL SHALL BE HAND SHOVELED OR SHOVEL SLICED INTO PLACE TO ALLOW FOR PROPER COMPACTION WITHOUT SOFT SPOTS. BACKFILL SHALL BE PLACED IN 8" +/- LOOSE LIFTS AND COMPACTED TO 90% STANDARD PROCTOR PER AASHTO T 99. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO LIFT (16") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHOULD BE ADVANCED ALONG THE LENGTH OF THE SYSTEM TO AVOID DIFFERENTIAL LOADING. WHERE CONVENTIONAL COMPACTION TESTING IS NOT PRACTICAL, THE MATERIAL SHALL BE MECHANICALLY COMPACTED UNTIL NO FURTHER YIELDING OF MATERIAL IS OBSERVED UNDER THE COMPACTOR. **IN AREAS WITH HIGH WATER TABLE FLUCTUATIONS THAT INTERACT WITH THE PIPE ZONE, CONSIDER INSTALLING A GEOTEXTILE SEPARATION LAYER TO PREVENT SOIL MIGRATION.	
6	COVER MATERIAL	UP TO MIN. COVER - **AASHTO M 145: A-1, A-2, A-3** ABOVE MIN. COVER - PER ENGINEER OF RECORD	COVER MATERIAL MAY INCLUDE NON-BITUMINOUS, GRANULAR ROADBASE MATERIAL WITHIN MIN COVER LIMITS	
7	RIGID OR FLEXIBLE PAVEMENT (IF APPLICABLE)	PER ENGINEER OF RECORD	FLEXIBLE PAVEMENT SHOULD NOT BE COUNTED AS PART OF THE FILL HEIGHT OVER THE CMP. FINAL BACKFILL MATERIAL SELECTION AND COMPACTION REQUIREMENTS SHALL FOLLOW THE PROJECT PLANS AND SPECIFICATIONS PER THE ENGINEER OF RECORD.	
A	OPTIONAL SIDE GEOTEXTILE	NONE	GEOTEXTILE LAYER IS RECOMMENDED ON SIDES OF EXCAVATION TO PREVENT SOIL MIGRATION.	
B	GEOTEXTILE BETWEEN LAYERS	NONE	IF SOIL TYPES DIFFER AT ANY POINT ABOVE PIPE INVERT, A GEOTEXTILE LAYER IS RECOMMENDED TO BE PLACED BETWEEN THE LAYERS TO PREVENT SOIL MIGRATION.	

NOTES:

- FOR MULTIPLE BARREL INSTALLATIONS, THE RECOMMENDED STANDARD SPACING BETWEEN PARALLEL PIPE RUNS SHALL BE THE PIPE DIAMETER /2 BUT NO LESS THAN 12" FOR DIAMETERS <72". FOR 72" AND LARGER DIAMETERS, THE MINIMUM SPACING IS 36". CONTACT YOUR CONTECH REPRESENTATIVE FOR NONSTANDARD SPACING.

* APPROVED REGIONAL EQUIVALENTS FOR SECTION 5 INCLUDE CA-7, MIDOT 6AA, 6A, OR 5G, PROVIDED THEY MEET THE PARTICLE SIZES INDICATED.

MANUFACTURER RECOMMENDED BACKFILL

NOT TO SCALE

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CONTECH **DYODS** DRAWING

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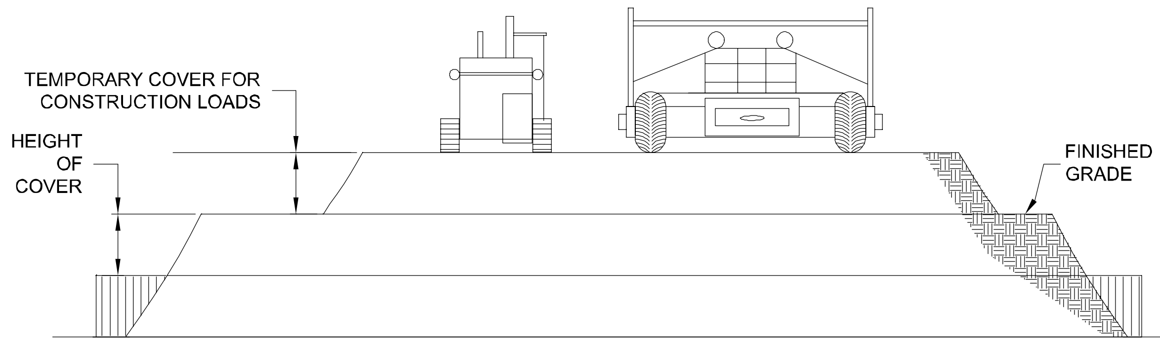


CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

PIPE
THE PIPE SHALL BE MANUFACTURED IN ACCORDANCE TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2: AASHTO M-36 OR ASTM A-760

GALVANIZED: AASHTO M-36 OR ASTM A-760

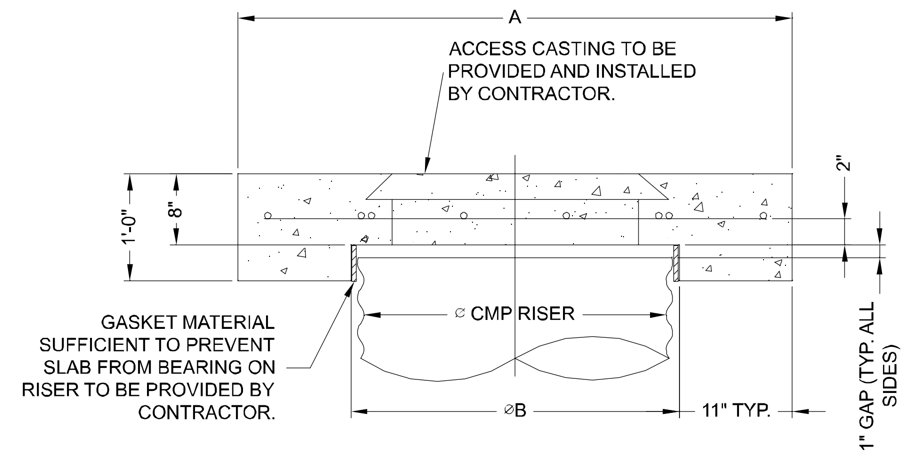
POLYMER COATED: AASHTO M-245 OR ASTM A-762

ALUMINUM: AASHTO M-196 OR ASTM B-745

HANDLING AND ASSEMBLY
SHALL BE IN ACCORDANCE WITH NCSP'S (NATIONAL CORRUGATED STEEL PIPE ASSOCIATION) FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL. SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR ALUMINUM PIPE.

INSTALLATION
SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II DIVISION II OR ASTM A-798 (FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL) OR ASTM B-788 (FOR ALUMINUM PIPE) AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.

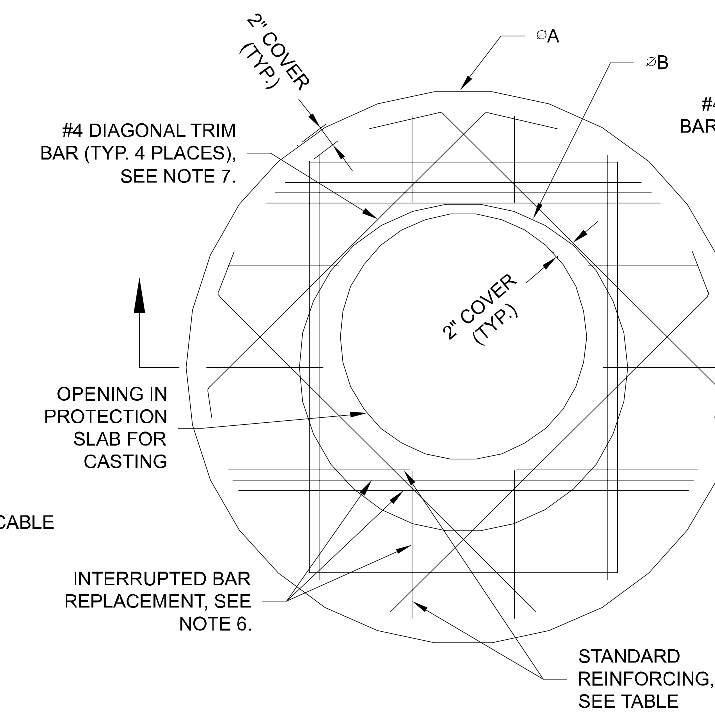


SECTION VIEW

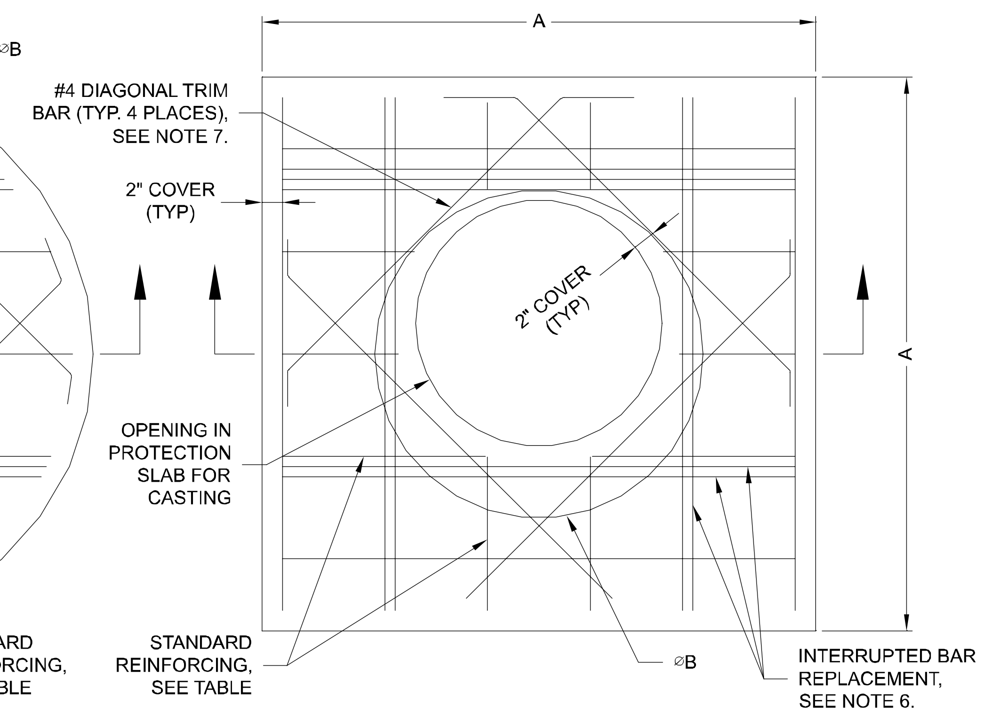
REINFORCING TABLE

⌀ CMP RISER	A	⌀ B	REINFORCING	**BEARING PRESSURE (PSF)
24"	⌀ 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	⌀ 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	⌀ 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	⌀ 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	⌀ 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 3,500 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

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CONTECH CMP DETENTION SYSTEMS

CONTECH DYODS DRAWING

DYO47954 Olive Park Apartments
East Storage-2
Oceanside, CA
DETENTION SYSTEM

PROJECT No.: 33155	SEQ. No.: 47954	DATE: 8/7/2024
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		

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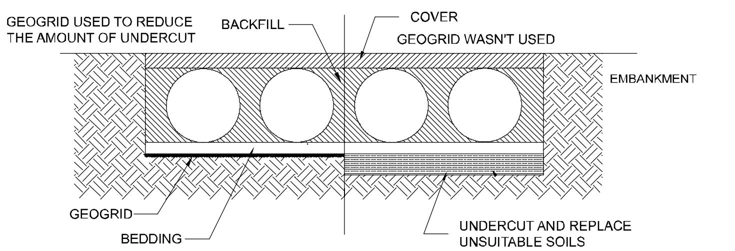
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.

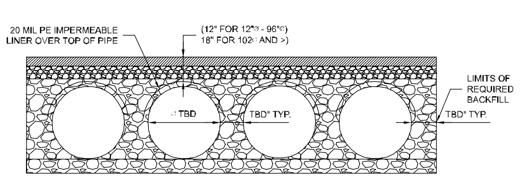


GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED, SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL SERVICE LIFE.

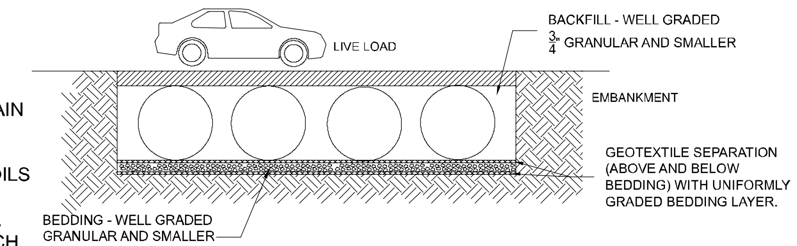
THE PROJECT'S ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.



IN-SITU TRENCH WALL

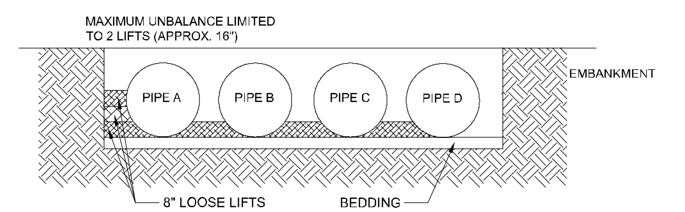
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



BACKFILL PLACEMENT

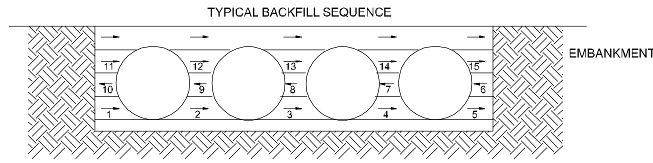
MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.



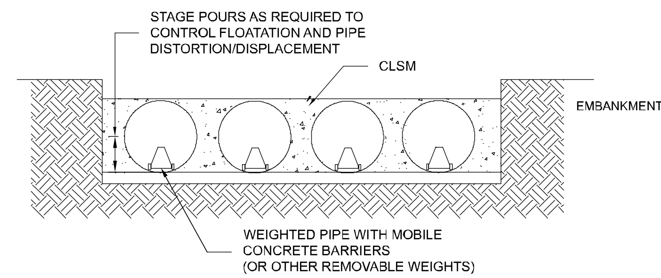
IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10-FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.

TYPICAL BACKFILL SEQUENCE



WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

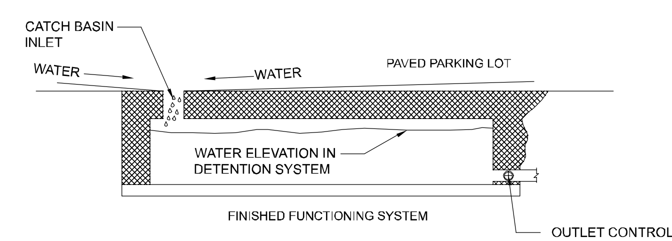


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

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CONTECH CMP DETENTION SYSTEMS

CONTECH DYODS DRAWING

DYO47954 Olive Park Apartments
East Storage-2
Oceanside, CA
DETENTION SYSTEM

PROJECT No.: 33155	SEQ. No.: 47954	DATE: 8/7/2024
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: 1		

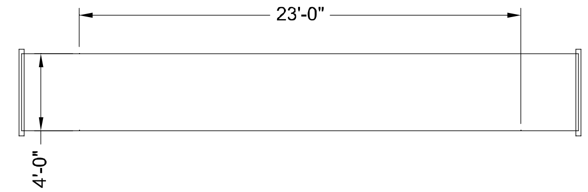
PROJECT SUMMARY

CALCULATION DETAILS
- LOADING = HS20/HS25
- APPROX. LINEAR FOOTAGE = 29 LF

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = 550 CF
- PIPE STORAGE VOLUME = 364 CF
- BACKFILL STORAGE VOLUME = 226 CF
- TOTAL STORAGE PROVIDED = 591 CF
- STONE VOID = 40%

PIPE DETAILS
- DIAMETER = 48"
- CORRUGATION = 2 2/3x1/2
- GAGE = 16
- COATING = ALT2
- WALL TYPE = PERFORATED
- BARREL SPACING = 24"

BACKFILL DETAILS
- WIDTH AT ENDS = 12"
- ABOVE PIPE = 12"
- WIDTH AT SIDES = 12"
- BELOW PIPE = 0"



ASSEMBLY
SCALE: 1" = 10'

NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE $2\frac{2}{3}$" x $\frac{1}{2}$" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

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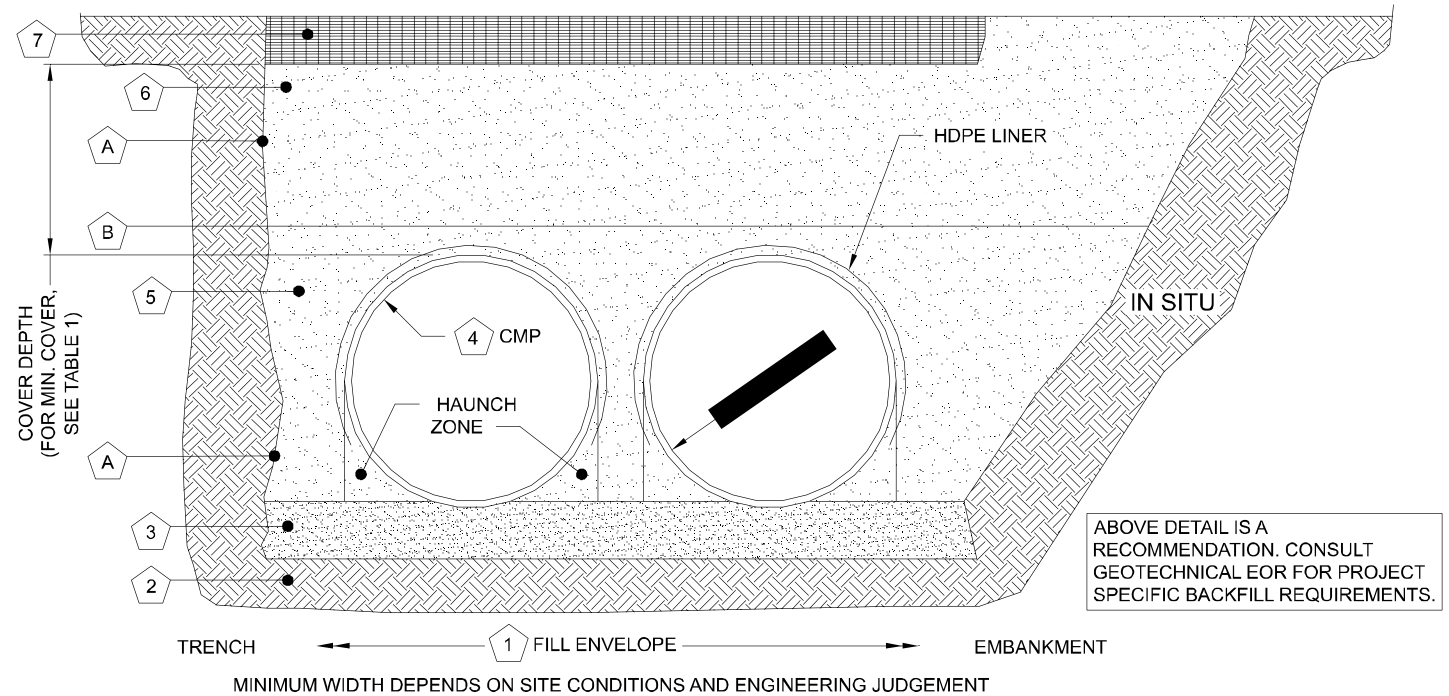
DYO61024 Olive Park Apartments
East Storage-2 - COPY
Oceanside, CA
DETENTION SYSTEM

PROJECT No.: 33155	SEQ. No.: 61024	DATE: 10/10/2024
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		

TABLE 1:

DIAMETER, D	MIN. COVER	CORR. PROFILE
6"-10"	12"	1 1/2" x 1/4"
12"-48"	12"	2 2/3" x 1/2"
>48"-96"	12"	3" x 1", 5" x 1"
>96"	D/8	3" x 1", 5" x 1"

- STRUCTURAL BACKFILL MUST EXTEND TO LIMITS OF THE TABLE
- TOTAL HEIGHT OF COMPACTED COVER FOR CONVENTIONAL HIGHWAY LOADS IS MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT.



ABOVE DETAIL IS A RECOMMENDATION. CONSULT GEOTECHNICAL EOR FOR PROJECT SPECIFIC BACKFILL REQUIREMENTS.

MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT

INSTALLATION NOTES

1. WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES.
2. OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.
3. AN HDPE MEMBRANE LINER WILL BE PLACED ON THE CROWN OF EACH PIPE TO PROVIDE AN IMPERMEABLE BARRIER AGAINST ENVIRONMENTAL CHANGES THAT MAY ADVERSELY AFFECT THE SYSTEM OVER TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL TECHNICAL DETAILS.

TABLE 2: PERFORATED STANDARD

CMP RETENTION STANDARD BACKFILL SPECIFICATIONS

	MATERIAL LOCATION	MATERIAL SPECIFICATION	DESCRIPTION	
1	FILL ENVELOPE WIDTH	PER ENGINEER OF RECORD	MINIMUM TRENCH WIDTH MUST ALLOW ROOM FOR PROPER COMPACTION OF HAUNCH MATERIALS UNDER THE PIPE. THE SUGGESTED MINIMUM TRENCH WIDTH, OR EOR RECOMMENDATION: PIPE ≤ 12": D + 16" PIPE > 12": 1.5D + 12"	MINIMUM EMBANKMENT WIDTH (IN FEET) FOR INITIAL FILL ENVELOPE: PIPE < 24": 3.0D PIPE 24" - 144": D + 4'0" PIPE > 144": D + 10'0"
2	FOUNDATION	**AASHTO 26.5.2** - PER ENGINEER OF RECORD	PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND FOUNDATION BROUGHT BACK TO GRADE WITH A FILL MATERIAL APPROVED BY THE ENGINEER OF RECORD.	
3	BEDDING	**AASHTO M 43: 3, 357, 4, 467, 5, 56, 57**	ENGINEER OF RECORD TO DETERMINE IF BEDDING IS REQUIRED. PIPE MAY BE PLACED ON THE TRENCH BOTTOM OF A RELATIVELY LOOSE, NATIVE SUITABLE WELL GRADED GRANULAR MATERIAL THAT IS ROUGHLY SHAPED TO FIT THE BOTTOM OF THE PIPE, 2" MIN DEPTH. THE BEDDING MATERIAL MAY BE SUITABLE OPEN GRADED GRANULAR BEDDING CONFORMING TO AASHTO SOIL CLASSIFICATIONS A1, A2, OR A3 WITH MAXIMUM PARTICLE SIZE OF 3" PER AASHTO 26.3.8.1	
4	CORRUGATED METAL PIPE			
5	BACKFILL	FREE-DRAINING, ANGULAR, NATURALLY OCCURRING WASHED-STONE PER **AASHTO M 43: 3, 357, 4, 467, 5, 56, 57** OR APPROVED EQUAL *	HAUNCH ZONE MATERIAL SHALL BE HAND SHOVELED OR SHOVEL SLICED INTO PLACE TO ALLOW FOR PROPER COMPACTION WITHOUT SOFT SPOTS. BACKFILL SHALL BE PLACED IN 8" +/- LOOSE LIFTS AND COMPACTED TO 90% STANDARD PROCTOR PER AASHTO T 99. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO LIFT (16") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHOULD BE ADVANCED ALONG THE LENGTH OF THE SYSTEM TO AVOID DIFFERENTIAL LOADING. WHERE CONVENTIONAL COMPACTION TESTING IS NOT PRACTICAL, THE MATERIAL SHALL BE MECHANICALLY COMPACTED UNTIL NO FURTHER YIELDING OF MATERIAL IS OBSERVED UNDER THE COMPACTOR. **IN AREAS WITH HIGH WATER TABLE FLUCTUATIONS THAT INTERACT WITH THE PIPE ZONE, CONSIDER INSTALLING A GEOTEXTILE SEPARATION LAYER TO PREVENT SOIL MIGRATION.	
6	COVER MATERIAL	UP TO MIN. COVER - **AASHTO M 145: A-1, A-2, A-3** ABOVE MIN. COVER - PER ENGINEER OF RECORD	COVER MATERIAL MAY INCLUDE NON-BITUMINOUS, GRANULAR ROADBASE MATERIAL WITHIN MIN COVER LIMITS	
7	RIGID OR FLEXIBLE PAVEMENT (IF APPLICABLE)	PER ENGINEER OF RECORD	FLEXIBLE PAVEMENT SHOULD NOT BE COUNTED AS PART OF THE FILL HEIGHT OVER THE CMP. FINAL BACKFILL MATERIAL SELECTION AND COMPACTION REQUIREMENTS SHALL FOLLOW THE PROJECT PLANS AND SPECIFICATIONS PER THE ENGINEER OF RECORD.	
A	OPTIONAL SIDE GEOTEXTILE	NONE	GEOTEXTILE LAYER IS RECOMMENDED ON SIDES OF EXCAVATION TO PREVENT SOIL MIGRATION.	
B	GEOTEXTILE BETWEEN LAYERS	NONE	IF SOIL TYPES DIFFER AT ANY POINT ABOVE PIPE INVERT, A GEOTEXTILE LAYER IS RECOMMENDED TO BE PLACED BETWEEN THE LAYERS TO PREVENT SOIL MIGRATION.	

NOTES:
- FOR MULTIPLE BARREL INSTALLATIONS, THE RECOMMENDED STANDARD SPACING BETWEEN PARALLEL PIPE RUNS SHALL BE THE PIPE DIAMETER /2 BUT NO LESS THAN 12" FOR DIAMETERS <72". FOR 72" AND LARGER DIAMETERS, THE MINIMUM SPACING IS 36". CONTACT YOUR CONTECH REPRESENTATIVE FOR NONSTANDARD SPACING.

* APPROVED REGIONAL EQUIVALENTS FOR SECTION 5 INCLUDE CA-7, MIDOT 6AA, 6A, OR 5G, PROVIDED THEY MEET THE PARTICLE SIZES INDICATED.

MANUFACTURER RECOMMENDED BACKFILL

NOT TO SCALE

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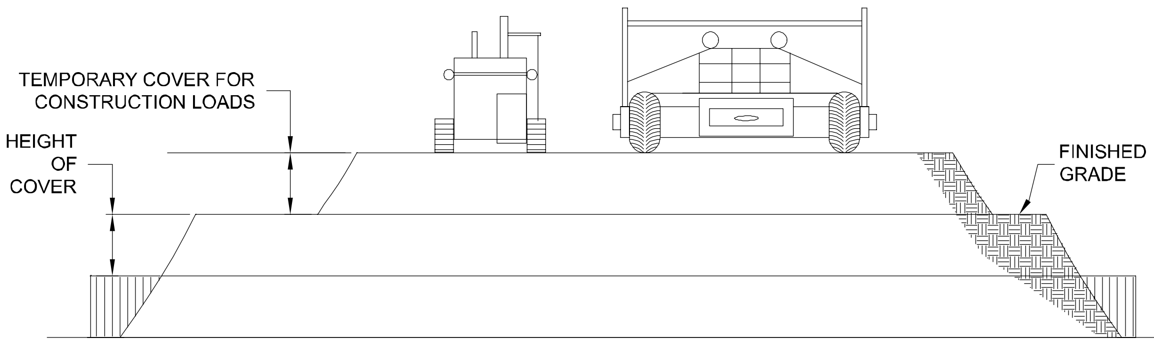
CONTECH® CMP DETENTION SYSTEMS

CONTECH DYODS DRAWING

DYO61024 Olive Park Apartments
East Storage-2 - COPY
Oceanside, CA
DETENTION SYSTEM

PROJECT No.: 33155	SEQ. No.: 61024	DATE: 10/10/2024
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		



CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

PIPE
THE PIPE SHALL BE MANUFACTURED IN ACCORDANCE TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2: AASHTO M-36 OR ASTM A-760

GALVANIZED: AASHTO M-36 OR ASTM A-760

POLYMER COATED: AASHTO M-245 OR ASTM A-762

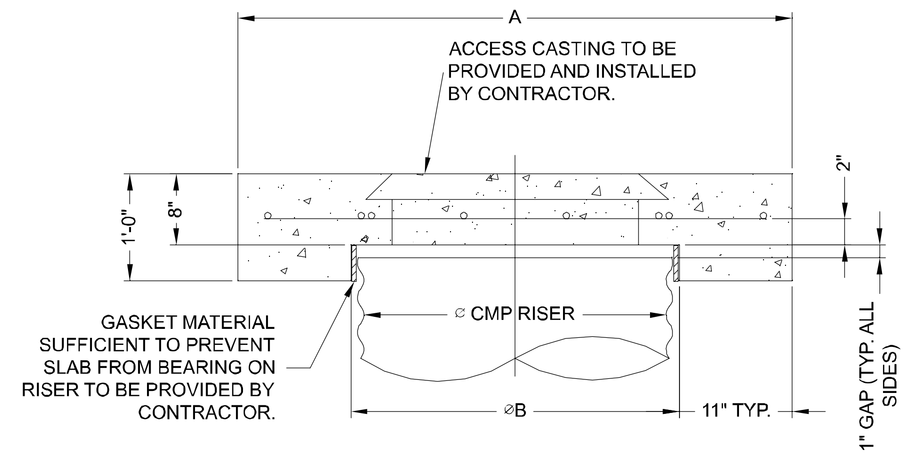
ALUMINUM: AASHTO M-196 OR ASTM B-745

HANDLING AND ASSEMBLY
SHALL BE IN ACCORDANCE WITH NCSP'S (NATIONAL CORRUGATED STEEL PIPE ASSOCIATION) FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL. SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR ALUMINUM PIPE.

INSTALLATION
SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II DIVISION II OR ASTM A-798 (FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL) OR ASTM B-788 (FOR ALUMINUM PIPE) AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.

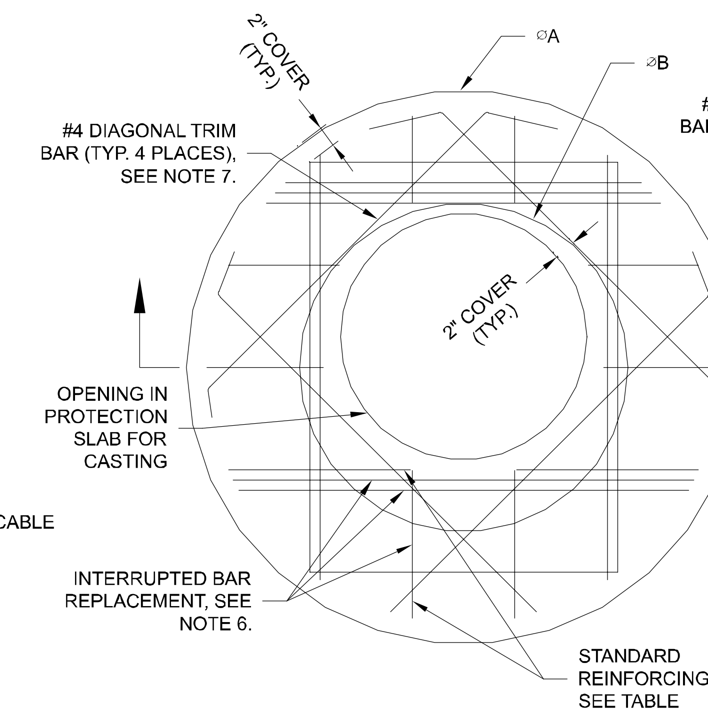
NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.



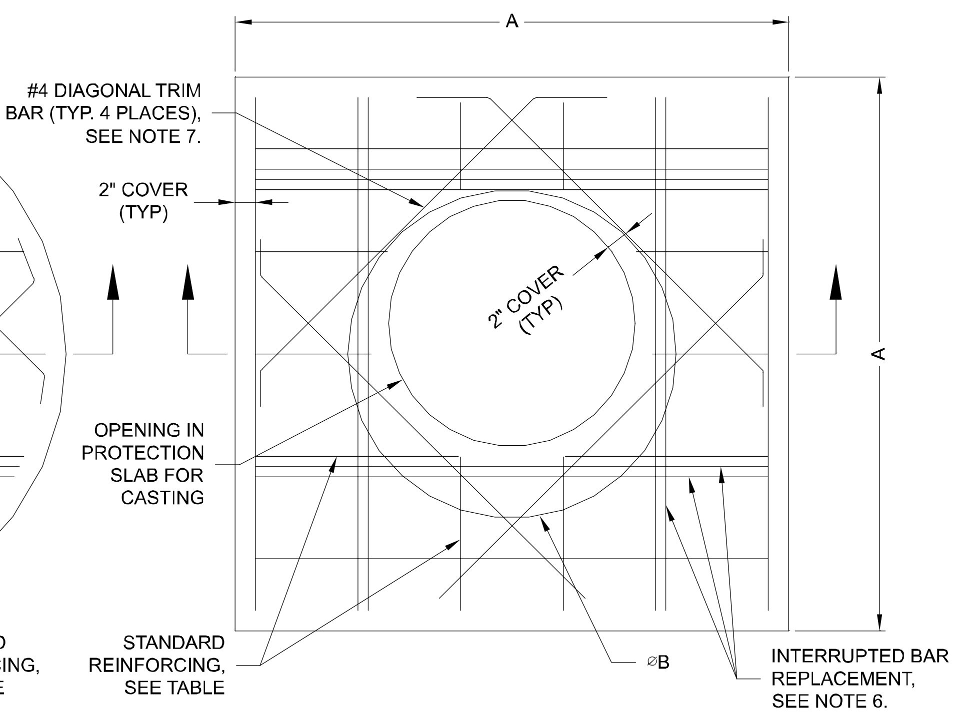
SECTION VIEW

REINFORCING TABLE				
∅ CMP RISER	A	∅ B	REINFORCING	**BEARING PRESSURE (PSF)
24"	∅ 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	∅ 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	∅ 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	∅ 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	∅ 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 3,500 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

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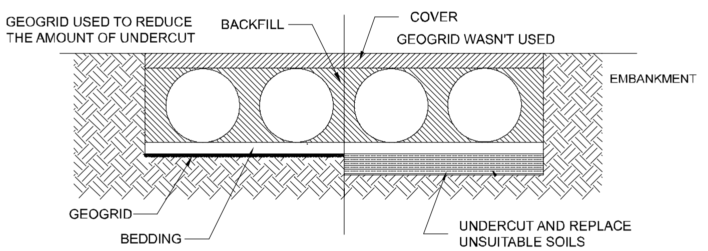
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

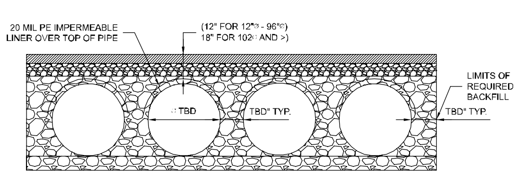
IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.



GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

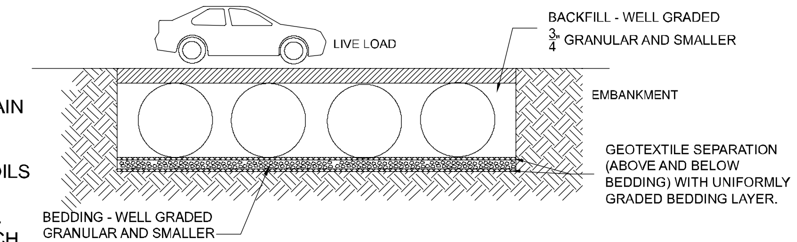
THE RESISTIVITY OF A PROJECT SITE MAY CHANGE OVER TIME DUE TO THE USE OF VARIOUS SALTING, DE-ICING, AND AGRICULTURAL AGENTS APPLIED ON OR NEAR THE AREA. TO MITIGATE THE POTENTIAL IMPACT OF THESE AGENTS, AN HDPE MEMBRANE LINER WILL BE INSTALLED ON THE CROWN OF EACH PIPE, CREATING AN IMPERMEABLE BARRIER. THIS MEASURE IS DESIGNED TO PROTECT THE SYSTEM FROM ENVIRONMENTAL CHANGES THAT COULD LEAD TO PREMATURE CORROSION AND REDUCE THE OVERALL SERVICE LIFE.



IN-SITU TRENCH WALL

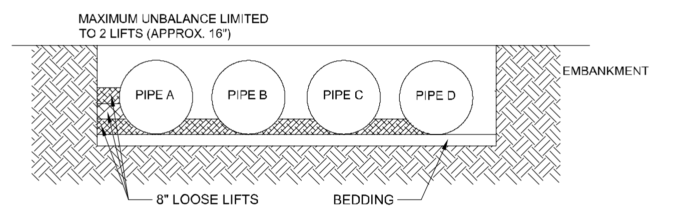
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



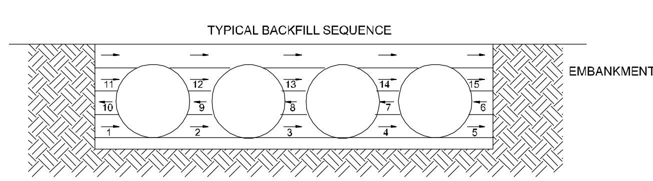
BACKFILL PLACEMENT

MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.

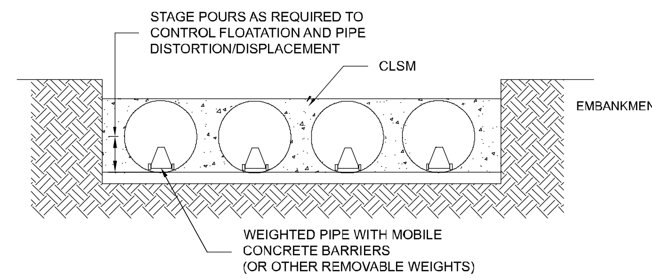


IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10-FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.



WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

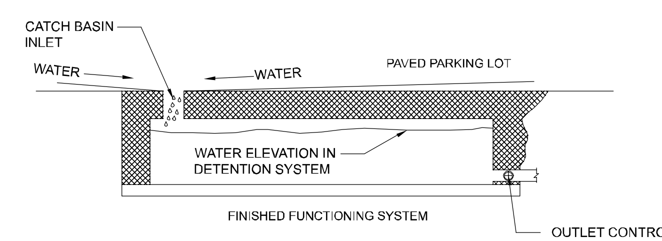


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

C:\EXPORTS\TEMPLATES\CMP_V10.DWG 10/18/2019 10:02 AM

DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

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STORMWATER MANAGEMENT INVESTIGATION

OLIVE PARK APARTMENTS
OLIVE DRIVE
OCEANSIDE, CALIFORNIA

AUGUST 7, 2024
PROJECT NO. G3035-52-01

PREPARED FOR:

CAPSTONE EQUITIES

Project No. G3035-52-01
August 7, 2024

Capstone Equities
5600 W Jefferson Boulevard
Los Angeles, California 90016

Attention: Mr. Brian Mikail

Subject: STORM WATER MANAGEMENT INVESTIGATION
OLIVE PARK APARTMENTS
OLIVE DRIVE
OCEANSIDE, CALIFORNIA

Reference: *Update Geotechnical Report, Olive Park Apartments, Olive Drive, Oceanside, California,* prepared by Geocon Incorporated, dated March 12, 2024 (Project No. G3035-52-01).

Dear Mr. Mikail

In accordance with the request of Mr. Spencer LaShells from Hunsaker & Associates Inc., we herein submit the results of our storm water management investigation for the property located west of Olive Drive in the City of Oceanside, California. We understand the City of Oceanside has requested that the infiltration feasibility be investigated for the site.

SITE AND PROJECT DESCRIPTION

The site is an approximately 43-acre, semi-rectangular-shaped property that is elongated in an east-west direction. The site is south of Oceanside Boulevard and the San Diego Northern Railway (SDNR) line, east of an undeveloped property, and north and west of existing residential subdivisions. Additionally, an eastern access road to the site from College Boulevard will be incorporated into the improvements of the development. The Geologic Map, Figure 1, shows the proposed development. The Existing Site Plans (Proposed Development and Access Road) shows the current site conditions.

Existing Site Plan-Proposed Development

Existing Site Plan-Access Road

Topographically, the site is located on slopes that descend northwest to Loma Alta Creek located along the north margin of the site. The DMA Plan, Figure 2, depicts the topography of the site with ascending natural slopes to the south with a maximum height of approximately 200 feet. The site is steeper on

the south and becomes flatter to the north. The gentle-gradient creek has a general west-flowing meandering orientation and has locally incised vertical embankments up to 10 feet high at the stream margins. A fill berm related to railroad improvements has been constructed along the northeast margin of the site. Elevations on site vary from a low of approximately 185 feet above Mean Sea Level (MSL) at Loma Alta Creek in the northwest corner of the site to 460 feet MSL at the top of the southeast slope.

SOIL AND GEOLOGIC CONDITIONS

We encountered five surficial soil unit and two geologic units at the site. The occurrence, distribution, and description of each unit encountered is shown on the Geologic Map, Figure 1, and on the boring and trench logs in Appendix A on the referenced report. The surficial soil and geologic units are described herein in order of increasing age. The surficial soils and geologic units are described herein in order of increasing age.

Undocumented Fill (Qudf)

Undocumented fill underlies the northern and western portions of the site. The northern fill areas are associated with a berm that was apparently graded to control water flow in Loma Alta Creek and support the existing rail line. The western undocumented fill area is associated with waterline backfill that traverses the site in a north-south direction. The fill material generally consists of soft, fine to medium, sandy clay with silt and has an estimated maximum thickness of 10 feet. The fill is not considered suitable for support of site development in its present condition and will require remedial grading.

Previously Placed Fill (Qpf)

Previously placed fill is present on the south and northeast portions of the property. The southern fill underlies residential building pads that bound the southern margin of the property along Wooster Drive. The southern fill likely consists of loose, silty, fine- to medium-grained sand, and is estimated to have a maximum thickness of about 25 feet at the top of slope. Improvements are not planned in the vicinity of the southern fill areas. Previously placed fill also underlies the residential development along Olive Drive adjacent to the northeastern corner of the site (as observed in Trench T-14 in the referenced report). The fill consists of loose, moist, clayey sand and is underlain by relatively thick topsoil.

Topsoil (Unmapped)

Topsoil typically blankets the site and consists of brown, sandy clay to sandy silt. Topsoil is generally on the order of 1 to 4 feet thick, but localized areas with greater thicknesses may exist. Due to its relatively thin thickness, topsoil is not shown on the Geologic Map, Figure 1.

Alluvium (Qal)

Alluvium exists on the northern portion of the site in the Loma Alta Creek drainage. The alluvial soil consists of soft, sandy to silty clay and loose silty to clayey sand. The alluvium is locally underlain by and interfingered with landslide deposits. We encountered alluvial materials up to approximately 15½ feet deep and likely extend deeper toward the north. A shallow groundwater table is likely to exist approximately 3 to 5 feet below existing grade in the area of the streambed at the northern portion of the site. The alluvium is compressible, possesses a "very low" to "high" expansion potential (expansion index of 130 or less), possibly subject to liquefaction, and may have low to high permeability. We expect some alluvium will remain in place on the western portion of the property due to grading limitations.

Landslide Deposits (Qls and Qsls)

We encountered and observed landslide deposits in many of the exploratory borings and trenches performed during this study and are mapped underlying the majority of the central and eastern portions of the site, including the areas of proposed development. The deepest landslide debris encountered is about 56 feet thick in Boring B-5. Borings B-6 and B-8 (in the refenced report and west of the proposed development) were unable to penetrate the full extent of landslide debris to a depth of up to 54 feet; therefore, the landslide debris is likely thicker than 56 feet in some areas. The landslide debris is up to approximately 40 feet thick in the vicinity of the proposed development.

Our exploratory borings and field observations suggest portions of the property are underlain by a series of landslides which have occurred within the Santiago Formation. Debris within the larger landslides consists of highly disturbed to relatively intact blocks of sandstone, siltstone, and claystone. Bedding orientations display evidence of displacement and rotation. Portions of the older landslide debris contained secondary mineralization and fracture infilling suggesting that these deposits have been partially "healed." The slip surfaces were typically located within claystone beds generally parallel to the direction of regional dip. The mechanism for the large-scale landsliding was likely deep-seated block failure along weakened planes within the claystone beds.

The debris composing the smaller, more recent landslides generally consist of loose, moist, olive gray to grayish brown, silty and clayey sands, sandy and clayey silts, and silty to sandy clays. Recent landslide debris typically contains highly disturbed and jumbled bedding, numerous fractures, roots, and sheared and remolded clays.

Landslide deposits are typically unstable within cut slopes and may be susceptible to significant settlement. Therefore, the highly compressible portions of the landslide debris within the proposed development areas should be removed and recompacted during the remedial grading of the site. In general, landslide debris is suitable for reuse as compacted fill provided potentially expansive clay is properly mixed with sandy material where located within about 5 feet of proposed grade.

We observed an isolated area of surficial landslide debris (Qsls) within the previously placed fill areas in the southern portion of the site. The near-surface portions (within 6 feet of the slope face) of the fill slope at the southeast corner of the site have locally failed. Adjacent homeowners have “end dumped” vegetation and other debris over the top of the slope. These deposits are likely the cause of failure of uncompacted “end dump” fill and not indicative of the near-surface soil conditions present along the steep slope portions of the site. We did not perform exploratory borings and trenches in the steep slope portions of the proposed open space areas to the south of the proposed development due to access limitations created by the presence of sensitive habitat.

Santiago Formation (Tsa)

We encountered the middle Eocene-age Santiago Formation underlying surficial soil in the majority of the exploratory excavations performed at the site. The Santiago Formation underlies the majority of the steep slope areas located to the south of the proposed development. The Santiago Formation is generally composed of light colored, massive to poorly bedded, fine- to medium-grained sandstone interbedded with weak siltstone and claystone layers. Claystone beds within the Santiago Formation contain bedding plane shears and internal shearing, some of which displayed out-of-slope bedding orientations. Bedding plane shears can be a contributing factor to slope instability. Cut slopes exposing out-of-slope bedding plane shears will require slope stabilization measures.

The Santiago Formation is considered suitable for foundation and/or fill support. However, the claystone and siltstone units may be susceptible to landsliding and slope instability. Additionally, some sandstone units of the Santiago Formation are poorly cemented and susceptible to erosion. Materials generated from excavations within the silty and sandy portions of the Santiago Formation are suitable for reuse as compacted fill. Claystone that is potentially expansive should be mixed with sandy material, as discussed herein.

Granitic Rock (Kgr)

Cretaceous-age granitic rock is mapped in the general vicinity of the site by Tan and Kennedy (1996) as the Green Valley Tonalite. We encountered granitic rock in Boring B-1 and in Trenches T-6, T-7, and T-11 through T-13 (in the referenced report). The granitic rock consists of yellowish brown to gray, moderately weak to moderately strong, highly to moderately weathered, and displayed a fine-to coarse-grained crystalline texture. Granitic rock is considered suitable for the support of structures and/or compacted fill.

STORM WATER MANAGEMENT INVESTIGATION

We understand storm water management devices will be used in accordance with the *2022 City of Oceanside BMP Design Manual*. If not properly constructed, there is a potential for distress to improvements and properties located hydrologically down gradient or adjacent to these devices. Factors such as the amount of water to be detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeological study at the site. If infiltration of storm water runoff occurs, downstream properties may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other undesirable impacts as a result of water infiltration.

Hydrologic Soil Group

The United States Department of Agriculture (USDA), Natural Resources Conservation Services, possesses general information regarding the existing soil conditions for areas within the United States. The USDA website also provides the Hydrologic Soil Group. The following table presents the descriptions of the hydrologic soil groups. If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. In addition, the USDA website also provides an estimated saturated hydraulic conductivity for the existing soil.

HYDROLOGIC SOIL GROUP DEFINITIONS

Soil Group	Soil Group Definition
A	Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
B	Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
C	Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
D	Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

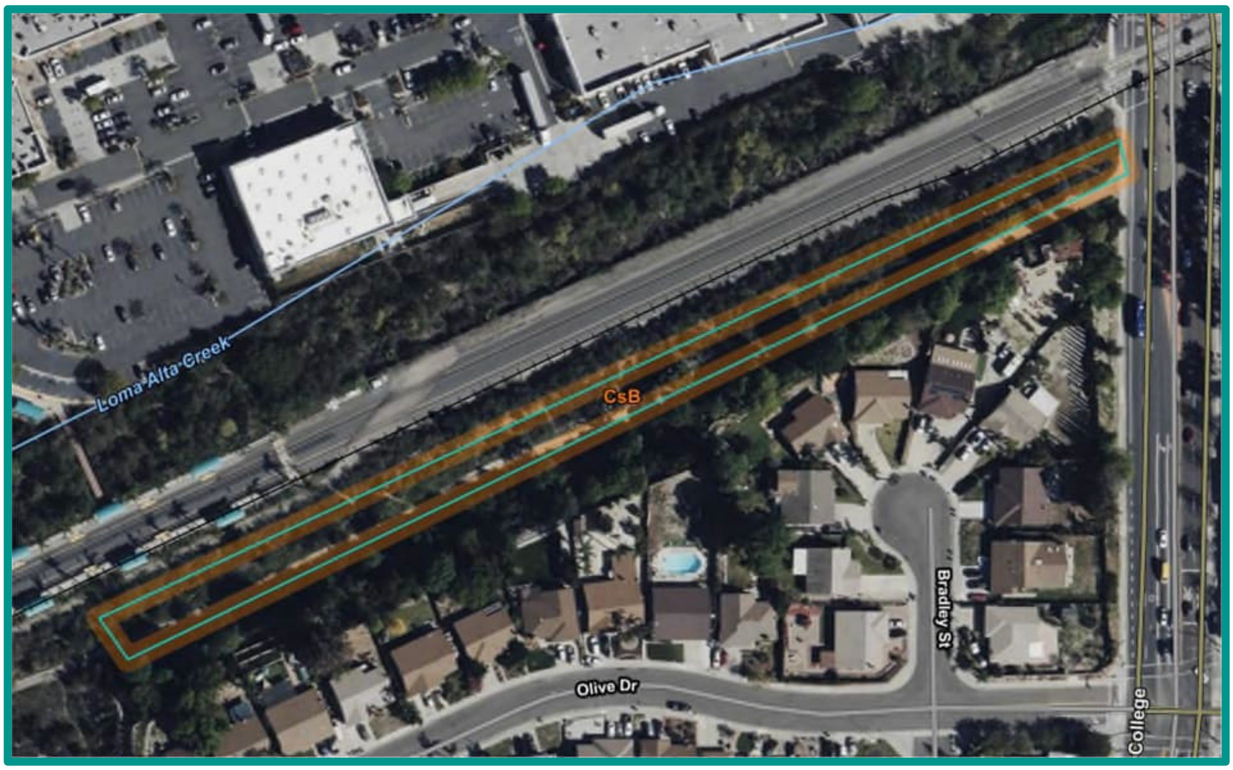
The property is underlain by man-made previously placed fill and cemented stadium conglomerate and should be classified as Soil Group D. The following table presents the information from the USDA website for the subject property. The Hydrologic Soil Group Map presents output from the USDA website showing the limits of the soil units.

USDA WEB SOIL SURVEY – HYDROLOGIC SOIL GROUP*

Map Unit Name	Map Unit Symbol	Approximate Percentage of Property	Hydrologic Soil Group	k_{SAT} of Most Limiting Layer (Inches/ Hour)
Corralitos loamy sand, 0 to 5 percent slopes	CsB	10	A	5.95-19.98
Diablo clay, 15 to 30 percent slopes, eroded, warm MAAT	DaE2	2	C	0.06-0.20
Diablo clay, 30 to 50 percent slopes, warm MAAT, MLRA 20	DaF	4	C	0.06-0.20
Gaviota fine sandy loam, 30 to 50 percent slopes	GaF	27	D	1.98-5.95
Las Flores loamy fine sand, 9 to 15 percent slopes, eroded	LeD2	36	D	0.00-0.06
Salinas clay loam, 0 to 2 percent slopes, warm MAAT, MLRA 19	SbA	21	C	0.00-0.14

*The areas of the property that possess fill materials should be considered to possess a Hydrologic Soil Group D.

Hydrologic Soil Group Map – Proposed Development



Hydrologic Soil Group Map – Access Road

In Situ Testing

The majority of the proposed development is underlain by landslide debris and landslide prone formational material. Additionally, groundwater within the alluvium is within 10 feet from existing grade and the proposed development will consist of fills greater than 5 feet across the entire site once the landslide debris is removed. Based on historic aerials, the access road appears to have been graded with fill and is adjacent to a slope down to the existing train tracks. Therefore, we did not perform infiltration tests within the granitic rock or Santiago Formation due to the proximity to groundwater, proposed fill depths, proximity to slopes, and geologic hazards that exist on site. Infiltration would be considered infeasible due to the presence of landslide debris across the site. If infiltration of storm water runoff occurs, downstream properties may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other undesirable impacts because of water infiltration.

GEOTECHNICAL CONSIDERATIONS

Groundwater Elevations

We encountered groundwater during the previous field investigation in several of our borings at depths ranging from 9 to 45 feet below existing grade (elevation 183 to 199 feet MSL). Therefore, infiltration in these areas are considered infeasible.

Soil or Groundwater Contamination

We are unaware of contaminated soil or groundwater contamination on the property. Therefore, infiltration associated with this risk would be considered feasible.

Expansive Soils

Based on previous laboratory testing, the soil encountered in the field investigation is “non-expansive” (expansion index [EI] of 20 or less) and “expansive” (EI greater than 20) as defined by 2022 California Building Code (CBC) Section 1803.5.3. We expect most of the soil on site will have a “very low” to “medium” expansion potential (expansion index of 90 or less). Infiltration would be feasible when considering the expansion potential of the soil on the property.

Formational Soil Properties

The on-site landslides have occurred within the weak claystone and/or siltstone beds of the Santiago Formation. The lower portions of the landslide debris in the western portion of the site were observed to be saturated and prone to significant caving and seepage. Therefore, due to slope instability and weak claystone/siltstone beds in the Santiago Formation infiltration should be considered infeasible on site.

New or Existing Utilities

Utilities are present within the existing roadways to the east on Olive Drive. Full or partial infiltration should not be allowed in the areas of the utilities to help prevent potential damage/distress to improvements. Mitigation measures to prevent water from infiltrating the utilities consist of setbacks, installing cutoff walls around the utilities and installing subdrains and/or installing liners.

Existing and Planned Structures

Existing railroad tracks and residential structures exist to the north and west of the site, respectively. Water should not be allowed to infiltrate in areas where it could affect the existing and neighboring properties and existing and adjacent structures, improvements, and roadways. Mitigation for existing structures consists of not allowing water infiltration within a 1:1 plane from existing foundations and extending the infiltration areas at least 10 feet from the existing foundations and into formational materials.

CONCLUSIONS AND RECOMMENDATIONS

Storm Water Evaluation Narrative

As discussed herein, the property consisted of mostly landslide debris, fill materials, and Santiago Formation with slide prone weak claystone/siltstone beds. Additionally, we encountered groundwater in the alluvium materials within 10 feet from existing grade. In order to develop the site, the landslide materials will be removed and replaced with properly compacted fill. This would result in most of the site being underlain by fills greater than 5 feet subsequent to grading and site development. In our experience, fill does not possess infiltration rates appropriate with infiltration. Therefore, the areas where infiltration could potentially be feasible are limited based on existing structures, groundwater, fill greater than 5 feet, and slide prone formational materials. The potential for additional landsliding would increase if infiltration were allowed in the existing landslide debris or formational materials.

Storm Water Evaluation Conclusion

Based on the geologic conditions exhibited in the Santiago Formation, shallow groundwater, areas of the site underlain by landslide debris, proposed fills greater than 5 feet, and existing structures we opine full and partial infiltration on the property is considered infeasible and the property possesses a "No Infiltration" condition.

Storm Water Management Devices

Liners and subdrains should be incorporated into the design and construction of the planned storm water devices. The liners should be impermeable (e.g. High-density polyethylene, HDPE, with a thickness of about 30 mil or equivalent Polyvinyl Chloride, PVC) to prevent water migration. The subdrains should be perforated within the liner area, installed at the base and above the liner, be at least 3 inches in diameter and consist of Schedule 40 PVC pipe. The subdrains outside of the liner should consist of solid pipe. The penetration of the liners at the subdrains should be properly waterproofed. The subdrains should be connected to a proper outlet. The devices should also be installed in accordance with the manufacturer's recommendations.

Storm Water Standard Worksheets

We evaluated the proposed project with respect to the infiltration restrictions contained in Table D.1-1 in Appendix D of the City of Oceanside BMP Design Manual (see following table).

CONSIDERATIONS FOR GEOTECHNICAL ANALYSIS OF INFILTRATION RESTRICTIONS

Restriction Element		Is Element Applicable? (Yes/No)
Mandatory Considerations	BMP is within 100' of Contaminated Soils	No
	BMP is within 100' of Industrial Activities Lacking Source Control	No
	BMP is within 100' of Well/Groundwater Basin	No
	BMP is within 50' of Septic Tanks/Leach Fields	No
	BMP is within 10' of Structures/Tanks/Walls	No
	BMP is within 10' of Sewer Utilities	No
	BMP is within 10' of Groundwater Table	No
	BMP is within Hydric Soils	No
	BMP is within Highly Liquefiable Soils and has Connectivity to Structures	No
	BMP is within 1.5 Times the Height of Adjacent Steep Slopes (≥25%)	No
	City Staff has Assigned "Restricted" Infiltration Category	No

Restriction Element		Is Element Applicable? (Yes/No)
Optional Considerations	BMP is within Predominantly Type D Soil	Yes
	BMP is within 10' of Property Line	No
	BMP is within Fill Depths of ≥5' (Existing or Proposed)	Yes
	BMP is within 10' of Underground Utilities	No
	BMP is within 250' of Ephemeral Stream	No
	Other (Provide detailed geotechnical support) – Landslide debris and slide prone formational materials (***See discussion herein)***	Yes
Result	Based on examination of the best available information, I have **not identified any restrictions** above.	
	Based on examination of the best available information, I have **identified one or more restrictions** above.	**X Restricted**

The BMP manual also has a worksheet (Table D.2-4 of Appendix D) that helps the project civil engineer estimate the factor of safety based on several factors. The following table describes the suitability assessment input parameters related to the geotechnical engineering aspects for the factor of safety determination.

GUIDANCE FOR DETERMINING INDIVIDUAL FACTOR VALUES – PART A

Consideration	High Concern – 3 Points	Medium Concern – 2 Points	Low Concern – 1 Point
Infiltration Test Method	Any	At least 2 tests of any kind within 50' of BMP	At least 4 tests within BMP footprint, OR Large/Small Scale Pilot Infiltration Testing over at least 5% of BMP footprint.
Soil Texture Class	Unknown, Silty, or Clayey	Loamy	Granular/Slightly Loamy
Site Variability	Unknown or High	Moderately Homogenous	Significantly Homogenous
Depth to Groundwater/ Obstruction	<5' below BMP	5-15' below BMP	>15' below BMP

The following table presents the estimated safety factor values for the evaluation of the factor of safety. This table only presents the suitability assessment safety factor (Part A) of the worksheet. The project civil engineer should evaluate the safety factor for design (Part B) and use the combined safety factor for the design infiltration rate.

DETERMINATION OF SAFETY FACTOR

<table>
<tr><th colspan="2">Consideration</th><th>Assigned Weight (w)</th><th>Factor Value (v)</th><th>Product (p = w x v)</th></tr>
<tr><td rowspan="5">Suitability Assessment (A)</td><td>Infiltration Testing Method</td><td>0.25</td><td>3</td><td>0.75</td></tr>
<tr><td>Soil Texture Class</td><td>0.25</td><td>2</td><td>0.50</td></tr>
<tr><td>Site Variability</td><td>0.25</td><td>3</td><td>0.75</td></tr>
<tr><td>Depth to Groundwater/Obstruction</td><td>0.25</td><td>2</td><td>0.50</td></tr>
<tr><td colspan="3">Suitability Assessment Safety Factor, $S_A = \sum p$</td><td>2.5</td></tr>
<tr><td rowspan="4">Design (B)</td><td>Pretreatment</td><td>*</td><td rowspan="3">Refer to Table D.2-4</td><td>*</td></tr>
<tr><td>Resiliency</td><td>*</td><td>*</td></tr>
<tr><td>Compaction</td><td>*</td><td>*</td></tr>
<tr><td colspan="3">Design Safety Factor, $S_B = \sum p$</td><td>*</td></tr>
<tr><td colspan="4">Safety Factor, $S = S_A \times S_B$
(Must be always greater than or equal to 2)</td><td>*</td></tr>
</table>

*The civil engineer should evaluate the “Design (B)” factors and the Safety Factor, S.

We also included herein the original I-8 Form from previous submittals for consistency with the current submittal process. The DMA Plan, Figure 2, shows the setback areas as discussed herein. We opine infiltration is not feasible for this property.

If you have any questions regarding this correspondence, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Nikolas Garcia, EIT
Senior Staff Engineer

Shawn Foy Weedon, GE 2714
Vice President/Senior Engineer

REGISTERED PROFESSIONAL ENGINEER
SHAWN WEEDON
No. 2714
GEOTECHNICAL
STATE OF CALIFORNIA

NG:SFW:arm

(e-mail) Addressee

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.		X
Provide basis: The majority of the proposed development is underlain by landslide debris and landslide prone formational material. Additionally, groundwater within the alluvium is within 10 feet from existing grade and the proposed development will consist of fills greater than 5 feet across the entire site once the landslide debris is removed. Therefore, we did not perform infiltration tests within the granitic rock or Santiago Formation due to the proximity to groundwater, proposed fill depths, and geologic hazards that exist on site and Infiltration would be considered infeasible across the site. 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		X
Provide basis: The majority of the proposed development is underlain by landslide debris and landslide prone formational material. Additionally, groundwater within the alluvium is within 10 feet from existing grade and the proposed development will consist of fills greater than 5 feet across the entire site once the landslide debris is removed. Therefore, infiltration should be considered infeasible due to the risk of slope stability, fill thickness and groundwater mounding. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Worksheet C.4-1 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		X
Provide basis: We encountered groundwater within the alluvium materials within 10 feet from existing grade. Therefore, infiltration should not be allowed in these areas. 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	X	
Provide basis: Geocon Incorporated does not expect infiltration will cause water balance issues such as seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters. 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		No Full 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 the City to substantiate findings.

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.		X

Provide basis:

The majority of the proposed development is underlain by landslide debris and landslide prone formational material. Additionally, groundwater within the alluvium is within 10 feet from existing grade and the proposed development will consist of fills greater than 5 feet across the entire site once the landslide debris is removed. Therefore, we did not perform infiltration tests within the granitic rock or Santiago Formation due to the proximity to groundwater, proposed fill depths, and geologic hazards that exist on site and Infiltration would be considered infeasible across the site.

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.

Criteria	Screening Question	Yes	No
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		X

Provide basis:

The majority of the proposed development is underlain by landslide debris and landslide prone formational material. Additionally, groundwater within the alluvium is within 10 feet from existing grade and the proposed development will consist of fills greater than 5 feet across the entire site once the landslide debris is removed. Therefore, we did not perform infiltration tests within the granitic rock or Santiago Formation due to the proximity to groundwater, proposed fill depths, and geologic hazards that exist on site and Infiltration would be considered infeasible across the site.

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.

Worksheet C.4-1 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		X
Provide basis: We encountered groundwater within the alluvium materials within 10 feet from existing grade. Therefore, infiltration should not be allowed in these areas. 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.	X	
Provide basis: Geocon Incorporated does not provide a study regarding water rights. However, these rights are not typical in the San Diego County area. 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.**	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 the City to substantiate findings.

B-1	
@5'	S:N59W/14NE
@13'	C:N38W/8SW
@22'	B:N16E/5SE

B-2	
@19'	S:N29E/6NW
@21'	B:N42W/5NE
@32'	B:N16W/6NE
@48'	S:N56W/12SW
@63'	C:N22E/7SE
@69.5'	S:N41W/11SW
@70.5'	S:N13W/15SW

B-3	
@19'	C:N64W/3NE
@20'	B:N7E/4NW
@32'	C:N75E/6NW
@34'	F:N54W/32SW
@35.5'	C:N29W/5NE
@35.5'	S:N68W/3NE
@56'	B:N10E/8SE
@70.5'	C:N18W/8SW

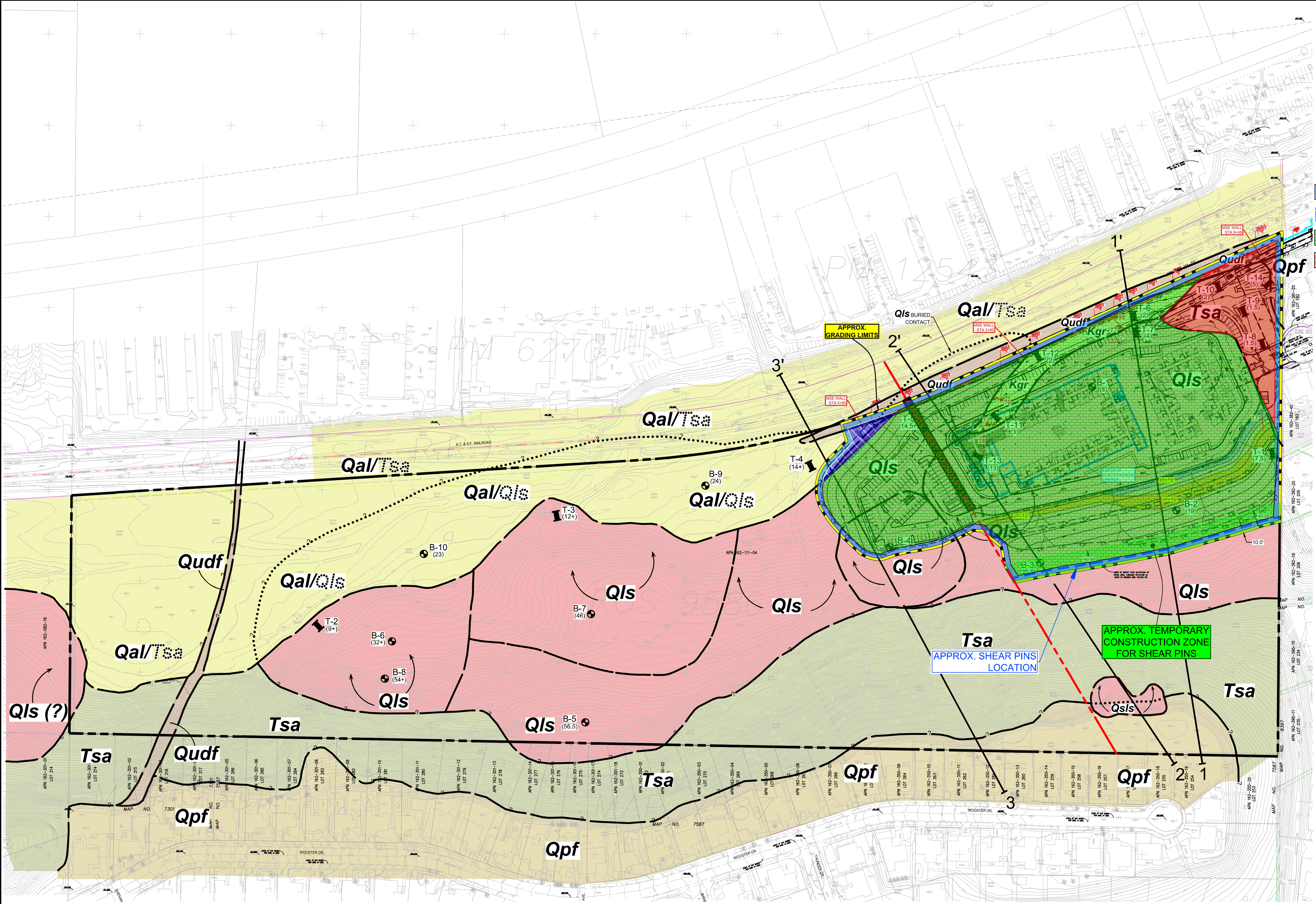
B-4	
@7'	B:N70E/22NW
@13'	S:N51E/36NW
@15.5'	C:N29E/16NW
@24'	S:N59W/14NE
@41.5'	C:N44W/6SW

B-5	
@47.5'	B:N81W/44SW
@55'	B:N81W/17SW
@56'	S:N11W/4NE
@65'	B:N17E/4NW

B-6	
@9.5'	C:N14W/46NE
@19'	B:N28E/38SE

B-7	
@ 7'	B:N56W/40SW
@17.5'	B:N85E/27NW
@21.5'	C:N83E/21SE
@45'	S:N46W/4NE

B-8	
@35'	B:N4E/53NW



...10 Foot Property Setback (Infiltration Infeasible)

...Shallow Groundwater Setback (Infiltration Infeasible)

...Landslide Debris/Proposed Fill Greater Than 5 Feet Setback (Infiltration Infeasible)

...Slide Prone Formational Materials Setback (Infiltration Infeasible)

0' 100' 200' 300' 400'

SCALE 1"=100' (On 36x24)

GEOCON LEGEND

Qudf ........UNDOCUMENTED FILL

Qpf ....PREVIOUSLY PLACED FILL

Qal ....ALLUVIUM

Qsls ....SURFICIAL LANDSLIDE DEBRIS

Qls ....LANDSLIDE DEBRIS (Dotted Where Buried; Queried Where Uncertain)

Tsa ....SANTIAGO FORMATION (Dotted Where Buried)

Kgr ....GRANITIC ROCK (Dotted Where Buried)

B-10 ....APPROX. LOCATION OF EXPLORATORY BORINGS

T-14 ....APPROX. LOCATION OF EXPLORATORY TRENCHES

(56.5) ....APPROX. DEPTH TO FORMATIONAL MATERIAL (In Feet)

77 ....APPROX. ORIENTATION OF GEOLOGIC STRUCTURE

38 ....APPROX. ORIENTATION OF CONTACT BETWEEN GEOLOGIC UNITS

........APPROX. LOCATION OF SHEAR PINS

3 3' ....APPROX. LOCATION OF GEOLOGIC CROSS SECTION

W=35' ....APPROX. WIDTH OF KEY (In Feet)

?........APPROX. LOCATION OF GEOLOGIC CONTACT (Dotted Where Buried; Queried Where Uncertain)

........APPROX. LOCATION OF BUTTRESS KEY WIDTH

........APPROX. LOCATION OF STABILITY FILL KEY WIDTH

GEOLOGIC MAP

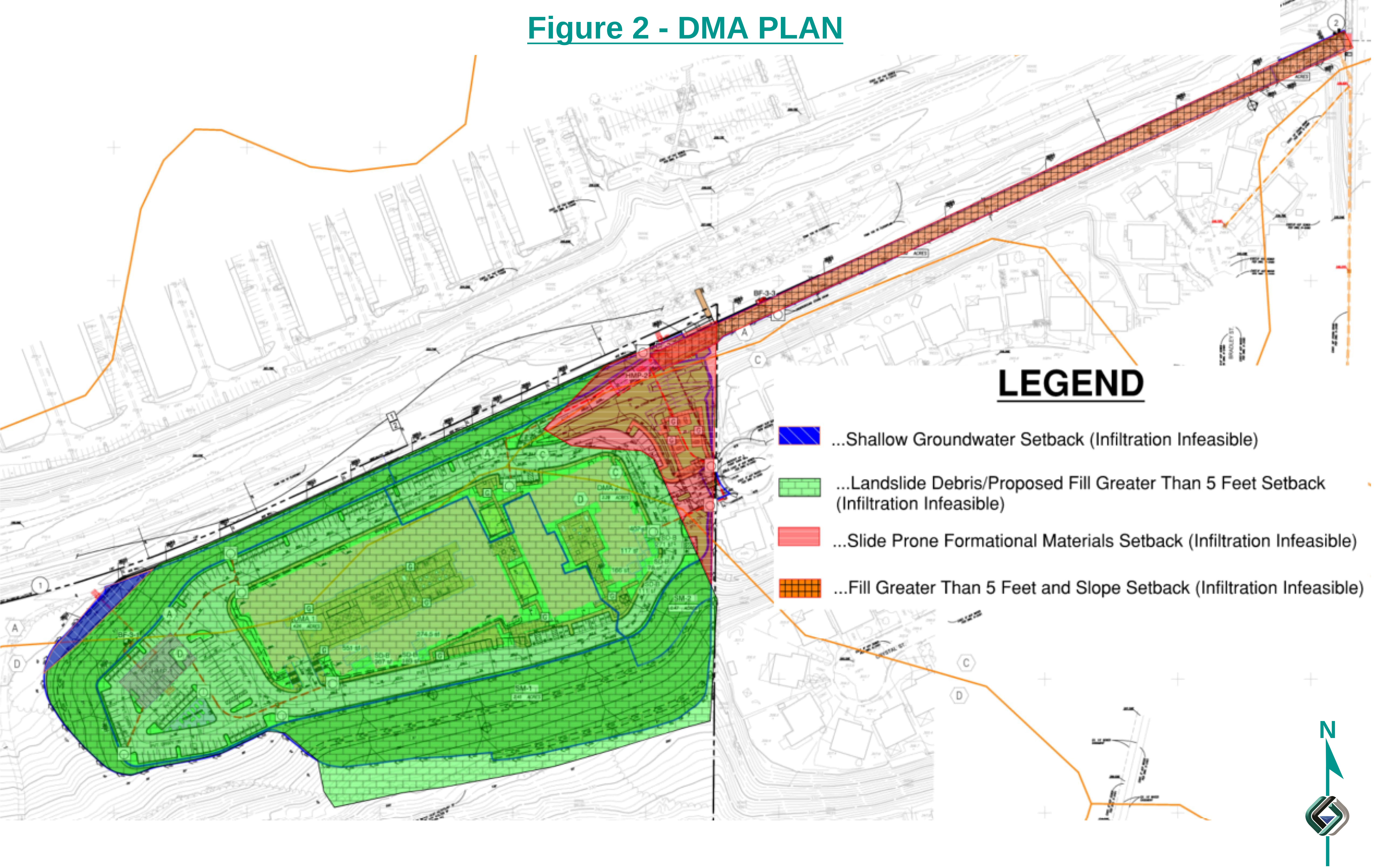
OLIVE PARK APARTMENTS
OCEANSIDE, CALIFORNIA

GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SCALE 1" = 100' | DATE 08-07-2024
PROJECT NO. G3035 - 52 - 01 | FIGURE 1
SHEET 1 OF 1

Plotted:03/12/2024 2:30PM | By:RUBEN AGUILAR | File Location:Y:\PROJECTS\G3035-52-01 Oceanside Trolley Place\SHEETS\G3035-52-01 GeologicMAP.dwg

Figure 2 - DMA PLAN



EL CORAZON OBC DISTRICT
DMA CALCULATIONS

Appendix B: Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

Tabular Summary of DMAs — **Worksheet B-1**

DMA Unique Identifier	Type of Surface	Area (square feet)	Impervious Area (square feet)	% Imp	Hydrologic Soil Group	Area Weighted Runoff Coefficient	Treated by (BMP ID)	Proposed Pollutant Control Type	Drains to (POC ID)
DMA 1	ROOF	53792	53792	100%	A&D	0.90	BF-3-1	MWS Unit	1
	CONCRETE/ASPHALT*	106810	106810	100%	A&D	0.90			
	PLAYGROUND	1250	250	20%	D	0.26			
	DG	1639	0	0%	D	0.30			
	LANDSCAPE	21945	0	0%	A&D	0.10			
DMA 2	ROOF	15202	15202	100%	D &C	0.90	BF-3-2	MWS Unit	2 &1
	CONCRETE/ASPHALT*	51883	51883	100%	A,C&D	0.90			
	PLAYGROUND	1031	206	20%	D	0.26			
	LANDSCAPE	32792	0	0%	A,C&D	0.10			
DMA 3	ROOF	0	0	100%	A	0.90	BF-3-3	MWS Unit	2&1
	CONCRETE/ASPHALT	21008	21008	100%	A	0.90			
	LANDSCAPE	1499	0	0%	A	0.10			
DMA 4	ROOF	0	0	100%	A	0.90	BF-3-4	MWS Unit	3
	CONCRETE/ASPHALT	2523	2523	100%	A	0.90			
	LANDSCAPE	540	0	0%	A	0.10			
SM-1	ROOF	0	0	100%	A&D	0.90	NA	Self-Mitigating	1
	CONCRETE/ASPHALT	896	896	100%	A&D	0.90			
	LANDSCAPE	105961	0	0%	A&D	0.10			
SM-2	ROOF	0	0	100%	A&D	0.90	NA	Self-Mitigating	2&1
	CONCRETE/ASPHALT	0	0	100%	A&D	0.90			
	LANDSCAPE	20436	0	0%	A&D	0.10			
Total Disturbed Area =		439,208	252,571	186636					
			186,636						

Summary of DMA Information (Must match Project description and SWQMP narrative)

No. of DMAs	Total DMA Area (acres)	Total Impervious Area (acres)	% Impervious	Area Weighted Runoff Coefficient	Design Captured Volume (CFT)	Design Intensity Rate (In\hr)	Design Flow Rate (cfs)	Proposed Pollutant Control Type	POC ID #
DMA 1	4.26	3.69	87%	0.80	N/A	N/A	N/A	MWS Unit	1
DMA 2	2.32	1.54	67%	0.63	N/A	N/A	N/A	MWS Unit	2 &1
DMA 3	0.52	0.48	93%	0.85	N/A	N/A	N/A	MWS Unit	2&1
DMA 4	0.07	0.06	82%	0.76	N/A	N/A	N/A	MWS Unit	3
SM-1	2.45	0.02	1%	0.00	N/A	N/A	N/A	Self-Mitigating	1
SM-2	0.47	0.00	0%	0.04	N/A	N/A	N/A		2&1
Σ =	10.08	5.80	58%						
Note:			4.28						

* Includes the Courtyard area

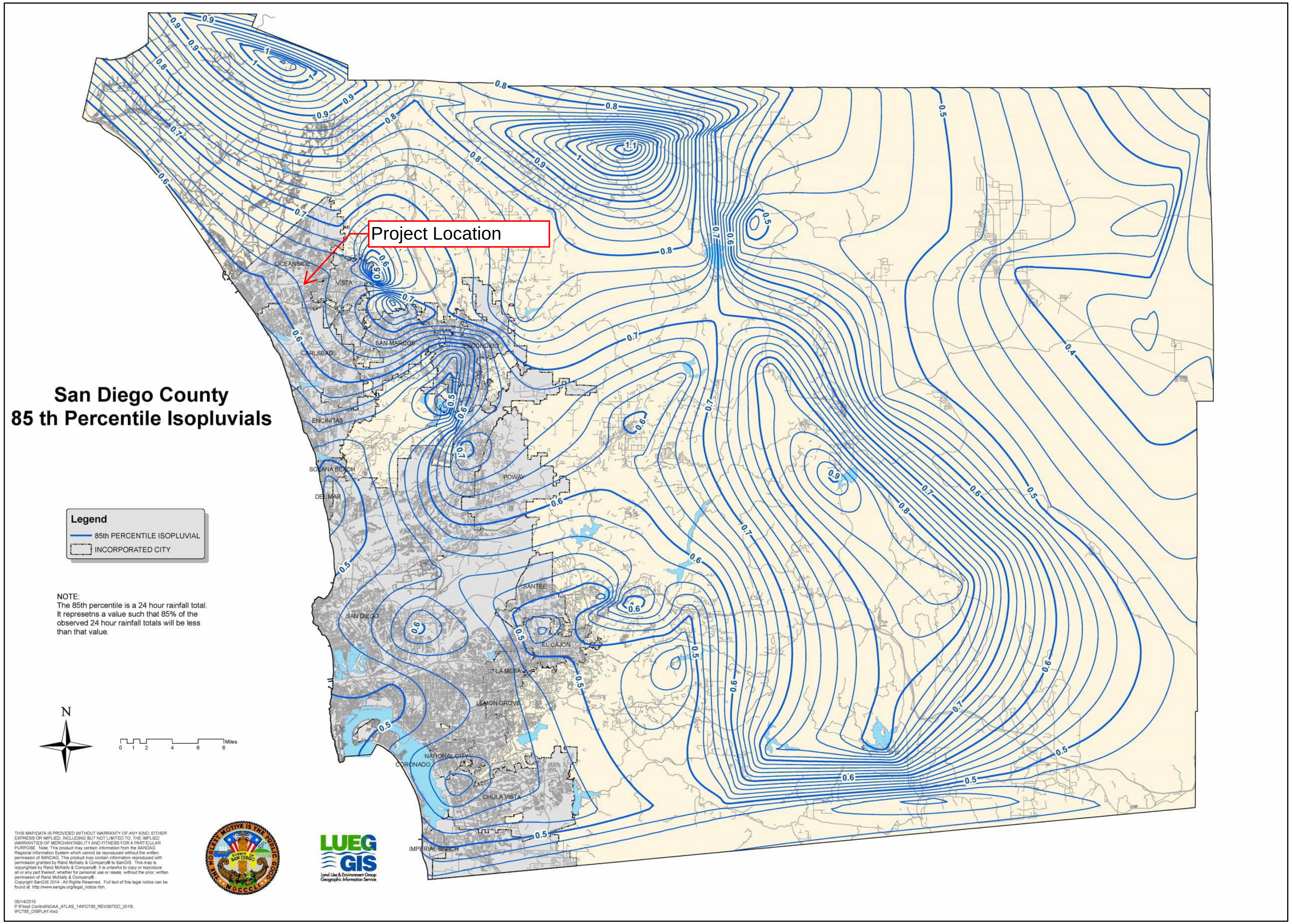


Figure B.1-1: 85th Percentile 24-hour Isopluvial Map

Worksheet B-6.1

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

Category	#	Description	i	ii	iii	iv	Units
Standard Drainage Basin Inputs	1	Drainage Basin ID or Name	DMA 1	DMA 2	DMA 3	DMA 4	unitless
	2	85th Percentile 24-hr Storm Depth	0.62	0.62	0.62	0.62	inches
	3	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	159,276	66,197	21,008	2,523	sq-ft
	4	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)	1,639				sq-ft
	5	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)	22,003	32,886	1,499	540	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?	Yes	Yes	No	No	yes/no
	11	Impervious Surfaces Directed to Dispersion Area per SD-B (Ci=0.90)	1,576	1,095			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)	942	730			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	185,436	100,908	22,507	3,063	sq-ft
	23	Initial Runoff Factor for Standard Drainage Areas	0.80	0.63	0.85	0.76	unitless
	24	Initial Runoff Factor for Dispersed & Dispersion Areas	0.60	0.58	0.00	0.00	unitless
	25	Initial Weighted Runoff Factor	0.80	0.63	0.85	0.76	unitless
	26	Initial Design Capture Volume	7,665	3,285	988	120	cubic-feet
Dispersion Area Adjustments	27	Total Impervious Area Dispersed to Pervious Surface	1,576	1,095	0	0	sq-ft
	28	Total Pervious Dispersion Area	942	730	0	0	sq-ft
	29	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	1.70	1.50	n/a	n/a	ratio
	30	Adjustment Factor for Dispersed & Dispersion Areas	0.00	0.00	1.00	1.00	ratio
	31	Runoff Factor After Dispersion Techniques	0.79	0.62	0.85	0.76	unitless
	32	Design Capture Volume After Dispersion Techniques	7,569	3,232	988	120	cubic-feet
Tree & Barrel Adjustments	33	Total Tree Well Volume Reduction	0	0	0	0	cubic-feet
	34	Total Rain Barrel Volume Reduction	0	0	0	0	cubic-feet
Results	35	Final Adjusted Runoff Factor	0.79	0.62	0.85	0.76	unitless
	36	Final Effective Tributary Area	146,494	62,563	19,131	2,328	sq-ft
	37	Initial Design Capture Volume Retained by Site Design Elements	96	53	0	0	cubic-feet
	38	Final Design Capture Volume Tributary to BMP	7,569	3,232	988	120	cubic-feet

No Warning Messages

Automated Worksheet B.2: Retention Requirements (V2.0)

Category	#	Description	*i*	*ii*	*iii*	*iv*	Units
Basic Analysis	1	Drainage Basin ID or Name	DMA 1	DMA 2	DMA 3	DMA 4	unitless
	2	85th Percentile Rainfall Depth	0.62	0.62	0.62	0.62	inches
	3	Predominant NRCS Soil Type Within BMP Location	D	D	A	A	unitless
	4	Is proposed BMP location Restricted or Unrestricted for Infiltration Activities?	Restricted	Restricted	Restricted	Restricted	unitless
	5	Nature of Restriction	Soil Type	Soil Type	Soil Type	Soil Type	unitless
	6	Do Minimum Retention Requirements Apply to this Project?	Yes	Yes	Yes	Yes	yes/no
	7	Are Habitable Structures Greater than 9 Stories Proposed?	No	No	No	No	yes/no
Advanced Analysis	8	Has Geotechnical Engineer Performed an Infiltration Analysis?	No	No	No	No	yes/no
	9	Design Infiltration Rate Recommended by Geotechnical Engineer					in/hr
Result	10	Design Infiltration Rate Used To Determine Retention Requirements	0.000	0.000	0.000	0.000	in/hr
	11	Percent of Average Annual Runoff that Must be Retained within DMA	1.5%	1.5%	1.5%	1.5%	percentage
	12	Fraction of DCV Requiring Retention	0.01	0.01	0.01	0.01	ratio
	13	Required Retention Volume	76	32	10	1	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 1	DMA 2	DMA 3	DMA 4	-	-	-	-	-	-	sq-ft
	2	Design Infiltration Rate Recommended	0.000	0.000	0.000	0.000	-	-	-	-	-	-	in/hr
	3	Design Capture Volume Tributary to BMP	7,569	3,232	988	120	-	-	-	-	-	-	cubic-feet
	4	Is BMP Vegetated or Unvegetated?											unitless
	5	Is BMP Impermeably Lined or Unlined?											unitless
	6	Does BMP Have an Underdrain?											unitless
	7	Does BMP Utilize Standard or Specialized Media?											unitless
	8	Provided Surface Area											sq-ft
	9	Provided Surface Ponding Depth											inches
	10	Provided Soil Media Thickness											inches
	11	Provided Gravel Thickness (Total Thickness)											inches
	12	Underdrain Offset											inches
	13	Diameter of Underdrain or Hydromod Orifice (Select Smallest)											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	1.00	1.00	1.00	1.00	1.00	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)	0.40	0.40	0.40	0.40	0.40	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	24	Fraction of DCV Retained (Independent of Drawdown Time)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	25	Calculated Retention Storage Drawdown Time	0	0	0	0	0	0	0	0	0	0	hours
	26	Efficacy of Retention Processes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	27	Volume Retained by BMP (Considering Drawdown Time)	0	0	0	0	0	0	0	0	0	0	cubic-feet
	28	Design Capture Volume Remaining for Biofiltration	7,569	3,232	988	120	0	0	0	0	0	0	cubic-feet
Biofiltration Calculations	29	Max Hydromod Flow Rate through Underdrain	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	cfs
	30	Max Soil Filtration Rate Allowed by Underdrain Orifice	0.00	0.00	0.00	0.00	0.00	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	in/hr
	33	Depth Biofiltered Over 6 Hour Storm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	34	Ponding Pore Space Available for Biofiltration	0.00	0.00	0.00	0.00	0.00	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	38	Drawdown Time for Surface Ponding	0	0	0	0	0	0	0	0	0	0	hours
	39	Drawdown Time for Effective Biofiltration Depth	0	0	0	0	0	0	0	0	0	0	hours
	40	Total Depth Biofiltered	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	41	Option 1 - Biofilter 1.50 DCV: Target Volume	11,354	4,848	1,482	180	0	0	0	0	0	0	cubic-feet
	42	Option 1 - Provided Biofiltration Volume	0	0	0	0	0	0	0	0	0	0	cubic-feet
	43	Option 2 - Store 0.75 DCV: Target Volume	5,677	2,424	741	90	0	0	0	0	0	0	cubic-feet
	44	Option 2 - Provided Storage Volume	0	0	0	0	0	0	0	0	0	0	cubic-feet
	45	Portion of Biofiltration Performance Standard Satisfied	0.00	0.00	0.00	0.00	0.00	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	No	No	-	-	-	-	-	-	yes/no
	47	Overall Portion of Performance Standard Satisfied (BMP Efficacy Factor)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	48	Deficit of Effectively Treated Stormwater	-7,569	-3,232	-988	-120	n/a	n/a	n/a	n/a	n/a	n/a	cubic-feet

Attention!

-Minimum annual retention criteria are not satisfied for each individual drainage area. Implement additional site design elements, increase structural BMP retention capacity, or demonstrate that such requirements are satisfied at the project-level.
-This BMP does not fully satisfy the performance standards for pollutant control for the drainage area.

Water quality for DMAs 1 through 4 will be met using proprietary biofiltration unit (Modular Wetland Units by Contech). BF-3-1 and BF-3-2 corresponding to DMAs 1 and 2 will be volume-based unit located downstream of an underground storage facility that will includes an outlet structure designed to regulate the flows entering the units and control the drawdown. BF-3-3 and BF-3-4 corresponding to DMAs 3 and 4 are curb-type and flow-based MWS units that have been sized using worksheet B-6.1.

SSD-BMP Automated Worksheet I-1: Step 1. Calculation of Design Capture Volume (V1.0)

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
Standard Drainage Basin Inputs	1	Drainage Basin ID or Name	DMA 1	DMA 2									unitless
	2	85th Percentile 24-hr Storm Depth	0.62	0.62									inches
	3	Is Hydromodification Control Applicable?	No	No									yes/no
	4	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)											sq-ft
	5	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)											sq-ft
	6	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)											sq-ft
	7	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)											sq-ft
	8	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)											sq-ft
	9	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)											sq-ft
	10	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)											sq-ft
SSD-BMPs Proposed	11	Does Tributary Incorporate Dispersion and/or Rain Barrels?	Yes	Yes									yes/no
	12	Does Tributary Incorporate Tree Wells?	No	No									yes/no
Dispersion Area & Rain Barrel Inputs (Optional)	13	Impervious Surfaces Directed to Dispersion Area per SD-B (Ci=0.90)	1,576	1,095									sq-ft
	14	Semi-Pervious Surfaces Serving as Dispersion Area per SD-B (Ci=0.30)											sq-ft
	15	Engineered Pervious Surfaces Serving as Dispersion Area per SD-B (Ci=0.10)	942	730									sq-ft
	16	Natural Type A Soil Serving as Dispersion Area per SD-B (Ci=0.10)											sq-ft
	17	Natural Type B Soil Serving as Dispersion Area per SD-B (Ci=0.14)											sq-ft
	18	Natural Type C Soil Serving as Dispersion Area per SD-B (Ci=0.23)											sq-ft
	19	Natural Type D Soil Serving as Dispersion Area per SD-B (Ci=0.30)											sq-ft
	20	Number of Rain Barrels Proposed per SD-E											#
	21	Average Rain Barrel Size											gal
Initial Runoff Factor Calculation	22	Total Tributary Area	2,518	1,825	0	0	0	0	0	0	0	0	sq-ft
	23	Initial Runoff Factor for Standard Drainage Areas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	24	Initial Runoff Factor for Dispersed & Dispersion Areas	0.60	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	25	Initial Weighted Runoff Factor	0.60	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	26	Initial Design Capture Volume	78	55	0	0	0	0	0	0	0	0	cubic-feet
Dispersion Area Adjustment & Rain Barrel Adjustment	27	Total Impervious Area Dispersed to Pervious Surface	1,576	1,095	0	0	0	0	0	0	0	0	sq-ft
	28	Total Pervious Dispersion Area	942	730	0	0	0	0	0	0	0	0	sq-ft
	29	Ratio of Dispersed Impervious Area to Pervious Dispersion Area for DCV Reduction	1.70	1.50	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	ratio
	30	Adjustment Factor for Dispersed & Dispersion Areas	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	ratio
	31	Runoff Factor After Dispersion Techniques	0.00	0.00	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	unitless
	32	Design Capture Volume After Dispersion Techniques	0	0	0	0	0	0	0	0	0	0	cubic-feet
	33	Total Rain Barrel Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
Results	34	Final Adjusted Runoff Factor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	35	Final Effective Tributary Area	0	0	0	0	0	0	0	0	0	0	sq-ft
	36	Initial Design Capture Volume Retained by Dispersion Area and Rain Barrel(s)	78	55	0	0	0	0	0	0	0	0	cubic-feet
	37	Remaining Design Capture Volume Tributary to Tree Well(s)	0	0	0	0	0	0	0	0	0	0	cubic-feet

No Warning Messages

SSD-BMP Automated Worksheet I-2: Step 2. Dispersion Area Validation (V1.0)

Category	#	Description	i	ii	iii	iv	v	vi	vii	viii	ix	x	Units
Standard Dispersion Area Inputs	1	Drainage Basin ID or Name	DMA 1	DMA 2	-	-	-	-	-	-	-	-	unitless
	2	Final Design Capture Volume (DCV)	0	0	-	-	-	-	-	-	-	-	cubic-feet
	3	Is Hydromodification Control Applicable?	No	No	-	-	-	-	-	-	-	-	yes/no
	4	Total Impervious Area Dispersed to Pervious Surface	1,576	1,095	-	-	-	-	-	-	-	-	sq-ft
	5	Total Engineered Pervious Surface and/or Natural Soil Dispersion Area (Does Not Include Semi-Pervious Surfaces Serving as Dispersion Area)	942	730	-	-	-	-	-	-	-	-	sq-ft
	6	Ratio of Dispersed Impervious Area to Total Engineered Pervious Surface and/or Natural Soil Dispersion Area	1.67	1.50	-	-	-	-	-	-	-	-	unitless
	7	Dispersion Area Length (Length of Sheet Flow Across Dispersion Area)	10	10									feet
	8	Dispersion Area Slope	5.0	5.0									%
	9	Thickness of Amended Soil	0	0									inches
	10	How is Flow Dispersed Across Width of Dispersion Area (definitions below*)?	Roof Drains	Curb Cuts									unitless
Results	11	Is DCV Requirement Fully Satisfied by Dispersion Area?	Yes	Yes	-	-	-	-	-	-	-	-	yes/no
	12	Is Hydromodification Control Requirement Satisfied by Dispersion Area?	n/a	n/a	-	-	-	-	-	-	-	-	yes/no
	13	Are Dispersion Area Length, Slope, and Thickness of Amended Soil (when applicable) Adequate?	Yes	Yes	-	-	-	-	-	-	-	-	yes/no

No Warning Messages

Notes:

*How is Flow Dispersed Across Width of Pervious Dispersion Area?

Sheet Flow: Flow arrives as sheet flow across the width of the adjacent impervious area

Spreader(s): Flow is discharged from flow spreader(s) across the width of the pervious area

Roof Drains: Discharge from roof drains distributed across the width of the pervious area

Curb Cuts: Discharge from curb cuts distributed across the width of the pervious area

Other: Other (Describe in PDP SWQMP)

DMA CALCULATIONS

	DMA 1	DMA 2	DMA 3	DMA4	Onsite Retention Volume
Required Retention Volume	76	32	10	1	118
Provided Retention Volume	96	53	0	0	149
Do Site Design Elements and BMPs Satisfy Annual Retention Requirements?	YES	YES	NO	NO	YES

Worksheet B-6.1

Appendix B: Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

	Flow-thru Design Flows (BF-3-3)	Worksheet B.6-1		
1	DCV	DCV	988	cubic-feet
2	DCV retained	$DCV_{retained}$	0	cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$	0	cubic-feet
4	DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3)	$DCV_{flow-thru}$	0	cubic-feet
5	Adjustment factor (Line 4 / Line 1)*	AF=	1	unitless
6	Design rainfall intensity	i=	0.20	in/hr
7	Area tributary to BMP (s)	A=	0.52	acres
8	Area-weighted runoff factor (estimate using Appx B.2)	C=	0.85	unitless
9	Calculate Flow Rate = AF x (C x i x A)	Q=	0.089	cfs
10	Design Flow Rate (Appx F.2.2, BMP Manual) = 1.5Q	Q=	0.133	cfs

Appendix B: Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

	Flow-thru Design Flows (BF-3-4)	Worksheet B.6-1		
1	DCV	DCV	120	cubic-feet
2	DCV retained	$DCV_{retained}$	0	cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$	0	cubic-feet
4	DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3)	$DCV_{flow-thru}$	0	cubic-feet
5	Adjustment factor (Line 4 / Line 1)*	AF=	1	unitless
6	Design rainfall intensity	i=	0.20	in/hr
7	Area tributary to BMP (s)	A=	0.07	acres
8	Area-weighted runoff factor (estimate using Appx B.2)	C=	0.76	unitless
9	Calculate Flow Rate = AF x (C x i x A)	Q=	0.011	cfs
10	Design Flow Rate (Appx F.2.2, BMP Manual) = 1.5Q	Q=	0.016	cfs

MWS Linear | *Sizing Options*

Flow Based Sizing

The MWS Linear can be used in stand alone applications to meet treatment flow requirements. Since the MWS Linear is the only biofiltration system that can accept inflow pipes several feet below the surface it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

Model #	Dimensions	WetlandMEDIA Surface Area	Treatment Flow Rate (cfs)
MWS-L-4-4	4′ x 4′	23 sq. ft.	0.052
MWS-L-4-6	4′ x 6′	32 sq. ft.	0.073
MWS-L-4-8	4′ x 8′	50 sq. ft.	0.115
MWS-L-4-13	4′ x 13′	63 sq. ft.	0.144
MWS-L-4-15	4′ x 15′	76 sq. ft.	0.175
MWS-L-4-17	4′ x 17′	90 sq. ft.	0.206
MWS-L-4-19	4′ x 19′	103 sq. ft.	0.237
MWS-L-4-21	4′ x 21′	117 sq. ft.	0.268
MWS-L-6-8	7′ x 9′	64 sq. ft.	0.147
MWS-L-8-8	8′ x 8′	100 sq. ft.	0.230
MWS-L-8-12	8′ x 12′	151 sq. ft.	0.346
MWS-L-8-16	8′ x 16′	201 sq. ft.	0.462
MWS-L-8-20	9′ x 21′	252 sq. ft.	0.577
MWS-L-8-24	9′ x 25′	302 sq. ft.	0.693

2 DCV 63 hrs

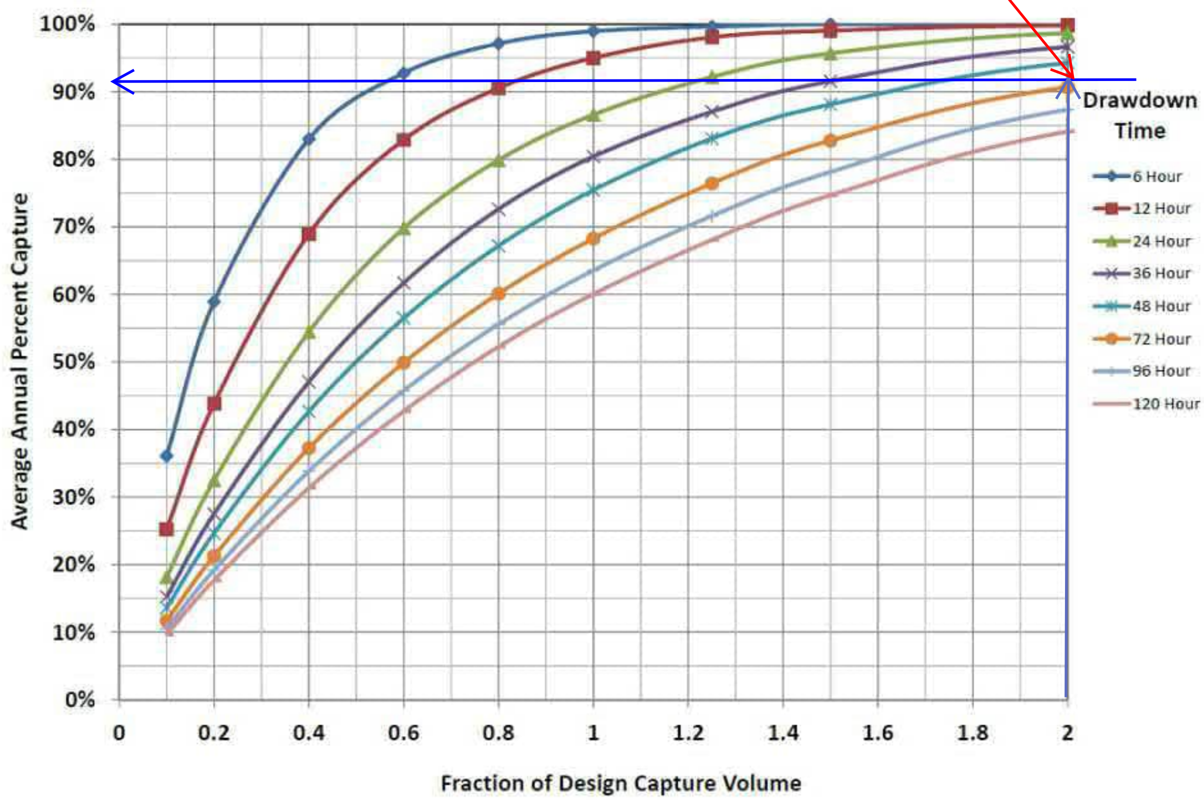


Figure B.3-1: Percent Capture Nomograph

Part 6) Determine the efficacy of the retention processes provided by the BMP. This value represents the portion of the pollutant control performance standard that is satisfied through retention processes of the BMP and is calculated as follows.

BF-3-1 and BF-3-2
63 hrs DD, 2 DCV
=> 92% Average Annual Percent capture

$E_R = P_C/80\%$

Where:
E_R: Efficacy of retention processes (decimal)
P_C: Average Annual Percent Capture (%)

Part 7) Determine the total volume retained by the proposed BMP.

$V_{RBMP} = DCV \times E_R$

Where:
V_{RBMP}: Total volume retained by BMP (ft^3)
DCV: Design capture volume (ft^3)
E_R: Efficacy of retention processes (decimal)

Part 8) Determine the volume of storm water runoff still available for biofiltration treatment as shown

CMP-1 Discharge to MWS BF-3-1

Discharge vs Elevation Table

Low orifice:	0.5625 "	Top orifice:	0.625 "
Number:	8	Number:	0
Cg-low:	0.61	Cg-low:	0.61
invert elev:	0.00 ft	invert elev:	0.40 ft

h	H/D-low	H/D-mid	H/D-top	Qlow-orif	Qlow-weir	Qtot-low	Qmid-orif	Qmid-weir	Qtot-med	Qtop-orif	Qtop-weir	Qtot-top	Qpeak-top	Qtot
(ft)	-	-	-	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
0.17	3.56	0.00	0.00	0.026	0.031	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0256
0.33	7.11	0.00	0.00	0.038	2.023	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0376
0.50	10.67	0.00	1.92	0.047	23.644	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0467
0.67	14.22	2.42	5.12	0.054	118.943	0.054	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0542
0.83	17.78	4.85	8.32	0.061	399.127	0.061	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0608
1.00	21.33	7.27	11.52	0.067	1053.340	0.067	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0668
1.17	24.89	9.70	14.72	0.072	2369.442	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0723
1.33	28.44	12.12	17.92	0.077	4754.788	0.077	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0773
1.50	32.00	14.55	21.12	0.082	8757.006	0.082	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0821
1.67	35.56	16.97	24.32	0.087	15084.775	0.087	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0866
1.83	39.11	19.39	27.52	0.091	24628.607	0.091	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0909
2.00	42.67	21.82	30.72	0.095	38481.619	0.095	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0950
2.17	46.22	24.24	33.92	0.099	57960.320	0.099	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0989
2.33	49.78	26.67	37.12	0.103	84625.382	0.103	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1027
2.50	53.33	29.09	40.32	0.106	120302.423	0.106	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1064
2.67	56.89	31.52	43.52	0.110	167102.785	0.110	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1099
2.83	60.44	33.94	46.72	0.113	227444.312	0.113	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1133

CMP #1 Stage Storage					
Input DCV			7,569		
Input Factor			2		
WQ Ponding Depth			2.833	ft	
Note: Find out the elevation value in relation to required WQ volume					
HMP-2-A Stage Storage					
depth	area	area (ac)	elevation	volume (cf)	volume (acft)
0.00	3008.4	0.0691	0.00	0.0	0.00000
0.17	3990.6	0.0916	0.17	611.1	0.01403
0.33	4380.5	0.1006	0.33	1,310.7	0.03009
0.50	4667.7	0.1072	0.50	2,065.7	0.04742
0.67	4899.6	0.1125	0.67	2,863.6	0.06574
0.83	5094.9	0.1170	0.83	3,696.9	0.08487
1.00	5262.9	0.1208	1.00	4,560.4	0.10469
1.17	5409.5	0.1242	1.17	5,450.0	0.12512
1.33	5538.3	0.1271	1.33	6,362.6	0.14606
1.50	5652.0	0.1298	1.50	7,295.3	0.16748
1.67	5752.5	0.1321	1.67	8,245.8	0.18930
1.83	5841.1	0.1341	1.83	9,212.1	0.21148
2.00	5919.0	0.1359	2.00	10,192.3	0.23398
2.17	5986.9	0.1374	2.17	11,184.6	0.25676
2.33	6045.6	0.1388	2.33	12,187.4	0.27978
2.50	6095.5	0.1399	2.50	13,199.3	0.30301
2.67	6137.2	0.1409	2.67	14,218.8	0.32642
2.83	6170.8	0.1417	2.83	15,244.5	0.34997
3.00	6196.8	0.1423	3.00	16,275.3	0.37363
3.17	6215.2	0.1427	3.17	17,309.7	0.39738
3.33	6226.1	0.1429	3.33	18,346.6	0.42118
3.50	6229.8	0.1430	3.50	19,384.7	0.44501
3.67	6226.1	0.1429	3.67	20,422.8	0.46884
3.83	6215.2	0.1427	3.83	21,459.7	0.49265
4.00	6196.8	0.1423	4.00	22,494.1	0.51639
4.17	6170.8	0.1417	4.17	23,524.8	0.54006
4.33	6137.2	0.1409	4.33	24,550.6	0.56360
4.50	6095.5	0.1399	4.50	25,570.1	0.58701
4.67	6045.6	0.1388	4.67	26,582.0	0.61024
4.83	5986.9	0.1374	4.83	27,584.8	0.63326
5.00	5919.0	0.1359	5.00	28,577.1	0.65604
5.17	5841.1	0.1341	5.17	29,557.2	0.67854
5.33	5752.5	0.1321	5.33	30,523.5	0.70072
5.50	5652.0	0.1298	5.50	31,474.1	0.72255
5.67	5538.3	0.1271	5.67	32,406.8	0.74396
5.83	5409.5	0.1242	5.83	33,319.4	0.76491
6.00	5262.9	0.1208	6.00	34,209.0	0.78533
6.17	5094.9	0.1170	6.17	35,072.5	0.80515
6.33	4899.6	0.1125	6.33	35,905.8	0.82428
6.50	4667.7	0.1072	6.50	36,703.7	0.84260
6.67	4380.5	0.1006	6.67	37,458.6	0.85993
6.83	3990.6	0.0916	6.83	38,158.3	0.87599
7.00	3008.4	0.0691	7.00	38,769.4	0.89002
7.17	3008.4	0.0691	7.17	39,270.8	0.90153
7.33	3008.4	0.0691	7.33	39,772.2	0.91304
7.50	3008.4	0.0691	7.50	40,273.6	0.92455

CONTECH ENGINEERED SOLUTIONS

Date:	8/7/2024
Project Name:	West Storage-1 - 47951 (8-7-2024 21-27-19)
City / County:	
State:	
Designed By:	
Company:	
Telephone:	

CMP: Underground Detention System Storage Volume Estimation

=Adjustable Input Cells

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular applicaton and are subject to verification of the Engineer of Record. This tool is only applicable for rectangular shaped systems.

Summary of Inputs

System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	**107.0**	**Backfill Porosity (%):**	**40%**	**System Diameter (in):**	**84**
Out-to-out width (ft):	**67.0**	**Depth Above Pipe (in):**	**6.0**	**Pipe Spacing (in):**	**36**
Number of Manifolds (ea):	**1.0**	**Depth Below Pipe (in):**	**0.0**	**Incremental Analysis (in):**	**2**
Number of Barrels (ea):	**7.0**	**Width At Ends (ft):**	**1.0**	**System Invert (Elevation):**	**238**
		Width At Sides (ft):	**1.0**		

Storage Volume Estimation

System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	**Elevation (ft)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Percent Open Storage (%)**	**Ave. Surface Area (sf)**
0.00	238.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	3,008.4
0.17	238.16	182.8	182.8	428.3	428.3	611.1	611.1	29.9%	3,990.6
0.33	238.33	330.4	513.2	369.2	797.5	699.7	1,310.7	39.2%	4,380.5
0.50	238.50	422.6	935.8	332.3	1,129.9	755.0	2,065.7	45.3%	4,667.7
0.67	238.66	494.1	1,430.0	303.7	1,433.6	797.9	2,863.6	49.9%	4,899.6
0.83	238.83	553.2	1,983.2	280.1	1,713.7	833.3	3,696.9	53.6%	5,094.9
1.00	239.00	603.5	2,586.6	260.0	1,973.7	863.5	4,560.4	56.7%	5,262.9
1.17	239.16	647.1	3,233.7	242.6	2,216.3	889.6	5,450.0	59.3%	5,409.5
1.33	239.33	685.2	3,918.9	227.3	2,443.6	912.5	6,362.6	61.6%	5,538.3
1.50	239.50	718.9	4,637.8	213.8	2,657.5	932.7	7,295.3	63.6%	5,652.0
1.67	239.66	748.6	5,386.4	202.0	2,859.4	950.6	8,245.8	65.3%	5,752.5
1.83	239.83	774.8	6,161.2	191.5	3,050.9	966.3	9,212.1	66.9%	5,841.1
2.00	240.00	797.9	6,959.1	182.2	3,233.1	980.1	10,192.3	68.3%	5,919.0
2.17	240.16	818.1	7,777.3	174.1	3,407.3	992.3	11,184.6	69.5%	5,986.9
2.33	240.33	835.7	8,613.0	167.1	3,574.4	1,002.8	12,187.4	70.7%	6,045.6
2.50	240.50	850.8	9,463.8	161.1	3,735.5	1,011.9	13,199.3	71.7%	6,095.5
2.67	240.66	863.5	10,327.3	156.0	3,891.5	1,019.5	14,218.8	72.6%	6,137.2
2.83	240.83	874.0	11,201.2	151.8	4,043.3	1,025.8	15,244.5	73.5%	6,170.8
3.00	241.00	882.2	12,083.5	148.5	4,191.8	1,030.7	16,275.3	74.2%	6,196.8
3.17	241.16	888.4	12,971.9	146.0	4,337.9	1,034.4	17,309.7	74.9%	6,215.2
3.33	241.33	892.5	13,864.3	144.4	4,482.3	1,036.9	18,346.6	75.6%	6,226.1
3.50	241.50	894.5	14,758.8	143.6	4,625.9	1,038.1	19,384.7	76.1%	6,229.8
3.67	241.66	894.5	15,653.3	143.6	4,769.5	1,038.1	20,422.8	76.6%	6,226.1
3.83	241.83	892.5	16,545.8	144.4	4,913.9	1,036.9	21,459.7	77.1%	6,215.2
4.00	242.00	888.4	17,434.2	146.0	5,059.9	1,034.4	22,494.1	77.5%	6,196.8
4.17	242.16	882.2	18,316.4	148.5	5,208.4	1,030.7	23,524.8	77.9%	6,170.8
4.33	242.33	874.0	19,190.3	151.8	5,360.3	1,025.8	24,550.6	78.2%	6,137.2
4.50	242.50	863.5	20,053.8	156.0	5,516.3	1,019.5	25,570.1	78.4%	6,095.5
4.67	242.66	850.8	20,904.6	161.1	5,677.3	1,011.9	26,582.0	78.6%	6,045.6
4.83	242.83	835.7	21,740.3	167.1	5,844.5	1,002.8	27,584.8	78.8%	5,986.9
5.00	243.00	818.1	22,558.5	174.1	6,018.6	992.3	28,577.1	78.9%	5,919.0
5.17	243.16	797.9	23,356.4	182.2	6,200.8	980.1	29,557.2	79.0%	5,841.1
5.33	243.33	774.8	24,131.2	191.5	6,392.3	966.3	30,523.5	79.1%	5,752.5
5.50	243.50	748.6	24,879.8	202.0	6,594.3	950.6	31,474.1	79.0%	5,652.0
5.67	243.66	718.9	25,598.7	213.8	6,808.1	932.7	32,406.8	79.0%	5,538.3
5.83	243.83	685.2	26,283.9	227.3	7,035.4	912.5	33,319.4	78.9%	5,409.5
6.00	244.00	647.1	26,931.0	242.6	7,278.0	889.6	34,209.0	78.7%	5,262.9
6.17	244.16	603.5	27,534.5	260.0	7,538.0	863.5	35,072.5	78.5%	5,094.9
6.33	244.33	553.2	28,087.6	280.1	7,818.1	833.3	35,905.8	78.2%	4,899.6
6.50	244.50	494.1	28,581.8	303.7	8,121.9	797.9	36,703.7	77.9%	4,667.7
6.67	244.66	422.6	29,004.4	332.3	8,454.2	755.0	37,458.6	77.4%	4,380.5
6.83	244.83	330.4	29,334.8	369.2	8,823.5	699.7	38,158.3	76.9%	3,990.6
7.00	245.00	182.8	29,517.6	428.3	9,251.8	611.1	38,769.4	76.1%	3,008.4
7.17	245.16	0.0	29,517.6	501.4	9,753.2	501.4	39,270.8	75.2%	3,008.4
7.33	245.33	0.0	29,517.6	501.4	10,254.6	501.4	39,772.2	74.2%	3,008.4
7.50	245.50	0.0	29,517.6	501.4	10,756.0	501.4	40,273.6	73.3%	3,008.4

WQ Drawdown @		2.83	ft=	62.68
Elevation	Q_{AVG} (CFS)	ΔV (CF)	ΔT (HR)	Total T
0.00	0.026	611	6.64	62.68
0.17	0.032	700	6.15	56.05
0.33	0.042	755	4.98	49.90
0.50	0.050	798	4.40	44.92
0.67	0.058	833	4.02	40.52
0.83	0.064	863	3.76	36.50
1.00	0.070	890	3.55	32.74
1.17	0.075	913	3.39	29.19
1.33	0.080	933	3.25	25.80
1.50	0.084	951	3.13	22.55
1.67	0.089	966	3.02	19.42
1.83	0.093	980	2.93	16.40
2.00	0.097	992	2.84	13.47
2.17	0.101	1003	2.76	10.62
2.33	0.105	1012	2.69	7.86
2.50	0.108	1020	2.62	5.17
2.67	0.112	1026	2.55	2.55
2.83				

CMP-2 Discharge to MWS BF-3-2

Discharge vs Elevation Table

Low orifice:	0.525 "	Top orifice:	0.75 "
Number:	4	Number:	0
Cg-low:	0.61	Cg-low:	0.61
invert elev:	0.00 ft	invert elev:	0.75 ft

h	H/D-low	H/D-mid	H/D-top	Qlow-orif	Qlow-weir	Qtot-low	Qmid-orif	Qmid-weir	Qtot-med	Qtop-orif	Qtop-weir	Qtot-top	Qpeak-top	Qtot
(ft)	-	-	-	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
0.17	3.81	0.00	0.00	0.011	0.016	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0112
0.33	7.62	0.00	0.00	0.016	1.321	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0164
0.50	11.43	0.00	0.00	0.020	14.762	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0204
0.67	15.24	2.42	0.00	0.024	73.005	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0236
0.83	19.05	4.85	1.33	0.027	242.879	0.027	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0265
1.00	22.86	7.27	4.00	0.029	637.724	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0291
1.17	26.67	9.70	6.67	0.031	1429.734	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0315
1.33	30.48	12.12	9.33	0.034	2862.302	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0337
1.50	34.29	14.55	12.00	0.036	5262.368	0.036	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0358
1.67	38.10	16.97	14.67	0.038	9052.761	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0378
1.83	41.90	19.39	17.33	0.040	14764.544	0.040	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0396
2.00	45.71	21.82	20.00	0.041	23049.363	0.041	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0414
2.17	49.52	24.24	22.67	0.043	34691.785	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0431
2.33	53.33	26.67	25.33	0.045	50621.653	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0448
2.50	57.14	29.09	28.00	0.046	71926.420	0.046	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0463
2.67	60.95	31.52	30.67	0.048	99863.503	0.048	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0479
2.83	64.76	33.94	33.33	0.049	135872.625	0.049	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0494
3.00	68.57	36.36	36.00	0.051	181588.157	0.051	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0508
3.17	72.38	38.79	38.67	0.052	238851.469	0.052	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0522

CMP #HMP-2 Stage Storage					
Input DCV			3,285		
Input Factor			2.05		
WQ Ponding Depth			3.000	ft	
Note: Find out the elevation value in relation to required WQ volume					
HMP-2-A Stage Storage					
depth	Average Surface area	area (ac)	elevation	Comulative volume (cf)	volume (acft)
0.00	1244.4	0.0286	0.00	0.0	0.0
0.17	1650.4	0.0379	0.17	252.7	0.00580
0.33	1811.9	0.0416	0.33	542.1	0.01244
0.50	1931.4	0.0443	0.50	854.4	0.01961
0.67	2028.1	0.0466	0.67	1,184.6	0.02720
0.83	2109.9	0.0484	0.83	1,529.6	0.03512
1.00	2180.6	0.0501	1.00	1,887.3	0.04333
1.17	2242.5	0.0515	1.17	2,256.0	0.05179
1.33	2297.3	0.0527	1.33	2,634.4	0.06048
1.50	2346.0	0.0539	1.50	3,021.5	0.06936
1.67	2389.3	0.0549	1.67	3,416.1	0.07842
1.83	2428.0	0.0557	1.83	3,817.6	0.08764
2.00	2462.3	0.0565	2.00	4,225.2	0.09700
2.17	2492.6	0.0572	2.17	4,638.2	0.10648
2.33	2519.4	0.0578	2.33	5,055.9	0.11607
2.50	2542.6	0.0584	2.50	5,477.8	0.12575
2.67	2562.7	0.0588	2.67	5,903.3	0.13552
2.83	2579.6	0.0592	2.83	6,331.8	0.14536
3.00	2593.6	0.0595	3.00	6,763.0	0.15526
3.17	2604.6	0.0598	3.17	7,196.2	0.16520
3.33	2612.9	0.0600	3.33	7,631.0	0.17518
3.50	2618.3	0.0601	3.50	8,067.0	0.18519
3.67	2621.1	0.0602	3.67	8,503.7	0.19522
3.83	2621.1	0.0602	3.83	8,940.5	0.20525
4.00	2618.3	0.0601	4.00	9,377.2	0.21527
4.17	2612.9	0.0600	4.17	9,813.2	0.22528
4.33	2604.6	0.0598	4.33	10,248.0	0.23526
4.50	2593.6	0.0595	4.50	10,681.2	0.24521
4.67	2579.6	0.0592	4.67	11,112.4	0.25510
4.83	2562.7	0.0588	4.83	11,540.9	0.26494
5.00	2542.6	0.0584	5.00	11,966.4	0.27471
5.17	2519.4	0.0578	5.17	12,388.3	0.28440
5.33	2492.6	0.0572	5.33	12,806.0	0.29399
5.50	2462.3	0.0565	5.50	13,219.0	0.30347
5.67	2428.0	0.0557	5.67	13,626.6	0.31282
5.83	2389.3	0.0549	5.83	14,028.1	0.32204
6.00	2346.0	0.0539	6.00	14,422.7	0.33110
6.17	2297.3	0.0527	6.17	14,809.8	0.33999
6.33	2242.5	0.0515	6.33	15,188.2	0.34867
6.50	2180.6	0.0501	6.50	15,556.9	0.35714
6.67	2109.9	0.0484	6.67	15,914.6	0.36535
6.83	2028.1	0.0466	6.83	16,259.6	0.37327
7.00	1931.4	0.0443	7.00	16,589.8	0.38085
7.17	1811.9	0.0416	7.17	16,902.1	0.38802
7.33	1650.4	0.0379	7.33	17,191.5	0.39466
7.50	1244.4	0.0286	7.50	17,444.2	0.40046
7.67	1244.4	0.0286	7.67	17,651.6	0.40522
7.83	1244.4	0.0286	7.83	17,859.0	0.40999
8.00	1244.4	0.0286	8.00	18,066.4	0.41475
8.17	1244.4	0.0286	8.17	18,273.8	0.41951

CONTECH ENGINEERED SOLUTIONS

Date: 8/7/2024
Project Name: East Storage-2 - 47954 (8-7-2024 0-5-24)

City / County:
State:

Designed By:
Company:
Telephone:

CMP: Underground Detention System
Storage Volume Estimation

=Adjustable Input Cells

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular applicaton and are subject to verification of the Engineer of Record. This tool is only applicable for rectangular shaped systems.

Summary of Inputs

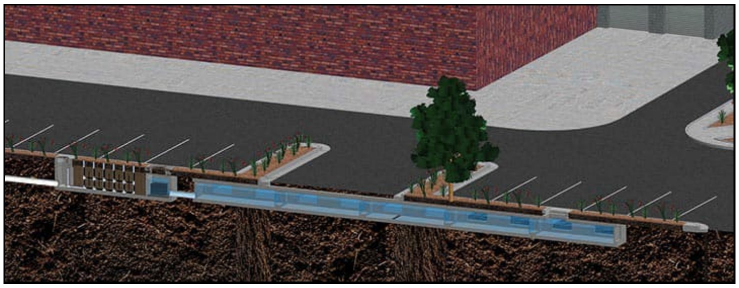
System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	100.0	Backfill Porosity (%):	40%	System Diameter (in):	90
Out-to-out width (ft):	28.5	Depth Above Pipe (in):	9.0	Pipe Spacing (in):	36
Number of Manifolds (ea):	1.0	Depth Below Pipe (in):	0.0	Incremental Analysis (in):	2
Number of Barrels (ea):	3.0	Width At Ends (ft):	1.0	System Invert (Elevation):	223.5
		Width At Sides (ft):	1.0		

Storage Volume Estimation

System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	Elevation (ft)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Percent Open Storage (%)	Ave. Surface Area (sf)
0.00	223.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	1,244.4
0.17	223.66	75.5	75.5	177.2	177.2	252.7	252.7	29.9%	1,650.4
0.33	223.83	136.6	212.1	152.7	329.9	289.4	542.1	39.1%	1,811.9
0.50	224.00	174.9	387.0	137.4	467.4	312.3	854.4	45.3%	1,931.4
0.67	224.16	204.7	591.7	125.5	592.9	330.2	1,184.6	49.9%	2,028.1
0.83	224.33	229.4	821.1	115.7	708.6	345.0	1,529.6	53.7%	2,109.9
1.00	224.50	250.5	1,071.5	107.2	815.8	357.7	1,887.3	56.8%	2,180.6
1.17	224.66	268.8	1,340.4	99.9	915.7	368.7	2,256.0	59.4%	2,242.5
1.33	224.83	285.0	1,625.4	93.4	1,009.0	378.4	2,634.4	61.7%	2,297.3
1.50	225.00	299.4	1,924.8	87.7	1,096.7	387.0	3,021.5	63.7%	2,346.0
1.67	225.16	312.1	2,236.9	82.5	1,179.2	394.7	3,416.1	65.5%	2,389.3
1.83	225.33	323.5	2,560.4	78.0	1,257.2	401.5	3,817.6	67.1%	2,428.0
2.00	225.50	333.6	2,894.0	74.0	1,331.2	407.6	4,225.2	68.5%	2,462.3
2.17	225.66	342.6	3,236.6	70.4	1,401.5	413.0	4,638.2	69.8%	2,492.6
2.33	225.83	350.5	3,587.2	67.2	1,468.7	417.7	5,055.9	71.0%	2,519.4
2.50	226.00	357.5	3,944.6	64.4	1,533.1	421.9	5,477.8	72.0%	2,542.6
2.67	226.16	363.5	4,308.1	62.0	1,595.2	425.5	5,903.3	73.0%	2,562.7
2.83	226.33	368.6	4,676.7	60.0	1,655.1	428.6	6,331.8	73.9%	2,579.6
3.00	226.50	372.9	5,049.6	58.2	1,713.3	431.1	6,763.0	74.7%	2,593.6
3.17	226.66	376.4	5,426.0	56.9	1,770.2	433.2	7,196.2	75.4%	2,604.6
3.33	226.83	379.1	5,805.1	55.8	1,826.0	434.8	7,631.0	76.1%	2,612.9
3.50	227.00	381.0	6,186.0	55.0	1,881.0	436.0	8,067.0	76.7%	2,618.3
3.67	227.16	382.1	6,568.1	54.6	1,935.6	436.7	8,503.7	77.2%	2,621.1
3.83	227.33	382.5	6,950.6	54.4	1,990.0	436.9	8,940.5	77.7%	2,621.1
4.00	227.50	382.1	7,332.7	54.6	2,044.5	436.7	9,377.2	78.2%	2,618.3
4.17	227.66	381.0	7,713.6	55.0	2,099.6	436.0	9,813.2	78.6%	2,612.9
4.33	227.83	379.1	8,092.7	55.8	2,155.3	434.8	10,248.0	79.0%	2,604.6
4.50	228.00	376.4	8,469.0	56.9	2,212.2	433.2	10,681.2	79.3%	2,593.6
4.67	228.16	372.9	8,841.9	58.2	2,270.4	431.1	11,112.4	79.6%	2,579.6
4.83	228.33	368.6	9,210.6	60.0	2,330.4	428.6	11,540.9	79.8%	2,562.7
5.00	228.50	363.5	9,574.0	62.0	2,392.4	425.5	11,966.4	80.0%	2,542.6
5.17	228.66	357.5	9,931.5	64.4	2,456.8	421.9	12,388.3	80.2%	2,519.4
5.33	228.83	350.5	10,282.0	67.2	2,524.0	417.7	12,806.0	80.3%	2,492.6
5.50	229.00	342.6	10,624.6	70.4	2,594.3	413.0	13,219.0	80.4%	2,462.3
5.67	229.16	333.6	10,958.3	74.0	2,668.3	407.6	13,626.6	80.4%	2,428.0
5.83	229.33	323.5	11,281.8	78.0	2,746.3	401.5	14,028.1	80.4%	2,389.3
6.00	229.50	312.1	11,593.9	82.5	2,828.8	394.7	14,422.7	80.4%	2,346.0
6.17	229.66	299.4	11,893.3	87.7	2,916.5	387.0	14,809.8	80.3%	2,297.3
6.33	229.83	285.0	12,178.3	93.4	3,009.9	378.4	15,188.2	80.2%	2,242.5
6.50	230.00	268.8	12,447.1	99.9	3,109.7	368.7	15,556.9	80.0%	2,180.6
6.67	230.16	250.5	12,697.6	107.2	3,217.0	357.7	15,914.6	79.8%	2,109.9
6.83	230.33	229.4	12,926.9	115.7	3,332.6	345.0	16,259.6	79.5%	2,028.1
7.00	230.50	204.7	13,131.6	125.5	3,458.2	330.2	16,589.8	79.2%	1,931.4
7.17	230.66	174.9	13,306.5	137.4	3,595.6	312.3	16,902.1	78.7%	1,811.9
7.33	230.83	136.6	13,443.1	152.7	3,748.3	289.4	17,191.5	78.2%	1,650.4
7.50	231.00	75.5	13,518.7	177.2	3,925.5	252.7	17,444.2	77.5%	1,244.4
7.67	231.16	0.0	13,518.7	207.4	4,132.9	207.4	17,651.6	76.6%	1,244.4
7.83	231.33	0.0	13,518.7	207.4	4,340.3	207.4	17,859.0	75.7%	1,244.4
8.00	231.50	0.0	13,518.7	207.4	4,547.7	207.4	18,066.4	74.8%	1,244.4
8.17	231.66	0.0	13,518.7	207.4	4,755.1	207.4	18,273.8	74.0%	1,244.4

WQ Drawdown @		3.00	ft=	62.00
Elevation	Q_{AVG} (CFS)	ΔV (CF)	ΔT (HR)	Total T
0.00	0.011	253	6.27	62.00
0.17	0.014	289	5.82	55.74
0.33	0.018	312	4.72	49.92
0.50	0.022	330	4.17	45.20
0.67	0.025	345	3.82	41.03
0.83	0.028	358	3.57	37.21
1.00	0.030	369	3.38	33.64
1.17	0.033	378	3.22	30.26
1.33	0.035	387	3.09	27.03
1.50	0.037	395	2.98	23.94
1.67	0.039	402	2.88	20.96
1.83	0.041	408	2.79	18.07
2.00	0.042	413	2.71	15.28
2.17	0.044	418	2.64	12.56
2.33	0.046	422	2.57	9.92
2.50	0.047	425	2.51	7.35
2.67	0.049	429	2.45	4.84
2.83	0.050	431	2.39	2.39
3.00				

Volume based Sizing letter from Contech will be provided during Final Engineering.



63 Hr

Volume Based Sizing

Many states require treatment of a water quality volume and do not offer the option of flow based design. The MWS Linear and its unique horizontal flow makes it the only biofilter that can be used in volume based design installed downstream of ponds, detention basins, and underground storage systems.

Model #	Treatment Capacity (cu. ft.) @ 24-Hour Drain Down	Treatment Capacity (cu. ft.) @ 48-Hour Drain Down	
MWS-L-4-4	1140	2280	
MWS-L-4-6	1600	3200	
MWS-L-4-8	2518	5036	6609
MWS-L-4-13	3131	6261	
MWS-L-4-15	3811	7623	
MWS-L-4-17	4492	8984	
MWS-L-4-19	5172	10345	
MWS-L-4-21	5853	11706	
MWS-L-6-8	3191	6382	
MWS-L-8-8	5036	10072	
MWS-L-8-12	7554	15109	19,830
MWS-L-8-16	10073	20145	
MWS-L-8-20	12560	25120	
MWS-L-8-24	15108	30216	

considerations to provide for continued effectiveness of pollutant and flow control functions.

Biofiltration Criteria Checklist

The applicant shall provide documentation of compliance with each criterion in this checklist as part of the project submittal. The right column of this checklist identifies the submittal information that is recommended to document compliance with each criterion. Biofiltration BMPs that substantially meet all aspects of Fact Sheets PR-1 or BF-1 should still use this checklist; however additional documentation (beyond what is already required for project submittal) should not be required.

1. **Biofiltration BMPs shall be allowed to be used only as described in the BMP selection process based on a documented feasibility analysis.**

Intent: This manual defines a specific prioritization of pollutant treatment BMPs, where BMPs that retain water (retained includes evapotranspired, infiltrated, and/or harvested and used) must be used before considering BMPs that have a biofiltered discharge to the MS4 or surface waters. Use of a biofiltration BMP in a manner in conflict with this prioritization (i.e., without a feasibility analysis justifying its use) is not permitted, regardless of the adequacy of the sizing and design of the system.

☒	The project applicant has demonstrated that it is not technically feasible to retain the full DCV onsite. Stormwater management investigation has been provided Attachment 6	Document feasibility analysis and findings in …t submittalSWQMP per Appendix C.

2. **Biofiltration BMPs must be sized using acceptable sizing methods.**

Intent: The MS4 Permit and this manual defines specific sizing methods that must be used to size biofiltration BMPs. Sizing of biofiltration BMPs is a fundamental factor in the amount of storm water that can be treated and also influences volume and pollutant retention processes.

☒	The project applicant has demonstrated that biofiltration BMPs are sized to meet one of the biofiltration sizing options available	Submit sizing worksheets (Appendix B.5) or other equivalent documentation with the

The MWS BF-3-1 and BF-3-2 were sized to biofilter 2 DCV.within 63 hrs to treat 92% of the annual captured volume. For BF-3-3 Section F.2.2 of the BMP manual was used to design a flow based MWs unit.

3. **Biofiltration BMPs must be sited and designed to achieve maximum feasible infiltration and evapotranspiration.**

Intent: Various decisions about BMP placement and design influence how much water is retained via infiltration and evapotranspiration. The MS4 Permit requires that biofiltration BMPs achieve maximum feasible retention (evapotranspiration and infiltration) of storm water volume.

Min retention met on site using dispersion

☒	The biofiltration BMP is sited to allow for maximum infiltration of runoff volume based on the feasibility factors considered in site planning efforts. It is also designed to maximize evapotranspiration through the use of amended media and plants (biofiltration designs without amended media and plants may be permissible; see Item 5).	Document site planning and feasibility analyses in SWQMP per Section 5.4.
☒	For biofiltration BMPs categorized as "Partial Infiltration Condition" the infiltration storage depth in the biofiltration design has been selected to drain in 36 hours (+/-25%) or an alternative value shown to maximize infiltration on the site.	Included documentation of estimated infiltration rate per Appendix D; provide calculations using Appendix B.4 and B.5 to show that the infiltration storage depth meets this criterion. Note, depths that are too shallow or too deep may not be acceptable.
☒	For biofiltration BMP locations categorized as "Partial Infiltration Condition," the infiltration storage is over the entire bottom of the biofiltration BMP footprint.	Document on plans that the infiltration storage covers the entire bottom of the BMP (i.e., not just underdrain trenches); or an equivalent footprint elsewhere on the site.
☒	For biofiltration BMP locations categorized as "Partial Infiltration Condition," the sizing factor used for the infiltration storage area is not less than the minimum biofiltration BMP sizing factors calculated using Worksheet B.5.1 to achieve 40% average annual percent capture within the BMP or downstream of the BMP. .	Provide a table that compares the minimum sizing factor per Appendix B.5 to the provided sizing factor. Note: The infiltration storage area could be a separate storage feature located downstream of the biofiltration BMP, not necessarily within the same footprint.
☒	An impermeable liner or other hydraulic restriction layer is only used when needed to avoid geotechnical and/or subsurface contamination issues in locations identified as "No Infiltration Condition."	If using an impermeable liner or hydraulic restriction layer, provide documentation of feasibility findings per Appendix C that recommend the use of this feature.
☒	The use of "compact" biofiltration BMP design[2] is permitted only in conditions identified as "No Infiltration Condition" and where site-specific documentation demonstrates that the use of larger footprint biofiltration BMPs would be infeasible.	Provide documentation of feasibility findings that recommend no infiltration is feasible. Provide site-specific information to demonstrate that a larger footprint biofiltration BMP would not be feasible.

[2] Compact biofiltration BMPs are defined as features with infiltration storage footprint less than the minimum sizing factors required to achieve 40% volume retention. Note that if a biofiltration BMP is accompanied by an infiltrating area downstream that has a footprint equal to at least the minimum sizing factors calculated using

4. Biofiltration BMPs must be designed with a hydraulic loading rate to maximize pollutant retention, preserve pollutant control processes, and minimize potential for pollutant washout.

Intent: Various decisions about biofiltration BMP design influence the degree to which pollutants are retained. The MS4 Permit requires that biofiltration BMPs achieve maximum feasible retention of storm water pollutants.

☒	Media selected for the biofiltration BMP meets minimum quality and material specifications per 2021 City of San Diego Storm Water Standards or County BMP Design Manual, including the maximum allowable design filtration rate and minimum thickness of media.	Provide documentation that media meets the specifications in 2021 City of San Diego Storm Water Standards or County BMP Design Manual.
	OR	
☒	Alternatively, for proprietary designs and custom media mixes not meeting the media specifications contained in the 2021 City of San Diego Storm Water Standards or County BMP Design Manual, field scale testing data are provided to demonstrate that proposed media meets the pollutant treatment performance criteria in Section F.1 below.	Provide documentation of performance information as described in Section F.1 For BMP design and pollutant removal a TAPE certified for MWS unit has been provided In attachment 1e
☒	To the extent practicable, filtration rates are outlet controlled (e.g., via an underdrain and orifice/weir) instead of controlled by the infiltration rate of the media.	Include outlet control in designs or provide documentation of why outlet control is not practicable.
☒	The water surface drains to at least 12 inches below the media surface within 24 hours from the end of storm event flow to preserve plant health and promote healthy soil structure.	Include calculations to demonstrate that drawdown rate is adequate. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the City Engineer if certified by a landscape architect or agronomist.

Worksheet B.5.1 assuming a partial infiltration condition, then it is not considered to be a compact biofiltration BMP for the purpose of Item 4 of the checklist. For potential configurations with a higher rate biofiltration BMP upstream of an larger footprint infiltration area, the BMP would still need to comply with Item 5 of this checklist for pollutant treatment effectiveness.

☒	If nutrients are a pollutant of concern, design of the biofiltration BMP follows nutrient-sensitive design criteria.	Follow specifications for nutrient sensitive design in Fact Sheet BF-2. Or provide alternative documentation that nutrient treatment is addressed and potential for nutrient release is minimized.
☒	Media gradation calculations or geotextile selection calculations demonstrate that migration of media between layers will be prevented and permeability will be preserved.	Follow specification for choking layer or geotextile in Fact Sheet PR-1 or BF-1. Or include calculations to demonstrate that choking layer is appropriately specified.

5. Biofiltration BMPs must be designed to promote appropriate biological activity to support and maintain treatment processes.

Intent: Biological processes are an important element of biofiltration performance and longevity.

☒	Plants have been selected to be tolerant of project climate, design ponding depths and the treatment media composition.	Provide documentation justifying plant selection. Refer to the plant list in Appendix E.20.

These open-top vegetated biofiltration BMP systems promote biological processes found in both upland bio-retention systems and subsurface wetlands. The system utilizes an advanced horizontal flow design to ensure maximum contact with the wetland media. Bacterial growth, supported by the adjusted loads of the wetland media performs a number of treatment processes. These vary as a function of moisture, temperature, pH, salinity, and pollutant concentrations. Biologically available forms of nitrogen, phosphorus, and carbon are actively taken into the cells of the biofilm created within the subsurface wetland, and are used for metabolic processes (i.e., energy production and growth). Nitrogen and phosphorus are actively taken up as nutrients that are vital for a number of cell functions, growth, and energy production. These processes remove metabolites from the media during and between storm events, making the media available to capture more nutrients from subsequent storms. Soil organisms in the wetland chamber can break down a wide array of organic compounds into less toxic forms or completely break them down into carbon dioxide and water (Means and Hinchee 1994). Bacteria can also cause metals to precipitate out as salts, bind them within organic material, and accumulate metals in nodules within the cells. The MWS is approved under TAPE protocol with and without plants meeting the minimum requirements set forth in the performance standard. The development of a schmutzdecke (a biological layer) within this subsurface application creates a diversity of microorganisms that meets the necessary requirement for biological activity.

	processes (e.g., biofilm in a subsurface flow wetland).	support effective treatment and how they will be sustained.

6. Biofiltration BMPs must be designed with a hydraulic loading rate to prevent erosion, scour, and channeling within the BMP.

Intent: Erosion, scour, and/or channeling can disrupt treatment processes and reduce biofiltration effectiveness.

☒	Scour protection has been provided for both sheet flow and pipe inflows to the BMP, where needed.	Provide documentation of scour protection as described in Fact Sheets PR-1 or BF-1 or
☒	Where scour protection has not been provided, flows into and within the BMP are kept to non-erosive velocities.	PR-1 or BF-1 or approved equivalent.

For BMP design and pollutant removal a TAPE certified for MWS unit has been provided In attachment 1e

☐	For proprietary BMPs, the BMP is used in a manner consistent with manufacturer guidelines and conditions of its third-party certification[3] (i.e., maximum tributary area, maximum inflow velocities, etc., as applicable).	Provide copy of manufacturer recommendations and conditions of third-party certification.

7. Biofiltration BMP must include operations and maintenance design features and planning considerations for continued effectiveness of pollutant and flow control functions.

Intent: Biofiltration BMPs require regular maintenance in order provide ongoing function as intended. Additionally, it is not possible to foresee and avoid potential issues as part of design; therefore plans must be in place to correct issues if they arise.

☐	The biofiltration BMP O&M plan describes specific inspection activities, regular/p maintenance activities and specific co actions relating to scour, erosion, char media clogging, vegetation health, and inflow and outflow structures.	attachment 3
☐	Adequate site area and features have been provided for BMP inspection and maintenance access.	Illustrate maintenance access routes, setbacks, maintenance features as needed on project water quality plans.
☐	For proprietary biofiltration BMPs, the BMP maintenance plan is consistent with manufacturer guidelines and conditions of its third-party certification (i.e., maintenance activities, frequencies).	Provide copy of manufacturer recommendations and conditions of third-party certification.

[3] Certifications or verifications issued by the Washington Technology Acceptance Protocol-Ecology program and the New Jersey Corporation for Advanced Technology programs are typically accompanied by a set of guidelines regarding appropriate design and maintenance conditions that would be consistent with the certification/verification

January 2024

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS) METALS AND PHOSPHORUS TREATMENT

For

Contech Engineered Solutions, LLC (Contech) Modular Wetlands Linear

Ecology's Decision

Based on Modular Wetland Systems, Inc, application submissions, including the Technical Evaluation Report, dated April 1, 2014, Ecology hereby issues the following use level designation:

1. General Use Level Designation (GULD) for the Modular Wetlands Linear Stormwater Treatment System for Basic, Phosphorus, and Metals treatment
    - Sized at a hydraulic loading rate of:
        - 1 gallon per minute (gpm) per square foot (sq ft) of Wetland Cell Surface Area
        - Prefilter box (approved at either 22 inches or 33 inches tall)
            - 3.0 gpm/sq ft of prefilter box surface area for moderate pollutant loading rates (low to medium density residential basins).
            - 2.1 gpm/sq ft of prefilter box surface area for high pollutant loading rates (commercial and industrial basins).
2. Ecology approves the Modular Wetlands Linear Stormwater Treatment System units for Basic, Phosphorus, and Metals treatment at the hydraulic loading rate listed above. Designers shall calculate the water quality design flow rates using the following procedures:
    - Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute water quality treatment design flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology- approved continuous runoff model.

- Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute water quality treatment design flow rate as calculated using one of the three methods described in Chapter 2.7.6 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
- Entire State: For treatment installed downstream of detention, the water quality treatment design flow rate is the full 2-year release rate of the detention facility.

3. These use level designations have no expiration date but may be amended or revoked by Ecology, and are subject to the conditions specified below.

Ecology's Conditions of Use

Applicants shall comply with the following conditions:

1) Design, assemble, install, operate, and maintain the Modular Wetlands Linear Stormwater Treatment System units, in accordance with Contech's. applicable manuals and documents and the Ecology Decision.
2) Each site plan must undergo Contech review and approval before site installation. This ensures that site grading and slope are appropriate for use of a Modular Wetlands Linear Stormwater Treatment System unit.
3) Modular Wetlands Linear Stormwater Treatment System media shall conform to the specifications submitted to and approved by Ecology.
4) The applicant tested the Modular Wetlands Linear Stormwater Treatment System with an external bypass weir. This weir limited the depth of water flowing through the media, and therefore the active treatment area, to below the root zone of the plants. This GULD applies to Modular Wetlands Linear Stormwater Treatment Systems whether plants are included in the final product or not.
5) Maintenance: The required maintenance interval for stormwater treatment devices is often dependent upon the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of stormwater treatment technology.
    - Typically, Contech designs Modular Wetland systems for a target prefilter media life of 6 to 12 months.
    - Indications of the need for maintenance include effluent flow decreasing to below the design flow rate or decrease in treatment below required levels.
    - Owners/operators must inspect Modular Wetland systems for a minimum of twelve months from the start of post-construction operation to determine site-specific maintenance schedules and requirements. You must conduct inspections monthly during the wet season, and every other month during the dry season (According to the SWMMWW, the wet season in western Washington is October 1 to April 30. According to the SWMMEW, the wet

season in eastern Washington is October 1 to June 30). After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.

- Conduct inspections by qualified personnel, follow manufacturer's guidelines, and use methods capable of determining either a decrease in treated effluent flowrate and/or a decrease in pollutant removal ability.
- When inspections are performed, the following findings typically serve as maintenance triggers:
  - Standing water remains in the vault between rain events, or
  - Bypass occurs during storms smaller than the design storm.
  - If excessive floatables (trash and debris) are present (but no standing water or excessive sedimentation), perform a minor maintenance consisting of gross solids removal, not prefilter media replacement.
  - Additional data collection will be used to create a correlation between pretreatment chamber sediment depth and pre-filter clogging (see *Issues to be Addressed by the Company* section below)

6) Discharges from the Modular Wetlands Linear Stormwater Treatment System units shall not cause or contribute to water quality standards violations in receiving waters.

Applicant: Contech Engineered Solutions, LLC

Applicant's Address: 11815 NE Glenn Widing Dr.
Portland, OR 97220

Application Documents:

Original Application for Conditional Use Level Designation, Modular Wetland System, Linear Stormwater Filtration System Modular Wetland Systems, Inc., January 2011

Quality Assurance Project Plan: Modular Wetland System – Linear Treatment System Performance Monitoring Project, draft, January 2011

Revised Application for Conditional Use Level Designation, Modular Wetland System, Linear Stormwater Filtration System Modular Wetland Systems, Inc., May 2011

Memorandum: Modular Wetland System-Linear GULD Application Supplementary Data, April 2014

Technical Evaluation Report: Modular Wetland System Stormwater Treatment System Performance Monitoring, April 2014

Applicant's Use Level Request:

- General Use Level Designation as a Basic, Metals, and Phosphorus treatment device in accordance with Ecology's Guidance for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) January 2011 Revision.

Applicant's Performance Claims:

- The Modular Wetlands Linear is capable of removing a minimum of 80-percent of TSS from stormwater with influent concentrations between 100 and 200 mg/L.
- The Modular Wetlands Linear is capable of removing a minimum of 50-percent of total phosphorus from stormwater with influent concentrations between 0.1 and 0.5 mg/L.
- The Modular Wetlands Linear is capable of removing a minimum 30-percent of dissolved copper from stormwater with influent concentrations between 0.005 and 0.020 mg/L.
- The Modular Wetlands Linear is capable of removing a minimum 60-percent of dissolved zinc from stormwater with influent concentrations between 0.02 and 0.30 mg/L.

Ecology's Recommendations:

- Contech has shown Ecology, through laboratory and field-testing, that the Modular Wetlands Linear Stormwater Treatment System filter system is capable of attaining Ecology's Basic, Phosphorus, and Metals treatment goals.

Findings of Fact:

<u>Laboratory Testing</u>

The Modular Wetlands Linear Stormwater Treatment System has the:

- Capability to remove 99 percent of total suspended solids (using Sil-Co-Sil 106) in a quarter-scale model with influent concentrations of 270 mg/L.
- Capability to remove 91 percent of total suspended solids (using Sil-Co-Sil 106) in laboratory conditions with influent concentrations of 84.6 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 93 percent of dissolved Copper in a quarter-scale model with influent concentrations of 0.757 mg/L.
- Capability to remove 79 percent of dissolved Copper in laboratory conditions with influent concentrations of 0.567 mg/L at a flow rate of 3.0 gpm per square foot of media.

- Capability to remove 80.5-percent of dissolved Zinc in a quarter-scale model with influent concentrations of 0.95 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 78-percent of dissolved Zinc in laboratory conditions with influent concentrations of 0.75 mg/L at a flow rate of 3.0 gpm per square foot of media.

Field Testing

- Modular Wetland Systems, Inc. conducted monitoring of an MWS-Linear (Model # MWS-L-4-13) from April 2012 through May 2013, at a transportation maintenance facility in Portland, Oregon. The manufacturer collected flow-weighted composite samples of the system's influent and effluent during 28 separate storm events. The system treated approximately 75 percent of the runoff from 53.5 inches of rainfall during the monitoring period. The applicant sized the system at 1 gpm/sq ft. (wetland media) and 3gpm/sq ft. (prefilter).
- Influent TSS concentrations for qualifying sampled storm events ranged from 20 to 339 mg/L. Average TSS removal for influent concentrations greater than 100 mg/L (n=7) averaged 85 percent. For influent concentrations in the range of 20-100 mg/L (n=18), the upper 95 percent confidence interval about the mean effluent concentration was 12.8 mg/L.
- Total phosphorus removal for 17 events with influent TP concentrations in the range of 0.1 to 0.5 mg/L averaged 65 percent. A bootstrap estimate of the lower 95 percent confidence limit (LCL95) of the mean total phosphorus reduction was 58 percent.
- The lower 95 percent confidence limit of the mean percent removal was 60.5 percent for dissolved zinc for influent concentrations in the range of 0.02 to 0.3 mg/L (n=11). The lower 95 percent confidence limit of the mean percent removal was 32.5 percent for dissolved copper for influent concentrations in the range of 0.005 to 0.02 mg/L (n=14) at flow rates up to 28 gpm (design flow rate 41 gpm). Laboratory test data augmented the data set, showing dissolved copper removal at the design flow rate of 41 gpm (93 percent reduction in influent dissolved copper of 0.757 mg/L).

Issues to be addressed by the Company:

1. Contech should collect maintenance and inspection data for the first year on all installations in the Northwest in order to assess standard maintenance requirements for various land uses in the region. Contech should use these data to establish required maintenance cycles.
2. Contech should collect pre-treatment chamber sediment depth data for the first year of operation for all installations in the Northwest. Contech will use these data to create a correlation between sediment depth and pre-filter clogging.

Technology Description:
Download at https://www.conteches.com/modular-wetlands

Contact Information:

Applicant: Jeremiah Lehman
Contech Engineered Solutions, LLC
11815 NE Glenn Widing Dr.
Portland, OR 97220
Jeremiah.Lehman@ContechES.com

Applicant website: http://www.conteches.com

Ecology web link: http://www.ecy.wa.gov/programs/wg/stormwater/newtech/index.html

Ecology: Douglas C. Howie, P.E.
Department of Ecology
Water Quality Program
(360) 870-0983
douglas.howie@ecy.wa.gov

Revision History

Date	Revision
June 2011	Original use-level-designation document
September 2012	Revised dates for TER and expiration
January 2013	Modified Design Storm Description, added Revision Table, added maintenance discussion, modified format in accordance with Ecology standard
December 2013	Updated name of Applicant
April 2014	Approved GULD designation for Basic, Phosphorus, and Enhanced treatment
December 2015	Updated GULD to document the acceptance of MWS – Linear Modular Wetland installations with or without the inclusion of plants
July 2017	Revised Manufacturer Contact Information (name, address, and email)
December 2019	Revised Manufacturer Contact Address
July 2021	Added additional prefilter sized at 33 inches
August 2021	Changed "Prefilter" to "Prefilter box"
November 2022	Changed Contacts to Contech ES
January 2024	Revised Dissolved Metals (Enhanced) to Metals

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:

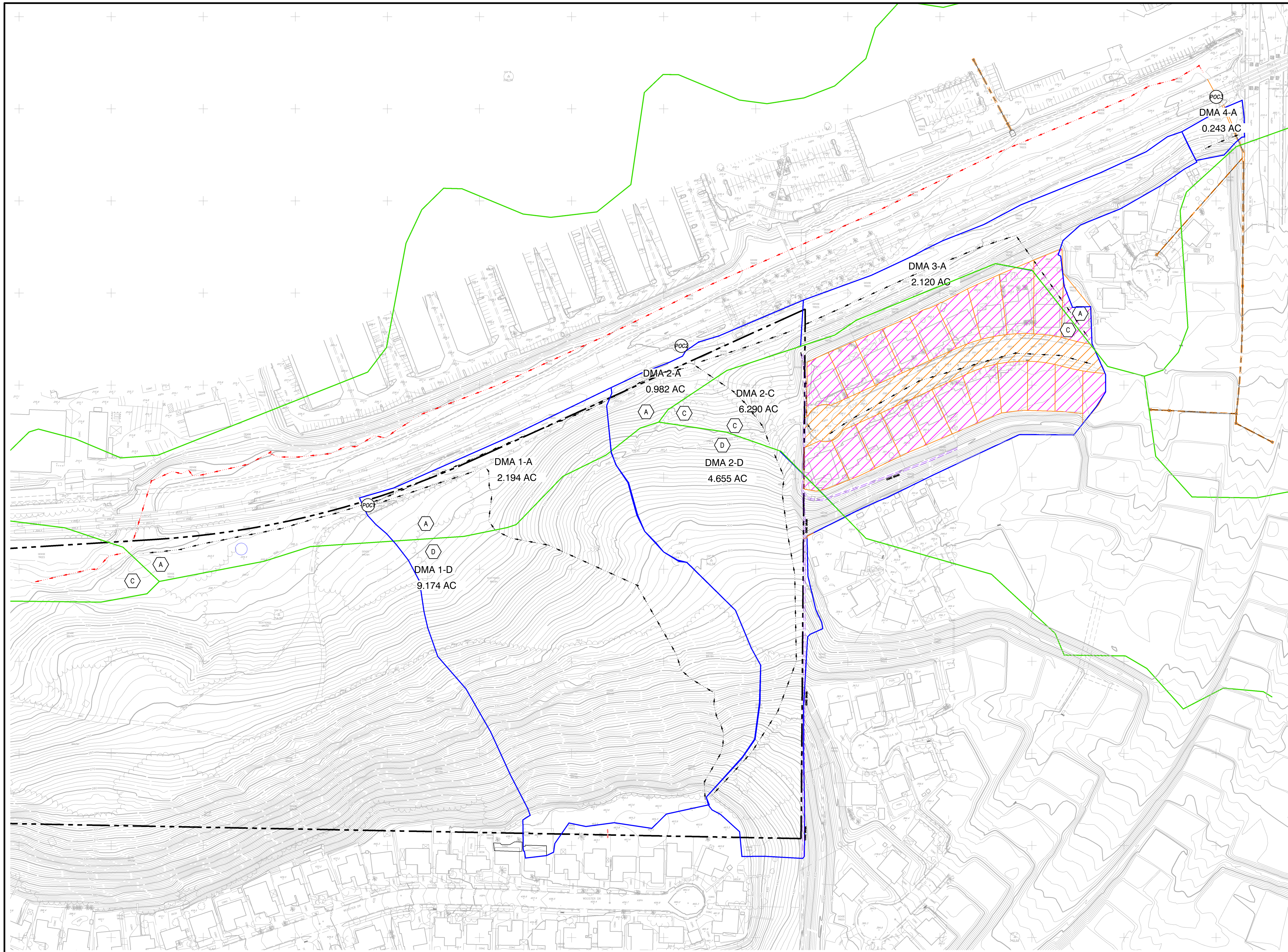
The Hydromodification Management Exhibit must identify:

☒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.



LEGEND

- PROJECT BOUNDARY
- DRAINAGE BOUNDARY
- LOMA ALTA CREEK
- FLOW DIRECTION
- 00.00 ACRES — AREA
- X — HYDROLOGIC SOIL TYPE
- POC — POINT OF COMPLIANCE
- EXISTING STORM DRAIN SYSTEM
- EXISTING SINGLE FAMILY DEVELOPMENT 65% IMPERVIOUSNESS
- EXISTING ROADS 90% IMPERVIOUSNESS
- HYDROLOGIC SOIL GROUP BOUNDARY

100 0 100 200 300
SCALE 1"= 100'

PREPARED BY:
HUNSAKER & ASSOCIATES SAN DIEGO, INC
PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 · FX(858)558-1414

PRE-DEVELOPED CONDITIONS
HYDROMODIFICATION EXHIBIT

OLIVE PARK APARTMENTS

CITY OF OCEANSIDE, CALIFORNIA

MAP 1 OF 1

W.O.# 3785-0002

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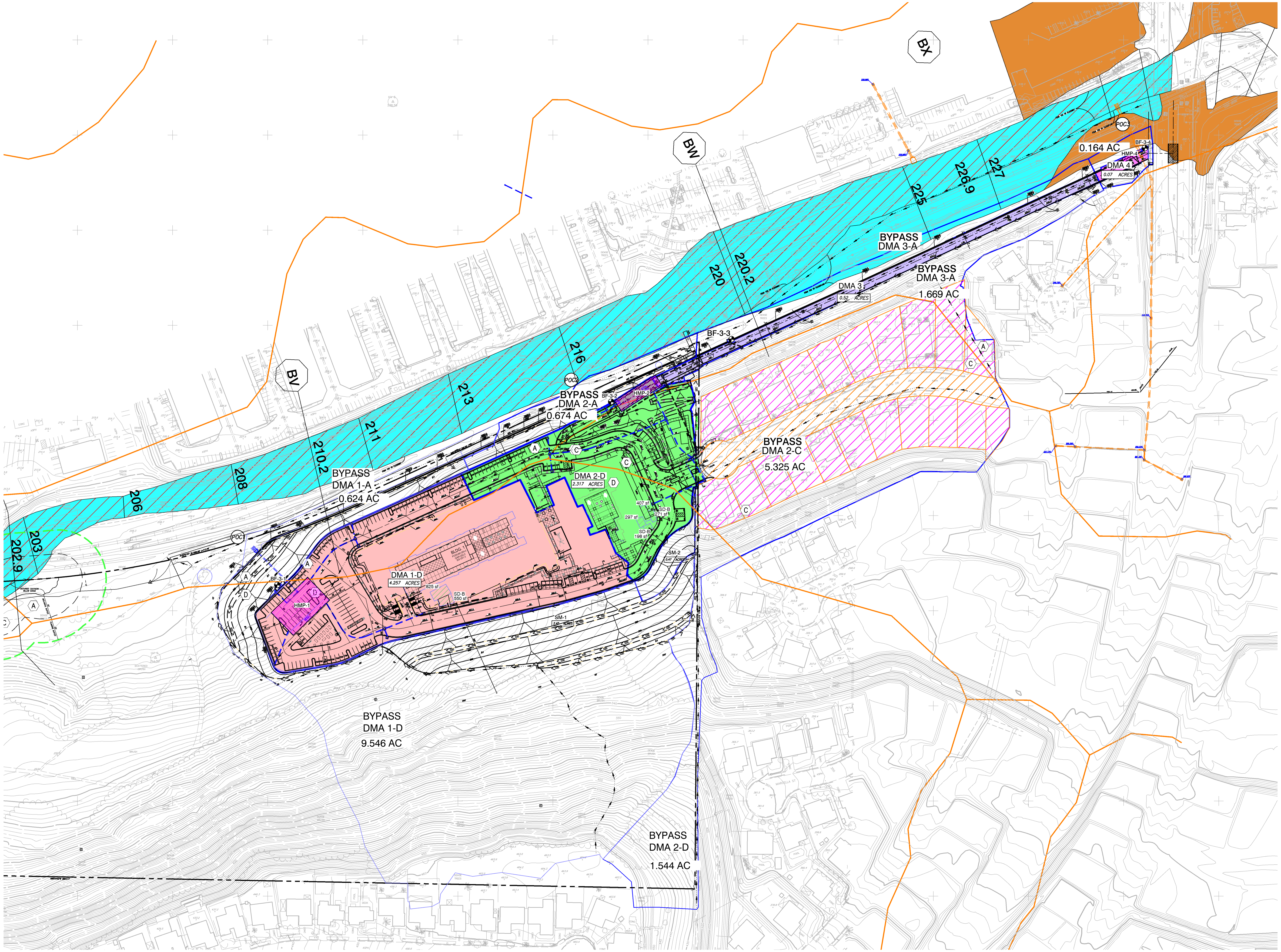

LEGEND: SYMBOL:

- PROJECT BOUNDARY
- DMA BOUNDARY
- PROPOSED STORM DRAIN
- EXISTING STORM DRAIN
- FLOW LINE
- SUBAREA ACREAGE — 00.00 ACRES
- DMA ICON — DMA
- DMA 1
- DMA 2
- DMA 3
- DMA 4
- INLET
- HYDROLOGIC SOIL TYPE — D
- POINT OF COMPLIANCE — X
- STRUCTURAL BMP\ MWS UNIT
- UNDERGROUND STORAGE FACILITY
- SOIL TYPE BOUNDARY
- HMP ICON — HMP
- BMP ICON — BF
- 100-YEAR FLOOD WAY PER FEMA FIRM
- 100-YEAR FLOOD PLAIN PER FEMA FIRM\ ZONE AE
- 500-YEAR FLOOD PLAIN PER FEMA FIRM\ ZONE X
- FEMA CROSS SECTION — BW 220.2

100 0 100 200 300

SCALE 1"= 100'

PREPARED BY:

HUNSAKER & ASSOCIATES SAN DIEGO, INC

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POST-DEVELOPED CONDITIONS HYDROMODIFICATION EXHIBIT

OLIVE PARK APARTMENTS

CITY OF OCEANSIDE, CALIFORNIA

MAP 1 OF 1

W.O.# 3785-0002

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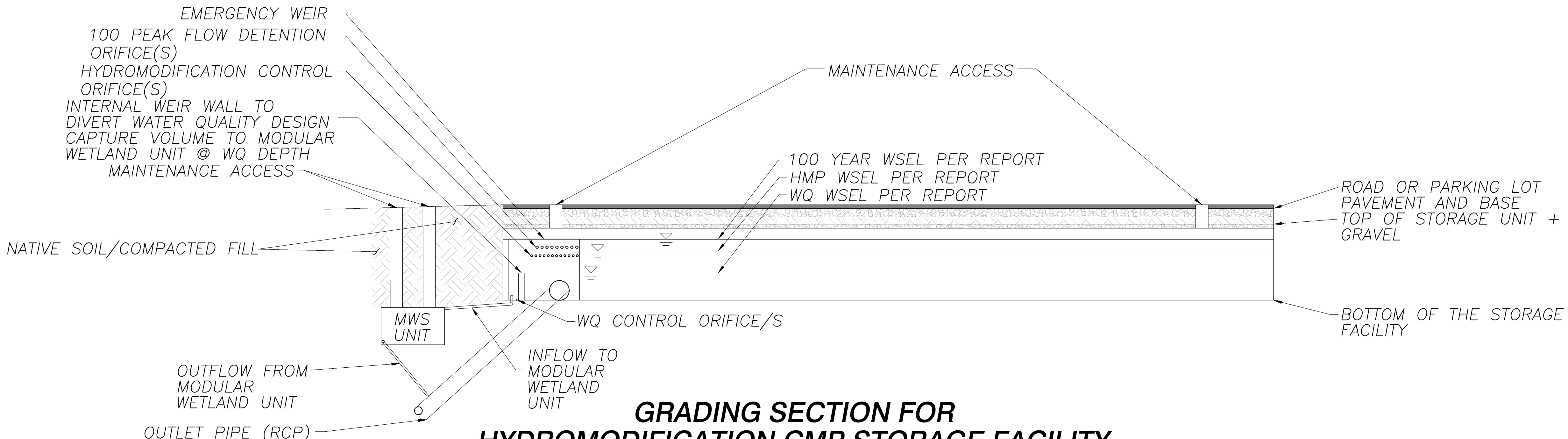
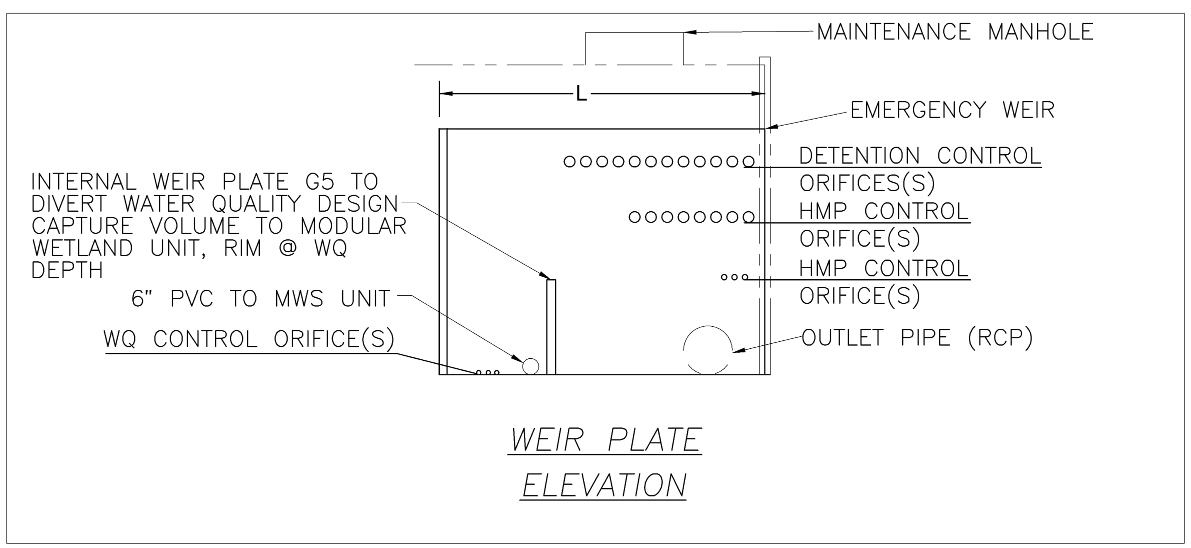


GRADING SECTION FOR HYDROMODIFICATION CMP STORAGE FACILITY

PRIVATE

NOT TO SCALE



TYPICAL RISER DETAIL

NOT TO SCALE

RISER ORIFICE CONFIGURATION SUMMARY

RISER #	RISER 1	RISER 2
WQ ORIFICE(S)	8–0.5625" @ 0	4–0.525" @ 0
WQ DEPTH	2.83'	3.00'
LOW ORIFICE(S)	1–0.5" @ 2.83'	1–0.5" @ 3.00'
MIDDLE ORIFICE(S)	10–2" @ 4.75'	1–4" @ 5.50'
TOP ORIFICE(S)	12–4" @ 5.00'	12–3" @ 6.00'
EMERGENCY RISER	3'x4' @ 6.40'	3'x4' @ 7.00'

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CONCEPTUAL STORAGE FACILITIES & RISER DETAILS

OLIVE PARK APARTMENTS

CITY OF OCEANSIDE, CALIFORNIA

MAP 1 OF 1

W.O.# 3785-0002

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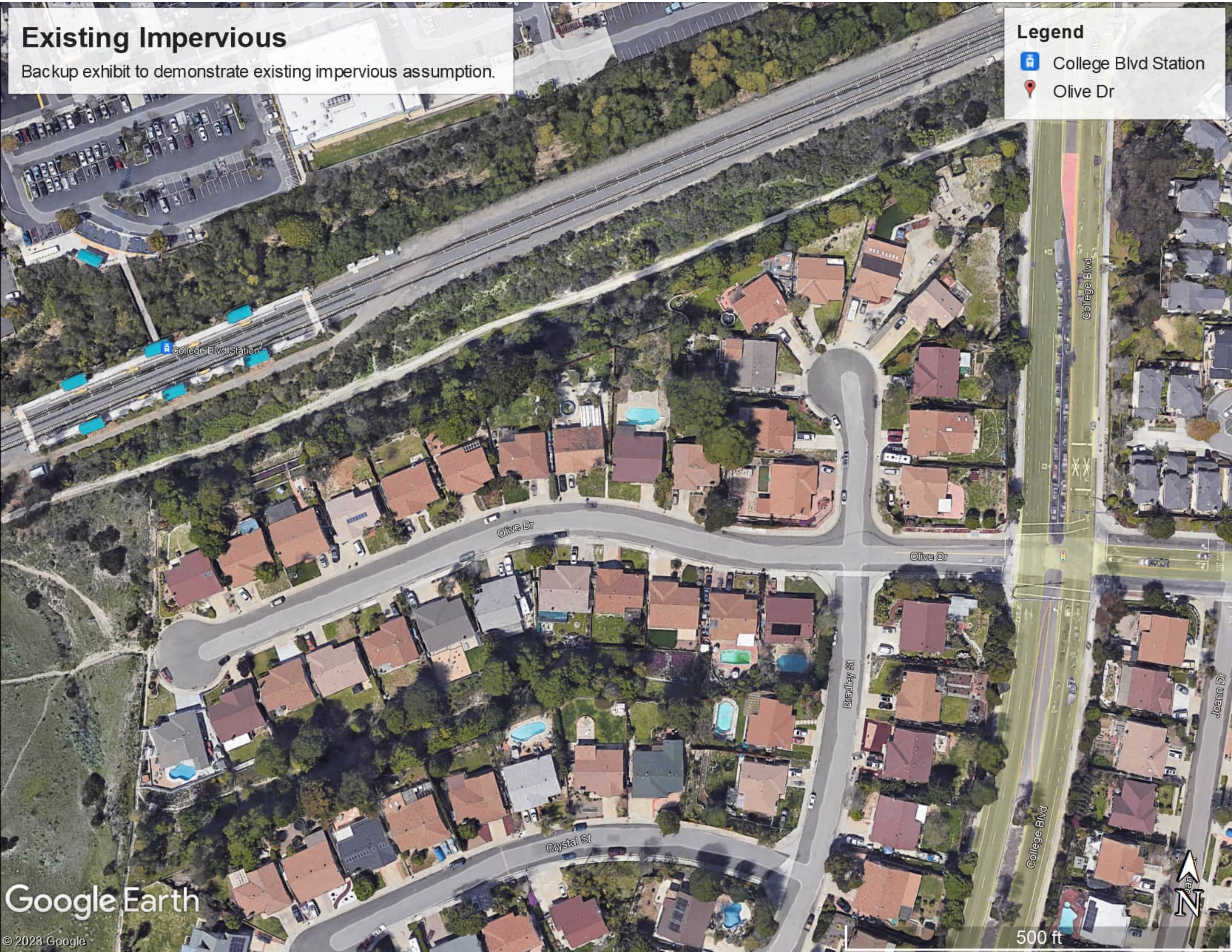
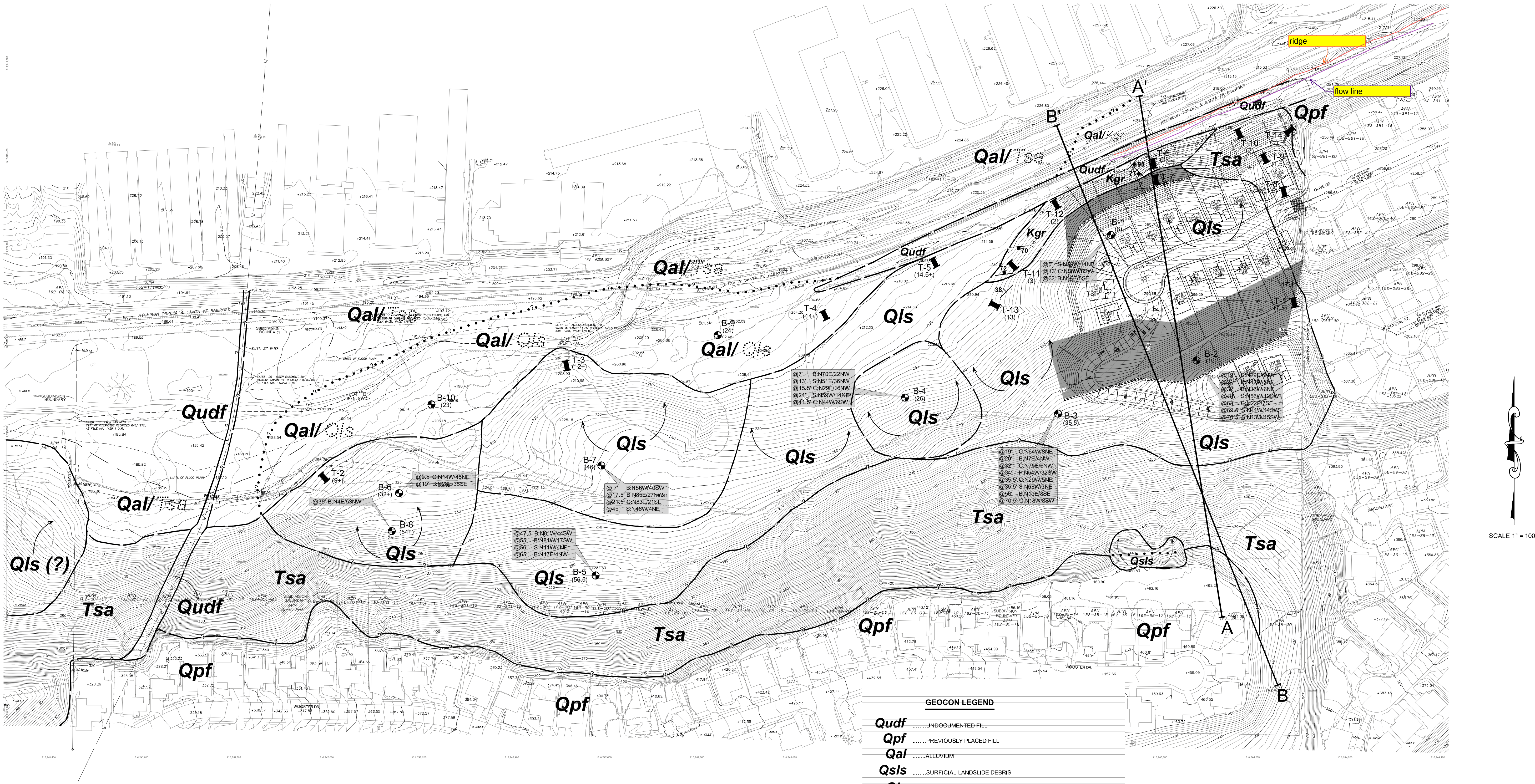
Existing Impervious

Backup exhibit to demonstrate existing impervious assumption.





GEOCON LEGEND

Qudf	UNDOCUMENTED FILL
Qpf	PREVIOUSLY PLACED FILL
Qal	ALLUVIUM
Qsls	SURFICIAL LANDSLIDE DEBRIS
Qls	LANDSLIDE DEBRIS (Dotted Where Buried; Queried Where Uncertain)
Tsa	SANTIAGO FORMATION (Dotted Where Buried)
Kgr	GRANITIC ROCK (Dotted Where Buried)
B-10	APPROX. LOCATION OF EXPLORATORY BORINGS
T-14	APPROX. LOCATION OF EXPLORATORY TRENCHES
(56.5)	APPROX. DEPTH TO FORMATIONAL MATERIAL
77	APPROX. ORIENTATION OF GEOLOGIC STRUCTURE
@35' B:N4E/53NW	APPROX. DEPTH AND ORIENTATION OF GEOLOGIC FEATURE IN BORING
	APPROX. LOCATION OF PROPOSED WIDTH OF BUTTRESS
B B'	APPROX. LOCATION OF GEOLOGIC CROSS SECTION
	APPROX. LOCATION OF GEOLOGIC CONTACT (Dotted Where Buried; Queried Where Uncertain)
	APPROX. LOCATION OF BUTTRESS DRAIN

GEOLOGIC MAP

OCEANSIDE VISTA

OCEANSIDE, CALIFORNIA

GEOCON INCORPORATED
GEOTECHNICAL CONSULTANTS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SCALE	DATE	PROJECT NO.	FIGURE	SHEET
1" = 100'	10 - 12 - 2005	07227 - 52 - 02	2	1 OF 1

X:\07227-52-02\RAWA_7227 NEW COLORED GEOLOGIC MAP (UPGRADED 10-10-2005).DWG.

Placeholder – **WMAA Exhibit**

Replace placeholder with required exhibit.

OCEANSIDE SENIOR AFFORDABLE
CCSYA WMAA MAP
Legend
CCSYA
Wooster Dr
Limit of disturbance
Olive Dr.
SITE BOUNDARY
Crystal St.
College Blvd
Wooster Dr
Google Earth
Image © 2024 Airbus
1000 ft
N

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

Replace placeholder with required calculations/documentation.

Leave placeholder intact if not applicable.

☐Not Applicable

NOT APPLICABLE

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

BMP Sizing Spreadsheet V3.0

Project Name:	Olive Park Apartments
Project Applicant:	CAPSTONE EQUITIES
Jurisdiction:	City of Oceanside
Parcel (APN):	1621110400
Hydrologic Unit:	CARLSBAD
Rain Gauge:	Oceanside
Total Project Area (sf):	266,088
Channel Susceptibility:	High

BMP Sizing Spreadsheet V3.0			
Project Name:	Olive Park Apartments	Hydrologic Unit:	CARLSBAD
Project Applicant:	CAPSTONE EQUITIES	Rain Gauge:	Oceanside
Jurisdiction:	City of Oceanside	Total Project Area:	266,088
Parcel (APN):	1621110400	Low Flow Threshold:	0.1Q2
BMP Name:	HMP4	BMP Type:	Cistern
BMP Native Soil Type:	D	BMP Infiltration Rate (in/hr):	NA

Areas Draining to BMP						HMP Sizing Factors	Minimum BMP Size
DMA Name	Area (sf)	Pre Project Soil Type	Pre-Project Slope	Post Project Surface Type	Area Weighted Runoff Factor (Table G.2-1)[1]	Volume	Volume (CF)
DMA4	3,063	D	Moderate	Mixed	0.9	0.12	344
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
BMP Tributary Area	3,063					Minimum BMP Size	344
						Proposed BMP Size*	350

* Assumes standard configuration

Standard Cistern Depth (Overflow Elevation)	3.5	ft
Provided Cistern Depth (Overflow Elevation)	3.5	ft
Minimum Required Cistern Footprint)	98	CF

Notes:

1. Runoff factors which are used for hydromodification management flow control (Table G.2-1) are different from the runoff factors used for pollutant control BMP sizing (Table B.1-1). Table references are taken from the San Diego Region Model BMP Design Manu

Describe the BMP's in sufficient detail in your PDP SWQMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

BMP's must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head.
Designated Staff have final review and approval authority over the project design.

This BMP Sizing Spreadsheet has been updated in conformance with the San Diego Region Model BMP Design Manual, April 2018. For questions or concerns please contact the jurisdiction in which your project is located.

BMP Sizing Spreadsheet V3.0			
Project Name:	Olive Park Apartments	Hydrologic Unit:	CARLSBAD
Project Applicant:	CAPSTONE EQUITIES	Rain Gauge:	Oceanside
Jurisdiction:	City of Oceanside	Total Project Area:	266,088
Parcel (APN):	1621110400	Low Flow Threshold:	0.1Q2
BMP Name	HMP4	BMP Type:	Cistern

DMA Name	Rain Gauge	Pre-developed Condition		Unit Runoff Ratio (cfs/ac)	DMA Area (ac)	Orifice Flow - %Q_2 (cfs)	Orifice Area (in^2)
		Soil Type	Slope				
DMA4	Oceanside	D	Moderate	0.575	0.070	0.004	0.06

3.50	0.004	0.06	0.28
Max Orifice Head (feet)	Max Tot. Allowable Orifice Flow (cfs)	Max Tot. Allowable Orifice Area (in^2)	Max Orifice Diameter (in)

Provide Hand Calc.	0.003	0.05	0.250
Average outflow during surface drawdown (cfs)	Max Orifice Outflow (cfs)	Actual Orifice Area (in^2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	86 hrs

CMP #4 Discharge HMP Riser

Discharge vs Elevation Table

Low orifice:	0.25 "	Top orifice:	1 "
Number:	1	Number:	0
Cg-low:	0.61	Cg-low:	3
invert elev:	0.00 ft	invert elev:	1.00 ft
Middle orifice:	2 "	Emergency inlet:	
number of orif:	0	Rim height:	2.90 ft
Cg-middle:	0.61	Riser Box D	3x4
invert elev:	1.00 ft	Weir Length	3.14 ft

h	H/D-low	H/D-mid	H/D-top	Qlow-orif	Qlow-weir	Qtot-low	Qmid-orif	Qmid-weir	Qtot-med	Qtop-orif	Qtop-weir	Qtot-top	Qpeak-top	Qtot
(ft)	-	-	-	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.17	8.00	0.00	0.00	0.001	0.070	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
0.33	16.00	0.00	0.00	0.001	3.723	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
0.50	24.00	0.00	0.00	0.001	32.236	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
0.67	32.00	0.00	0.00	0.001	144.148	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
0.83	40.00	0.00	0.00	0.002	454.986	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
1.00	48.00	0.00	0.00	0.002	1156.986	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
1.17	56.00	1.00	2.00	0.002	2538.816	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
1.33	64.00	2.00	4.00	0.002	5005.303	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
1.50	72.00	3.00	6.00	0.002	9097.150	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
1.67	80.00	4.00	8.00	0.002	15510.669	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
1.83	88.00	5.00	10.00	0.002	25117.495	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
2.00	96.00	6.00	12.00	0.002	38984.315	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
2.17	104.00	7.00	14.00	0.002	58392.588	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
2.33	112.00	8.00	16.00	0.003	84858.274	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
2.50	120.00	9.00	18.00	0.003	120151.551	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
2.67	128.00	10.00	20.00	0.003	166316.542	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
2.83	136.00	11.00	22.00	0.003	225691.037	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
3.00	144.00	12.00	24.00	0.003	300926.219	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.331	0.334
3.17	152.00	13.00	26.00	0.003	395006.385	0.003	0.000	0.000	0.000	0.000	0.000	0.000	1.440	1.443
3.33	160.00	14.00	28.00	0.003	511268.668	0.003	0.000	0.000	0.000	0.000	0.000	0.000	2.983	2.986
3.50	168.00	15.00	30.00	0.003	653422.765	0.003	0.000	0.000	0.000	0.000	0.000	0.000	4.860	4.863
3.67	176.16	16.02	32.04	0.003	829349.841	0.003	0.000	0.000	0.000	0.000	0.000	0.000	7.065	7.068
3.83	184.00	17.00	34.00	0.003	1032226.336	0.003	0.000	0.000	0.000	0.000	0.000	0.000	9.428	9.431
4.00	192.00	18.00	36.00	0.003	1278335.521	0.003	0.000	0.000	0.000	0.000	0.000	0.000	12.063	12.067
4.17	200.00	19.00	38.00	0.003	1569295.390	0.003	0.000	0.000	0.000	0.000	0.000	0.000	14.906	14.910
4.33	208.00	20.00	40.00	0.003	1910974.299	0.003	0.000	0.000	0.000	0.000	0.000	0.000	17.943	17.946
4.50	216.00	21.00	42.00	0.004	2309731.506	0.004	0.000	0.000	0.000	0.000	0.000	0.000	21.162	21.165
4.67	224.00	22.00	44.00	0.004	2772436.895	0.004	0.000	0.000	0.000	0.000	0.000	0.000	24.553	24.557
4.83	232.00	23.00	46.00	0.004	3306490.700	0.004	0.000	0.000	0.000	0.000	0.000	0.000	28.108	28.112
5.00	240.00	24.00	48.00	0.004	3919843.227	0.004	0.000	0.000	0.000	0.000	0.000	0.000	31.820	31.824

CMP #4 Stage Storage					
HMP Volume			350		
HMP Ponding Depth			2.667	ft	
Note: Find out the elevation value in relation to required WQ volume					
HMP-2-A Stage Storage					
depth	area	area (ac)	elevation	volume (cf)	volume (acft)
0.00	74.4	0.0017	0.00	0.0	0.00000
0.17	102.2	0.0023	0.17	15.5	0.00036
0.33	112.9	0.0026	0.33	33.5	0.00077
0.50	120.4	0.0028	0.50	53.0	0.00122
0.67	126.3	0.0029	0.67	73.6	0.00169
0.83	130.9	0.0030	0.83	95.0	0.00218
1.00	134.7	0.0031	1.00	117.1	0.00269
1.17	137.7	0.0032	1.17	139.9	0.00321
1.33	140.0	0.0032	1.33	163.0	0.00374
1.50	141.8	0.0033	1.50	186.5	0.00428
1.67	143.0	0.0033	1.67	210.2	0.00483
1.83	143.8	0.0033	1.83	234.1	0.00538
2.00	144.0	0.0033	2.00	258.1	0.00593
2.17	143.8	0.0033	2.17	282.1	0.00648
2.33	143.0	0.0033	2.33	306.0	0.00703
2.50	141.8	0.0033	2.50	329.8	0.00757
2.67	140.0	0.0032	2.67	353.3	0.00811
2.83	137.7	0.0032	2.83	376.4	0.00864
3.00	134.7	0.0031	3.00	399.1	0.00916
3.17	130.9	0.0030	3.17	421.3	0.00967
3.33	126.3	0.0029	3.33	442.7	0.01016
3.50	120.4	0.0028	3.50	463.3	0.01064
3.67	112.9	0.0026	3.67	482.8	0.01108
3.83	102.2	0.0023	3.83	500.7	0.01150
4.00	74.4	0.0017	4.00	516.3	0.01185
4.17	74.4	0.0017	4.17	528.7	0.01214
4.33	74.4	0.0017	4.33	541.1	0.01242
4.50	74.4	0.0017	4.50	553.5	0.01271
4.67	74.4	0.0017	4.67	565.9	0.01299
4.83	74.4	0.0017	4.83	578.3	0.01327
5.00	74.4	0.0017	5.00	590.7	0.01356

CONTECH ENGINEERED SOLUTIONS

Date: 10/10/2024
Project Name: East Storage-2 - COPY - 61024 (10-10-2024 18-3-52)

City / County:
State:

Designed By:
Company:
Telephone:

CMP: Underground Detention System Storage Volume Estimation

=Adjustable Input Cells

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular applicaton and are subject to verification of the Engineer of Record. This tool is only applicable for rectangular shaped systems.

Summary of Inputs

System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	**29.0**	**Backfill Porosity (%):**	**40%**	**System Diameter (in):**	**48**
Out-to-out width (ft):	**4.0**	**Depth Above Pipe (in):**	**12.0**	**Pipe Spacing (in):**	**24**
Number of Manifolds (ea):	**1.0**	**Depth Below Pipe (in):**	**0.0**	**Incremental Analysis (in):**	**2**
Number of Barrels (ea):	**1.0**	**Width At Ends (ft):**	**1.0**	**System Invert (Elevation):**	**331**
		Width At Sides (ft):	**1.0**		

Storage Volume Estimation

System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	**Elevation (ft)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Percent Open Storage (%)**	**Ave. Surface Area (sf)**
0.00	331.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	74.4
0.17	331.16	5.2	5.2	10.3	10.3	15.5	15.5	33.5%	102.2
0.33	331.33	9.3	14.5	8.7	19.0	18.0	33.5	43.3%	112.9
0.50	331.50	11.8	26.3	7.7	26.7	19.5	53.0	49.6%	120.4
0.67	331.66	13.6	39.9	6.9	33.6	20.6	73.6	54.3%	126.3
0.83	331.83	15.1	55.0	6.4	40.0	21.4	95.0	57.9%	130.9
1.00	332.00	16.2	71.2	5.9	45.9	22.1	117.1	60.8%	134.7
1.17	332.16	17.2	88.4	5.5	51.4	22.7	139.9	63.2%	137.7
1.33	332.33	17.9	106.3	5.2	56.7	23.1	163.0	65.2%	140.0
1.50	332.50	18.5	124.8	5.0	61.7	23.5	186.5	66.9%	141.8
1.67	332.66	18.9	143.7	4.8	66.5	23.7	210.2	68.4%	143.0
1.83	332.83	19.2	162.9	4.7	71.2	23.9	234.1	69.6%	143.8
2.00	333.00	19.3	182.2	4.7	75.9	24.0	258.1	70.6%	144.0
2.17	333.16	19.3	201.5	4.7	80.6	24.0	282.1	71.4%	143.8
2.33	333.33	19.2	220.7	4.7	85.3	23.9	306.0	72.1%	143.0
2.50	333.50	18.9	239.6	4.8	90.2	23.7	329.8	72.7%	141.8
2.67	333.66	18.5	258.1	5.0	95.2	23.5	353.3	73.1%	140.0
2.83	333.83	17.9	276.0	5.2	100.4	23.1	376.4	73.3%	137.7
3.00	334.00	17.2	293.2	5.5	105.9	22.7	399.1	73.5%	134.7
3.17	334.16	16.2	309.4	5.9	111.8	22.1	421.3	73.5%	130.9
3.33	334.33	15.1	324.5	6.4	118.2	21.4	442.7	73.3%	126.3
3.50	334.50	13.6	338.1	6.9	125.1	20.6	463.3	73.0%	120.4
3.67	334.66	11.8	349.9	7.7	132.8	19.5	482.8	72.5%	112.9
3.83	334.83	9.3	359.2	8.7	141.5	18.0	500.7	71.7%	102.2
4.00	335.00	5.2	364.4	10.3	151.8	15.5	516.3	70.6%	74.4
4.17	335.16	0.0	364.4	12.4	164.2	12.4	528.7	68.9%	74.4
4.33	335.33	0.0	364.4	12.4	176.6	12.4	541.1	67.4%	74.4
4.50	335.50	0.0	364.4	12.4	189.0	12.4	553.5	65.8%	74.4
4.67	335.66	0.0	364.4	12.4	201.4	12.4	565.9	64.4%	74.4
4.83	335.83	0.0	364.4	12.4	213.8	12.4	578.3	63.0%	74.4
5.00	336.00	0.0	364.4	12.4	226.2	12.4	590.7	61.7%	74.4

HMP-4 Drawdown @		5	ft=	85.68
Elevation	Q_{AVG} (CFS)	∆V (CF)	∆T (HR)	Total T
0.00	0.000	16	13.07	85.68
0.17	0.000	18	15.15	72.61
0.33	0.001	19	6.73	57.46
0.50	0.001	21	5.40	50.73
0.67	0.001	21	4.73	45.33
0.83	0.001	22	4.29	40.60
1.00	0.002	23	3.97	36.30
1.17	0.002	23	3.72	32.33
1.33	0.002	23	3.51	28.61
1.50	0.002	24	3.33	25.09
1.67	0.002	24	3.17	21.76
1.83	0.002	24	3.03	18.58
2.00	0.002	24	2.89	15.56
2.17	0.002	24	2.76	12.66
2.33	0.002	24	2.64	9.90
2.50	0.003	23	2.52	7.26
2.67	0.003	23	2.40	4.74
2.83	0.003	23	2.28	2.33
3.00	0.168	22	0.04	0.05
3.17	0.888	21	0.01	0.01
3.33	2.214	21	0.00	0.01
3.50	3.924	19	0.00	0.00
3.67	5.965	18	0.00	0.00
3.83	8.250	16	0.00	0.00
4.00	10.749	12	0.00	0.00
4.17	13.488	12	0.00	0.00
4.33	16.428	12	0.00	0.00
4.50	19.556	12	0.00	0.00
4.67	22.861	12	0.00	0.00
4.83	26.334	12	0.00	0.00
5.00	29.968			

GEOCON

STORMWATER MANAGEMENT INVESTIGATION

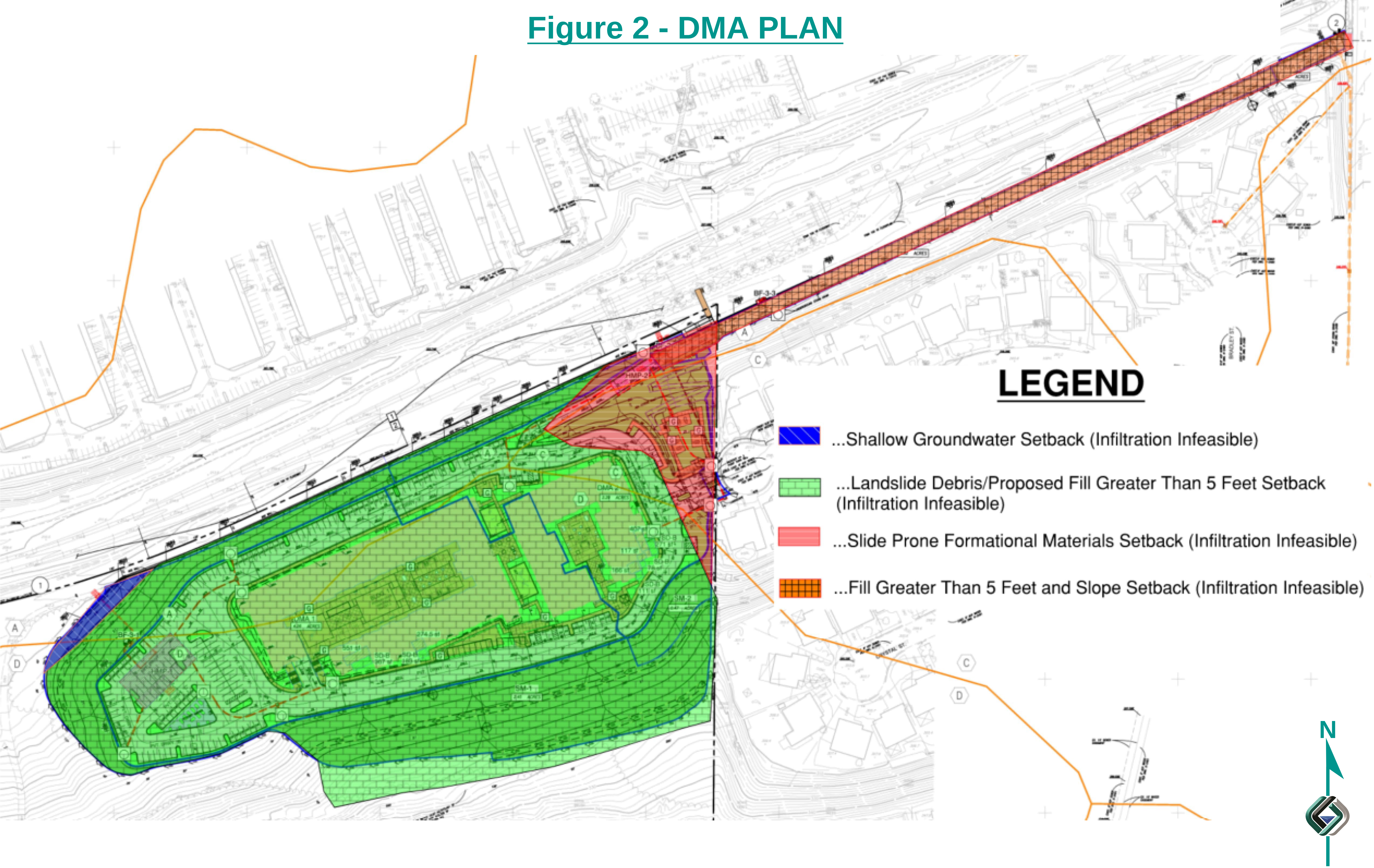
OLIVE PARK APARTMENTS
OLIVE DRIVE
OCEANSIDE, CALIFORNIA

AUGUST 7, 2024
PROJECT NO. G3035-52-01

PREPARED FOR:

CAPSTONE EQUITIES

Figure 2 - DMA PLAN



CMP-1 Discharge to MWS BF-3-1

Discharge vs Elevation Table

Low orifice:	0.5625 "	Top orifice:	0.625 "
Number:	8	Number:	0
Cg-low:	0.61	Cg-low:	0.61
invert elev:	0.00 ft	invert elev:	0.40 ft

h	H/D-low	H/D-mid	H/D-top	Qlow-orif	Qlow-weir	Qtot-low	Qmid-orif	Qmid-weir	Qtot-med	Qtop-orif	Qtop-weir	Qtot-top	Qpeak-top	Qtot
(ft)	-	-	-	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
0.17	3.56	0.00	0.00	0.026	0.031	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0256
0.33	7.11	0.00	0.00	0.038	2.023	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0376
0.50	10.67	0.00	1.92	0.047	23.644	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0467
0.67	14.22	2.42	5.12	0.054	118.943	0.054	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0542
0.83	17.78	4.85	8.32	0.061	399.127	0.061	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0608
1.00	21.33	7.27	11.52	0.067	1053.340	0.067	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0668
1.17	24.89	9.70	14.72	0.072	2369.442	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0723
1.33	28.44	12.12	17.92	0.077	4754.788	0.077	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0773
1.50	32.00	14.55	21.12	0.082	8757.006	0.082	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0821
1.67	35.56	16.97	24.32	0.087	15084.775	0.087	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0866
1.83	39.11	19.39	27.52	0.091	24628.607	0.091	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0909
2.00	42.67	21.82	30.72	0.095	38481.619	0.095	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0950
2.17	46.22	24.24	33.92	0.099	57960.320	0.099	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0989
2.33	49.78	26.67	37.12	0.103	84625.382	0.103	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1027
2.50	53.33	29.09	40.32	0.106	120302.423	0.106	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1064
2.67	56.89	31.52	43.52	0.110	167102.785	0.110	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1099
2.83	60.44	33.94	46.72	0.113	227444.312	0.113	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1133

CMP #1 Stage Storage					
Input DCV			7,569		
Input Factor			2		
WQ Ponding Depth			2.833	ft	
Note: Find out the elevation value in relation to required WQ volume					
HMP-2-A Stage Storage					
depth	area	area (ac)	elevation	volume (cf)	volume (acft)
0.00	3008.4	0.0691	0.00	0.0	0.00000
0.17	3990.6	0.0916	0.17	611.1	0.01403
0.33	4380.5	0.1006	0.33	1,310.7	0.03009
0.50	4667.7	0.1072	0.50	2,065.7	0.04742
0.67	4899.6	0.1125	0.67	2,863.6	0.06574
0.83	5094.9	0.1170	0.83	3,696.9	0.08487
1.00	5262.9	0.1208	1.00	4,560.4	0.10469
1.17	5409.5	0.1242	1.17	5,450.0	0.12512
1.33	5538.3	0.1271	1.33	6,362.6	0.14606
1.50	5652.0	0.1298	1.50	7,295.3	0.16748
1.67	5752.5	0.1321	1.67	8,245.8	0.18930
1.83	5841.1	0.1341	1.83	9,212.1	0.21148
2.00	5919.0	0.1359	2.00	10,192.3	0.23398
2.17	5986.9	0.1374	2.17	11,184.6	0.25676
2.33	6045.6	0.1388	2.33	12,187.4	0.27978
2.50	6095.5	0.1399	2.50	13,199.3	0.30301
2.67	6137.2	0.1409	2.67	14,218.8	0.32642
2.83	6170.8	0.1417	2.83	15,244.5	0.34997
3.00	6196.8	0.1423	3.00	16,275.3	0.37363
3.17	6215.2	0.1427	3.17	17,309.7	0.39738
3.33	6226.1	0.1429	3.33	18,346.6	0.42118
3.50	6229.8	0.1430	3.50	19,384.7	0.44501
3.67	6226.1	0.1429	3.67	20,422.8	0.46884
3.83	6215.2	0.1427	3.83	21,459.7	0.49265
4.00	6196.8	0.1423	4.00	22,494.1	0.51639
4.17	6170.8	0.1417	4.17	23,524.8	0.54006
4.33	6137.2	0.1409	4.33	24,550.6	0.56360
4.50	6095.5	0.1399	4.50	25,570.1	0.58701
4.67	6045.6	0.1388	4.67	26,582.0	0.61024
4.83	5986.9	0.1374	4.83	27,584.8	0.63326
5.00	5919.0	0.1359	5.00	28,577.1	0.65604
5.17	5841.1	0.1341	5.17	29,557.2	0.67854
5.33	5752.5	0.1321	5.33	30,523.5	0.70072
5.50	5652.0	0.1298	5.50	31,474.1	0.72255
5.67	5538.3	0.1271	5.67	32,406.8	0.74396
5.83	5409.5	0.1242	5.83	33,319.4	0.76491
6.00	5262.9	0.1208	6.00	34,209.0	0.78533
6.17	5094.9	0.1170	6.17	35,072.5	0.80515
6.33	4899.6	0.1125	6.33	35,905.8	0.82428
6.50	4667.7	0.1072	6.50	36,703.7	0.84260
6.67	4380.5	0.1006	6.67	37,458.6	0.85993
6.83	3990.6	0.0916	6.83	38,158.3	0.87599
7.00	3008.4	0.0691	7.00	38,769.4	0.89002
7.17	3008.4	0.0691	7.17	39,270.8	0.90153
7.33	3008.4	0.0691	7.33	39,772.2	0.91304
7.50	3008.4	0.0691	7.50	40,273.6	0.92455

CONTECH ENGINEERED SOLUTIONS

Date: 8/7/2024
Project Name: West Storage-1 - 47951 (8-7-2024 21-27-19)

City / County:
State:

Designed By:
Company:
Telephone:

CMP: Underground Detention System Storage Volume Estimation

=Adjustable Input Cells

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular applicaton and are subject to verification of the Engineer of Record. This tool is only applicable for rectangular shaped systems.

Summary of Inputs

System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	107.0	**Backfill Porosity (%):**	40%	**System Diameter (in):**	84
Out-to-out width (ft):	67.0	**Depth Above Pipe (in):**	6.0	**Pipe Spacing (in):**	36
Number of Manifolds (ea):	1.0	**Depth Below Pipe (in):**	0.0	**Incremental Analysis (in):**	2
Number of Barrels (ea):	7.0	**Width At Ends (ft):**	1.0	**System Invert (Elevation):**	238
		Width At Sides (ft):	1.0		

Storage Volume Estimation

System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	**Elevation (ft)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Percent Open Storage (%)**	**Ave. Surface Area (sf)**
0.00	238.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	3,008.4
0.17	238.16	182.8	182.8	428.3	428.3	611.1	611.1	29.9%	3,990.6
0.33	238.33	330.4	513.2	369.2	797.5	699.7	1,310.7	39.2%	4,380.5
0.50	238.50	422.6	935.8	332.3	1,129.9	755.0	2,065.7	45.3%	4,667.7
0.67	238.66	494.1	1,430.0	303.7	1,433.6	797.9	2,863.6	49.9%	4,899.6
0.83	238.83	553.2	1,983.2	280.1	1,713.7	833.3	3,696.9	53.6%	5,094.9
1.00	239.00	603.5	2,586.6	260.0	1,973.7	863.5	4,560.4	56.7%	5,262.9
1.17	239.16	647.1	3,233.7	242.6	2,216.3	889.6	5,450.0	59.3%	5,409.5
1.33	239.33	685.2	3,918.9	227.3	2,443.6	912.5	6,362.6	61.6%	5,538.3
1.50	239.50	718.9	4,637.8	213.8	2,657.5	932.7	7,295.3	63.6%	5,652.0
1.67	239.66	748.6	5,386.4	202.0	2,859.4	950.6	8,245.8	65.3%	5,752.5
1.83	239.83	774.8	6,161.2	191.5	3,050.9	966.3	9,212.1	66.9%	5,841.1
2.00	240.00	797.9	6,959.1	182.2	3,233.1	980.1	10,192.3	68.3%	5,919.0
2.17	240.16	818.1	7,777.3	174.1	3,407.3	992.3	11,184.6	69.5%	5,986.9
2.33	240.33	835.7	8,613.0	167.1	3,574.4	1,002.8	12,187.4	70.7%	6,045.6
2.50	240.50	850.8	9,463.8	161.1	3,735.5	1,011.9	13,199.3	71.7%	6,095.5
2.67	240.66	863.5	10,327.3	156.0	3,891.5	1,019.5	14,218.8	72.6%	6,137.2
2.83	240.83	874.0	11,201.2	151.8	4,043.3	1,025.8	15,244.5	73.5%	6,170.8
3.00	241.00	882.2	12,083.5	148.5	4,191.8	1,030.7	16,275.3	74.2%	6,196.8
3.17	241.16	888.4	12,971.9	146.0	4,337.9	1,034.4	17,309.7	74.9%	6,215.2
3.33	241.33	892.5	13,864.3	144.4	4,482.3	1,036.9	18,346.6	75.6%	6,226.1
3.50	241.50	894.5	14,758.8	143.6	4,625.9	1,038.1	19,384.7	76.1%	6,229.8
3.67	241.66	894.5	15,653.3	143.6	4,769.5	1,038.1	20,422.8	76.6%	6,226.1
3.83	241.83	892.5	16,545.8	144.4	4,913.9	1,036.9	21,459.7	77.1%	6,215.2
4.00	242.00	888.4	17,434.2	146.0	5,059.9	1,034.4	22,494.1	77.5%	6,196.8
4.17	242.16	882.2	18,316.4	148.5	5,208.4	1,030.7	23,524.8	77.9%	6,170.8
4.33	242.33	874.0	19,190.3	151.8	5,360.3	1,025.8	24,550.6	78.2%	6,137.2
4.50	242.50	863.5	20,053.8	156.0	5,516.3	1,019.5	25,570.1	78.4%	6,095.5
4.67	242.66	850.8	20,904.6	161.1	5,677.3	1,011.9	26,582.0	78.6%	6,045.6
4.83	242.83	835.7	21,740.3	167.1	5,844.5	1,002.8	27,584.8	78.8%	5,986.9
5.00	243.00	818.1	22,558.5	174.1	6,018.6	992.3	28,577.1	78.9%	5,919.0
5.17	243.16	797.9	23,356.4	182.2	6,200.8	980.1	29,557.2	79.0%	5,841.1
5.33	243.33	774.8	24,131.2	191.5	6,392.3	966.3	30,523.5	79.1%	5,752.5
5.50	243.50	748.6	24,879.8	202.0	6,594.3	950.6	31,474.1	79.0%	5,652.0
5.67	243.66	718.9	25,598.7	213.8	6,808.1	932.7	32,406.8	79.0%	5,538.3
5.83	243.83	685.2	26,283.9	227.3	7,035.4	912.5	33,319.4	78.9%	5,409.5
6.00	244.00	647.1	26,931.0	242.6	7,278.0	889.6	34,209.0	78.7%	5,262.9
6.17	244.16	603.5	27,534.5	260.0	7,538.0	863.5	35,072.5	78.5%	5,094.9
6.33	244.33	553.2	28,087.6	280.1	7,818.1	833.3	35,905.8	78.2%	4,899.6
6.50	244.50	494.1	28,581.8	303.7	8,121.9	797.9	36,703.7	77.9%	4,667.7
6.67	244.66	422.6	29,004.4	332.3	8,454.2	755.0	37,458.6	77.4%	4,380.5
6.83	244.83	330.4	29,334.8	369.2	8,823.5	699.7	38,158.3	76.9%	3,990.6
7.00	245.00	182.8	29,517.6	428.3	9,251.8	611.1	38,769.4	76.1%	3,008.4
7.17	245.16	0.0	29,517.6	501.4	9,753.2	501.4	39,270.8	75.2%	3,008.4
7.33	245.33	0.0	29,517.6	501.4	10,254.6	501.4	39,772.2	74.2%	3,008.4
7.50	245.50	0.0	29,517.6	501.4	10,756.0	501.4	40,273.6	73.3%	3,008.4

WQ Drawdown @		2.83	ft=	62.68
Elevation	Q_{AVG} (CFS)	ΔV (CF)	ΔT (HR)	Total T
0.00	0.026	611	6.64	62.68
0.17	0.032	700	6.15	56.05
0.33	0.042	755	4.98	49.90
0.50	0.050	798	4.40	44.92
0.67	0.058	833	4.02	40.52
0.83	0.064	863	3.76	36.50
1.00	0.070	890	3.55	32.74
1.17	0.075	913	3.39	29.19
1.33	0.080	933	3.25	25.80
1.50	0.084	951	3.13	22.55
1.67	0.089	966	3.02	19.42
1.83	0.093	980	2.93	16.40
2.00	0.097	992	2.84	13.47
2.17	0.101	1003	2.76	10.62
2.33	0.105	1012	2.69	7.86
2.50	0.108	1020	2.62	5.17
2.67	0.112	1026	2.55	2.55
2.83				

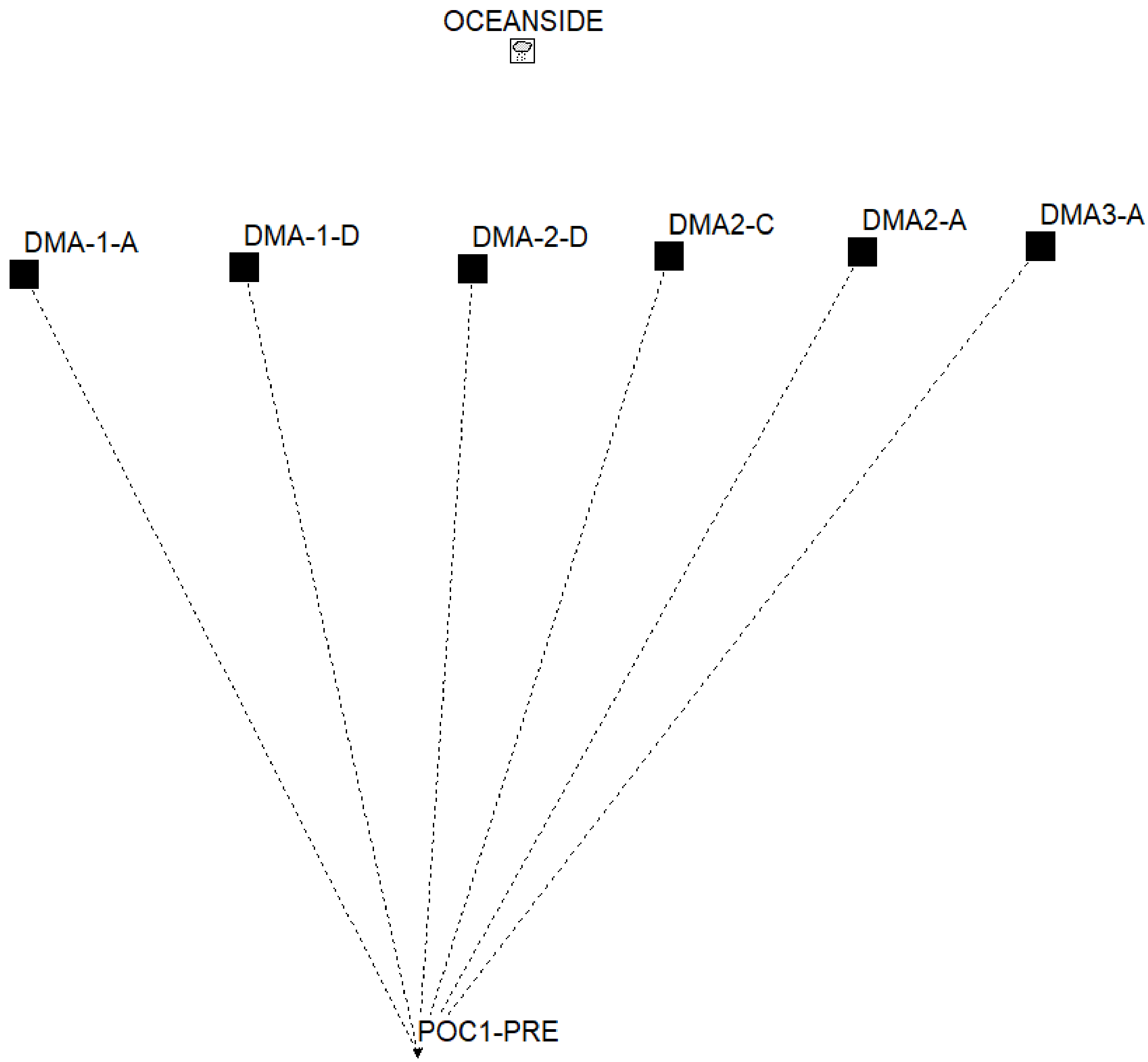
CMP #1 Discharge HMP Riser

Discharge vs Elevation Table

Low orifice:	0.50 "	Top orifice:	4 "
Number:	1	Number:	12
Cg-low:	0.61	Cg-low:	0.61
invert elev:	2.83 ft	invert elev:	5.00 ft
Middle orifice:	2 "	Emergency inlet:	
number of orif:	10	Rim height:	6.40 ft
Cg-middle:	0.61	Riser Box D	3x4
invert elev:	4.75 ft	Weir Length	14.00 ft

h	H/D-low	H/D-mid	H/D-top	Qlow-orif	Qlow-weir	Qtot-low	Qmid-orif	Qmid-weir	Qtot-med	Qtop-orif	Qtop-weir	Qtot-top	Qpeak-top	Qtot	Peak Flow WQ+HMP Qtot
(ft)	-	-	-	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
0.17	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0256
0.33	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0376
0.50	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0467
0.67	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0542
0.83	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0608
1.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0668
1.17	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0723
1.33	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0773
1.50	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0821
1.67	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0866
1.83	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0909
2.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0950
2.17	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0989
2.33	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1027
2.50	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1064
2.67	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1099
2.83	0.08	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1133
3.00	4.08	0.00	0.00	0.003	0.005	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.1192
3.17	8.08	0.00	0.00	0.004	0.422	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.1236
3.33	12.08	0.00	0.00	0.005	4.470	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.1276
3.50	16.08	0.00	0.00	0.005	21.637	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.1314
3.67	20.16	0.00	0.00	0.006	72.690	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.1351
3.83	24.08	0.00	0.00	0.007	185.564	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.1385
4.00	28.08	0.00	0.00	0.007	414.035	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.1419
4.17	32.08	0.00	0.00	0.008	826.024	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.1452
4.33	36.08	0.00	0.00	0.008	1514.674	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.1484
4.50	40.08	0.00	0.00	0.009	2600.318	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.1516
4.67	44.08	0.00	0.00	0.009	4233.968	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.1546
4.83	48.08	0.50	0.00	0.009	6600.799	0.009	0.000	0.087	0.087	0.000	0.000	0.000	0.000	0.096	0.2445
5.00	52.08	1.50	0.00	0.010	9923.637	0.010	0.436	0.530	0.436	0.000	0.000	0.000	0.000	0.446	0.5965
5.17	56.08	2.50	0.50	0.010	14466.445	0.010	0.617	0.788	0.617	0.000	0.590	0.590	0.000	1.217	1.3701
5.33	60.08	3.50	1.00	0.011	20537.809	0.011	0.755	0.888	0.755	2.093	1.999	1.999	0.000	2.765	2.9209
5.50	64.08	4.50	1.50	0.011	28494.427	0.011	0.872	2.617	0.872	2.960	3.599	2.960	0.000	3.843	4.0007
5.67	68.08	5.50	2.00	0.011	38744.594	0.011	0.975	10.607	0.975	3.625	4.814	3.625	0.000	4.611	4.7715
5.83	72.08	6.50	2.50	0.012	51751.690	0.012	1.068	33.432	1.068	4.186	5.351	4.186	0.000	5.265	5.4280
6.00	76.08	7.50	3.00	0.012	68037.662	0.012	1.154	84.691	1.154	4.680	5.434	4.680	0.000	5.845	6.0102
6.17	80.08	8.50	3.50	0.012	88186.518	0.012	1.233	184.101	1.233	5.126	6.031	5.126	0.000	6.372	6.5391
6.33	84.08	9.50	4.00	0.012	112847.808	0.012	1.308	358.584	1.308	5.537	9.089	5.537	0.000	6.857	7.0272
6.50	88.08	10.50	4.50	0.013	142740.112	0.013	1.379	643.360	1.379	5.919	17.762	5.919	1.474	8.785	8.9570
6.67	92.08	11.50	5.00	0.013	178654.529	0.013	1.446	1083.034	1.446	6.278	36.645	6.278	6.420	14.157	14.3315
6.83	96.08	12.50	5.50	0.013	221458.160	0.013	1.510	1732.686	1.510	6.618	72.003	6.618	13.299	21.440	21.6166
7.00	100.08	13.50	6.00	0.014	272097.598	0.014	1.572	2658.962	1.572	6.941	132.003	6.941	21.667	30.194	30.3721
7.17	104.08	14.50	6.50	0.014	331602.411	0.014	1.631	3941.161	1.631	7.250	226.944	7.250	31.296	40.190	40.3710
7.33	108.08	15.50	7.00	0.014	401088.632	0.014	1.689	5672.326	1.689	7.546	369.491	7.546	42.037	51.285	51.4677
7.50	112.08	16.50	7.50	0.014	481762.245	0.014	1.744	7960.336	1.744	7.831	574.902	7.831	53.785	63.374	63.5587

HMP-2A Drawdown @		7.5	ft=	91.23
Elevation	Q_{AVG} (CFS)	ΔV (CF)	ΔT (HR)	Total T
0.00	0.019	611	9.02	91.23
0.17	0.032	700	6.15	82.20
0.33	0.042	755	4.98	76.05
0.50	0.050	798	4.40	71.07
0.67	0.058	833	4.02	66.68
0.83	0.064	863	3.76	62.65
1.00	0.070	890	3.55	58.90
1.17	0.075	913	3.39	55.34
1.33	0.080	933	3.25	51.95
1.50	0.084	951	3.13	48.70
1.67	0.089	966	3.02	45.57
1.83	0.093	980	2.93	42.55
2.00	0.097	992	2.84	39.62
2.17	0.101	1003	2.76	36.78
2.33	0.105	1012	2.69	34.02
2.50	0.108	1020	2.62	31.33
2.67	0.112	1026	2.55	28.71
2.83	0.116	1031	2.46	26.15
3.00	0.121	1034	2.37	23.69
3.17	0.126	1037	2.29	21.32
3.33	0.129	1038	2.23	19.03
3.50	0.133	1038	2.16	16.80
3.67	0.137	1037	2.11	14.64
3.83	0.140	1034	2.05	12.53
4.00	0.144	1031	1.99	10.49
4.17	0.147	1026	1.94	8.49
4.33	0.150	1020	1.89	6.55
4.50	0.153	1012	1.84	4.66
4.67	0.200	1003	1.40	2.83
4.83	0.421	992	0.66	1.43
5.00	0.983	980	0.28	0.78
5.17	2.145	966	0.13	0.50
5.33	3.461	951	0.08	0.37
5.50	4.386	933	0.06	0.30
5.67	5.100	913	0.05	0.24
5.83	5.719	890	0.04	0.19
6.00	6.275	863	0.04	0.14
6.17	6.783	833	0.03	0.11
6.33	7.992	798	0.03	0.07
6.50	11.644	755	0.02	0.04
6.67	17.974	700	0.01	0.03
6.83	25.994	611	0.01	0.02
7.00	35.372	501	0.00	0.01
7.17	45.919	501	0.00	0.01
7.33	57.513	501	0.00	0.00
7.50	31.779			


OCEANSIDE
DMA-1-A
DMA-1-D
DMA-2-D
DMA2-C
DMA2-A
DMA3-A
POC1-PRE

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[TITLE]
;;Project Title/Notes
OLIVE PARK APARTMENTS - POC1 PRE-DEVELOPED

[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           08/28/1951
START_TIME           00:00:00
REPORT_START_DATE    08/28/1951
REPORT_START_TIME    00:00:00
END_DATE             05/23/2008
END_TIME             23:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:12:00
DRY_STEP             03:00:00
ROUTING_STEP         0:01:00
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         12.557
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
;;-------------- ----------------
MONTHLY          0.06   0.08   0.11   0.15   0.17   0.19   0.19   0.18   0.15   0.11   0.08   0.06
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- ------ ------ ----------
OCEANSIDE        INTENSITY 1:00     1.0      TIMESERIES OCEANSIDE-RAIN

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
;Soil Type A
DMA-1-A          OCEANSIDE        POC1-PRE         1.823    0        294      9.59     0
;Soil type D
DMA-1-D          Oceanside        poc1-pre         9.174    0.3      1598     39       0
;Soil Type D
DMA-2-D          OCEANSIDE        POC1-PRE         4.655    0        680      25       0
;Soil Type C
DMA2-C           OCEANSIDE        POC1-PRe         6.29     46.3     1300     3        0
;Soil Type A
DMA2-A           OCEANSIDE        POC1-pre         0.982    0        280      2.31     0
;Soil Type A,Soil Type A, reduced conductivity (existing compacted unpaved road)
DMA3-A           OCEANSIDE        POC1-pre         2.12     5.9      350      40       0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
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;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
DMA-1-A          0.012      0.15       0.05       0.1        25         OUTLET
DMA-1-D          0.012      0.15       0.05       0.1        25         OUTLET
DMA-2-D          0.012      0.15       0.05       0.1        25         OUTLET
DMA2-C           0.012      0.15       0.05       0.10       25         OUTLET
DMA2-A           0.012      0.15       0.05       0.10       25         OUTLET
DMA3-A           0.012      0.15       0.05       0.10       25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    Ksat       IMD
;;-------------- ---------- ---------- ----------
DMA-1-A          1.5        0.3        0.3
DMA-1-D          9          0.025      0.33
DMA-2-D          9          0.025      0.33
DMA2-C           6          0.075      0.32
DMA2-A           1.5        0.3        0.3
DMA3-A           1.5        0.3        0.3

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
POC1-PRE         0          FREE                        NO

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
OCEANSIDE-RAIN   FILE "OCEANSIDE.prn"

[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
;;-------------- ------------------ ------------------
POC1-PRE         4122.966           2332.731

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
DMA-1-A          1705.508           7118.644
DMA-1-D          3050.847           7161.017
DMA-2-D          4461.709           7147.614
DMA-2-D          4461.709           7147.614
DMA2-C           5664.613           7227.113
DMA2-A           6852.993           7253.521
DMA3-A           7944.542           7288.732

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
OCEANSIDE        4778.107           8476.331
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.014)
--------------------------------------------------------------

OLIVE PARK APARTMENTS - POC1 PRE-DEVELOPED


*********************************************************
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 ........... NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Starting Date ............ 08/28/1951 00:00:00
Ending Date .............. 05/23/2008 23:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Wet Time Step ............ 00:12:00
Dry Time Step ............ 03:00:00


**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......      1409.247       675.250
Evaporation Loss .........        51.639        24.743
Infiltration Loss ........      1035.471       496.153
Surface Runoff ...........       333.460       159.779
Final Storage ............         0.011         0.005
Continuity Error (%) .....        -0.804

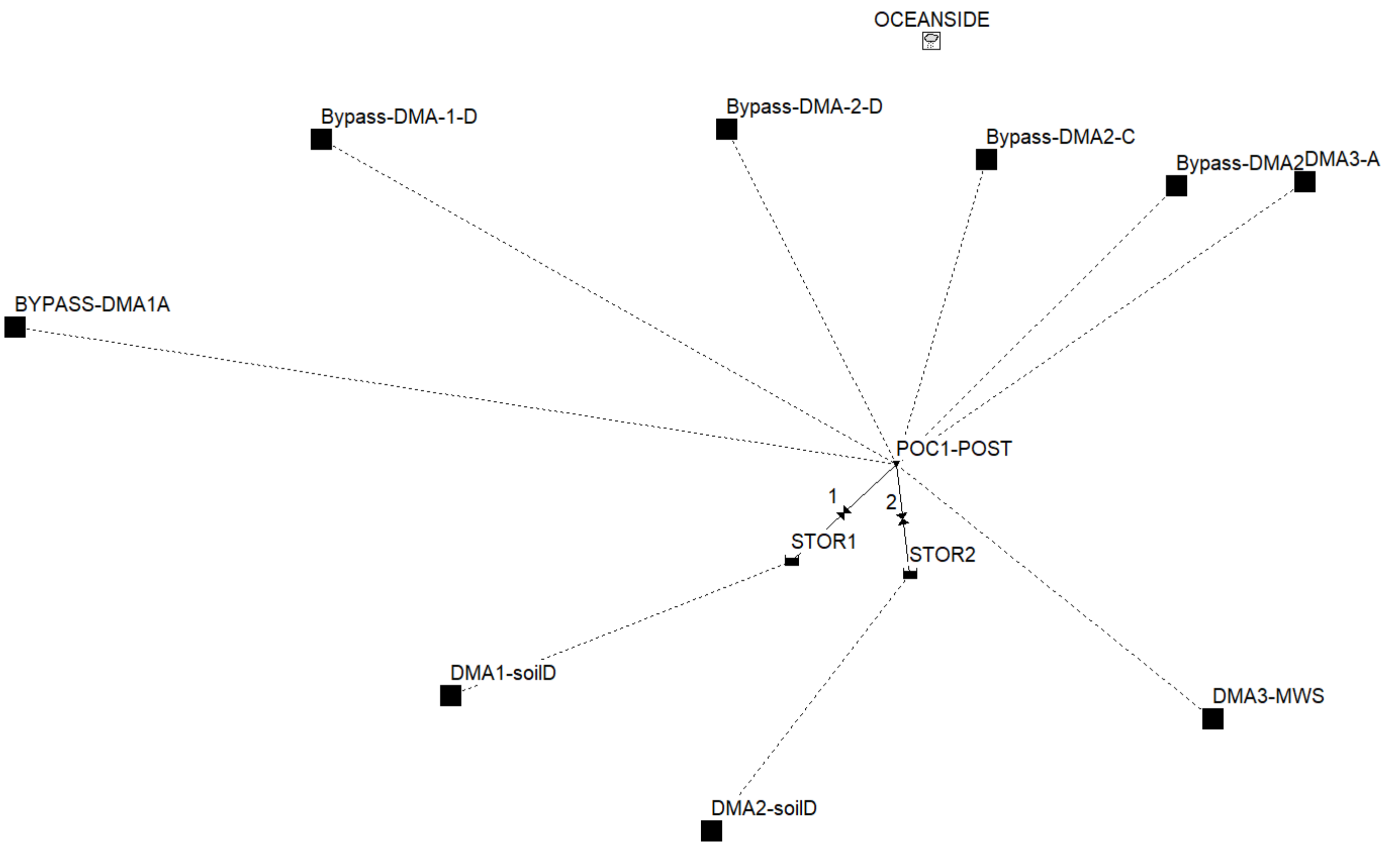

**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......       333.459       108.663
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........       333.459       108.663
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 ......         0.000         0.000
Continuity Error (%) .....         0.000


***************************
Subcatchment Runoff Summary
***************************


----------------------------------------------------------------------------------------------------------------
--------------
                           Total      Total      Total      Total     Imperv       Perv      Total        Total
 Peak  Runoff
                          Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff       Runoff
```

Subcatchment	in	in	in	in	in	in	in	10^6 gal	Runoff CFS	Coeff
DMA-1-A	675.25	0.00	0.66	666.54	0.00	8.45	8.45	0.42	1.61	0.013
DMA-1-D	675.25	0.00	20.54	517.15	1.80	143.01	144.80	36.07	10.27	0.214
DMA-2-D	675.25	0.00	20.65	520.45	0.00	141.00	141.00	17.82	5.20	0.209
DMA2-C	675.25	0.00	50.84	327.74	269.67	32.31	301.98	51.58	7.31	0.447
DMA2-A	675.25	0.00	0.66	666.77	0.00	8.18	8.18	0.22	0.86	0.012
DMA3-A	675.25	0.00	6.35	626.07	34.96	9.31	44.26	2.55	1.95	0.066

Analysis begun on: Wed Aug 7 10:17:43 2024
Analysis ended on: Wed Aug 7 10:17:57 2024
Total elapsed time: 00:00:14


OCEANSIDE
Bypass-DMA-1-D
Bypass-DMA-2-D
Bypass-DMA2-C
Bypass-DMA2
DMA3-A
BYPASS-DMA1A
POC1-POST
1
2
STOR1
STOR2
DMA1-soilD
DMA3-MWS
DMA2-soilD

```
[TITLE]
;;Project Title/Notes
OLIVE PARK APARTMENTS - POC1 PRE-DEVELOPED

[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           08/28/1951
START_TIME           00:00:00
REPORT_START_DATE    08/28/1951
REPORT_START_TIME    00:00:00
END_DATE             05/23/2008
END_TIME             23:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:12:00
DRY_STEP             03:00:00
ROUTING_STEP         0:01:00
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         12.557
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
;;-------------- ----------------
MONTHLY          0.06   0.08   0.11   0.15   0.17   0.19   0.19   0.18   0.15   0.11   0.08   0.06
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- ------ ------ ----------
OCEANSIDE        INTENSITY 1:00     1.0      TIMESERIES OCEANSIDE-RAIN

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
;Soil type D+ the proposed slopes in Soil A
Bypass-DMA-1-D   OCEANSIDE        POC1-POST        9.546    0.29     832      33       0
;Soil Type D
Bypass-DMA-2-D   OCEANSIDE        POC1-POST        1.544    0        2363     25       0
;Soil Type C
Bypass-DMA2-C    OCEANSIDE        POC1-POST        5.325    54.6     1300     1.18     0
;Soil Type A
Bypass-DMA2-A    OCEANSIDE        POC1-POST        0.674    0        280      2.31     0
;Soil Type A,Soil Type A, reduced conductivity (existing compacted unpaved road)
DMA3-A           OCEANSIDE        POC1-POST        1.669    7.5      275      4.28     0
;Soil Type D
DMA3-MWS         OCEANSIDE        POC1-POST        0.517    93.3     845      2.5      0
DMA1-soilD       OCEANSIDE        stor1            4.257    90       950      1.5      0
DMA2-soilD       OCEANSIDE        stor2            2.317    68       675      1.5      0
BYPASS-DMA1A     OCEANSIDE        POC1-POST        0.624    0        91       3.54     0
```

```
[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
Bypass-DMA-1-D   0.012      0.15       0.05       0.1        25         OUTLET
Bypass-DMA-2-D   0.012      0.15       0.05       0.1        25         OUTLET
Bypass-DMA2-C    0.012      0.15       0.05       0.10       25         OUTLET
Bypass-DMA2-A    0.012      0.15       0.05       0.10       25         OUTLET
DMA3-A           0.012      0.15       0.05       0.10       25         OUTLET
DMA3-MWS         0.012      0.15       0.05       0.10       25         IMPERVIOUS 100
DMA1-soilD       0.012      0.15       0.05       0.10       25         IMPERVIOUS 100
DMA2-soilD       0.012      0.15       0.05       0.10       25         IMPERVIOUS 100
BYPASS-DMA1A     0.012      0.15       0.05       0.10       25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    Ksat       IMD
;;-------------- ---------- ---------- ----------
Bypass-DMA-1-D   9          0.025      0.33
Bypass-DMA-2-D   9          0.025      0.33
Bypass-DMA2-C    6          0.075      0.32
Bypass-DMA2-A    1.5        0.3        0.3
DMA3-A           1.5        0.3        0.3
DMA3-MWS         9          0.0175     0.33
DMA1-soilD       9          0.0175     0.33
DMA2-soilD       9          0.0175     0.25
BYPASS-DMA1A     1.5        0.3        0.3

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
POC1-POST        0          FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            N/A      Fevap    Psi
  Ksat     IMD
;;-------------- -------- ---------- ----------- ---------- ---------------------------- -------- --------
   -------- --------
STOR1            0        7.5        0          TABULAR    Stor1                        0        0
STOR2            0        7.5        0          TABULAR    Stor2                        0        0

[OUTLETS]
;;Name           From Node        To Node          Offset     Type            QTable/Qcoeff    Qexpon     Gated

;;-------------- ---------------- ---------------- ---------- --------------- ---------------- ----------
--------
1                STOR1            POC1-POST        0          TABULAR/DEPTH   Outlet1                     NO

2                STOR2            POC1-POST        0          TABULAR/DEPTH   Outlet2                     NO


[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
Outlet1          Rating     0.00       0.0000
Outlet1                     0.17       0.0256
Outlet1                     0.33       0.0376
Outlet1                     0.50       0.0467
Outlet1                     0.67       0.0542
Outlet1                     0.83       0.0608
Outlet1                     1.00       0.0668
Outlet1                     1.17       0.0723
Outlet1                     1.33       0.0773
Outlet1                     1.50       0.0821
Outlet1                     1.67       0.0866
Outlet1                     1.83       0.0909
Outlet1                     2.00       0.0950
Outlet1                     2.17       0.0989
Outlet1                     2.33       0.1027
Outlet1                     2.50       0.1064
Outlet1                     2.67       0.1099
Outlet1                     2.83       0.1133
```

```
Outlet1                     3.00        0.1192
Outlet1                     3.17        0.1236
Outlet1                     3.33        0.1276
Outlet1                     3.50        0.1314
Outlet1                     3.67        0.1351
Outlet1                     3.83        0.1385
Outlet1                     4.00        0.1419
Outlet1                     4.17        0.1452
Outlet1                     4.33        0.1484
Outlet1                     4.50        0.1516
Outlet1                     4.67        0.1546
Outlet1                     4.83        0.2445
Outlet1                     5.00        0.5965
Outlet1                     5.17        1.3701
Outlet1                     5.33        2.9209
Outlet1                     5.50        4.0007
Outlet1                     5.67        4.7715
Outlet1                     5.83        5.4280
Outlet1                     6.00        6.0102
Outlet1                     6.17        6.5391
Outlet1                     6.33        7.0272
Outlet1                     6.50        8.9570
Outlet1                     6.67        14.3315
Outlet1                     6.83        21.6166
Outlet1                     7.00        30.3721
Outlet1                     7.17        40.3710
Outlet1                     7.33        51.4677
Outlet1                     7.50        63.5587
;
Outlet2          Rating     0.00        0.0000
Outlet2                     0.17        0.0112
Outlet2                     0.33        0.0164
Outlet2                     0.50        0.0204
Outlet2                     0.67        0.0236
Outlet2                     0.83        0.0265
Outlet2                     1.00        0.0291
Outlet2                     1.17        0.0315
Outlet2                     1.33        0.0337
Outlet2                     1.50        0.0358
Outlet2                     1.67        0.0378
Outlet2                     1.83        0.0396
Outlet2                     2.00        0.0414
Outlet2                     2.17        0.0431
Outlet2                     2.33        0.0448
Outlet2                     2.50        0.0463
Outlet2                     2.67        0.0479
Outlet2                     2.83        0.0494
Outlet2                     3.00        0.0508
Outlet2                     3.17        0.0547
Outlet2                     3.33        0.0573
Outlet2                     3.50        0.0595
Outlet2                     3.67        0.0616
Outlet2                     3.83        0.0635
Outlet2                     4.00        0.0653
Outlet2                     4.17        0.0671
Outlet2                     4.33        0.0688
Outlet2                     4.50        0.0704
Outlet2                     4.67        0.0720
Outlet2                     4.83        0.0736
Outlet2                     5.00        0.0751
Outlet2                     5.17        0.0765
Outlet2                     5.33        0.0780
Outlet2                     5.50        0.0794
Outlet2                     5.67        0.1186
Outlet2                     5.83        0.1398
Outlet2                     6.00        0.1558
Outlet2                     6.17        0.6556
Outlet2                     6.33        1.4973
Outlet2                     6.50        1.9577
Outlet2                     6.67        2.3241
Outlet2                     6.83        2.6381
```

```
Outlet2                 7.00       2.9173
Outlet2                 7.17       6.3435
Outlet2                 7.33       12.3781
Outlet2                 7.50       20.1080
Outlet2                 7.67       29.3216
Outlet2                 7.83       39.1938
Outlet2                 8.00       50.7508
Outlet2                 8.17       63.3117
;
Stor1           Storage 0.00       3008.4
Stor1                   0.17       3990.6
Stor1                   0.33       4380.5
Stor1                   0.50       4667.7
Stor1                   0.67       4899.6
Stor1                   0.83       5094.9
Stor1                   1.00       5262.9
Stor1                   1.17       5409.5
Stor1                   1.33       5538.3
Stor1                   1.50       5652.0
Stor1                   1.67       5752.5
Stor1                   1.83       5841.1
Stor1                   2.00       5919.0
Stor1                   2.17       5986.9
Stor1                   2.33       6045.6
Stor1                   2.50       6095.5
Stor1                   2.67       6137.2
Stor1                   2.83       6170.8
Stor1                   3.00       6196.8
Stor1                   3.17       6215.2
Stor1                   3.33       6226.1
Stor1                   3.50       6229.8
Stor1                   3.67       6226.1
Stor1                   3.83       6215.2
Stor1                   4.00       6196.8
Stor1                   4.17       6170.8
Stor1                   4.33       6137.2
Stor1                   4.50       6095.5
Stor1                   4.67       6045.6
Stor1                   4.83       5986.9
Stor1                   5.00       5919.0
Stor1                   5.17       5841.1
Stor1                   5.33       5752.5
Stor1                   5.50       5652.0
Stor1                   5.67       5538.3
Stor1                   5.83       5409.5
Stor1                   6.00       5262.9
Stor1                   6.17       5094.9
Stor1                   6.33       4899.6
Stor1                   6.50       4667.7
Stor1                   6.67       4380.5
Stor1                   6.83       3990.6
Stor1                   7.00       3008.4
Stor1                   7.17       3008.4
Stor1                   7.33       3008.4
Stor1                   7.50       3008.4
;
Stor2           Storage 0.00       1244.4
Stor2                   0.17       1650.4
Stor2                   0.33       1811.9
Stor2                   0.50       1931.4
Stor2                   0.67       2028.1
Stor2                   0.83       2109.9
Stor2                   1.00       2180.6
Stor2                   1.17       2242.5
Stor2                   1.33       2297.3
Stor2                   1.50       2346.0
Stor2                   1.67       2389.3
Stor2                   1.83       2428.0
Stor2                   2.00       2462.3
Stor2                   2.17       2492.6
Stor2                   2.33       2519.4
```

```
Stor2                       2.50       2542.6
Stor2                       2.67       2562.7
Stor2                       2.83       2579.6
Stor2                       3.00       2593.6
Stor2                       3.17       2604.6
Stor2                       3.33       2612.9
Stor2                       3.50       2618.3
Stor2                       3.67       2621.1
Stor2                       3.83       2621.1
Stor2                       4.00       2618.3
Stor2                       4.17       2612.9
Stor2                       4.33       2604.6
Stor2                       4.50       2593.6
Stor2                       4.67       2579.6
Stor2                       4.83       2562.7
Stor2                       5.00       2542.6
Stor2                       5.17       2519.4
Stor2                       5.33       2492.6
Stor2                       5.50       2462.3
Stor2                       5.67       2428.0
Stor2                       5.83       2389.3
Stor2                       6.00       2346.0
Stor2                       6.17       2297.3
Stor2                       6.33       2242.5
Stor2                       6.50       2180.6
Stor2                       6.67       2109.9
Stor2                       6.83       2028.1
Stor2                       7.00       1931.4
Stor2                       7.17       1811.9
Stor2                       7.33       1650.4
Stor2                       7.50       1244.4
Stor2                       7.67       1244.4
Stor2                       7.83       1244.4
Stor2                       8.00       1244.4
Stor2                       8.17       1244.4

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
OCEANSIDE-RAIN   FILE "OCEANSIDE.prn"

[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
;;-------------- ------------------ ------------------
POC1-POST        4462.719           4879.386
STOR1            3571.429           4057.623
STOR2            4579.832           3937.575

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Bypass-DMA-1-D   -433.996           7649.186
Bypass-DMA-2-D   3019.892           7739.602
Bypass-DMA-2-D   3019.892           7739.602
Bypass-DMA2-C    5228.091           7478.992
```

```
Bypass-DMA2-A    6852.993          7253.521
DMA3-A           7944.542          7288.732
DMA3-MWS         7160.940          2712.477
DMA1-soilD       669.078           2911.392
DMA2-soilD       2893.309          1754.069
BYPASS-DMA1A     -3039.474         6052.632

[SYMBOLS]
;;Gage           X-Coord           Y-Coord
;;-------------- ------------------ ------------------
OCEANSIDE        4778.107          8476.331
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.014)
--------------------------------------------------------------

OLIVE PARK APARTMENTS - POC1 PRE-DEVELOPED


*********************************************************
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 ............ 08/28/1951 00:00:00
Ending Date .............. 05/23/2008 23:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Wet Time Step ............ 00:12:00
Dry Time Step ............ 03:00:00
Routing Time Step ........ 60.00 sec


**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......      1489.658       675.250
Evaporation Loss .........        99.918        45.292
Infiltration Loss ........       807.673       366.112
Surface Runoff ...........       594.273       269.379
Final Storage ............         0.033         0.015
Continuity Error (%) .....        -0.822


**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......       594.271       193.652
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........       594.235       193.640
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 ......         0.008         0.003
Continuity Error (%) .....         0.005


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


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

Routing Time Step Summary
****
Minimum Time Step : 60.00 sec
Average Time Step : 60.00 sec
Maximum Time Step : 60.00 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
Bypass-DMA-1-D	675.25	0.00	20.39	521.41	1.73	136.99	138.72	35.96	10.64	0.205
Bypass-DMA-2-D	675.25	0.00	19.22	510.80	0.00	154.22	154.22	6.47	1.73	0.228
Bypass-DMA2-C	675.25	0.00	59.13	277.43	316.71	26.89	343.59	49.68	6.22	0.509
Bypass-DMA2-A	675.25	0.00	0.66	666.15	0.00	8.90	8.90	0.16	0.60	0.013
DMA3-A	675.25	0.00	8.03	617.03	44.15	7.27	51.42	2.33	1.49	0.076
DMA3-MWS	675.25	0.00	94.63	31.25	561.09	13.24	561.09	7.88	0.62	0.831
DMA1-soilD	675.25	0.00	96.83	46.98	538.20	18.82	538.20	62.21	5.10	0.797
DMA2-soilD	675.25	0.00	79.60	145.51	458.23	63.76	458.23	28.83	2.75	0.679
BYPASS-DMA1A	675.25	0.00	0.67	667.60	0.00	7.25	7.25	0.12	0.52	0.011

****
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
POC1-POST	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
STOR1	STORAGE	0.08	5.51	5.51	15835 21:01	5.51
STOR2	STORAGE	0.08	6.60	6.60	15835 21:01	6.60

****
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
POC1-POST	OUTFALL	21.82	27.73	18857 17:01	103	194	0.000

STOR1	STORAGE	5.10	5.10	18857	16:49	62.2	62.2	0.009
STOR2	STORAGE	2.75	2.75	18857	17:01	28.8	28.8	0.011

****
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
STOR1	0.365	1	0	0	31.505	78	15835 21:01	4.05
STOR2	0.173	1	0	0	15.769	91	15835 21:01	2.18

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
POC1-POST	11.60	0.12	27.73	193.626
System	11.60	0.12	27.73	193.626

****
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
1	DUMMY	4.05	15835 21:01			
2	DUMMY	2.18	15835 21:01			

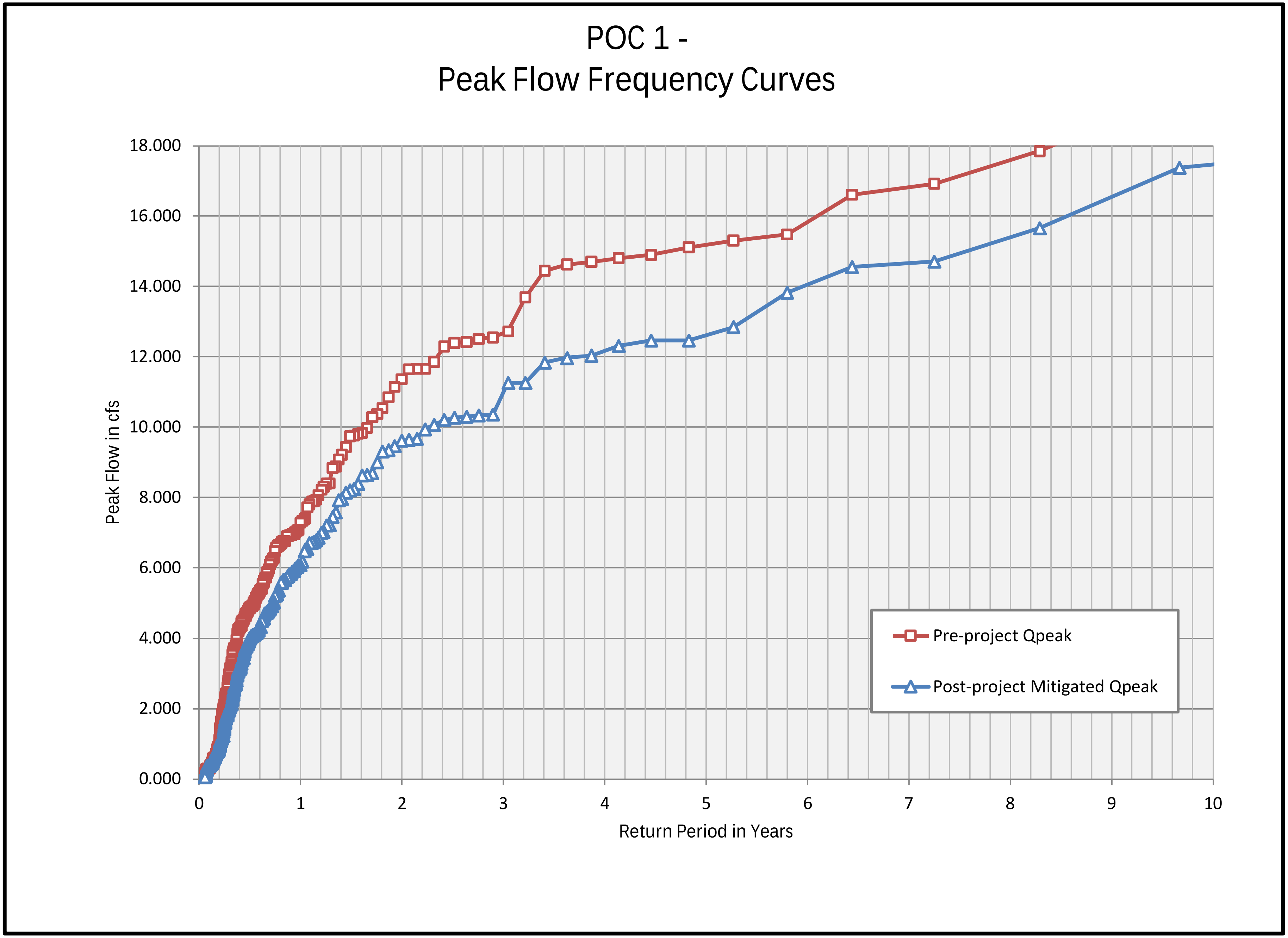
****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Aug 8 15:51:25 2024
Analysis ended on: Thu Aug 8 15:52:02 2024
Total elapsed time: 00:00:37

Peak Flow Frequency Summary

Return Period	Pre-project Qpeak (cfs)	Post-project - Mitigated Q (cfs)
LF = 0.1xQ2	1.137	0.962
2-year	11.367	9.620
5-year	15.183	12.609
10-year	19.866	17.460

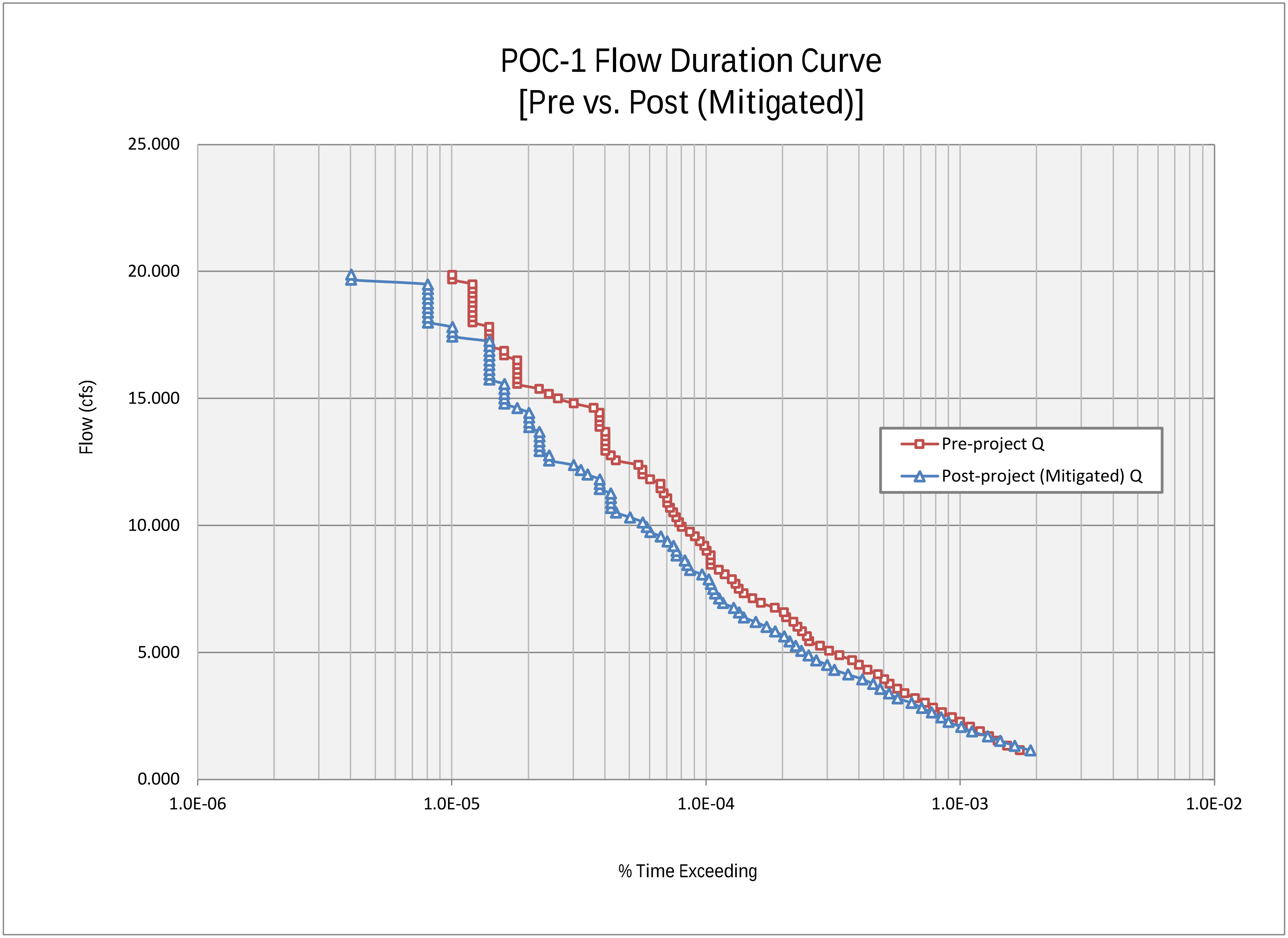

POC 1 -
Peak Flow Frequency Curves
18.000
16.000
14.000
12.000
10.000
8.000
6.000
4.000
2.000
0.000
Peak Flow in cfs
0
1
2
3
4
5
6
7
8
9
10
Return Period in Years
Pre-project Qpeak
Post-project Mitigated Qpeak

Low-flow Threshold:	10%	
0.1xQ2 (Pre):	1.137	cfs
Q10 (Pre):	19.866	cfs
Ordinate #:	100	
Incremental Q (Pre):	0.18729	cfs
Total Hourly Data:	497375	hours

The proposed BMP: PASSED

Interval	Pre-project Flow (cfs)	Pre-project Hours	Pre-project % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
0.000	1.137	855	1.72E-03	939	1.89E-03	109.82%	Pass
1	1.324	761	1.53E-03	814	1.64E-03	107%	Pass
2	1.511	698	1.40E-03	715	1.44E-03	102%	Pass
3	1.699	646	1.30E-03	638	1.28E-03	99%	Pass
4	1.886	597	1.20E-03	553	1.11E-03	93%	Pass
5	2.073	544	1.09E-03	502	1.01E-03	92%	Pass
6	2.260	498	1.00E-03	447	8.99E-04	90%	Pass
7	2.448	462	9.29E-04	419	8.42E-04	91%	Pass
8	2.635	423	8.50E-04	384	7.72E-04	91%	Pass
9	2.822	390	7.84E-04	351	7.06E-04	90%	Pass
10	3.010	362	7.28E-04	320	6.43E-04	88%	Pass
11	3.197	331	6.65E-04	282	5.67E-04	85%	Pass
12	3.384	301	6.05E-04	261	5.25E-04	87%	Pass
13	3.571	282	5.67E-04	241	4.85E-04	85%	Pass
14	3.759	263	5.29E-04	226	4.54E-04	86%	Pass
15	3.946	250	5.03E-04	205	4.12E-04	82%	Pass
16	4.133	236	4.74E-04	180	3.62E-04	76%	Pass
17	4.321	215	4.32E-04	159	3.20E-04	74%	Pass
18	4.508	199	4.00E-04	149	3.00E-04	75%	Pass
19	4.695	187	3.76E-04	135	2.71E-04	72%	Pass
20	4.883	167	3.36E-04	126	2.53E-04	75%	Pass
21	5.070	152	3.06E-04	118	2.37E-04	78%	Pass
22	5.257	140	2.81E-04	112	2.25E-04	80%	Pass
23	5.444	127	2.55E-04	106	2.13E-04	83%	Pass
24	5.632	124	2.49E-04	101	2.03E-04	81%	Pass
25	5.819	119	2.39E-04	93	1.87E-04	78%	Pass
26	6.006	114	2.29E-04	86	1.73E-04	75%	Pass
27	6.194	110	2.21E-04	78	1.57E-04	71%	Pass
28	6.381	103	2.07E-04	70	1.41E-04	68%	Pass
29	6.568	101	2.03E-04	67	1.35E-04	66%	Pass
30	6.755	93	1.87E-04	64	1.29E-04	69%	Pass
31	6.943	82	1.65E-04	58	1.17E-04	71%	Pass
32	7.130	76	1.53E-04	56	1.13E-04	74%	Pass
33	7.317	70	1.41E-04	54	1.09E-04	77%	Pass
34	7.505	67	1.35E-04	53	1.07E-04	79%	Pass
35	7.692	65	1.31E-04	52	1.05E-04	80%	Pass
36	7.879	63	1.27E-04	51	1.03E-04	81%	Pass
37	8.066	59	1.19E-04	48	9.65E-05	81%	Pass
38	8.254	56	1.13E-04	43	8.65E-05	77%	Pass
39	8.441	52	1.05E-04	42	8.44E-05	81%	Pass
40	8.628	52	1.05E-04	41	8.24E-05	79%	Pass
41	8.816	52	1.05E-04	38	7.64E-05	73%	Pass
42	9.003	50	1.01E-04	38	7.64E-05	76%	Pass
43	9.190	49	9.85E-05	37	7.44E-05	76%	Pass
44	9.378	47	9.45E-05	35	7.04E-05	74%	Pass
45	9.565	45	9.05E-05	33	6.63E-05	73%	Pass
46	9.752	43	8.65E-05	30	6.03E-05	70%	Pass
47	9.939	40	8.04E-05	29	5.83E-05	73%	Pass
48	10.127	39	7.84E-05	28	5.63E-05	72%	Pass
49	10.314	38	7.64E-05	25	5.03E-05	66%	Pass
50	10.501	37	7.44E-05	22	4.42E-05	59%	Pass
51	10.689	36	7.24E-05	21	4.22E-05	58%	Pass
52	10.876	35	7.04E-05	21	4.22E-05	60%	Pass
53	11.063	35	7.04E-05	21	4.22E-05	60%	Pass
54	11.250	34	6.84E-05	21	4.22E-05	62%	Pass
55	11.438	33	6.63E-05	19	3.82E-05	58%	Pass
56	11.625	33	6.63E-05	19	3.82E-05	58%	Pass
57	11.812	30	6.03E-05	19	3.82E-05	63%	Pass
58	12.000	28	5.63E-05	17	3.42E-05	61%	Pass
59	12.187	28	5.63E-05	16	3.22E-05	57%	Pass
60	12.374	27	5.43E-05	15	3.02E-05	56%	Pass
61	12.561	22	4.42E-05	12	2.41E-05	55%	Pass
62	12.749	21	4.22E-05	12	2.41E-05	57%	Pass
63	12.936	20	4.02E-05	11	2.21E-05	55%	Pass
64	13.123	20	4.02E-05	11	2.21E-05	55%	Pass
65	13.311	20	4.02E-05	11	2.21E-05	55%	Pass
66	13.498	20	4.02E-05	11	2.21E-05	55%	Pass

Interval	Pre-project Flow (cfs)	Pre-project Hours	Pre-project % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
67	13.685	20	4.02E-05	11	2.21E-05	55%	Pass
68	13.873	19	3.82E-05	10	2.01E-05	53%	Pass
69	14.060	19	3.82E-05	10	2.01E-05	53%	Pass
70	14.247	19	3.82E-05	10	2.01E-05	53%	Pass
71	14.434	19	3.82E-05	10	2.01E-05	53%	Pass
72	14.622	18	3.62E-05	9	1.81E-05	50%	Pass
73	14.809	15	3.02E-05	8	1.61E-05	53%	Pass
74	14.996	13	2.61E-05	8	1.61E-05	62%	Pass
75	15.184	12	2.41E-05	8	1.61E-05	67%	Pass
76	15.371	11	2.21E-05	8	1.61E-05	73%	Pass
77	15.558	9	1.81E-05	8	1.61E-05	89%	Pass
78	15.745	9	1.81E-05	7	1.41E-05	78%	Pass
79	15.933	9	1.81E-05	7	1.41E-05	78%	Pass
80	16.120	9	1.81E-05	7	1.41E-05	78%	Pass
81	16.307	9	1.81E-05	7	1.41E-05	78%	Pass
82	16.495	9	1.81E-05	7	1.41E-05	78%	Pass
83	16.682	8	1.61E-05	7	1.41E-05	88%	Pass
84	16.869	8	1.61E-05	7	1.41E-05	88%	Pass
85	17.056	7	1.41E-05	7	1.41E-05	100%	Pass
86	17.244	7	1.41E-05	7	1.41E-05	100%	Pass
87	17.431	7	1.41E-05	5	1.01E-05	71%	Pass
88	17.618	7	1.41E-05	5	1.01E-05	71%	Pass
89	17.806	7	1.41E-05	5	1.01E-05	71%	Pass
90	17.993	6	1.21E-05	4	8.04E-06	67%	Pass
91	18.180	6	1.21E-05	4	8.04E-06	67%	Pass
92	18.368	6	1.21E-05	4	8.04E-06	67%	Pass
93	18.555	6	1.21E-05	4	8.04E-06	67%	Pass
94	18.742	6	1.21E-05	4	8.04E-06	67%	Pass
95	18.929	6	1.21E-05	4	8.04E-06	67%	Pass
96	19.117	6	1.21E-05	4	8.04E-06	67%	Pass
97	19.304	6	1.21E-05	4	8.04E-06	67%	Pass
98	19.491	6	1.21E-05	4	8.04E-06	67%	Pass
99	19.679	5	1.01E-05	2	4.02E-06	40%	Pass
100	19.866	5	1.01E-05	2	4.02E-06	40%	Pass


POC-1 Flow Duration Curve
[Pre vs. Post (Mitigated)]
25.000
20.000
15.000
10.000
5.000
0.000
Flow (cfs)
1.0E-06
1.0E-05
1.0E-04
1.0E-03
1.0E-02
% Time Exceeding
Pre-project Q
Post-project (Mitigated) Q

CMP-2 Discharge to MWS BF-3-2

Discharge vs Elevation Table

Low orifice:	0.525 "	Top orifice:	0.75 "
Number:	4	Number:	0
Cg-low:	0.61	Cg-low:	0.61
invert elev:	0.00 ft	invert elev:	0.75 ft

h	H/D-low	H/D-mid	H/D-top	Qlow-orif	Qlow-weir	Qtot-low	Qmid-orif	Qmid-weir	Qtot-med	Qtop-orif	Qtop-weir	Qtot-top	Qpeak-top	Qtot
(ft)	-	-	-	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
0.17	3.81	0.00	0.00	0.011	0.016	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0112
0.33	7.62	0.00	0.00	0.016	1.321	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0164
0.50	11.43	0.00	0.00	0.020	14.762	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0204
0.67	15.24	2.42	0.00	0.024	73.005	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0236
0.83	19.05	4.85	1.33	0.027	242.879	0.027	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0265
1.00	22.86	7.27	4.00	0.029	637.724	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0291
1.17	26.67	9.70	6.67	0.031	1429.734	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0315
1.33	30.48	12.12	9.33	0.034	2862.302	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0337
1.50	34.29	14.55	12.00	0.036	5262.368	0.036	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0358
1.67	38.10	16.97	14.67	0.038	9052.761	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0378
1.83	41.90	19.39	17.33	0.040	14764.544	0.040	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0396
2.00	45.71	21.82	20.00	0.041	23049.363	0.041	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0414
2.17	49.52	24.24	22.67	0.043	34691.785	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0431
2.33	53.33	26.67	25.33	0.045	50621.653	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0448
2.50	57.14	29.09	28.00	0.046	71926.420	0.046	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0463
2.67	60.95	31.52	30.67	0.048	99863.503	0.048	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0479
2.83	64.76	33.94	33.33	0.049	135872.625	0.049	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0494
3.00	68.57	36.36	36.00	0.051	181588.157	0.051	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0508
3.17	72.38	38.79	38.67	0.052	238851.469	0.052	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0522

CMP #HMP-2 Stage Storage					
Input DCV			3,285		
Input Factor			2.05		
WQ Ponding Depth			3.000	ft	
Note: Find out the elevation value in relation to required WQ volume					
HMP-2-A Stage Storage					
depth	Average Surface area	area (ac)	elevation	Comulative volume (cf)	volume (acft)
0.00	1244.4	0.0286	0.00	0.0	0.0
0.17	1650.4	0.0379	0.17	252.7	0.00580
0.33	1811.9	0.0416	0.33	542.1	0.01244
0.50	1931.4	0.0443	0.50	854.4	0.01961
0.67	2028.1	0.0466	0.67	1,184.6	0.02720
0.83	2109.9	0.0484	0.83	1,529.6	0.03512
1.00	2180.6	0.0501	1.00	1,887.3	0.04333
1.17	2242.5	0.0515	1.17	2,256.0	0.05179
1.33	2297.3	0.0527	1.33	2,634.4	0.06048
1.50	2346.0	0.0539	1.50	3,021.5	0.06936
1.67	2389.3	0.0549	1.67	3,416.1	0.07842
1.83	2428.0	0.0557	1.83	3,817.6	0.08764
2.00	2462.3	0.0565	2.00	4,225.2	0.09700
2.17	2492.6	0.0572	2.17	4,638.2	0.10648
2.33	2519.4	0.0578	2.33	5,055.9	0.11607
2.50	2542.6	0.0584	2.50	5,477.8	0.12575
2.67	2562.7	0.0588	2.67	5,903.3	0.13552
2.83	2579.6	0.0592	2.83	6,331.8	0.14536
3.00	2593.6	0.0595	3.00	6,763.0	0.15526
3.17	2604.6	0.0598	3.17	7,196.2	0.16520
3.33	2612.9	0.0600	3.33	7,631.0	0.17518
3.50	2618.3	0.0601	3.50	8,067.0	0.18519
3.67	2621.1	0.0602	3.67	8,503.7	0.19522
3.83	2621.1	0.0602	3.83	8,940.5	0.20525
4.00	2618.3	0.0601	4.00	9,377.2	0.21527
4.17	2612.9	0.0600	4.17	9,813.2	0.22528
4.33	2604.6	0.0598	4.33	10,248.0	0.23526
4.50	2593.6	0.0595	4.50	10,681.2	0.24521
4.67	2579.6	0.0592	4.67	11,112.4	0.25510
4.83	2562.7	0.0588	4.83	11,540.9	0.26494
5.00	2542.6	0.0584	5.00	11,966.4	0.27471
5.17	2519.4	0.0578	5.17	12,388.3	0.28440
5.33	2492.6	0.0572	5.33	12,806.0	0.29399
5.50	2462.3	0.0565	5.50	13,219.0	0.30347
5.67	2428.0	0.0557	5.67	13,626.6	0.31282
5.83	2389.3	0.0549	5.83	14,028.1	0.32204
6.00	2346.0	0.0539	6.00	14,422.7	0.33110
6.17	2297.3	0.0527	6.17	14,809.8	0.33999
6.33	2242.5	0.0515	6.33	15,188.2	0.34867
6.50	2180.6	0.0501	6.50	15,556.9	0.35714
6.67	2109.9	0.0484	6.67	15,914.6	0.36535
6.83	2028.1	0.0466	6.83	16,259.6	0.37327
7.00	1931.4	0.0443	7.00	16,589.8	0.38085
7.17	1811.9	0.0416	7.17	16,902.1	0.38802
7.33	1650.4	0.0379	7.33	17,191.5	0.39466
7.50	1244.4	0.0286	7.50	17,444.2	0.40046
7.67	1244.4	0.0286	7.67	17,651.6	0.40522
7.83	1244.4	0.0286	7.83	17,859.0	0.40999
8.00	1244.4	0.0286	8.00	18,066.4	0.41475
8.17	1244.4	0.0286	8.17	18,273.8	0.41951

CONTECH ENGINEERED SOLUTIONS

Date: 8/7/2024
Project Name: East Storage-2 - 47954 (8-7-2024 0-5-24)

City / County:
State:

Designed By:
Company:
Telephone:

CMP: Underground Detention System Storage Volume Estimation

=Adjustable Input Cells

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular applicaton and are subject to verification of the Engineer of Record. This tool is only applicable for rectangular shaped systems.

Summary of Inputs

System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	100.0	Backfill Porosity (%):	40%	System Diameter (in):	90
Out-to-out width (ft):	28.5	Depth Above Pipe (in):	9.0	Pipe Spacing (in):	36
Number of Manifolds (ea):	1.0	Depth Below Pipe (in):	0.0	Incremental Analysis (in):	2
Number of Barrels (ea):	3.0	Width At Ends (ft):	1.0	System Invert (Elevation):	223.5
		Width At Sides (ft):	1.0		

Storage Volume Estimation

System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	Elevation (ft)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Percent Open Storage (%)	Ave. Surface Area (sf)
0.00	223.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	1,244.4
0.17	223.66	75.5	75.5	177.2	177.2	252.7	252.7	29.9%	1,650.4
0.33	223.83	136.6	212.1	152.7	329.9	289.4	542.1	39.1%	1,811.9
0.50	224.00	174.9	387.0	137.4	467.4	312.3	854.4	45.3%	1,931.4
0.67	224.16	204.7	591.7	125.5	592.9	330.2	1,184.6	49.9%	2,028.1
0.83	224.33	229.4	821.1	115.7	708.6	345.0	1,529.6	53.7%	2,109.9
1.00	224.50	250.5	1,071.5	107.2	815.8	357.7	1,887.3	56.8%	2,180.6
1.17	224.66	268.8	1,340.4	99.9	915.7	368.7	2,256.0	59.4%	2,242.5
1.33	224.83	285.0	1,625.4	93.4	1,009.0	378.4	2,634.4	61.7%	2,297.3
1.50	225.00	299.4	1,924.8	87.7	1,096.7	387.0	3,021.5	63.7%	2,346.0
1.67	225.16	312.1	2,236.9	82.5	1,179.2	394.7	3,416.1	65.5%	2,389.3
1.83	225.33	323.5	2,560.4	78.0	1,257.2	401.5	3,817.6	67.1%	2,428.0
2.00	225.50	333.6	2,894.0	74.0	1,331.2	407.6	4,225.2	68.5%	2,462.3
2.17	225.66	342.6	3,236.6	70.4	1,401.5	413.0	4,638.2	69.8%	2,492.6
2.33	225.83	350.5	3,587.2	67.2	1,468.7	417.7	5,055.9	71.0%	2,519.4
2.50	226.00	357.5	3,944.6	64.4	1,533.1	421.9	5,477.8	72.0%	2,542.6
2.67	226.16	363.5	4,308.1	62.0	1,595.2	425.5	5,903.3	73.0%	2,562.7
2.83	226.33	368.6	4,676.7	60.0	1,655.1	428.6	6,331.8	73.9%	2,579.6
3.00	226.50	372.9	5,049.6	58.2	1,713.3	431.1	6,763.0	74.7%	2,593.6
3.17	226.66	376.4	5,426.0	56.9	1,770.2	433.2	7,196.2	75.4%	2,604.6
3.33	226.83	379.1	5,805.1	55.8	1,826.0	434.8	7,631.0	76.1%	2,612.9
3.50	227.00	381.0	6,186.0	55.0	1,881.0	436.0	8,067.0	76.7%	2,618.3
3.67	227.16	382.1	6,568.1	54.6	1,935.6	436.7	8,503.7	77.2%	2,621.1
3.83	227.33	382.5	6,950.6	54.4	1,990.0	436.9	8,940.5	77.7%	2,621.1
4.00	227.50	382.1	7,332.7	54.6	2,044.5	436.7	9,377.2	78.2%	2,618.3
4.17	227.66	381.0	7,713.6	55.0	2,099.6	436.0	9,813.2	78.6%	2,612.9
4.33	227.83	379.1	8,092.7	55.8	2,155.3	434.8	10,248.0	79.0%	2,604.6
4.50	228.00	376.4	8,469.0	56.9	2,212.2	433.2	10,681.2	79.3%	2,593.6
4.67	228.16	372.9	8,841.9	58.2	2,270.4	431.1	11,112.4	79.6%	2,579.6
4.83	228.33	368.6	9,210.6	60.0	2,330.4	428.6	11,540.9	79.8%	2,562.7
5.00	228.50	363.5	9,574.0	62.0	2,392.4	425.5	11,966.4	80.0%	2,542.6
5.17	228.66	357.5	9,931.5	64.4	2,456.8	421.9	12,388.3	80.2%	2,519.4
5.33	228.83	350.5	10,282.0	67.2	2,524.0	417.7	12,806.0	80.3%	2,492.6
5.50	229.00	342.6	10,624.6	70.4	2,594.3	413.0	13,219.0	80.4%	2,462.3
5.67	229.16	333.6	10,958.3	74.0	2,668.3	407.6	13,626.6	80.4%	2,428.0
5.83	229.33	323.5	11,281.8	78.0	2,746.3	401.5	14,028.1	80.4%	2,389.3
6.00	229.50	312.1	11,593.9	82.5	2,828.8	394.7	14,422.7	80.4%	2,346.0
6.17	229.66	299.4	11,893.3	87.7	2,916.5	387.0	14,809.8	80.3%	2,297.3
6.33	229.83	285.0	12,178.3	93.4	3,009.9	378.4	15,188.2	80.2%	2,242.5
6.50	230.00	268.8	12,447.1	99.9	3,109.7	368.7	15,556.9	80.0%	2,180.6
6.67	230.16	250.5	12,697.6	107.2	3,217.0	357.7	15,914.6	79.8%	2,109.9
6.83	230.33	229.4	12,926.9	115.7	3,332.6	345.0	16,259.6	79.5%	2,028.1
7.00	230.50	204.7	13,131.6	125.5	3,458.2	330.2	16,589.8	79.2%	1,931.4
7.17	230.66	174.9	13,306.5	137.4	3,595.6	312.3	16,902.1	78.7%	1,811.9
7.33	230.83	136.6	13,443.1	152.7	3,748.3	289.4	17,191.5	78.2%	1,650.4
7.50	231.00	75.5	13,518.7	177.2	3,925.5	252.7	17,444.2	77.5%	1,244.4
7.67	231.16	0.0	13,518.7	207.4	4,132.9	207.4	17,651.6	76.6%	1,244.4
7.83	231.33	0.0	13,518.7	207.4	4,340.3	207.4	17,859.0	75.7%	1,244.4
8.00	231.50	0.0	13,518.7	207.4	4,547.7	207.4	18,066.4	74.8%	1,244.4
8.17	231.66	0.0	13,518.7	207.4	4,755.1	207.4	18,273.8	74.0%	1,244.4

WQ Drawdown @		3.00	ft=	62.00
Elevation	Q_{AVG} (CFS)	ΔV (CF)	ΔT (HR)	Total T
0.00	0.011	253	6.27	62.00
0.17	0.014	289	5.82	55.74
0.33	0.018	312	4.72	49.92
0.50	0.022	330	4.17	45.20
0.67	0.025	345	3.82	41.03
0.83	0.028	358	3.57	37.21
1.00	0.030	369	3.38	33.64
1.17	0.033	378	3.22	30.26
1.33	0.035	387	3.09	27.03
1.50	0.037	395	2.98	23.94
1.67	0.039	402	2.88	20.96
1.83	0.041	408	2.79	18.07
2.00	0.042	413	2.71	15.28
2.17	0.044	418	2.64	12.56
2.33	0.046	422	2.57	9.92
2.50	0.047	425	2.51	7.35
2.67	0.049	429	2.45	4.84
2.83	0.050	431	2.39	2.39
3.00				

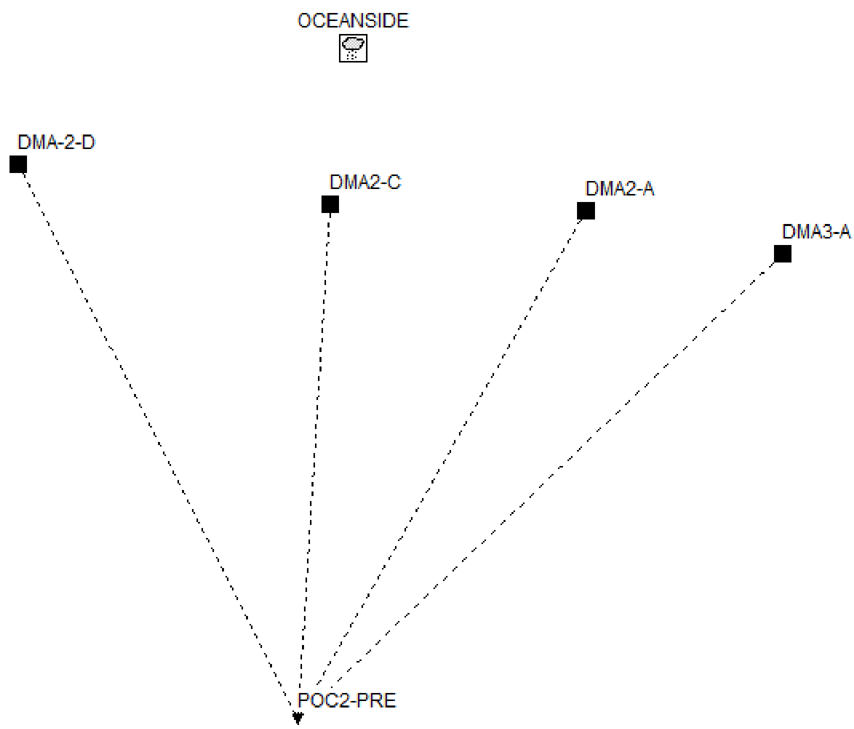
CMP #HMP-2 Discharge HMP Riser

Discharge vs Elevation Table

Bottom orifice:	0.50 "		
Number:	1		
Cg-low:	0.61		
invert elev:	3.00 ft		
Low orifice:	1 "	Top orifice:	3 "
Number:	4	Number:	16
Cg-low:	0.61	Cg-low:	0.61
invert elev:	5.50 ft	invert elev:	6.60 ft
Middle orifice:	3 "	Emergency inlet:	
number of orif:	12	Rim height:	7.00 ft
Cg-middle:	0.61	Riser Box D	3x4
invert elev:	6.00 ft	Weir Length	14.00 ft

h	H/D-bot	H/D-low	H/D-mid	H/D-top	Qbot-orif	Qbot-weir	Qtot-bot	Qlow-orif	Qlow-weir	Qtot-low	Qmid-orif	Qmid-weir	Qtot-med	Qtop-orif	Qtop-weir	Qtot-top	Qpeak-top	Qtot	Peak Flow WQ+HMP Qtot
(ft)		-	-	-	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
0.17	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0112
0.33	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0164
0.50	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0204
0.67	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0236
0.83	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0265
1.00	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0291
1.17	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0315
1.33	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0337
1.50	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0358
1.67	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0378
1.83	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0396
2.00	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0414
2.17	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0431
2.33	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0448
2.50	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0463
2.67	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0479
2.83	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0494
3.00	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0508
3.17	4.00	0.00	0.00	0.00	0.003	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0522
3.33	8.00	0.00	0.00	0.00	0.004	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0536
3.50	12.00	0.00	0.00	0.00	0.005	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0549
3.67	16.00	0.00	0.00	0.00	0.005	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0562
3.83	20.00	0.00	0.00	0.00	0.006	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0575
4.00	24.00	0.00	0.00	0.00	0.007	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0587
4.17	28.00	0.00	0.00	0.00	0.007	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0599
4.33	32.00	0.00	0.00	0.00	0.008	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0611
4.50	36.00	0.00	0.00	0.00	0.008	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0623
4.67	40.00	0.00	0.00	0.00	0.009	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0634
4.83	44.00	0.00	0.00	0.00	0.009	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0646
5.00	48.00	0.00	0.00	0.00	0.009	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0657
5.17	52.00	0.00	0.00	0.00	0.010	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0668
5.33	56.00	0.00	0.00	0.00	0.010	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0678
5.50	60.00	0.00	0.00	0.00	0.011	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0689
5.67	64.00	2.00	0.00	0.00	0.011	0.00	0.002	0.038	0.050	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.040	0.1099
5.83	68.00	4.00	0.00	0.00	0.011	0.00	0.004	0.058	0.095	0.058	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.062	0.1328
6.00	72.00	6.00	0.00	0.00	0.012	0.06	0.012	0.072	1.375	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.084	0.1558
6.17	76.00	8.00	0.67	0.00	0.012	0.40	0.012	0.084	8.971	0.084	0.589	0.486	0.486	0.000	0.000	0.000	0.000	0.583	0.6556
6.33	80.00	10.00	1.33	0.00	0.012	1.51	0.012	0.095	34.269	0.095	1.316	1.502	1.316	0.000	0.000	0.000	0.000	1.423	1.4973
6.50	84.00	12.00	2.00	0.00	0.012	4.31	0.012	0.105	97.420	0.105	1.766	2.345	1.766	0.000	0.000	0.000	0.000	1.883	1.9577
6.67	88.00	14.00	2.67	0.27	0.013	10.16	0.013	0.113	229.816	0.113	2.122	2.630	2.122	0.000	0.116	0.116	0.000	2.364	2.4401
6.83	92.00	16.00	3.33	0.93	0.013	21.06	0.013	0.121	476.546	0.121	2.427	2.766	2.427	1.265	1.160	1.160	0.000	3.722	3.7983
7.00	96.00	18.00	4.00	1.60	0.013	39.72	0.013	0.129	898.865	0.129	2.697	4.427	2.697	2.016	2.525	2.016	0.000	4.856	4.9335
7.17	100.00	20.00	4.67	2.27	0.014	69.68	0.014	0.136	1576.661	0.136	2.943	11.033	2.943	2.555	3.368	2.555	3.172	8.820	8.8986
7.33	104.00	22.00	5.33	2.93	0.014	115.39	0.014	0.143	2610.918	0.143	3.170	28.217	3.170	2.999	3.522	2.999	8.972	15.297	15.3768
7.50	108.00	24.00	6.00	3.60	0.014	182.35	0.014	0.149	4126.181	0.149	3.381	64.304	3.381	3.385	4.133	3.385	16.483	23.412	23.4926
7.67	112.08	26.04	6.68	4.28	0.014	279.47	0.014	0.156	6323.584	0.156	3.584	132.520	3.584	3.737	8.441	3.737	25.567	33.059	33.0591
7.83	115.92	27.96	7.32	4.92	0.015	404.91	0.015	0.162	9162.119	0.162	3.765	239.982	3.765	4.042	21.240	4.042	35.252	43.235	43.2353
8.00	120.00	30.00	8.00	5.60	0.015	583.75	0.015	0.167	13208.685	0.167	3.948	419.555	3.948	4.341	53.088	4.341	46.620	55.092	55.0921
8.17	124.08	32.04	8.68	6.28	0.015	820.71	0.015	0.173	18570.570	0.173	4.124	691.324	4.124	4.622	116.986	4.622	59.000	67.933	67.9333

HMP-2A Drawdown @		8.17	ft=	95.50
Elevation	Q_{AVG} (CFS)	∆V (CF)	∆T (HR)	Total T
0.00	0.011	253	6.27	95.50
0.17	0.014	289	5.82	89.23
0.33	0.018	312	4.72	83.41
0.50	0.022	330	4.17	78.69
0.67	0.025	345	3.82	74.52
0.83	0.028	358	3.57	70.70
1.00	0.030	369	3.38	67.13
1.17	0.033	378	3.22	63.75
1.33	0.035	387	3.09	60.52
1.50	0.037	395	2.98	57.43
1.67	0.039	402	2.88	54.45
1.83	0.041	408	2.79	51.57
2.00	0.042	413	2.71	48.77
2.17	0.044	418	2.64	46.06
2.33	0.046	422	2.57	43.41
2.50	0.047	425	2.51	40.84
2.67	0.049	429	2.45	38.33
2.83	0.050	431	2.39	35.88
3.00	0.051	433	2.34	33.49
3.17	0.053	435	2.28	31.16
3.33	0.054	436	2.23	28.87
3.50	0.056	437	2.18	26.64
3.67	0.057	437	2.14	24.45
3.83	0.058	437	2.09	22.32
4.00	0.059	436	2.04	20.23
4.17	0.061	435	2.00	18.19
4.33	0.062	433	1.95	16.19
4.50	0.063	431	1.91	14.24
4.67	0.064	429	1.86	12.34
4.83	0.065	425	1.81	10.48
5.00	0.066	422	1.77	8.66
5.17	0.067	418	1.72	6.89
5.33	0.068	413	1.68	5.17
5.50	0.089	408	1.27	3.49
5.67	0.121	402	0.92	2.23
5.83	0.144	395	0.76	1.31
6.00	0.406	387	0.26	0.55
6.17	1.076	378	0.10	0.28
6.33	1.727	369	0.06	0.18
6.50	2.199	358	0.05	0.13
6.67	3.119	345	0.03	0.08
6.83	4.366	330	0.02	0.05
7.00	6.916	312	0.01	0.03
7.17	12.138	289	0.01	0.02
7.33	19.435	253	0.00	0.01
7.50	28.276	207	0.00	0.01
7.67	38.147	207	0.00	0.00
7.83	49.164	207	0.00	0.00
8.00	61.513	207	0.00	0.00
8.17				


OCEANSIDE
DMA-2-D
DMA2-C
DMA2-A
DMA3-A
POC2-PRE

```
[TITLE]
;;Project Title/Notes
OLIVE PARK APARTMENTS - POC2 PRE-DEVELOPED

[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           08/28/1951
START_TIME           00:00:00
REPORT_START_DATE    08/28/1951
REPORT_START_TIME    00:00:00
END_DATE             05/23/2008
END_TIME             23:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:15:00
DRY_STEP             04:00:00
ROUTING_STEP         0:01:00
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         12.557
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
;;-------------- ----------------
MONTHLY          0.06   0.08   0.11   0.15   0.17   0.19   0.19   0.18   0.15   0.11   0.08   0.06
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- ------ ------ ----------
OCEANSIDE        INTENSITY 1:00     1.0      TIMESERIES OCEANSIDE-RAIN

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
;Soil Type D
DMA-2-D          OCEANSIDE        POC2-PRE         4.655    0        680      25       0
;Soil Type C
DMA2-C           OCEANSIDE        POC2-PRE         6.29     46.3     1300     3        0
;Soil Type A
DMA2-A           OCEANSIDE        POC2-PRE         0.982    0        280      2.31     0
;Soil Type A,Soil Type A, reduced conductivity (existing compacted unpaved road)
DMA3-A           OCEANSIDE        POC2-PRE         2.12     5.9      350      40       0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
DMA-2-D          0.012      0.15       0.05       0.1        25         OUTLET
DMA2-C           0.012      0.15       0.05       0.10       25         OUTLET
DMA2-A           0.012      0.15       0.05       0.10       25         OUTLET
```

```
DMA3-A           0.012      0.15       0.05       0.10       25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    Ksat       IMD
;;-------------- ---------- ---------- ----------
DMA-2-D          9          0.025      0.33
DMA2-C           6          0.075      0.32
DMA2-A           1.5        0.3        0.3
DMA3-A           1.5        0.3        0.3

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
POC2-PRE         0          FREE                        NO

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
OCEANSIDE-RAIN   FILE "OCEANSIDE.prn"

[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
;;-------------- ------------------ ------------------
POC2-PRE         4462.719           4879.386

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
DMA-2-D          2963.183           7862.233
DMA-2-D          2963.183           7862.233
DMA2-C           4637.767           7648.456
DMA2-A           6015.439           7612.827
DMA3-A           7072.447           7387.173

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
OCEANSIDE        4778.107           8476.331
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.014)
--------------------------------------------------------------

OLIVE PARK APARTMENTS - POC2 PRE-DEVELOPED


*********************************************************
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 ........... NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Starting Date ............ 08/28/1951 00:00:00
Ending Date .............. 05/23/2008 23:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Wet Time Step ............ 00:15:00
Dry Time Step ............ 04:00:00


**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......       790.436       675.250
Evaporation Loss .........        36.189        30.915
Infiltration Loss ........       538.854       460.329
Surface Runoff ...........       222.798       190.331
Final Storage ............         0.011         0.009
Continuity Error (%) .....        -0.938

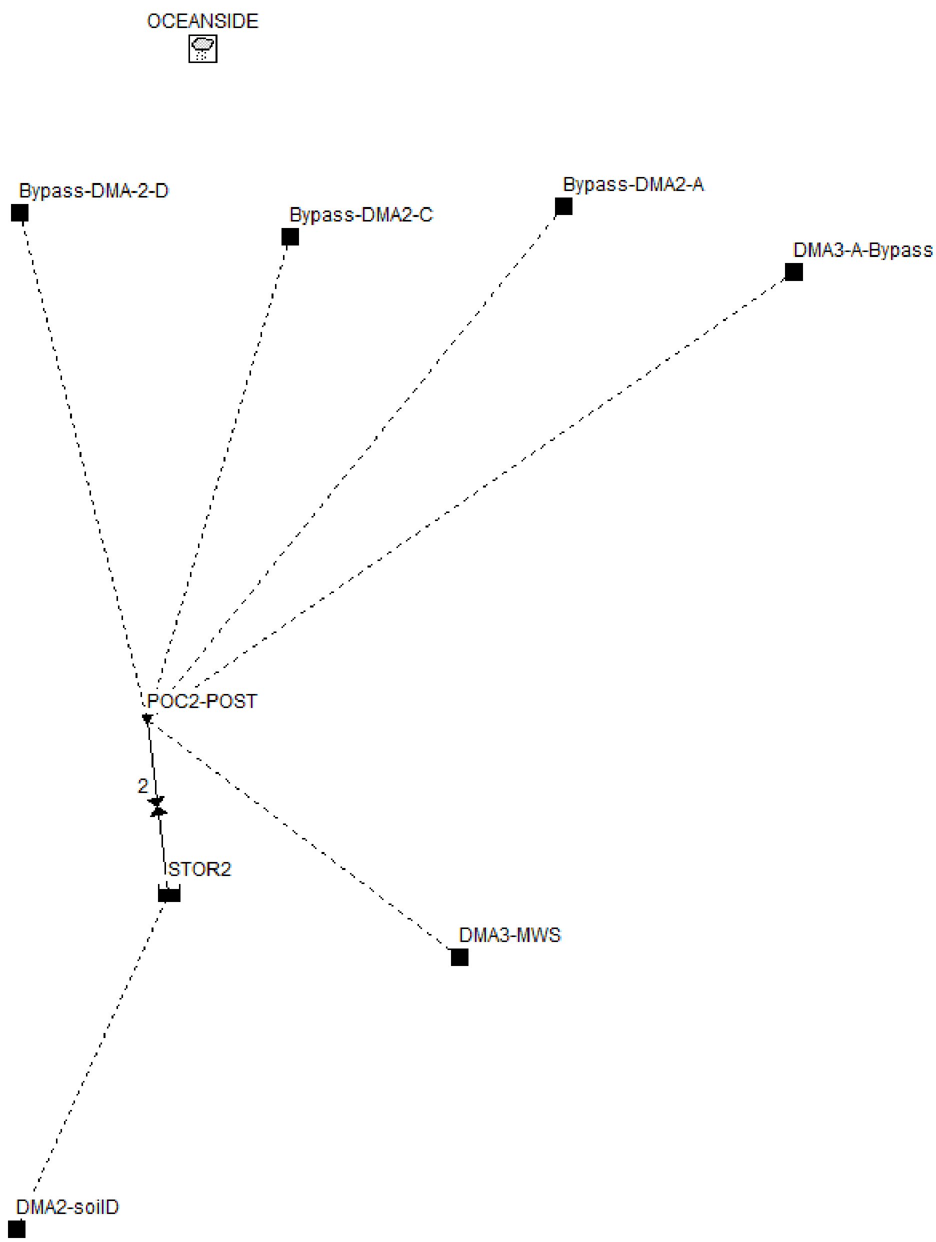

**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......       222.797        72.602
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........       222.797        72.602
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 ......         0.000         0.000
Continuity Error (%) .....         0.000


***************************
Subcatchment Runoff Summary
***************************

----------------------------------------------------------------------------------------------------------------
--------------
                         Total      Total      Total      Total     Imperv       Perv      Total        Total
  Peak  Runoff
                        Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff       Runoff
```

Subcatchment	in	in	in	in	in	in	in	10^6 gal	CFS	Runoff Coeff
DMA-2-D	675.25	0.00	21.66	520.64	0.00	142.06	142.06	17.96	5.20	0.210
DMA2-C	675.25	0.00	50.78	327.58	270.83	32.82	303.65	51.86	7.31	0.450
DMA2-A	675.25	0.00	0.66	666.83	0.00	8.31	8.31	0.22	0.86	0.012
DMA3-A	675.25	0.00	6.31	626.12	34.92	9.52	44.44	2.56	1.95	0.066

Analysis begun on: Wed Aug 7 09:18:47 2024
Analysis ended on: Wed Aug 7 09:19:00 2024
Total elapsed time: 00:00:13



OCEANSIDE
Bypass-DMA-2-D
Bypass-DMA2-C
Bypass-DMA2-A
DMA3-A-Bypass
POC2-POST
2
STOR2
DMA3-MWS
DMA2-soilD

```
[TITLE]
;;Project Title/Notes
OLIVE PARK APARTMENTS - POC1 PRE-DEVELOPED

[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           08/28/1951
START_TIME           00:00:00
REPORT_START_DATE    08/28/1951
REPORT_START_TIME    00:00:00
END_DATE             05/23/2008
END_TIME             23:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:15:00
DRY_STEP             04:00:00
ROUTING_STEP         0:01:00
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         12.557
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
;;-------------- ----------------
MONTHLY          0.06   0.08   0.11   0.15   0.17   0.19   0.19   0.18   0.15   0.11   0.08   0.06
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- ------ ------ ----------
OCEANSIDE        INTENSITY 1:00     1.0      TIMESERIES OCEANSIDE-RAIN

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
;Soil Type D
Bypass-DMA-2-D   OCEANSIDE        POC2-POST        1.544    0        236      25       0
;Soil Type C
Bypass-DMA2-C    OCEANSIDE        POC2-POST        5.325    54.6     1300     1.18     0
;Soil Type A
Bypass-DMA2-A    OCEANSIDE        POC2-POST        0.674    0        280      2.31     0
;Soil Type A,Soil Type A, reduced conductivity (existing compacted unpaved road)
DMA3-A-Bypass    OCEANSIDE        POC2-POST        1.669    7.5      275      4.28     0
DMA2-soilD       OCEANSIDE        stor2            2.317    68       675      1.5      0
;EVA to Flow based MWS-bypass vault
DMA3-MWS         OCEANSIDE        POc2-POSt        0.517    93.3     845      2.5      0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
```

```
Bypass-DMA-2-D   0.012      0.15       0.05       0.1        25         OUTLET
Bypass-DMA2-C    0.012      0.15       0.05       0.10       25         OUTLET
Bypass-DMA2-A    0.012      0.15       0.05       0.10       25         OUTLET
DMA3-A-Bypass    0.012      0.15       0.05       0.10       25         OUTLET
DMA2-soilD       0.012      0.15       0.05       0.10       25         IMPERVIOUS 100
DMA3-MWS         0.012      0.15       0.05       0.1        25         IMPERVIOUS 100

[INFILTRATION]
;;Subcatchment   Suction    Ksat       IMD
;;-------------- ---------- ---------- ----------
Bypass-DMA-2-D   9          0.025      0.33
Bypass-DMA2-C    6          0.075      0.32
Bypass-DMA2-A    1.5        0.3        0.3
DMA3-A-Bypass    1.5        0.3        0.3
DMA2-soilD       9          0.0175     0.25
DMA3-MWS         9          0.0175     0.33

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
POC2-POST        0          FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            N/A      Fevap    Psi
  Ksat     IMD
;;-------------- -------- ---------- ----------- ---------- ---------------------------- -------- --------
   -------- --------
STOR2            0        7.5        0          TABULAR    Stor2                        0        0

[OUTLETS]
;;Name           From Node        To Node          Offset     Type            QTable/Qcoeff    Qexpon     Gated

;;-------------- ---------------- ---------------- ---------- --------------- ---------------- ----------
--------
2                STOR2            POC2-POST        0          TABULAR/DEPTH   Outlet2                     NO


[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
Outlet2          Rating     0.00       0.0000
Outlet2                     0.17       0.0112
Outlet2                     0.33       0.0164
Outlet2                     0.50       0.0204
Outlet2                     0.67       0.0236
Outlet2                     0.83       0.0265
Outlet2                     1.00       0.0291
Outlet2                     1.17       0.0315
Outlet2                     1.33       0.0337
Outlet2                     1.50       0.0358
Outlet2                     1.67       0.0378
Outlet2                     1.83       0.0396
Outlet2                     2.00       0.0414
Outlet2                     2.17       0.0431
Outlet2                     2.33       0.0448
Outlet2                     2.50       0.0463
Outlet2                     2.67       0.0479
Outlet2                     2.83       0.0494
Outlet2                     3.00       0.0508
Outlet2                     3.17       0.0547
Outlet2                     3.33       0.0573
Outlet2                     3.50       0.0595
Outlet2                     3.67       0.0616
Outlet2                     3.83       0.0635
Outlet2                     4.00       0.0653
Outlet2                     4.17       0.0671
Outlet2                     4.33       0.0688
Outlet2                     4.50       0.0704
Outlet2                     4.67       0.0720
Outlet2                     4.83       0.0736
Outlet2                     5.00       0.0751
```

```
Outlet2                         5.17        0.0765
Outlet2                         5.33        0.0780
Outlet2                         5.50        0.0794
Outlet2                         5.67        0.1186
Outlet2                         5.83        0.1398
Outlet2                         6.00        0.1558
Outlet2                         6.17        0.6556
Outlet2                         6.33        1.4973
Outlet2                         6.50        1.9577
Outlet2                         6.67        2.3241
Outlet2                         6.83        2.6381
Outlet2                         7.00        2.9173
Outlet2                         7.17        6.3435
Outlet2                         7.33        12.3781
Outlet2                         7.50        20.1080
Outlet2                         7.67        29.3216
Outlet2                         7.83        39.1938
Outlet2                         8.00        50.7508
Outlet2                         8.17        63.3117
;
Stor2            Storage        0.00        1244.4
Stor2                           0.17        1650.4
Stor2                           0.33        1811.9
Stor2                           0.50        1931.4
Stor2                           0.67        2028.1
Stor2                           0.83        2109.9
Stor2                           1.00        2180.6
Stor2                           1.17        2242.5
Stor2                           1.33        2297.3
Stor2                           1.50        2346.0
Stor2                           1.67        2389.3
Stor2                           1.83        2428.0
Stor2                           2.00        2462.3
Stor2                           2.17        2492.6
Stor2                           2.33        2519.4
Stor2                           2.50        2542.6
Stor2                           2.67        2562.7
Stor2                           2.83        2579.6
Stor2                           3.00        2593.6
Stor2                           3.17        2604.6
Stor2                           3.33        2612.9
Stor2                           3.50        2618.3
Stor2                           3.67        2621.1
Stor2                           3.83        2621.1
Stor2                           4.00        2618.3
Stor2                           4.17        2612.9
Stor2                           4.33        2604.6
Stor2                           4.50        2593.6
Stor2                           4.67        2579.6
Stor2                           4.83        2562.7
Stor2                           5.00        2542.6
Stor2                           5.17        2519.4
Stor2                           5.33        2492.6
Stor2                           5.50        2462.3
Stor2                           5.67        2428.0
Stor2                           5.83        2389.3
Stor2                           6.00        2346.0
Stor2                           6.17        2297.3
Stor2                           6.33        2242.5
Stor2                           6.50        2180.6
Stor2                           6.67        2109.9
Stor2                           6.83        2028.1
Stor2                           7.00        1931.4
Stor2                           7.17        1811.9
Stor2                           7.33        1650.4
Stor2                           7.50        1244.4
Stor2                           7.67        1244.4
Stor2                           7.83        1244.4
Stor2                           8.00        1244.4
Stor2                           8.17        1244.4
```

```
[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
OCEANSIDE-RAIN   FILE "OCEANSIDE.prn"

[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
;;-------------- ------------------ ------------------
POC2-POST        4462.719           4879.386
STOR2            4579.832           3937.575

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Bypass-DMA-2-D   3775.510           7611.044
Bypass-DMA-2-D   3775.510           7611.044
Bypass-DMA2-C    5228.091           7478.992
Bypass-DMA2-A    6707.746           7640.845
DMA3-A-Bypass    7944.542           7288.732
DMA2-soilD       3762.279           2141.454
DMA3-MWS         6144.366           3609.155

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
OCEANSIDE        4778.107           8476.331
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.014)
--------------------------------------------------------------

OLIVE PARK APARTMENTS - POC1 PRE-DEVELOPED


*********************************************************
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 ............ 08/28/1951 00:00:00
Ending Date .............. 05/23/2008 23:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Wet Time Step ............ 00:15:00
Dry Time Step ............ 04:00:00
Routing Time Step ........ 60.00 sec


**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......       677.838       675.250
Evaporation Loss .........        49.550        49.360
Infiltration Loss ........       342.646       341.337
Surface Runoff ...........       292.490       291.373
Final Storage ............         0.019         0.018
Continuity Error (%) .....        -1.013


**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......       292.488        95.312
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........       292.476        95.308
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 ......         0.002         0.001
Continuity Error (%) .....         0.004


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


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

Routing Time Step Summary
****

Minimum Time Step : 60.00 sec
Average Time Step : 60.00 sec
Maximum Time Step : 60.00 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
Bypass-DMA-2-D	675.25	0.00	21.12	519.76	0.00	142.48	142.48	5.97	1.73	0.211
Bypass-DMA2-C	675.25	0.00	58.98	277.33	318.21	27.28	345.49	49.95	6.22	0.512
Bypass-DMA2-A	675.25	0.00	0.65	666.20	0.00	9.06	9.06	0.17	0.60	0.013
DMA3-A-Bypass	675.25	0.00	8.00	617.08	44.18	7.37	51.55	2.34	1.49	0.076
DMA2-soilD	675.25	0.00	79.98	145.60	460.72	64.47	460.72	28.99	2.78	0.682
DMA3-MWS	675.25	0.00	94.37	31.33	561.97	13.45	561.97	7.89	0.62	0.832

****
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
POC2-POST	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
STOR2	STORAGE	0.08	6.68	6.68	18857 17:06	6.64

****
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
POC2-POST	OUTFALL	10.66	12.95	18857 17:01	66.3	95.3	0.000
STOR2	STORAGE	2.78	2.78	18857 17:01	29	29	0.012

****
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
STOR2	0.174	1	0	0	15.940	92	18857 17:05	2.35

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
POC2-POST	10.04	0.07	12.95	95.300
System	10.04	0.07	12.95	95.300

****
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
2	DUMMY	2.35	18857 17:06			

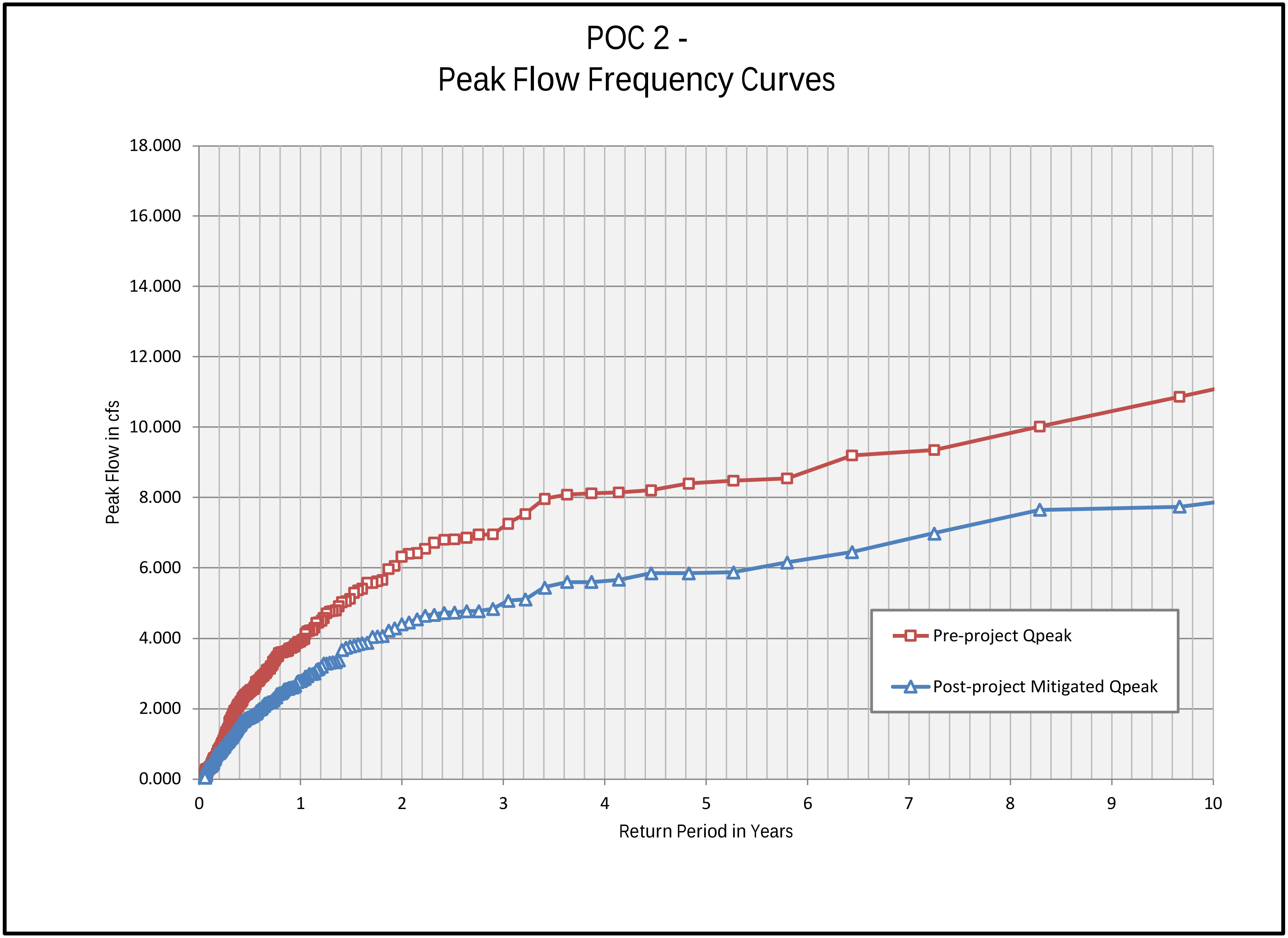
****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Aug 8 15:51:30 2024
Analysis ended on: Thu Aug 8 15:52:02 2024
Total elapsed time: 00:00:32

Peak Flow Frequency Summary

Return Period	Pre-project Qpeak (cfs)	Post-project - Mitigated Q (cfs)
LF = 0.1xQ2	0.632	0.440
2-year	6.323	4.403
5-year	8.431	5.862
10-year	11.070	7.861

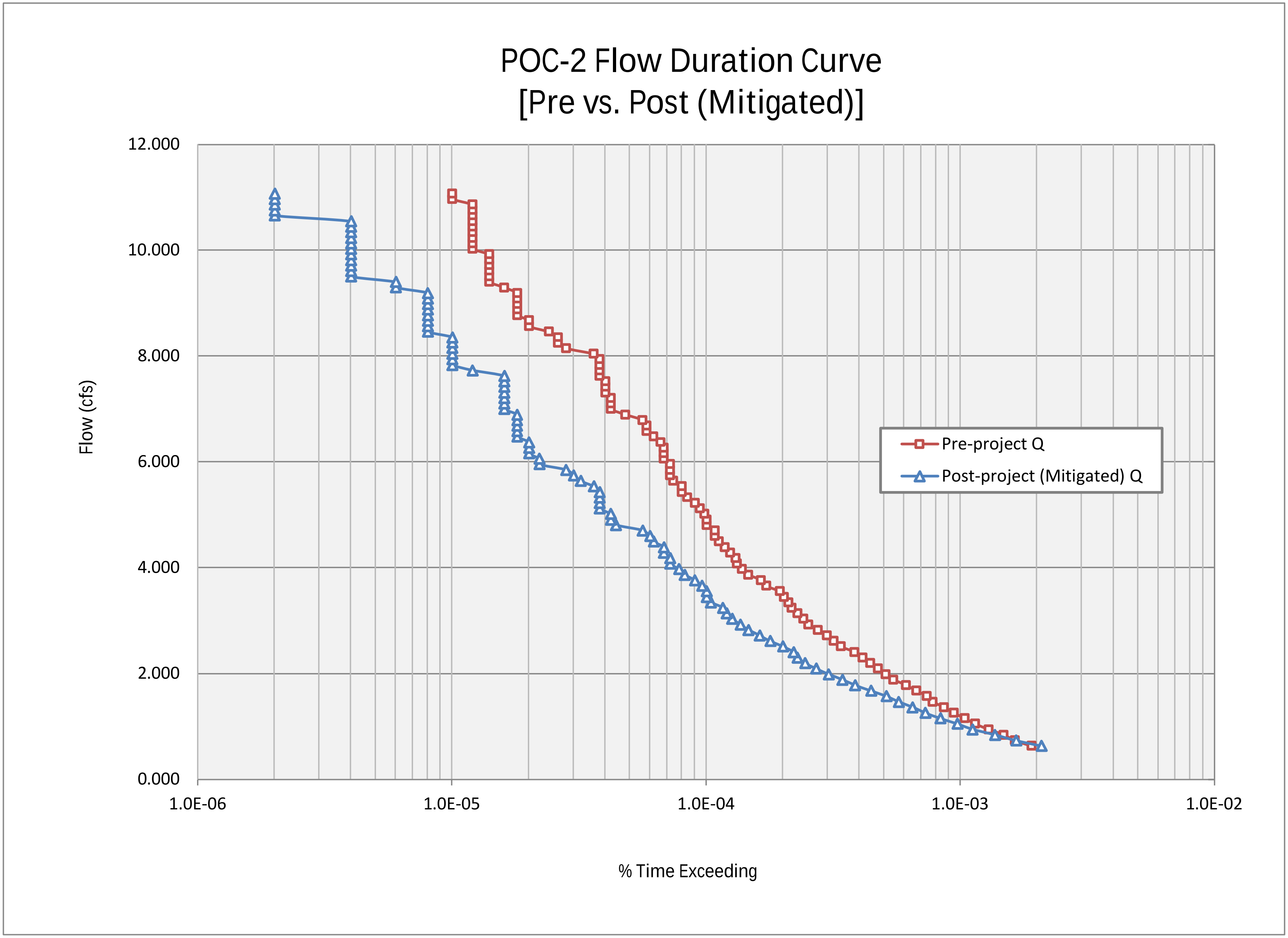

POC 2 -
Peak Flow Frequency Curves
Peak Flow in cfs
18.000
16.000
14.000
12.000
10.000
8.000
6.000
4.000
2.000
0.000
0
1
2
3
4
5
6
7
8
9
10
Return Period in Years
Pre-project Qpeak
Post-project Mitigated Qpeak

Low-flow Threshold:	10%	
0.1xQ2 (Pre):	0.632	cfs
Q10 (Pre):	11.070	cfs
Ordinate #:	100	
Incremental Q (Pre):	0.10437	cfs
Total Hourly Data:	497375	hours

The proposed BMP: PASSED

Interval	Pre-project Flow (cfs)	Pre-project Hours	Pre-project % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
0.000	0.632	950	1.91E-03	1040	2.09E-03	109%	Pass
1	0.737	816	1.64E-03	826	1.66E-03	101%	Pass
2	0.841	738	1.48E-03	681	1.37E-03	92%	Pass
3	0.945	643	1.29E-03	557	1.12E-03	87%	Pass
4	1.050	570	1.15E-03	485	9.75E-04	85%	Pass
5	1.154	518	1.04E-03	416	8.36E-04	80%	Pass
6	1.259	471	9.47E-04	363	7.30E-04	77%	Pass
7	1.363	429	8.63E-04	323	6.49E-04	75%	Pass
8	1.467	388	7.80E-04	285	5.73E-04	73%	Pass
9	1.572	368	7.40E-04	255	5.13E-04	69%	Pass
10	1.676	335	6.74E-04	222	4.46E-04	66%	Pass
11	1.780	304	6.11E-04	192	3.86E-04	63%	Pass
12	1.885	272	5.47E-04	171	3.44E-04	63%	Pass
13	1.989	253	5.09E-04	151	3.04E-04	60%	Pass
14	2.094	236	4.74E-04	135	2.71E-04	57%	Pass
15	2.198	220	4.42E-04	122	2.45E-04	55%	Pass
16	2.302	206	4.14E-04	114	2.29E-04	55%	Pass
17	2.407	191	3.84E-04	110	2.21E-04	58%	Pass
18	2.511	169	3.40E-04	100	2.01E-04	59%	Pass
19	2.615	158	3.18E-04	89	1.79E-04	56%	Pass
20	2.720	149	3.00E-04	81	1.63E-04	54%	Pass
21	2.824	137	2.75E-04	73	1.47E-04	53%	Pass
22	2.929	126	2.53E-04	68	1.37E-04	54%	Pass
23	3.033	120	2.41E-04	63	1.27E-04	53%	Pass
24	3.137	114	2.29E-04	60	1.21E-04	53%	Pass
25	3.242	108	2.17E-04	58	1.17E-04	54%	Pass
26	3.346	105	2.11E-04	52	1.05E-04	50%	Pass
27	3.450	101	2.03E-04	50	1.01E-04	50%	Pass
28	3.555	97	1.95E-04	50	1.01E-04	52%	Pass
29	3.659	86	1.73E-04	48	9.65E-05	56%	Pass
30	3.764	82	1.65E-04	45	9.05E-05	55%	Pass
31	3.868	73	1.47E-04	41	8.24E-05	56%	Pass
32	3.972	69	1.39E-04	39	7.84E-05	57%	Pass
33	4.077	66	1.33E-04	36	7.24E-05	55%	Pass
34	4.181	65	1.31E-04	36	7.24E-05	55%	Pass
35	4.285	62	1.25E-04	34	6.84E-05	55%	Pass
36	4.390	59	1.19E-04	34	6.84E-05	58%	Pass
37	4.494	56	1.13E-04	31	6.23E-05	55%	Pass
38	4.599	54	1.09E-04	30	6.03E-05	56%	Pass
39	4.703	54	1.09E-04	28	5.63E-05	52%	Pass
40	4.807	50	1.01E-04	22	4.42E-05	44%	Pass
41	4.912	50	1.01E-04	21	4.22E-05	42%	Pass
42	5.016	49	9.85E-05	21	4.22E-05	43%	Pass
43	5.120	47	9.45E-05	19	3.82E-05	40%	Pass
44	5.225	45	9.05E-05	19	3.82E-05	42%	Pass
45	5.329	42	8.44E-05	19	3.82E-05	45%	Pass
46	5.434	40	8.04E-05	19	3.82E-05	48%	Pass
47	5.538	40	8.04E-05	18	3.62E-05	45%	Pass
48	5.642	37	7.44E-05	16	3.22E-05	43%	Pass
49	5.747	36	7.24E-05	15	3.02E-05	42%	Pass

Interval	Pre-project Flow (cfs)	Pre-project Hours	Pre-project % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
50	5.851	36	7.24E-05	14	2.81E-05	39%	Pass
51	5.955	36	7.24E-05	11	2.21E-05	31%	Pass
52	6.060	34	6.84E-05	11	2.21E-05	32%	Pass
53	6.164	34	6.84E-05	10	2.01E-05	29%	Pass
54	6.269	34	6.84E-05	10	2.01E-05	29%	Pass
55	6.373	33	6.63E-05	10	2.01E-05	30%	Pass
56	6.477	31	6.23E-05	9	1.81E-05	29%	Pass
57	6.582	29	5.83E-05	9	1.81E-05	31%	Pass
58	6.686	29	5.83E-05	9	1.81E-05	31%	Pass
59	6.790	28	5.63E-05	9	1.81E-05	32%	Pass
60	6.895	24	4.83E-05	9	1.81E-05	38%	Pass
61	6.999	21	4.22E-05	8	1.61E-05	38%	Pass
62	7.104	21	4.22E-05	8	1.61E-05	38%	Pass
63	7.208	21	4.22E-05	8	1.61E-05	38%	Pass
64	7.312	20	4.02E-05	8	1.61E-05	40%	Pass
65	7.417	20	4.02E-05	8	1.61E-05	40%	Pass
66	7.521	20	4.02E-05	8	1.61E-05	40%	Pass
67	7.625	19	3.82E-05	8	1.61E-05	42%	Pass
68	7.730	19	3.82E-05	6	1.21E-05	32%	Pass
69	7.834	19	3.82E-05	5	1.01E-05	26%	Pass
70	7.939	19	3.82E-05	5	1.01E-05	26%	Pass
71	8.043	18	3.62E-05	5	1.01E-05	28%	Pass
72	8.147	14	2.81E-05	5	1.01E-05	36%	Pass
73	8.252	13	2.61E-05	5	1.01E-05	38%	Pass
74	8.356	13	2.61E-05	5	1.01E-05	38%	Pass
75	8.460	12	2.41E-05	4	8.04E-06	33%	Pass
76	8.565	10	2.01E-05	4	8.04E-06	40%	Pass
77	8.669	10	2.01E-05	4	8.04E-06	40%	Pass
78	8.774	9	1.81E-05	4	8.04E-06	44%	Pass
79	8.878	9	1.81E-05	4	8.04E-06	44%	Pass
80	8.982	9	1.81E-05	4	8.04E-06	44%	Pass
81	9.087	9	1.81E-05	4	8.04E-06	44%	Pass
82	9.191	9	1.81E-05	4	8.04E-06	44%	Pass
83	9.295	8	1.61E-05	3	6.03E-06	38%	Pass
84	9.400	7	1.41E-05	3	6.03E-06	43%	Pass
85	9.504	7	1.41E-05	2	4.02E-06	29%	Pass
86	9.609	7	1.41E-05	2	4.02E-06	29%	Pass
87	9.713	7	1.41E-05	2	4.02E-06	29%	Pass
88	9.817	7	1.41E-05	2	4.02E-06	29%	Pass
89	9.922	7	1.41E-05	2	4.02E-06	29%	Pass
90	10.026	6	1.21E-05	2	4.02E-06	33%	Pass
91	10.130	6	1.21E-05	2	4.02E-06	33%	Pass
92	10.235	6	1.21E-05	2	4.02E-06	33%	Pass
93	10.339	6	1.21E-05	2	4.02E-06	33%	Pass
94	10.443	6	1.21E-05	2	4.02E-06	33%	Pass
95	10.548	6	1.21E-05	2	4.02E-06	33%	Pass
96	10.652	6	1.21E-05	1	2.01E-06	17%	Pass
97	10.757	6	1.21E-05	1	2.01E-06	17%	Pass
98	10.861	6	1.21E-05	1	2.01E-06	17%	Pass
99	10.965	5	1.01E-05	1	2.01E-06	20%	Pass
100	11.070	5	1.01E-05	1	2.01E-06	20%	Pass


POC-2 Flow Duration Curve
[Pre vs. Post (Mitigated)]
12.000
10.000
8.000
6.000
4.000
2.000
0.000
Flow (cfs)
1.0E-06
1.0E-05
1.0E-04
1.0E-03
1.0E-02
% Time Exceeding
Pre-project Q
Post-project (Mitigated) Q

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).

Placeholder – **Structural BMP Maintenance Information**

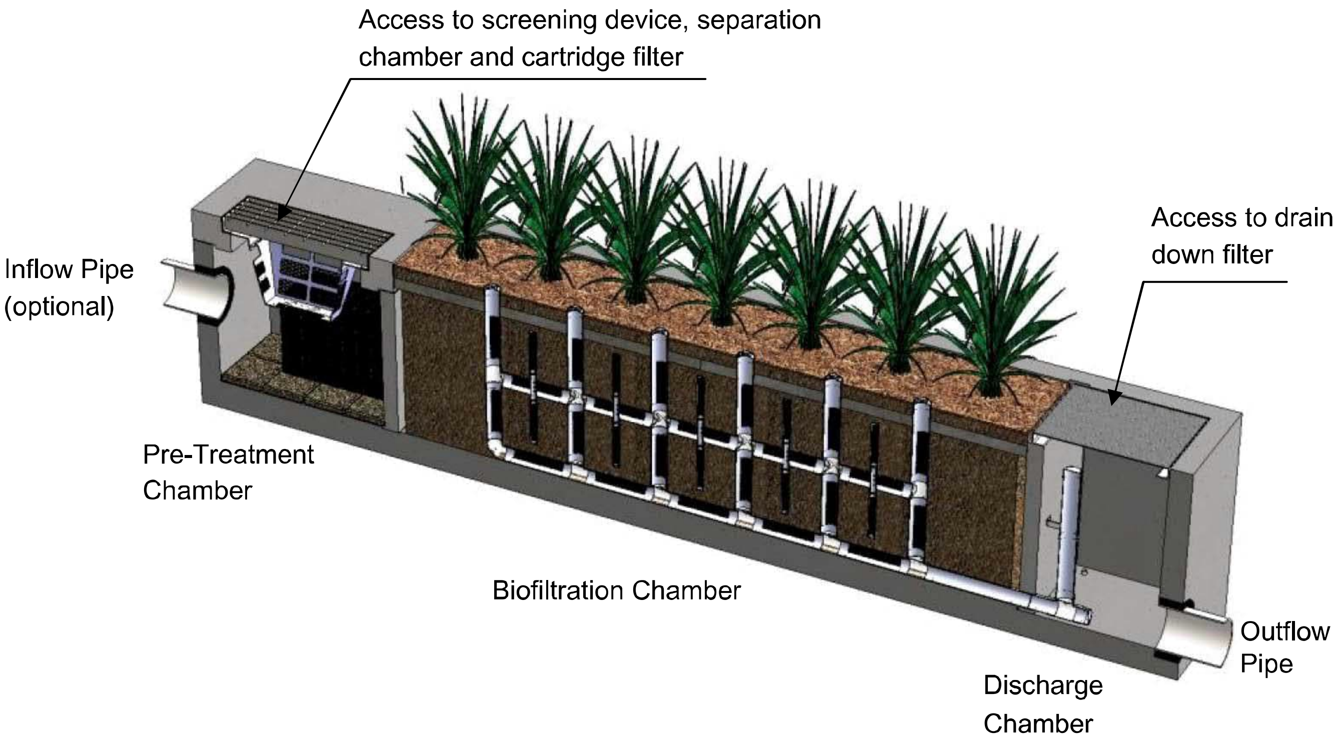
Replace placeholder with required documentation.

Maintenance Guidelines for
Modular Wetland System - Linear

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
  - (*5 minute average service time*).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
  - (*10 minute average service time*).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
  - (*10-15 minute per cartridge average service time*).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
  - (*5 minute average service time*).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre-Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screening device.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.

2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.

3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

4. Entry into chambers may require confined space training based on state and local regulations.

5. No fertilizer shall be used in the Biofiltration Chamber.

6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

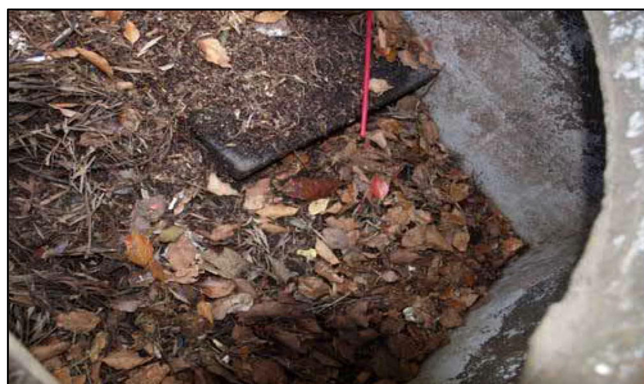
Maintenance Procedure Illustration

Screening Device

The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.

Separation Chamber

The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.



Cartridge Filters

The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.

Drain Down Filter

The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.

Trim Vegetation

Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.

Inspection Form

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Inspection Report
Modular Wetlands System

Project Name ______________________

Project Address ______________________ (city) (Zip Code)

Owner / Management Company ______________________

Contact ______________________ Phone ( ) –

Inspector Name ______________________ Date ____ / ____ / ______ Time ________ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition ______________________ Additional Notes ______________________

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

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): ____________ Size (22', 14' or etc.): ____________

Structural Integrity:	Yes	No	Comments	
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?				
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?				
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?				
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?				
Working Condition:				
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?				
Is there standing water in inappropriate areas after a dry period?				
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?				
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes, specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.				Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:	
Any signs of improper functioning in the discharge chamber? Note issues in comments section.				
Other Inspection Items:				
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?				
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.				
Is there a septic or foul odor coming from inside the system?				

Waste:	Yes	No
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: ______________________

Maintenance Report

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Cleaning and Maintenance Report
Modular Wetlands System

Project Name ____________________

Project Address ____________________ (city) (Zip Code)

Owner / Management Company ____________________

Contact ____________________ Phone (   )   –

Inspector Name ____________________ Date ___/___/______ Time ________ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition ____________________ Additional Notes ____________________

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

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:

ATTACHMENT 3b
Maintenance Information for Underground Detention Basins (UDB-1 & UDB-2)

Maintenance should be conducted during dry weather when no flow is entering the system. Confined space entry is usually required to maintain the Underground Detention Basins. Only personnel that are OSHA Confined Space Entry trained and certified may enter underground structures. Once safety measures such as traffic control have been deployed, the access covers may be removed and the following activities may be conducted to complete maintenance. All access covers will be securely replaced following inspection and/or maintenance

Inspection Activity	Maintenance Indicator(s)	Field Measurement	Minimum Frequency of Inspection	Maintenance Activity	Minimum Maintenance Frequency
Inspect vault twice during the first wet season of operation	N/A	Visual inspection	Post-construction	Set cleaning frequency	Post-construction
Inspect for cracks and inlet/outlet area erosion	Cracks or erosion present	Visual inspection	Semi-annually	Repair cracks/erosion. Consult engineers if immediate solution is not evident.	As needed
Inspect for litter, oil and grease from inlet/outlet areas	Litter, oil or grease present	Visual inspection	Beginning & end of rainy season	Remove litter, oil and grease	Semi-annually
Inspect for accumulated sediment	Sediment on the system floor exceeds 6”	Tape measure	Annually, prior to start of wet season	Remove sediment with vacuum truck. No jetting permitted to loosen sediment.	Bi-annually or as needed
Inspect for trash and debris	Trash and debris present	Visual inspection	Semi-annually	Remove trash and debris (e.g. via vacuum truck)	As needed
Inspect system for movement of modules	Spacing of modules exceeds ¾”	Tape measure	Semi-annually	Consult engineers	As needed
Inspect inlet and outlet for obstruction(s)	Obstruction is present	Visual inspection	Semi-annually	Remove obstruction	Semi-annually or as needed
Report drawdown rate	Drawdown rate exceeds 96 hours	Recording Device (pen & paper, voice recorder, etc.)	96 hours after wet weather	Remove any obstructions. Consult engineers if immediate solution not evident.	As needed

Contech® CMP Detention Inspection and Maintenance Guide

Underground stormwater detention and infiltration systems must be inspected and maintained at regular intervals for purposes of performance and longevity.

Inspection

Inspection is the key to effective maintenance of CMP detention systems and is easily performed. Contech recommends ongoing, quarterly inspections. The rate at which the system collects pollutants will depend more on site specific activities rather than the size or configuration of the system.

Inspections should be performed more often in equipment washdown areas, in climates where sanding and/or salting operations take place, and in other various instances in which one would expect higher accumulations of sediment or abrasive/corrosive conditions. A record of each inspection is to be maintained for the life of the system.

Maintenance

CMP detention systems should be cleaned when an inspection reveals accumulated sediment or trash is clogging the discharge orifice.

Accumulated sediment and trash can typically be evacuated through the manhole over the outlet orifice. If maintenance is not performed as recommended, sediment and trash may accumulate in front of the outlet orifice. Manhole covers should be securely seated following cleaning activities. Contech suggests that all systems be designed with an access/inspection manhole situated at or near the inlet and the outlet orifice. Should it be necessary to get inside the system to perform maintenance activities, all appropriate precautions regarding confined space entry and OSHA regulations should be followed.

Systems are to be rinsed, including above the spring line, annually soon after the spring thaw, and after any additional use of salting agents, as part of the maintenance program for all systems where salting agents may accumulate inside the pipe.

Maintaining an underground detention or infiltration system is easiest when there is no flow entering the system. For this reason, it is a good idea to schedule the cleanout during dry weather.

The foregoing inspection and maintenance efforts help ensure underground pipe systems used for stormwater storage continue to function as intended by identifying recommended regular inspection and maintenance practices. Inspection and maintenance related to the structural integrity of the pipe or the soundness of pipe joint connections is beyond the scope of this guide.

CONTECH® CMP DETENTION SYSTEMS

CONTECH® ENGINEERED SOLUTIONS

CMP MAINTENANCE GUIDE 2/17 PDF

CONTECH
ENGINEERED SOLUTIONS

Contech® CMP Detention & Infiltration Maintenance Guide

CONTECH
CMP DETENTION SYSTEMS

Contech® CMP Detention

Underground stormwater detention/infiltration and retention systems must be properly inspected and maintained at regular intervals for purposes of performance and longevity.

Inspection

Inspection is the key to effective maintenance and is easily performed. Contech recommends ongoing quarterly inspections. The rate at which the system collects pollutants will depend more heavily on site specific activities rather than the size or configuration of the system. Inspections should be performed more often in equipment washdown areas, in climates where sanding and/or salting operations take place, and in various other instances in which higher accumulations of sediment or abrasive / corrosive conditions may exist. Inspection and maintenance records should be maintained for the life of the system.

Maintenance

Systems should be cleaned when inspection reveals that accumulated sediment or trash is clogging the discharge orifice. Accumulated sediment and trash can typically be evacuated through the manhole over the outlet orifice. If maintenance is not performed as recommended, sediment and trash may accumulate in front of the outlet orifice. Manhole covers should be securely seated following cleaning activities. Contech suggests that all systems be designed with an access/inspection manhole situated at or near the inlet and the outlet orifice. Should it be necessary to get inside the system to perform maintenance activities, all appropriate precautions regarding confined space entry and OSHA regulations should be followed.

If inspectors observe any salt or other corrosive substance concentrations or accumulations in the system, or if salt or other corrosive substance is used or prevalent near the system, it is recommended to rinse the system above the spring line annually between late spring and early summer as part of the maintenance program. This maintenance is required for infiltration systems. Excessive salting should be avoided and pavement should be sealed to reduce salt infiltration from the surface.

Maintaining an underground detention or retention system is easiest when there is no flow entering the system. For this reason, it is a good idea to schedule the cleanout during dry weather.

The foregoing inspection and maintenance efforts help ensure underground pipe systems used for stormwater storage continue to function as intended by identifying recommended regular inspection and maintenance practices. Inspection and maintenance related to the structural integrity of the pipe or the soundness of pipe joint connections is beyond the scope of this guide.

Inspection & Maintenance Log Sample Template

________" Diameter System			Location: Anywhere, USA		
Date	**Depth of Sediment**	**Accumulated Trash**	**Maintenance Performed**	**Maintenance Personnel**	**Comments**
12/01/10	2"	None	Removed Sediment	B. Johnson	Installed
03/01/11	1"	Some	Removed Sediment and Trash	B. Johnson	Swept parking lot
06/01/11	0"	None	None		
09/01/11	0"	Heavy	Removed Trash	S. Riley	
12/01/11	1"	None	Removed Sediment	S. Riley	
04/01/12	0"	None	None	S. Riley	
04/15/01	2	Some	Removed Sediment and Trash	ACE Environmental Services	

CMP DETENTION SYSTEMS

Support

Drawings and specifications are available at www.ContechES.com.
Site-specific support is available from our engineers.

ENGINEERED SOLUTIONS
800.338.1122
www.ContechES.com

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, earth stabilization and wastewater treatment products. For information, visit www.ContechES.com or call 800.338.1122.

CMP® Maintenance Manual

CMP® Inspection & Maintenance

Inspection and maintenance of the CMP underground detention, retention, or infiltration system is vital for the performance and life cycle of the stormwater management system. All local, state, and federal permits and regulations must be followed for system compliance. Manway access locations are provided on each system for ease of ingress and egress for routine inspection and maintenance activities. Stormwater regulations require that most BMPs be inspected and maintained to ensure they are operating as designed and providing protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess the site specific conditions. Inspection after the first significant rainfall event and at semiannual intervals is typical. This is recommended because pollutant loading and pollutant characteristics can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding on roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided. Without appropriate maintenance a BMP can exceed its storage capacity, become blocked, or damaged, which can negatively affect its continued performance.

Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the underground detention, retention, or infiltration system:

- Contech Inspection and Maintenance Report Form
- Flashlight
- Manhole hook or appropriate tools to access hatches and covers
- Appropriate traffic control signage and procedures
- Measuring pole and/or tape measure
- Protective clothing and eye protection
- Note: Entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections of the system.

Inspection Steps

The key to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the CMP underground detention, retention, or infiltration system are quick and easy. As mentioned above, the first year should be seen as the maintenance interval establishment phase. During the first year more frequent inspections should occur in order to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long term inspection and maintenance interval requirements.

The CMP underground detention, retention, or infiltration system can be inspected though visual observation without entry into the system. All necessary pre-inspection steps must be carried out before inspection occurs, especially traffic control and other safety measures to protect the inspector and nearby pedestrians from any dangers associated with an open access hatch or manhole. Once these access covers have been safely opened, the inspection process can proceed:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other information (see inspection form).
- Observe the upstream drainage area and look for sources of pollution, sediment, trash and debris.
- Observe the inside of the system through the access manholes. If minimal light is available and vision into the unit is impaired, utilize a flashlight to see inside the system and all of its modules.
- Look for any out of the ordinary obstructions in the inflow and outflow pipes. Check pipes for movement or leakage. Write down any observations on the inspection form.
- Observe any movement of modules.
- Observe concrete for cracks and signs of deterioration.
- In detention and retention systems inspect for any signs of leakage.
- In infiltration systems inspect for any signs of blockage or reasons that the soils are not infiltrating.
- Through observation and/or digital photographs, estimate the amount of floatable debris accumulated in the system. Record this information on the inspection form. Next, utilizing a tape measure or measuring stick, estimate the amount of sediment accumulated in the system. Sediment depth may vary throughout the system, depending on the flow path. Record this depth on the inspection form.
- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

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

- Damaged inlet and outlet pipes.
- Obstructions in the system or its inlet or outlet.
- Excessive accumulation of floatables.
- Excessive accumulation of sediment of more than 6" in depth.
- Damaged joint sealant.

Maintenance Equipment

While maintenance can be done fully by hand it is recommended that a vacuum truck be utilized to minimize time requirements required to maintain the CMP underground detention, retention, or infiltration system:

- Contech Inspection and Maintenance Report Form
- Flashlight
- Manhole hook or appropriate tools to access hatches and covers
- Appropriate traffic control signage and procedures

- Measuring pole and/or tape measure
- Protective clothing and eye protection
- Vacuum truck
- Trash can
- Pressure washer
- Note: Entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections of the system. Entry into the system will be required if maintenance is required.

Maintenance Procedures

It is recommended that maintenance occurs at least three days after the most recent rain event to allow for drain down of the system and any upstream detention systems designed to drain down over an extended period of time. Maintaining the system while flows are still entering it will increase the time and complexity required for maintenance. Once all safety measures have been set up, cleaning of the system can proceed as follows:

- Using an extension on a boom on the vacuum truck, position the hose over the opened manway and lower into the system. Remove all floating debris, standing water (as needed) and sediment from the system. A power washer can be used to assist if sediments have become hardened and stuck to the walls and columns. Repeat the same procedure at each manway until the system has been fully maintained. Be sure not to pressure wash the infiltration area as it may scour. Pressure washing is acceptable for concrete base modules and base slabs only; do not use on systems with gravel bedding. Do not vacuum up the infiltration stone or wash accumulated solids into the stone via pressure washing.

If maintenance requires entry into the vault:

- Following rules for confined space entry use a gas meter to detect the presence of any hazardous gases. If hazardous gases are present do not enter the vault. Follow appropriate confined space procedures, such as utilizing venting system, to address the hazard. Once it is determined to be safe, enter utilizing appropriate entry equipment such as a ladder and tripod with harness.
- The last step is to close up and replace all manhole covers and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.

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SUPPORT

DRAWINGS AND SPECIFICATIONS ARE AVAILABLE AT WWW.CONTECHES.COM

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

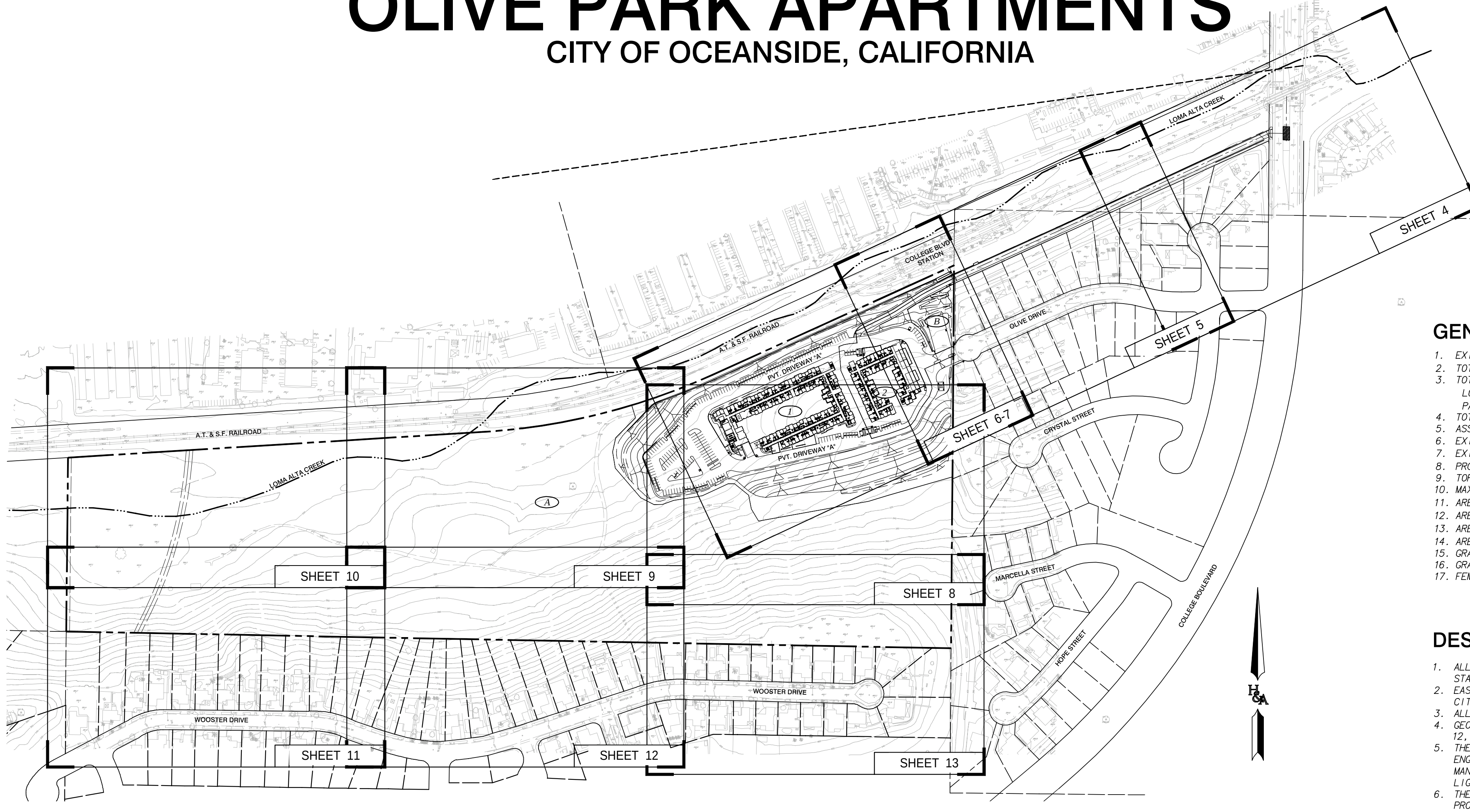
☒When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management

☒Include landscaping plan sheets showing vegetation requirements for vegetated structural BMP(s)

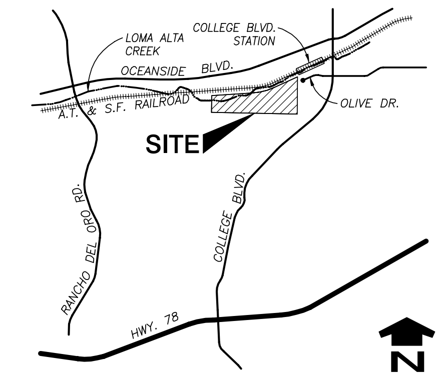
☒All BMPs must be fully dimensioned on the plans

☒When propritery BMPs are used, site specific cross section with outflow, inflow and model number shall be provided. Broucher photocopies are not allowed.

TENTATIVE PARCEL MAP/DEVELOPMENT PLAN
OLIVE PARK APARTMENTS
CITY OF OCEANSIDE, CALIFORNIA



SHEET KEY MAP
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

LEGEND

SUBDIVISION BOUNDARY	
LOT LINE	
LOT NUMBER	1
OPEN SPACE LOT NUMBER	A
EXISTING TOPO CONTOUR	230
FINISH FLOOR ELEVATION	FF=236.7
PAD ELEVATION	P=236.0
BROW DITCH	
SLOPE (2:1 MAX)	
PERCENT OF GRADE	2%
STREET ELEVATION	232.0
INVERT ELEVATION	232.0IE
EXISTING SEWER MAIN	S
PROPOSED SEWER MAIN	S
EXISTING WATER MAIN	W
PROPOSED WATER MAIN	W
EXISTING FIRE HYDRANT	
PROPOSED FIRE HYDRANT	
EXISTING STORM DRAIN	
PROPOSED STORM DRAIN	
STREET LIGHT	
DOWNSPOUT LOCATION	
RETAINING WALL	
TOP OF WALL	TW
FINISHED SURFACE	FS
ELECTRIC VEHICLE CAPABLE	EVC
ELECTRIC VEHICLE READY	EVR
ELECTRIC VEHICLE INSTALLED	EVI
FEMA WATER LEVEL	232
EXISTING EASEMENT	1
PROPOSED EASEMENT	1
CURB & GUTTER LINE	
EXISTING SEWER MAIN	

GENERAL NOTES

1. EXISTING GROSS SUBDIVISION AREA: 43.50 AC
2. TOTAL NUMBER OF EXISTING LOTS: 1 (VACANT)
3. TOTAL NUMBER OF PROPOSED LOTS: 4
   LOT 1 (8.68 AC), LOT 2 (1.81 AC), OPEN SPACE LOT A (32.60 AC), PARK LOT B (0.41 AC).
4. TOTAL NUMBER OF UNITS: 282
5. ASSESSOR PARCEL NUMBER: 162-111-04
6. EXISTING/PROPOSED GENERAL PLAN: MDA-R - MEDIUM DENSITY RESIDENTIAL
7. EXISTING/PROPOSED ZONING: RS - SINGLE FAMILY RESIDENTIAL
8. PROPOSED DENSITY: 6.5 DU/AC (282 DU's/43.50 AC)
9. TOPOGRAPHIC CONTOUR INTERVAL: 2 FOOT
10. MAXIMUM SLOPE GRADIENT: 2:1
11. AREA/PERCENT OF TOTAL BUILDING COVERAGE: 2.05 AC (4.7%)
12. AREA/PERCENT OF PROJECT IN STREETS : 2.62 (6.0%)
13. AREA/PERCENT OF PROJECT IN OPEN SPACE (LOTS A & B): 33.01 AC (75.9%)
14. AREA/PERCENT OF LANDSCAPING: 5.82 AC (13.4%)
15. GRADING QUANTITIES: RAW CUT: 116,900 C.Y. RAW FILL: 146,900 C.Y.
16. GRADED AREA: 10.87 AC
17. FEMA FLOOD DESIGNATION: ZONE AE. FIRM PANEL 758. EFFECTIVE MAY 16, 2012

DESIGN NOTES

1. ALL STREET DESIGN SHALL CONFORM TO THE CITY OF OCEANSIDE DESIGN STANDARDS AS REQUIRED BY THE CITY ENGINEER.
2. EASEMENTS SHALL BE PROVIDED, REMOVED OR RELOCATED AS REQUIRED BY THE CITY ENGINEER.
3. ALL PROPOSED UTILITIES SHALL BE UNDERGROUNDED AND EASEMENTS PROVIDED.
4. GEOTECHNICAL INVESTIGATION PREPARED BY: GEOCON INC., DATED OCTOBER 12, 2005.
5. THE DEVELOPER SHALL INSTALL STREET LIGHTS PER THE CITY OF OCEANSIDE ENGINEERING DEPARTMENT TRAFFIC DIVISION, THE STREET LIGHT DESIGN MANUAL AND THE CITY OF OCEANSIDE STANDARD DRAWING NO. M-4. STREET LIGHT LOCATIONS MAY VARY IN FINAL DESIGN.
6. THE PROPOSED ON-SITE SEWER SHALL BE PRIVATE AND MAINTAINED BY THE PROPERTY OWNER.
7. THE PROPOSED ON-SITE STORM DRAIN SHALL BE PRIVATE AND MAINTAINED BY THE PROPERTY OWNER.
8. THE PROPOSED WATER SHALL BE INSTALLED PER CITY OF OCEANSIDE STANDARDS. ALL ON-SITE WATER IS PUBLIC.
9. FINISH GRADES ARE APPROXIMATE AND SUBJECT TO CHANGE IN FINAL DESIGN.
10. ALL FUTURE DRIVEWAYS AND GEOMETRIC DESIGN SHALL BE DESIGNED IN COMPLIANCE WITH THE CITY OF OCEANSIDE ENGINEERS DESIGN STANDARDS.
11. THE PRESENT OR FUTURE OWNER/DEVELOPER SHALL INDEMNIFY AND SAVE CITY OF OCEANSIDE, ITS OFFICERS, AGENTS, AND EMPLOYEES HARMLESS FROM ANY AND ALL LIABILITIES, CLAIMS ARISING FROM ANY FLOODING THAT OCCURS ON THIS SITE AND FLOODING THAT MAYBE DISCHARGED FROM THIS SITE INTO ADJACENT PROPERTIES.
12. ALL SIDEWALK AND PATHWAYS SHALL BE ADA COMPLIANT.
13. DATUM: NAVD 88

BASIS OF BEARINGS

THE BASIS OF BEARINGS IS CALIFORNIA STATE PLANE COORDINATE SYSTEM NAD 83, ZONE 6, EPOCH 2011.00 AND IS BASED ON GRID BEARING BETWEEN CITY OF OCEANSIDE GEODETIC CONTROL NETWORK STATIONS NO. 1026 AND NO. 1036 PER RECORD OF SURVEY NO. 21787. I.E. N82°00'07"W

TOPOGRAPHY SOURCE

TOPOGRAPHY USED FOR THIS TENTATIVE PARCEL MAP WAS FLOWN ON 1/15/2021 BY PHOTO GEODETIC CORPORATION, CONTROL PROVIDED BY HUNSAKER & ASSOCIATES SAN DIEGO, INC. A FIELD VERIFICATION WAS PERFORMED BY HUNSAKER & ASSOCIATES SAN DIEGO, INC. ON 8/7/2024 WHICH VALIDATED THE DATUM AND CONFIRMED THE ACCURACY OF THE TOPOGRAPHIC MAPPING PROVIDED PER SAID FLIGHT. NO SUBSTANTIAL VARIATIONS OR CHANGES IN FIELD CONDITIONS WERE WITNESSED DURING THE PERFORMANCE OF THE FIELD VERIFICATION.

BENCHMARK

CITY OF OCEANSIDE ROS 21787 POINT 1036. 2.5" BRASS DISK IN CURB INLET WITH TRIANGLE/PUNCH STAMPED "L.S. 7854", FLUSH. EL. 234.47 NAVD88

LEGAL DESCRIPTION

SEE SHEET 3

EASEMENTS

SEE SHEET 3

PARKING SUMMARY

DEVELOPMENT STANDARD	REGULATION PER OZO* & SDBL**	PROPOSED PROJECT	NOTES
PROJECT PARKING (OZO 3103 & SDBL 65915(P)(3)): NO PARKING REQUIRED WHEN LOCATED WITHIN 1/2 MILE OF A MAJOR TRANSIT STOP	NO PARKING MINIMUM REQUIRED	346 PARKING SPACES: 205 SURFACE SPACES ① 141 PODIUM SPACES ②	COMPLIES WITH OZO & SDBL
ELECTRIC VEHICLE PARKING (OZO 3048)	OZO EV PARKING BASED ON "TOTAL REQUIRED PARKING SPACES" NO PARKING IS REQUIRED PER SDBL 65915(P)(3) WHEN LOCATED WITH IN 1/2 MILE OF A MAJOR TRANSIT STOP	346 SPACES PROVIDED: 25% EVR (READY) - 87 10% EVC (CAPABLE) - 35 5% EVI (INSTALLED) - 18	COMPLIES WITH OZO AND WITH CAL-GREEN BUILDING CODE: 25% EVR (READY) 10% EVC (CAPABLE) 5% EVI (INSTALLED)

*OCEANSIDE ZONING ORDINANCE
**STATE DENSITY BONUS LAW

① SURFACE PARKING INCLUDES 8 ACCESSIBLE SPACES
② PODIUM PARKING INCLUDES 6 ACCESSIBLE SPACES

OWNER

OCEANSIDE TROLLEY PLACE, LLC
8495 REDWOOD CREEK LN
SAN DIEGO, CA 92126

APPLICANT

CAPSTONE EQUITIES
5455 WILSHIRE BLVD.
SUITE 1012
LOS ANGELES, CA 90036
(310) 666-6860

CIVIL ENGINEER

HUNSAKER & ASSOCIATES, SAN DIEGO, INC
9707 WAPLES STREET
SAN DIEGO, CA 92121
(858) 558-4500

REGISTERED PROFESSIONAL ENGINEER
ALISA S. VIALPANDO
C 47945
CIVIL
STATE OF CALIFORNIA

ALISA S. VIALPANDO R.C.E. 47945 DATE

SHEET INDEX

PREPARED BY

HUNSAKER & ASSOCIATES
SAN DIEGO, INC
PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 · FX(858)558-1414

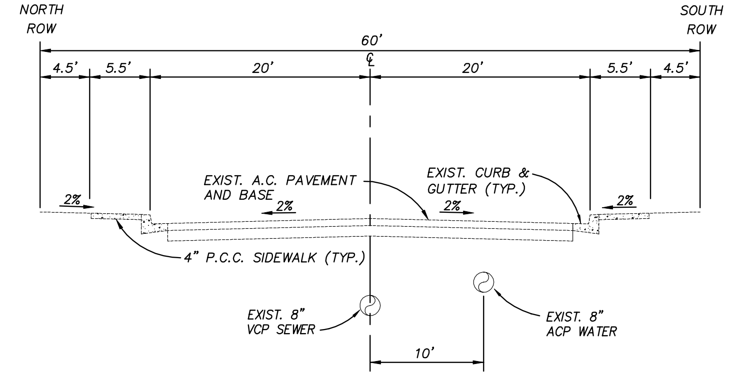
REVISION

ORIGINAL	03/15/24	H&A
REVISED PER CITY COMMENTS	08/08/24	H&A

TITLE SHEET
OLIVE PARK APARTMENTS
CITY OF OCEANSIDE, CALIFORNIA

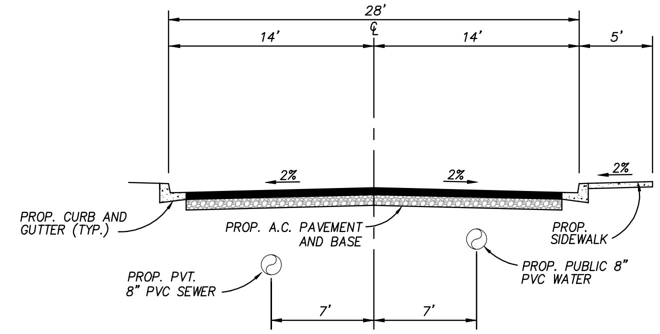
W.O. NO. 3785-02

R:\1746\&Pln\TM\1746 Site Plan Sht 1.dwg[]Aug-08-2024:15:27



OLIVE DRIVE (EXISTING)

NOT TO SCALE



SEE SHEET 6 FOR SECTION LOCATION

PRIVATE DRIVEWAY "A" - SECTION C

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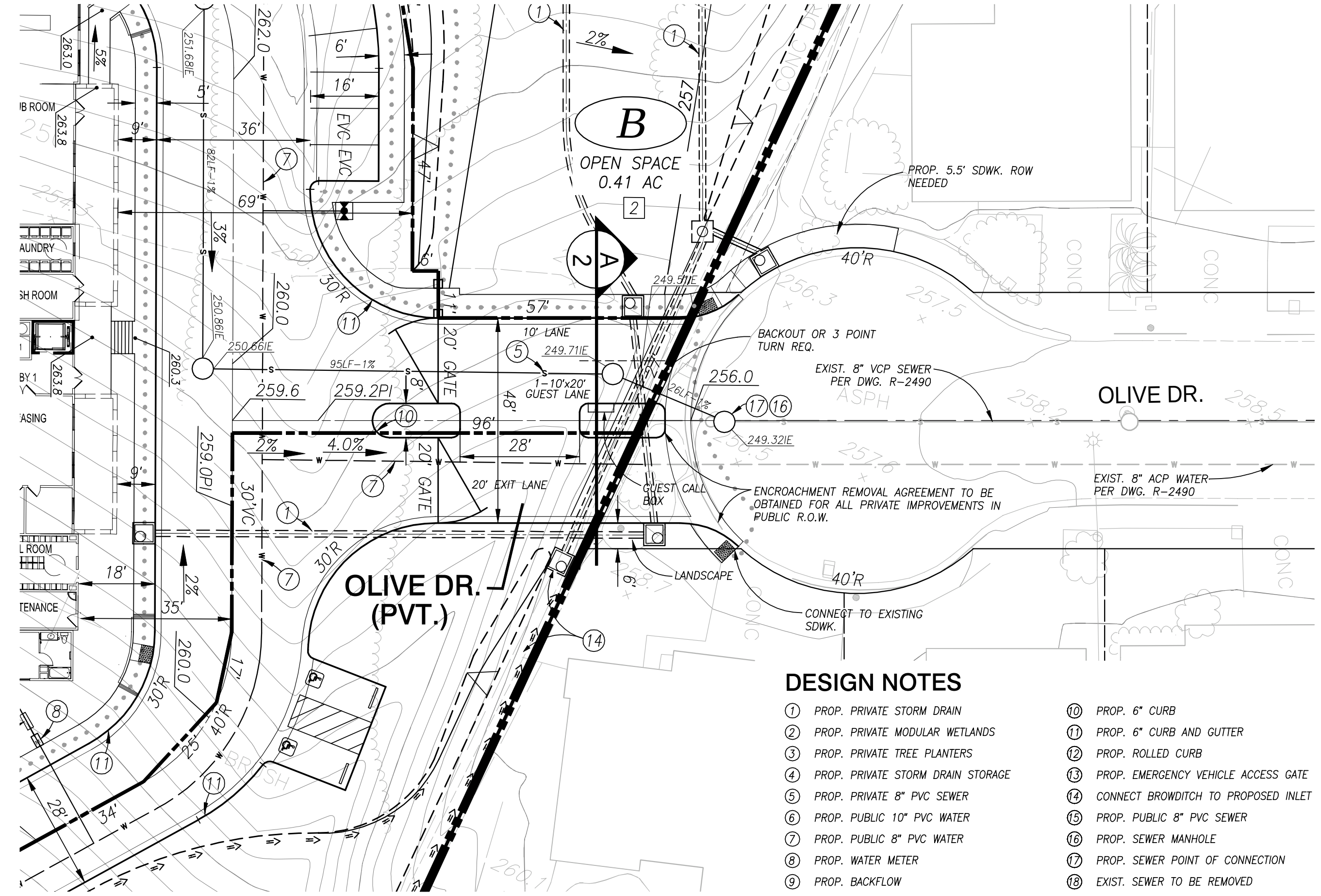
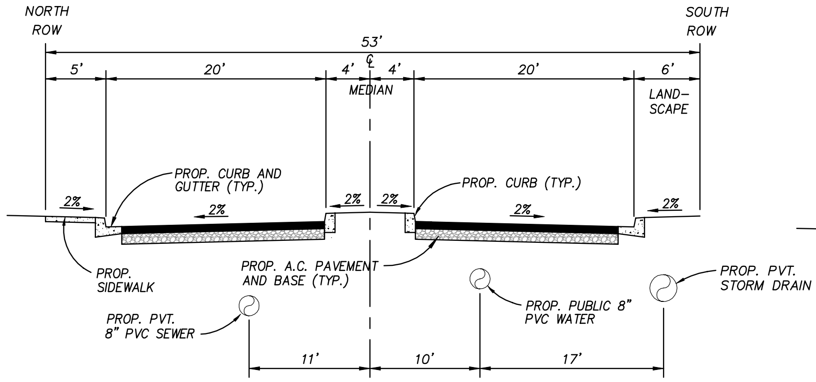


ENTRY ENLARGEMENT

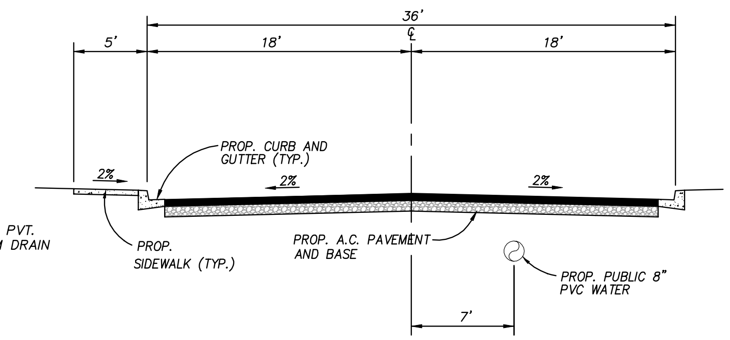
SCALE 1"=20'



SEE SHEET 6 FOR SECTION LOCATION

OLIVE DRIVE PRIVATE DRIVEWAY - SECTION A

NOT TO SCALE



SEE SHEET 6 FOR SECTION LOCATION

PRIVATE DRIVEWAY "A" - SECTION D

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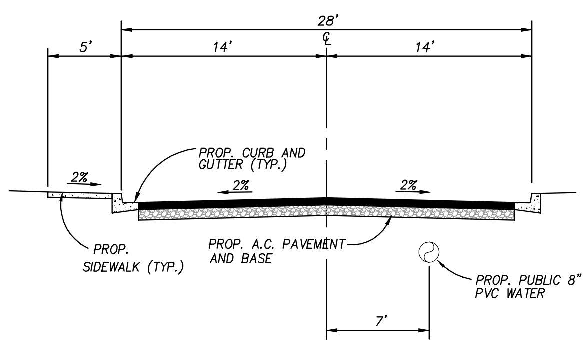

SEE SHEET 6 FOR SECTION LOCATION

PRIVATE DRIVEWAY "A" - SECTION B

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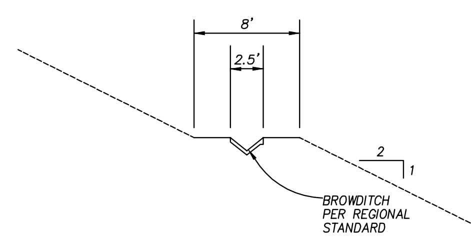

BROWDITCH - SECTION E

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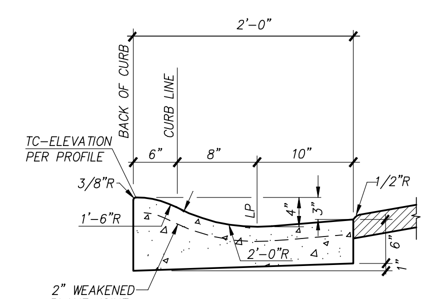
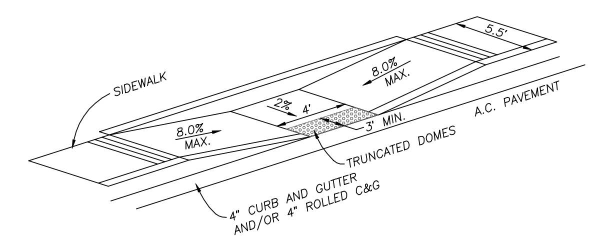


4" MOD. ROLLED 'G-4' CURB

NOT TO SCALE



MODIFIED CURB RAMP

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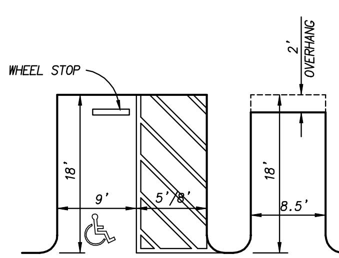
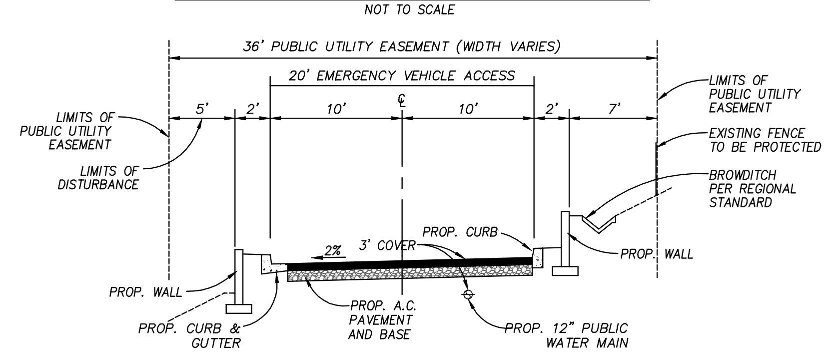


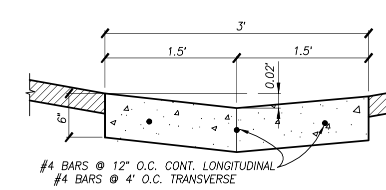
TYPICAL PARKING DETAIL

NOT TO SCALE



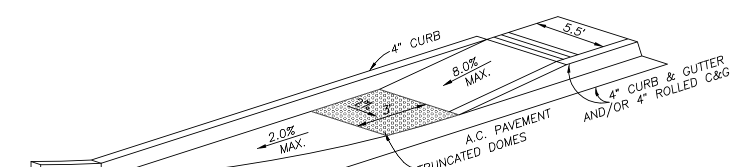
EMERGENCY VEHICLE ACCESS ROAD - SECTION F

NOT TO SCALE



3' CONCRETE RIBBON GUTTER

NOT TO SCALE



MODIFIED CURB RAMP

NOT TO SCALE

PREPARED BY

HUNSAKER & ASSOCIATES SAN DIEGO, INC

PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 · FX(858)558-1414

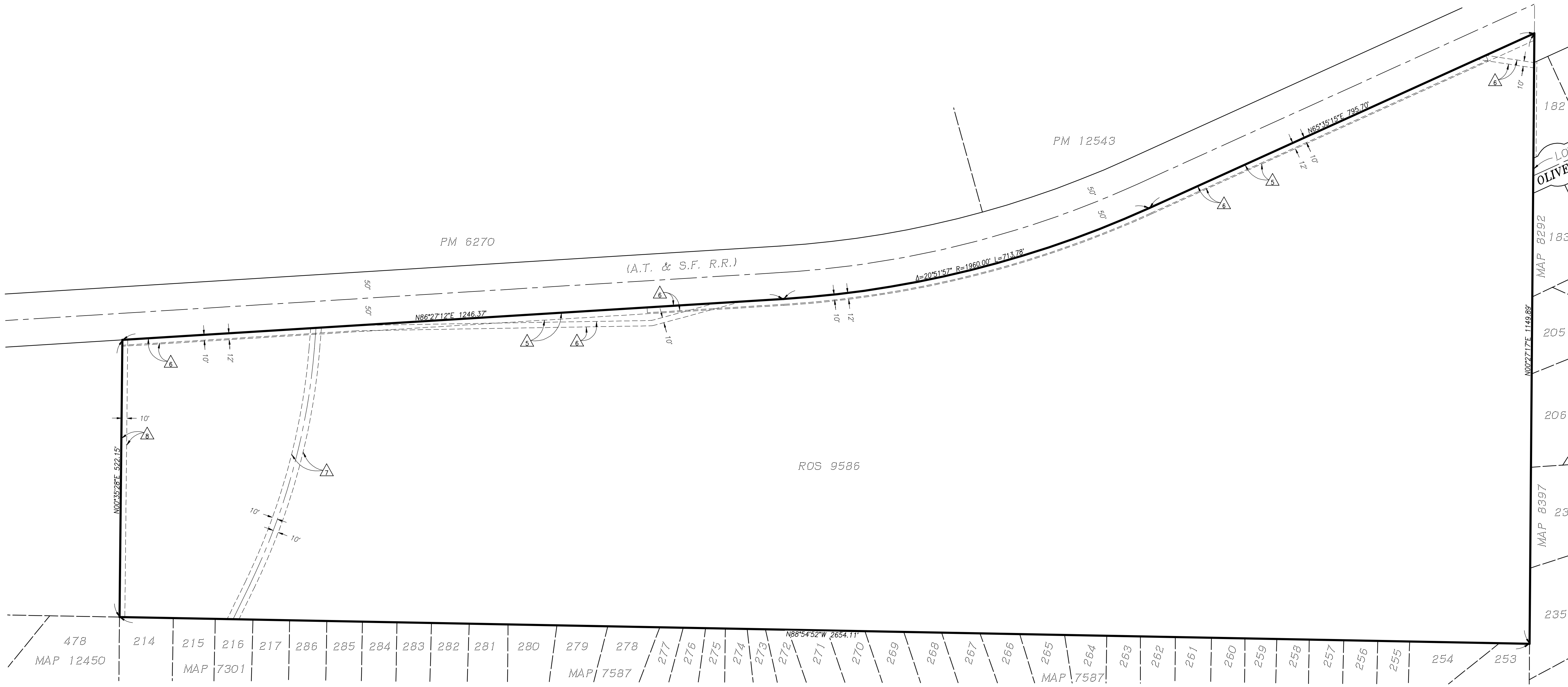
STREET SECTIONS AND DETAILS

OLIVE PARK APARTMENTS

CITY OF OCEANSIDE, CALIFORNIA

SHEET 2 OF 14

W.O. NO. 3785-02



TITLE REFERENCE

THIS SURVEY IS BASED ON THE COMMITMENT FOR TITLE INSURANCE ISSUED BY TICOR TITLE COMPANY AS ORDER NO. 00894200-995-CC1, EFFECTIVE DATE OF FEBRUARY 27, 2024; AMENDED MARCH 4, 2024.

LEGAL DESCRIPTION

THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:

ALL THAT PORTION OF THE NORTH ONE-HALF OF THE SOUTHWEST QUARTER OF SECTION 22, TOWNSHIP 11 SOUTH, RANGE 4 WEST, SAN BERNARDINO MERIDIAN, IN THE CITY OF OCEANSIDE, COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, ACCORDING TO UNITED STATES GOVERNMENT SURVEY APPROVED DECEMBER 27, 1870, LYING SOUTHERLY AND SOUTHEASTERLY OF THE SOUTHERLY AND SOUTHEASTERLY LINES OF THAT CERTAIN 100.00 FOOT RIGHT OF WAY AS DESCRIBED IN DEED TO THE CALIFORNIA CENTRAL RAILWAY, RECORDED SEPTEMBER 22, 1887, IN BOOK 97, PAGE 241, OF DEEDS.

ASSESSOR PARCEL NO.

162-111-04

TITLE REPORT EXCEPTIONS

1. PROPERTY TAXES, WHICH ARE A LIEN NOT YET DUE AND PAYABLE, INCLUDING ANY ASSESSMENTS COLLECTED WITH TAXES TO BE LEVIED FOR THE FISCAL YEAR 2024-2025

2. PROPERTY TAXES, INCLUDING ANY PERSONAL PROPERTY TAXES AND ANY ASSESSMENTS COLLECTED WITH TAXES, ARE AS FOLLOWS:
TAX IDENTIFICATION NO.: 162-111-04-00
FISCAL YEAR: 2023-2024
1ST INSTALLMENT: $7,780.29, PAID
2ND INSTALLMENT: $7,780.29, OPEN (DELINQUENT AFTER APRIL 10)
PENALTY AND COST: $788.02
HOMEOWNERS EXEMPTION: $NONE
CODE AREA: 07047

3. ANY LIENS OR OTHER ASSESSMENTS, BONDS, OR SPECIAL DISTRICT LIENS INCLUDING WITHOUT LIMITATION, COMMUNITY FACILITY DISTRICTS, THAT ARISE BY REASON OF ANY LOCAL, CITY, MUNICIPAL OR COUNTY PROJECT OR SPECIAL DISTRICT.

4. THE LIEN OF SUPPLEMENTAL OR ESCAPED ASSESSMENTS OF PROPERTY TAXES, IF ANY, MADE PURSUANT TO THE PROVISIONS OF CHAPTER 3.5 OR PART 2, CHAPTER 3, ARTICLES 3 AND 4 RESPECTIVELY (COMMENCING WITH SECTION 75) OF THE REVENUE AND TAXATION CODE OF THE STATE OF CALIFORNIA AS A RESULT OF THE TRANSFER OF TITLE TO THE VESTEE NAMED IN SCHEDULE A; OR AS A RESULT OF CHANGES IN OWNERSHIP OR NEW CONSTRUCTION OCCURRING PRIOR TO DATE OF POLICY

5. WATER RIGHTS, CLAIMS OR TITLE TO WATER, WHETHER OR NOT DISCLOSED BY THE PUBLIC RECORDS.

△5 EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT:
GRANTED TO: FRANK MOTTINO, ET UX.
PURPOSE: ROAD AND INCIDENTAL PURPOSES
RECORDING DATE: JUNE 27, 1930
RECORDING NO: BOOK 1788, PAGE 178, OF DEEDS
AFFECTS: A PORTION OF THE LAND DESCRIBED HEREIN.

△6 EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT:
GRANTED TO: THE PACIFIC TELEPHONE AND TELEGRAPH COMPANY
PURPOSE: PUBLIC UTILITIES, INGRESS AND EGRESS
RECORDING DATE: OCTOBER 21, 1954
RECORDING NO: BOOK 5406, PAGE 175, OF OFFICIAL RECORDS
AFFECTS: A PORTION OF THE LAND DESCRIBED HEREIN.

TITLE REPORT EXCEPTIONS

△7 EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT:
GRANTED TO: CITY OF OCEANSIDE
PURPOSE: WATER LINE
RECORDING DATE: AUGUST 16, 1962
RECORDING NO: 140278, OF OFFICIAL RECORDS
AFFECTS: A PORTION OF THE LAND DESCRIBED HEREIN.

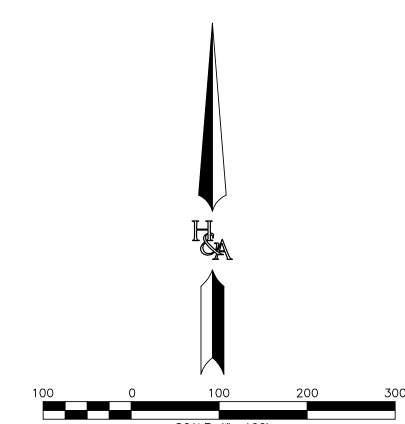
△8 EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT:
GRANTED TO: THE CITY OF OCEANSIDE
PURPOSE: SANITARY SEWER AND INCIDENTAL PURPOSES
RECORDING DATE: JUNE 8, 1973
RECORDING NO: 145914, OF OFFICIAL RECORDS
AFFECTS: A PORTION OF THE LAND DESCRIBED HEREIN.

9. PLEASE BE ADVISED THAT OUR SEARCH DID NOT DISCLOSE ANY OPEN DEEDS OF TRUST OF RECORD. IF YOU SHOULD HAVE KNOWLEDGE OF ANY OUTSTANDING OBLIGATION, PLEASE CONTACT THE TITLE DEPARTMENT IMMEDIATELY FOR FURTHER REVIEW PRIOR TO CLOSING.

10. ANY EASEMENTS NOT DISCLOSED BY THE PUBLIC RECORDS AS TO MATTERS AFFECTING TITLE TO REAL PROPERTY, WHETHER OR NOT SAID EASEMENTS ARE VISIBLE AND APPARENT.

11. MATTERS WHICH MAY BE DISCLOSED BY AN INSPECTION AND/OR BY A CORRECT ALTA/NSPS LAND TITLE SURVEY OF SAID LAND THAT IS SATISFACTORY TO THE COMPANY, AND/OR BY INQUIRY OF THE PARTIES IN POSSESSION THEREOF.

12. ANY RIGHTS OF THE PARTIES IN POSSESSION OF A PORTION OF, OR ALL OF, SAID LAND, WHICH RIGHTS ARE NOT DISCLOSED BY THE PUBLIC RECORDS.
THE COMPANY WILL REQUIRE, FOR REVIEW, A FULL AND COMPLETE COPY OF ANY UNRECORDED AGREEMENT, CONTRACT, LICENSE AND/OR LEASE, TOGETHER WITH ALL SUPPLEMENTS, ASSIGNMENTS AND AMENDMENTS THERETO, BEFORE ISSUING ANY POLICY OF TITLE INSURANCE WITHOUT EXCEPTING THIS ITEM FROM COVERAGE.
THE COMPANY RESERVES THE RIGHT TO EXCEPT ADDITIONAL ITEMS AND/OR MAKE ADDITIONAL REQUIREMENTS AFTER REVIEWING SAID DOCUMENTS.



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HUNSAKER & ASSOCIATES
SAN DIEGO, INC
PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 · FX(858)558-1414

BOUNDARY & ENCUMBRANCES
OLIVE PARK APARTMENTS
CITY OF OCEANSIDE, CALIFORNIA

WO NO. 3785-02

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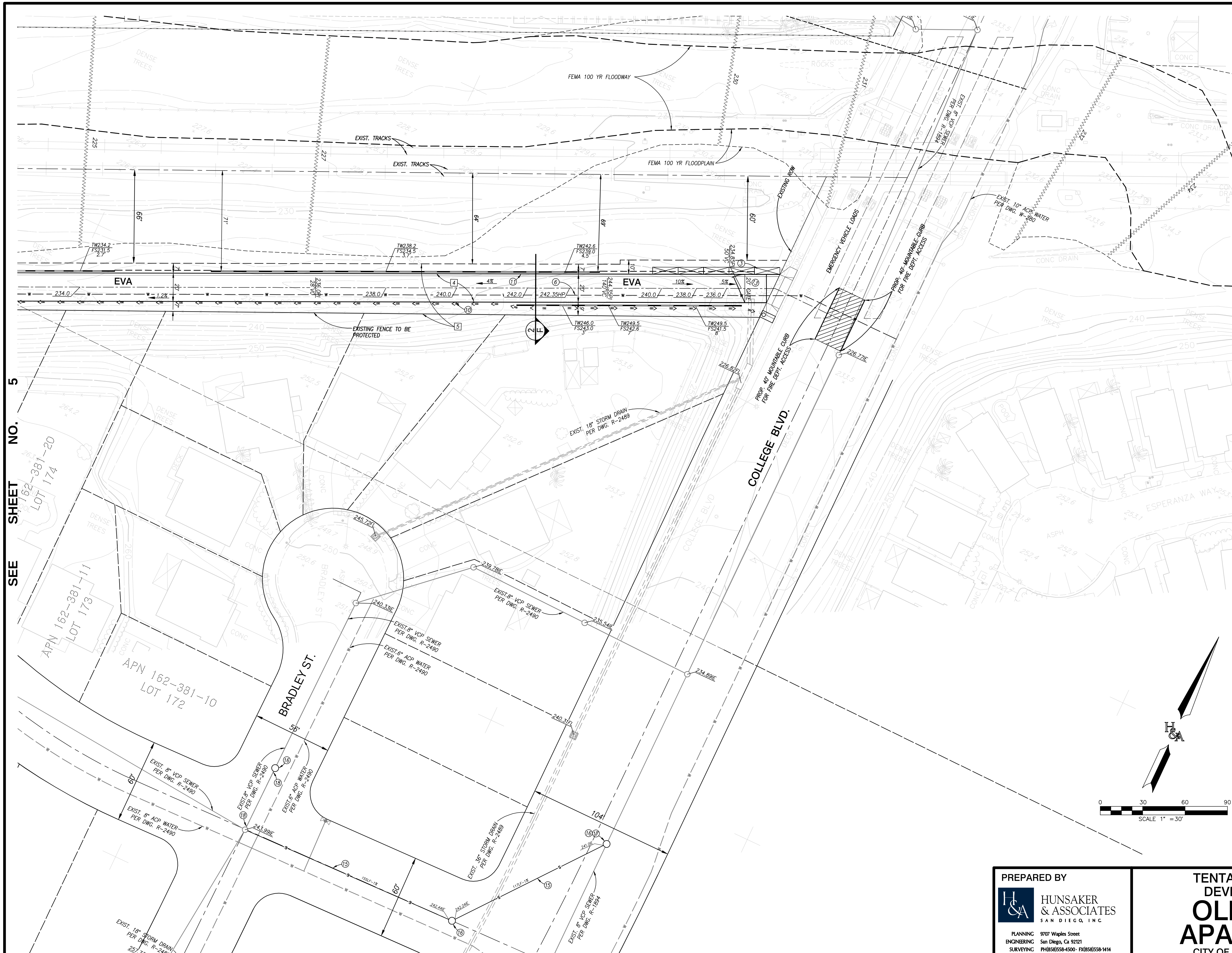

DESIGN NOTES

1. PROP. PRIVATE STORM DRAIN
2. PROP. PRIVATE MODULAR WETLANDS
3. PROP. PRIVATE TREE PLANTERS
4. PROP. PRIVATE STORM DRAIN STORAGE
5. PROP. PRIVATE 8" PVC SEWER
6. PROP. PUBLIC 10" PVC WATER
7. PROP. PUBLIC 8" PVC WATER
8. PROP. WATER METER
9. PROP. BACKFLOW
10. PROP. 6" CURB
11. PROP. 6" CURB AND GUTTER
12. PROP. ROLLED CURB
13. PROP. EMERGENCY VEHICLE ACCESS GATE
14. CONNECT BROWDITCH TO PROPOSED INLET
15. PROP. PUBLIC 8" PVC SEWER
16. PROP. SEWER MANHOLE
17. PROP. SEWER POINT OF CONNECTION
18. EXIST. SEWER TO BE REMOVED

PROPOSED EASEMENTS

1. PRIVATE RECIPROCAL ACCESS OVER LOT 1, 2 & A
2. PUBLIC ACCESS OVER LOT B
3. PUBLIC ACCESS
4. PUBLIC UTILITY/OFF SITE EMERGENCY WIDTH VARIES
5. OFF SITE EMERGENCY ACCESS EASEMENT – WIDTH VARIES

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SAN DIEGO, INC.
PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
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TENTATIVE PARCEL MAP
DEVELOPMENT PLAN

OLIVE PARK APARTMENTS

CITY OF OCEANSIDE, CALIFORNIA

WO NO. 3785-02

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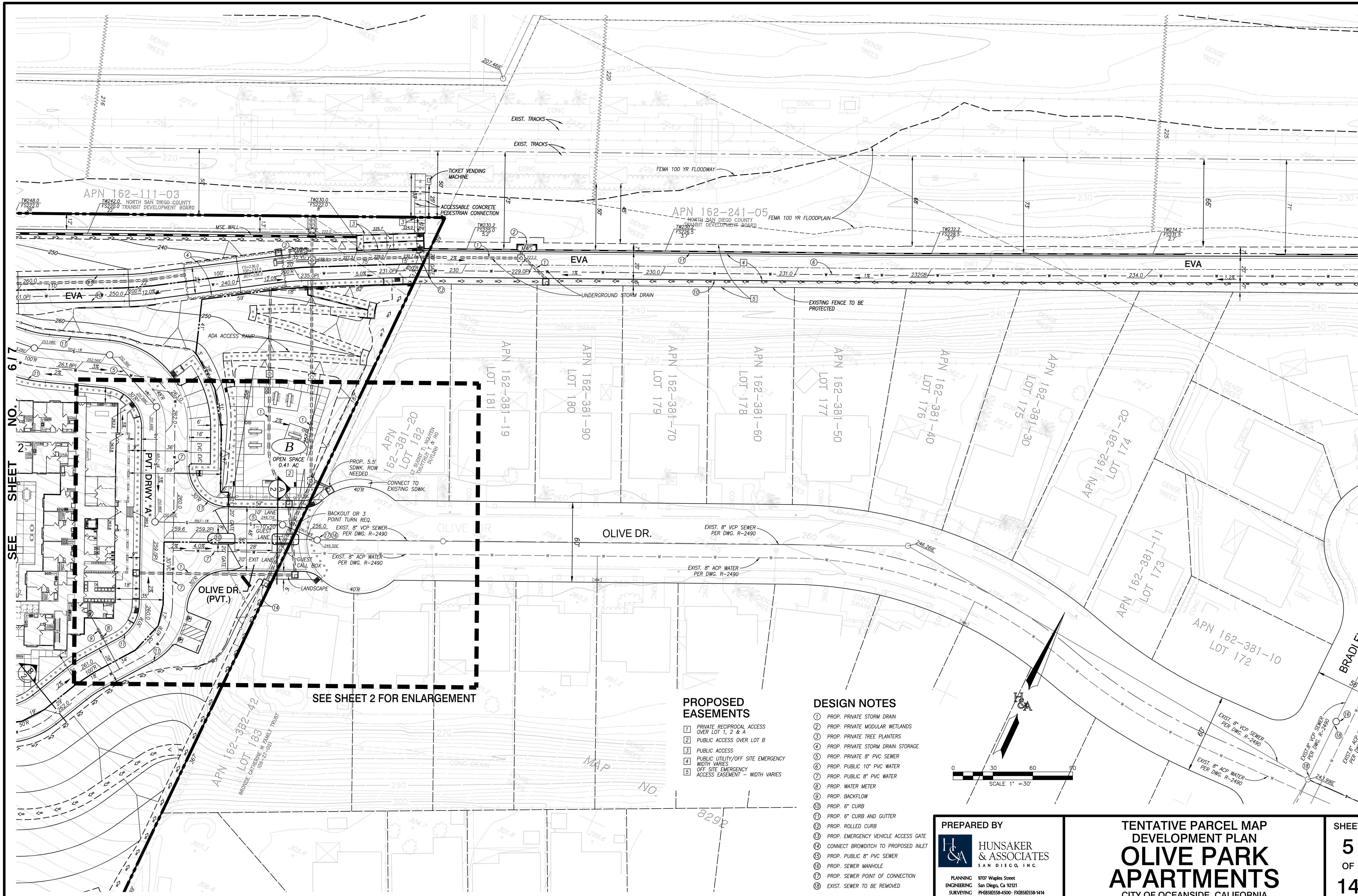

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TENTATIVE PARCEL MAP DEVELOPMENT PLAN
OLIVE PARK APARTMENTS
CITY OF OCEANSIDE, CALIFORNIA

WO NO. 3785-02

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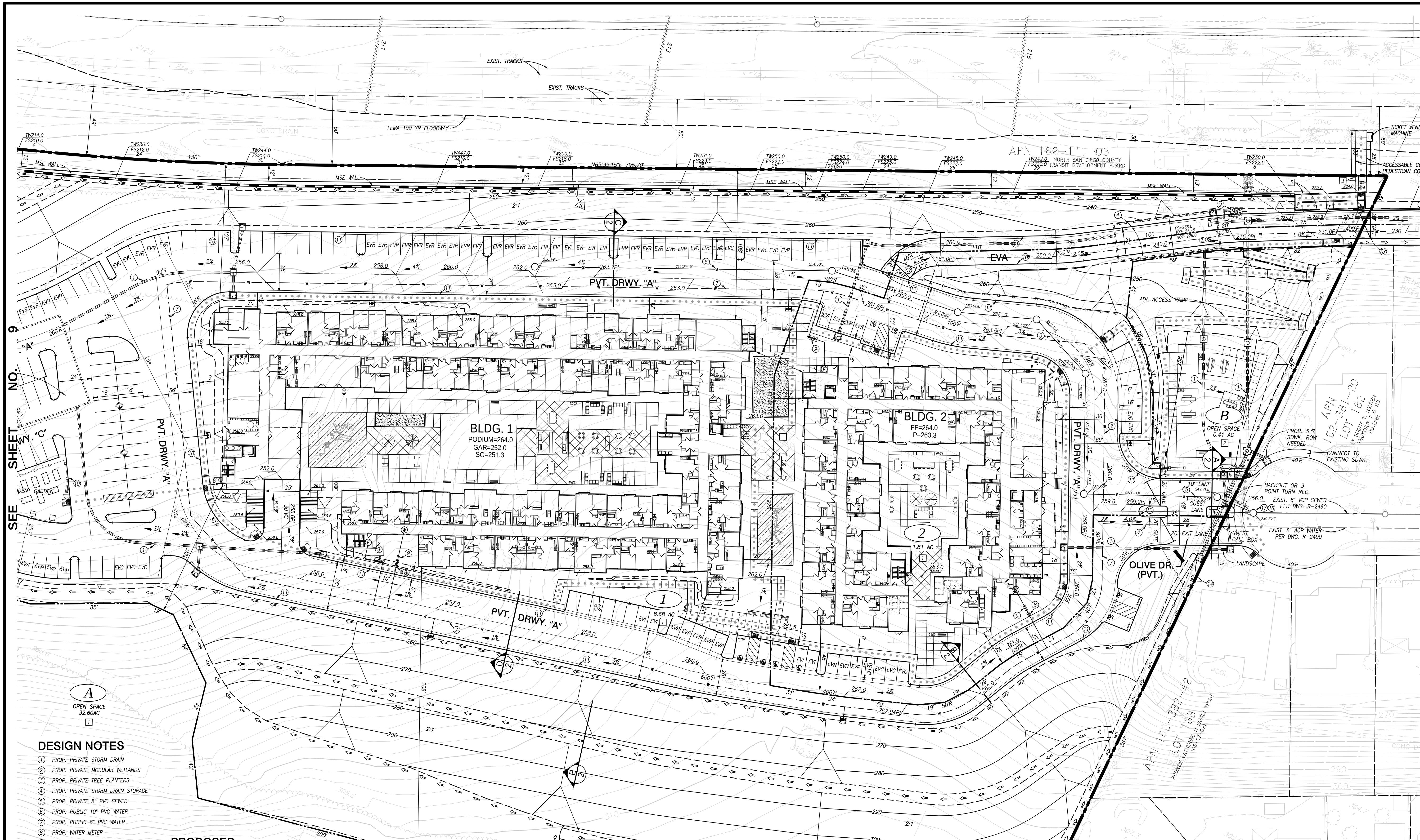

SEE SHEET NO. 9

SEE SHEET NO. 5

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SEE SHEET NO. 8

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HUNSAKER & ASSOCIATES SAN DIEGO, INC
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TENTATIVE PARCEL MAP DEVELOPMENT PLAN
OLIVE PARK APARTMENTS
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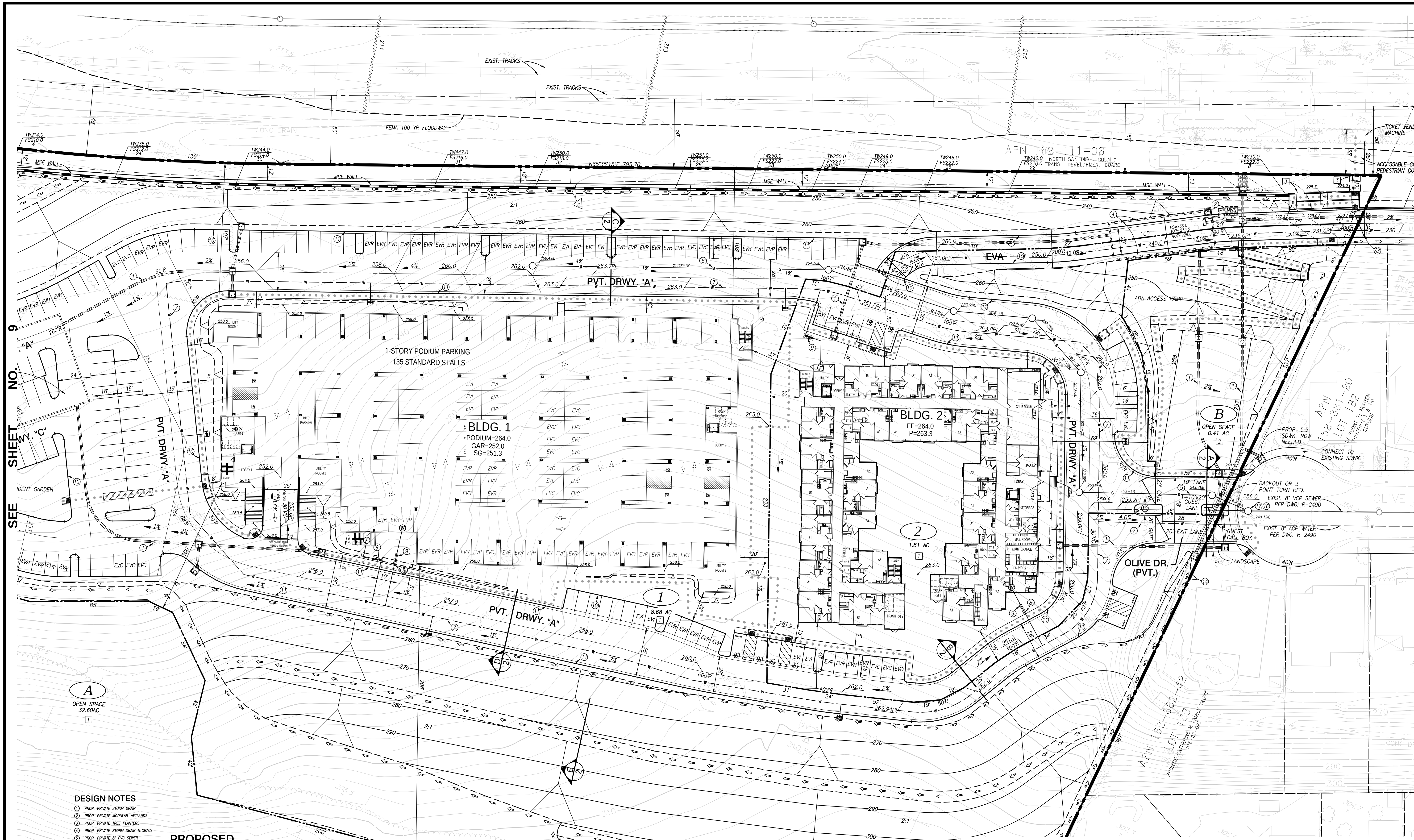

SEE SHEET NO. 6

SEE SHEET NO. 5

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PROPOSED LIMITS OF IMPACT 10.87 AC/473,481 SF
MAXIMUM LIMITS OF IMPACT 25%: 473,705 SF
(TOTAL AREA: 1,894,822 SF/43.499 AC)

SEE SHEET NO. 8

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TENTATIVE PARCEL MAP
DEVELOPMENT PLAN
OLIVE PARK APARTMENTS

CITY OF OCEANSIDE, CALIFORNIA

SHEET 7 OF 14

WO NO. 3785-02

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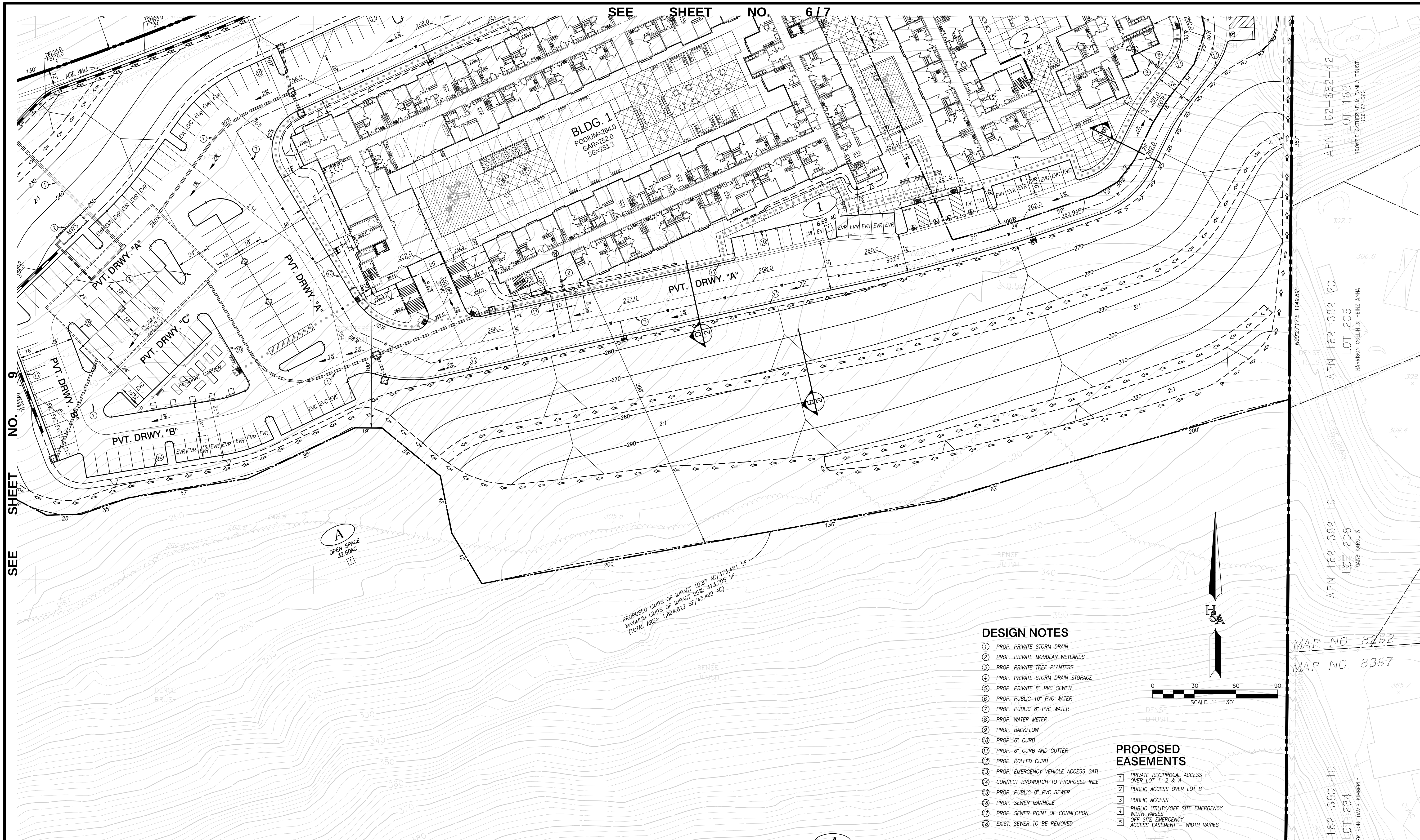
SEE SHEET NO. 6 / 7



SEE SHEET NO. 9

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SEE SHEET NO. 13

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TENTATIVE PARCEL MAP
DEVELOPMENT PLAN

OLIVE PARK APARTMENTS

CITY OF OCEANSIDE, CALIFORNIA

W.O. NO. 3785-02
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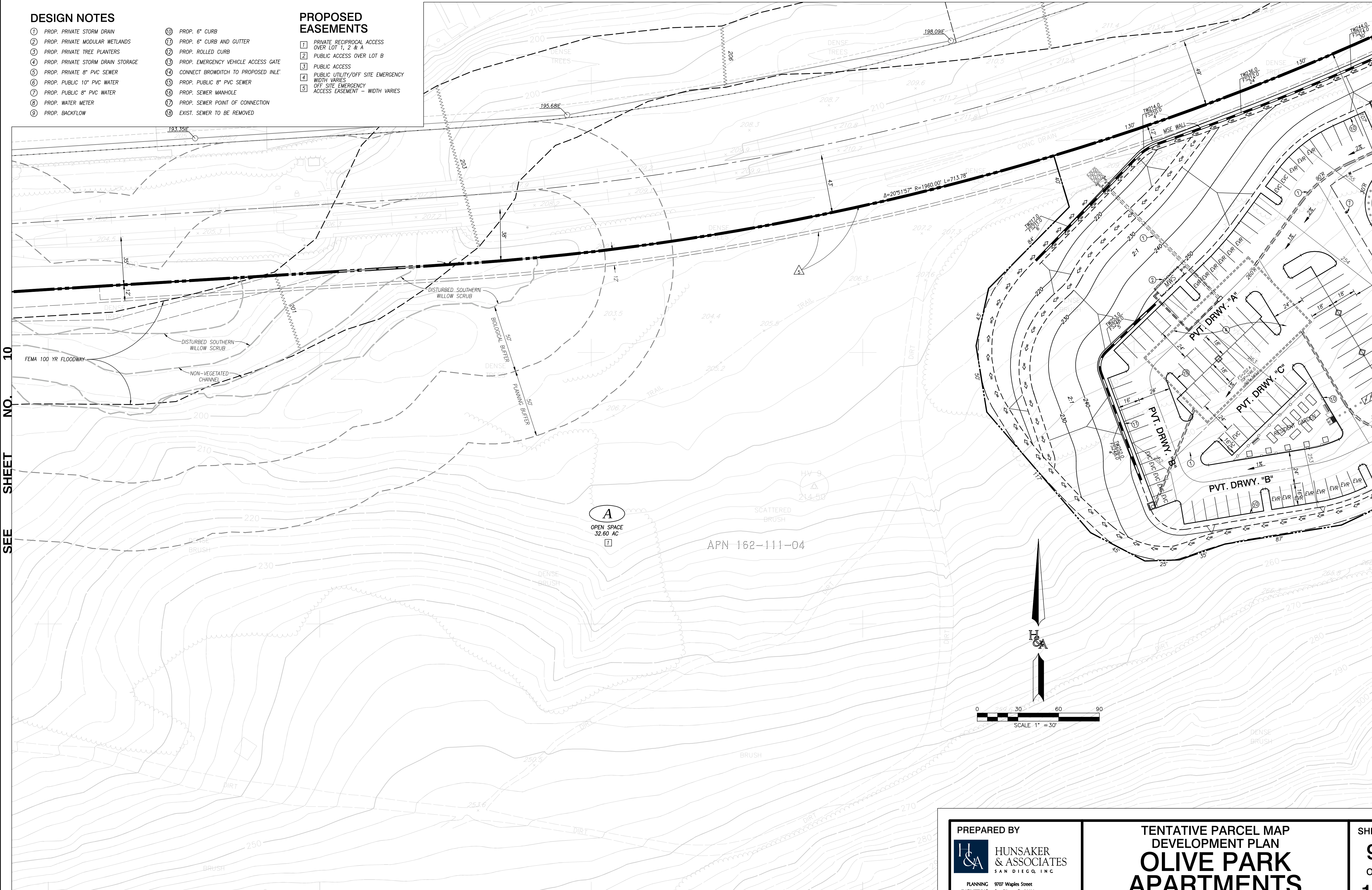

SEE SHEET NO. 12

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TENTATIVE PARCEL MAP
DEVELOPMENT PLAN

OLIVE PARK APARTMENTS

CITY OF OCEANSIDE, CALIFORNIA

W.O. NO. 3785-02

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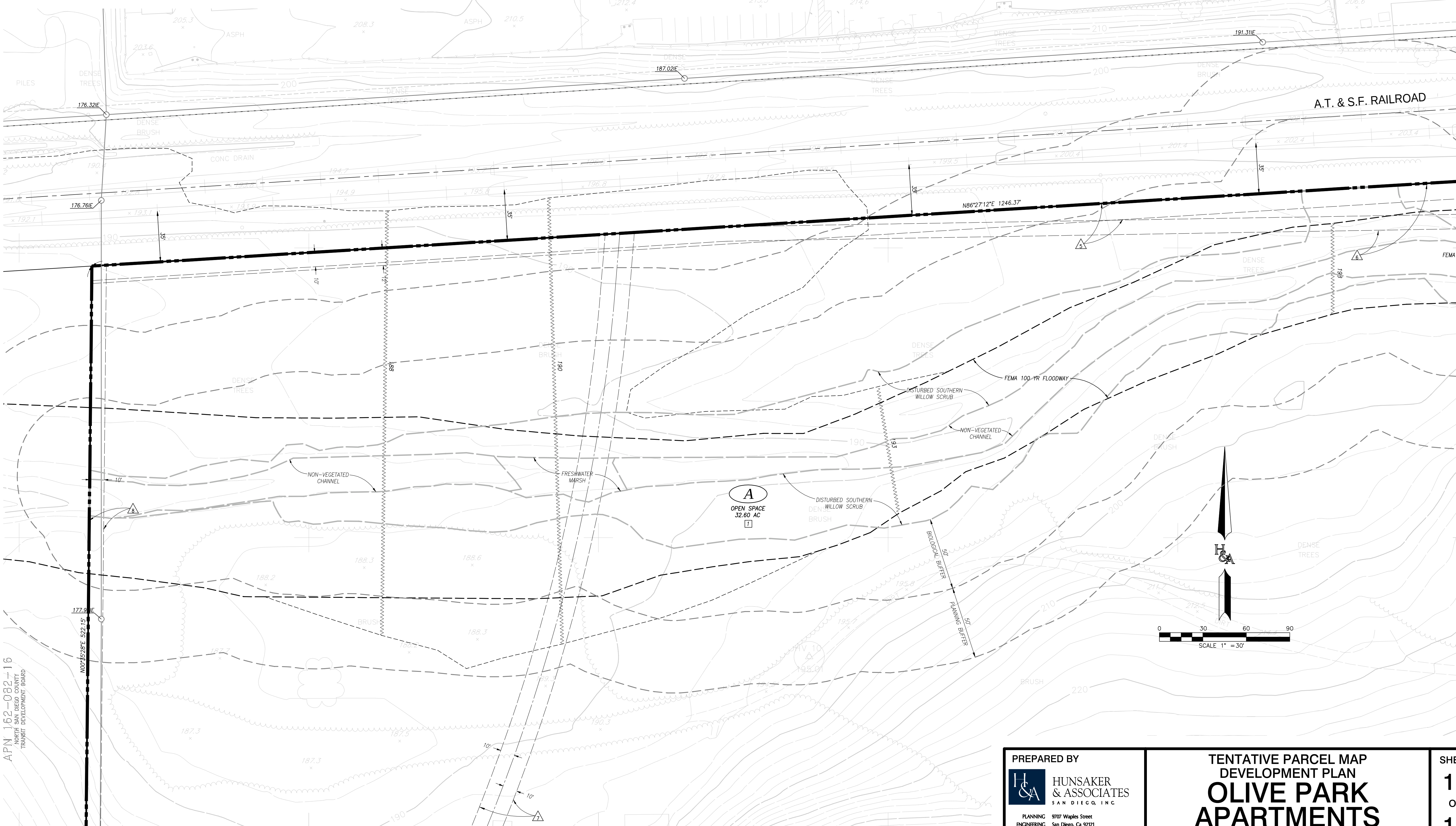

SEE SHEET NO. 9

SEE SHEET NO. 11

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ENGINEERING San Diego, Ca 92121
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TENTATIVE PARCEL MAP DEVELOPMENT PLAN
OLIVE PARK APARTMENTS
CITY OF OCEANSIDE, CALIFORNIA

SHEET 10 OF 14

WO NO. 3785-02

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TENTATIVE PARCEL MAP
DEVELOPMENT PLAN

OLIVE PARK APARTMENTS

CITY OF OCEANSIDE, CALIFORNIA

SHEET 11 OF 14

W.O. NO. 3785-02

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TENTATIVE PARCEL MAP
DEVELOPMENT PLAN

OLIVE PARK APARTMENTS

CITY OF OCEANSIDE, CALIFORNIA

SHEET 12 OF 14

WO NO. 3785-02

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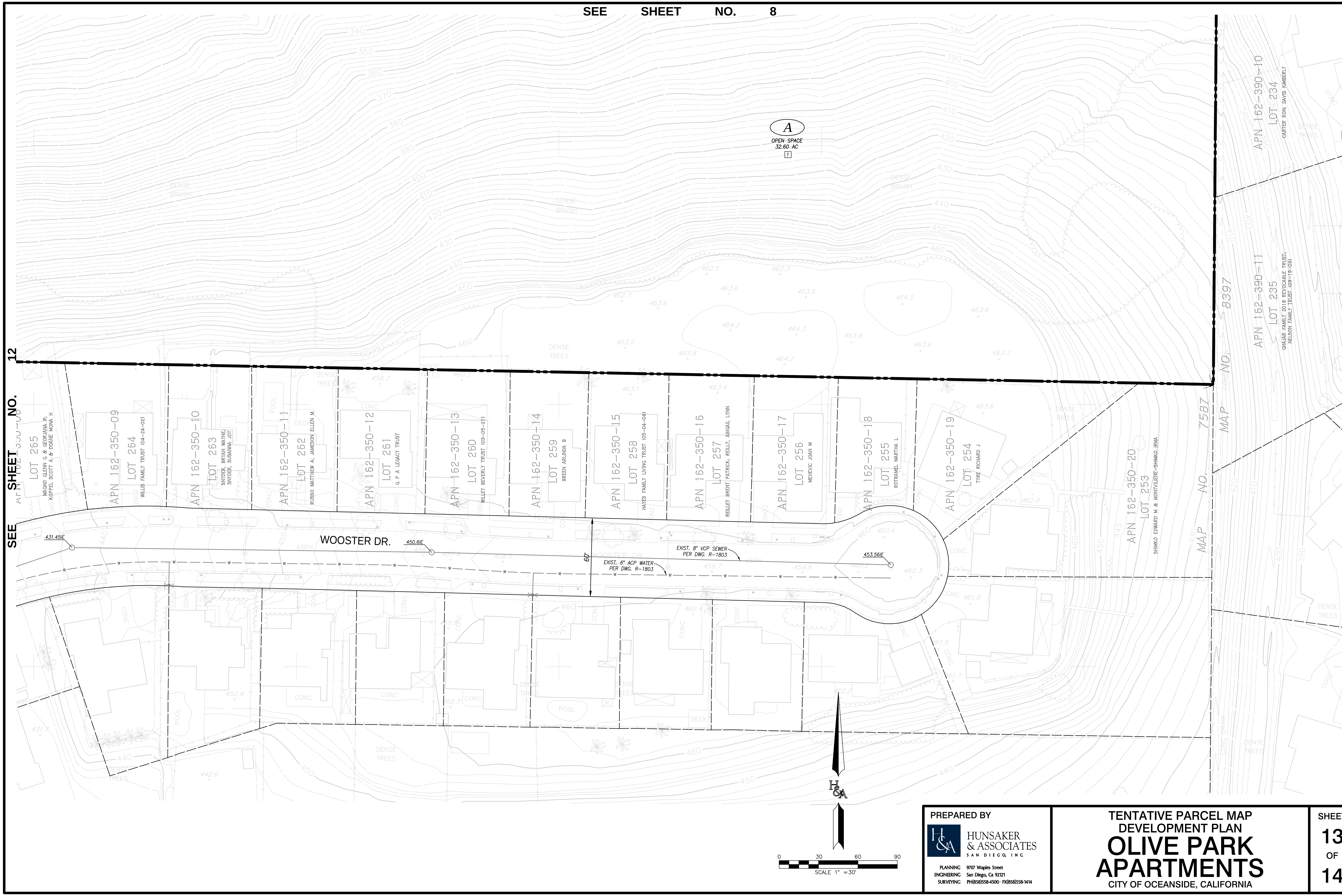

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TENTATIVE PARCEL MAP
DEVELOPMENT PLAN

OLIVE PARK APARTMENTS

CITY OF OCEANSIDE, CALIFORNIA

SHEET
13
OF
14

WO NO. 3785-02

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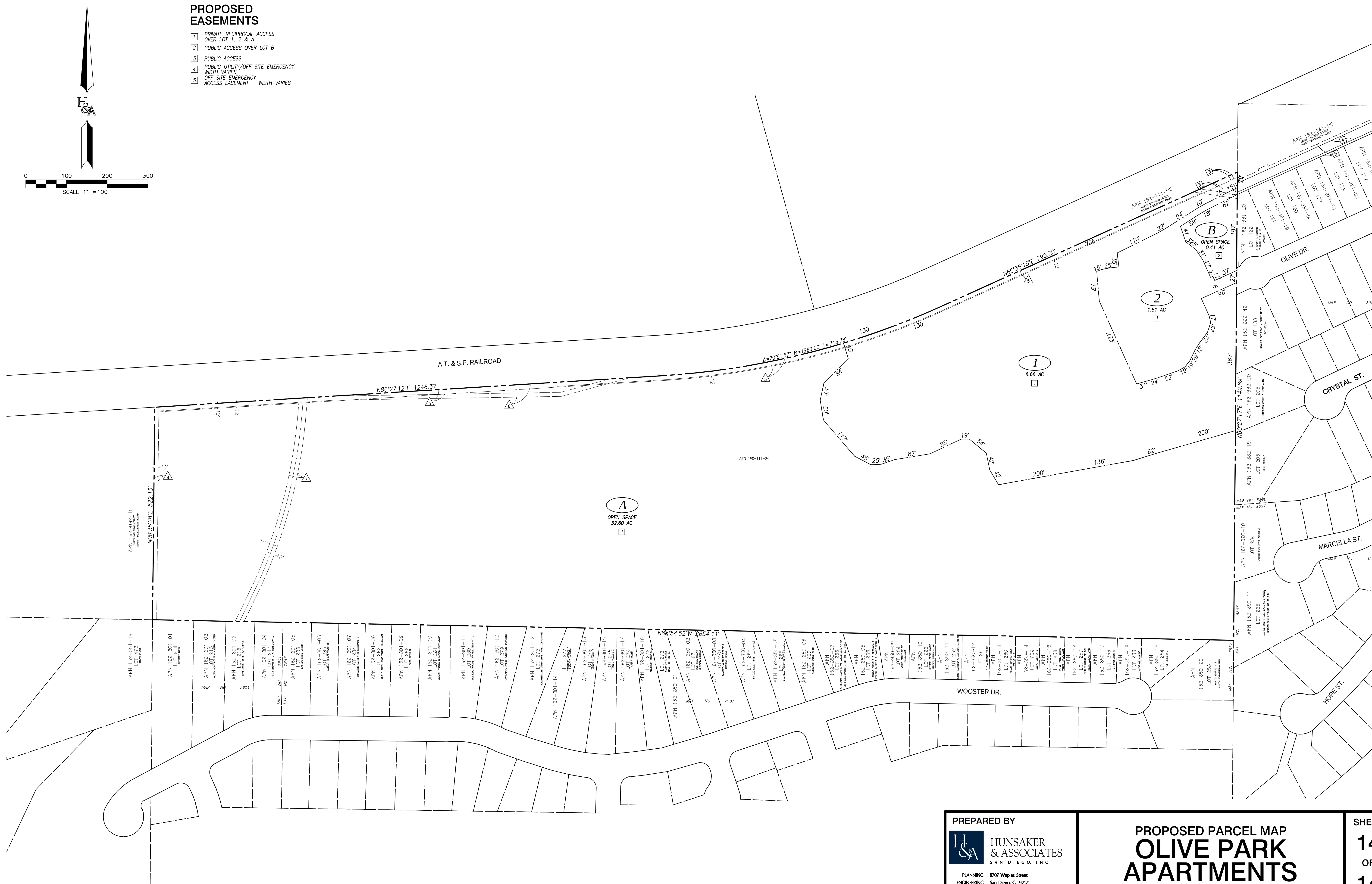

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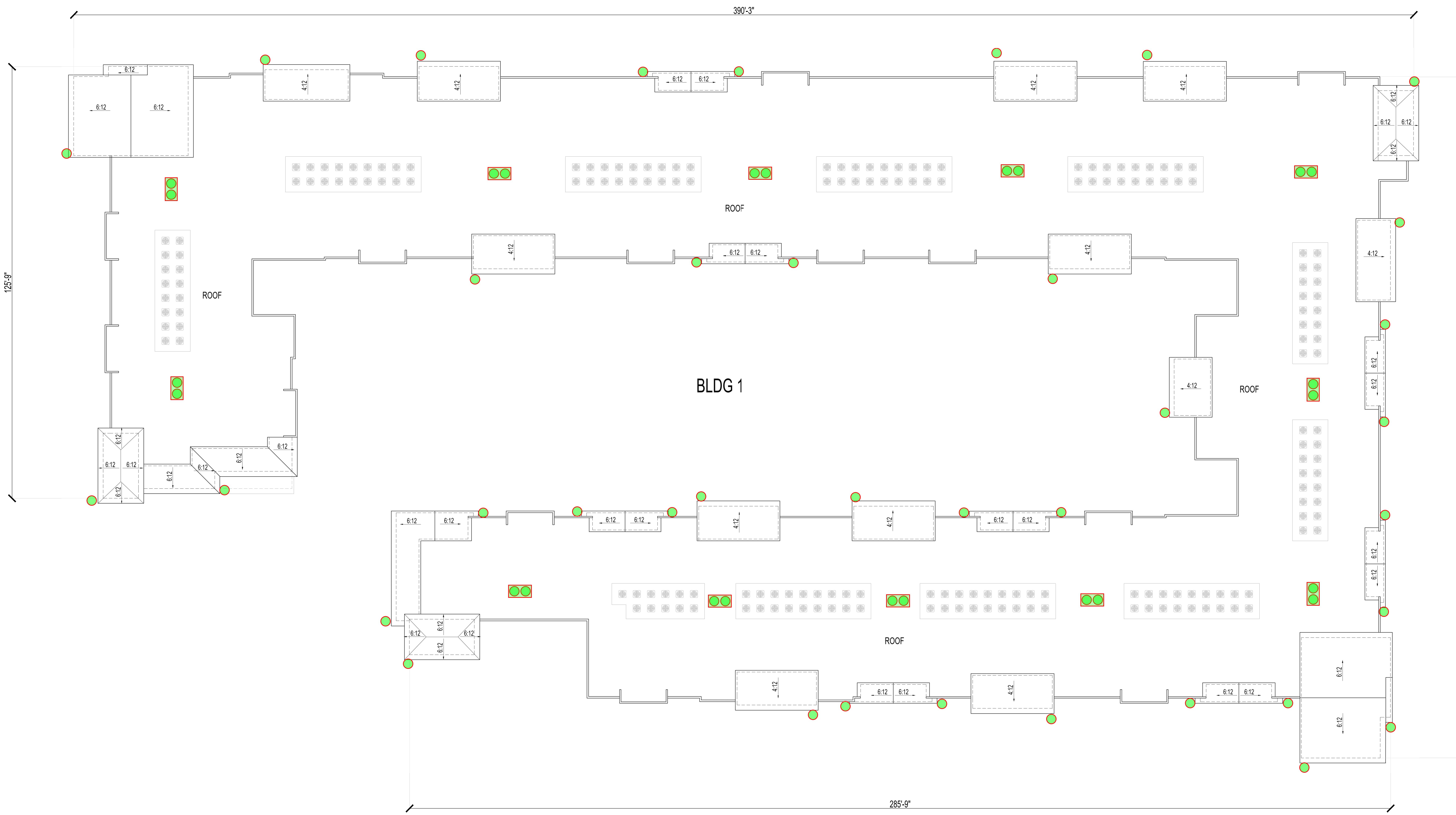
PROPOSED PARCEL MAP
OLIVE PARK APARTMENTS
CITY OF OCEANSIDE, CALIFORNIA

SHEET
14
OF
14

W.O. NO. 3785-02

R:\1746\&Pln\TM\1746 Site Plan Sht 4-12.dwg[]Aug-08-2024:15:28



Olive Park Apartments

Capstone Equities

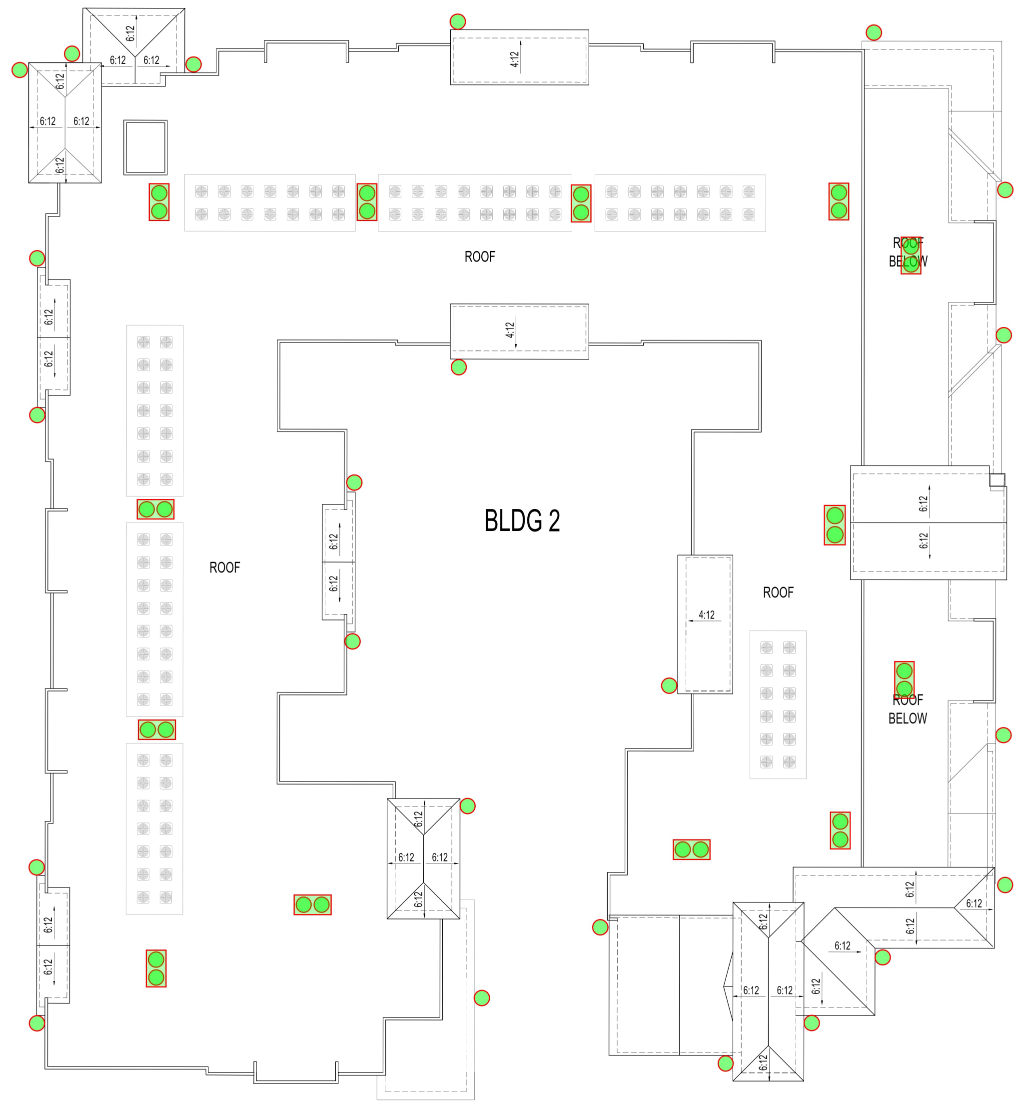
BUILDING 1 - ROOF PLAN

scale: 1/16" = 1'-0" on 24x36 sheet

A1.6

August 9, 2024

www.stkarch.com



Olive Park Apartments

BUILDING 2 - ROOF PLAN

Capstone Equities

scale: 1/16" = 1'-0" on 24x36 sheet

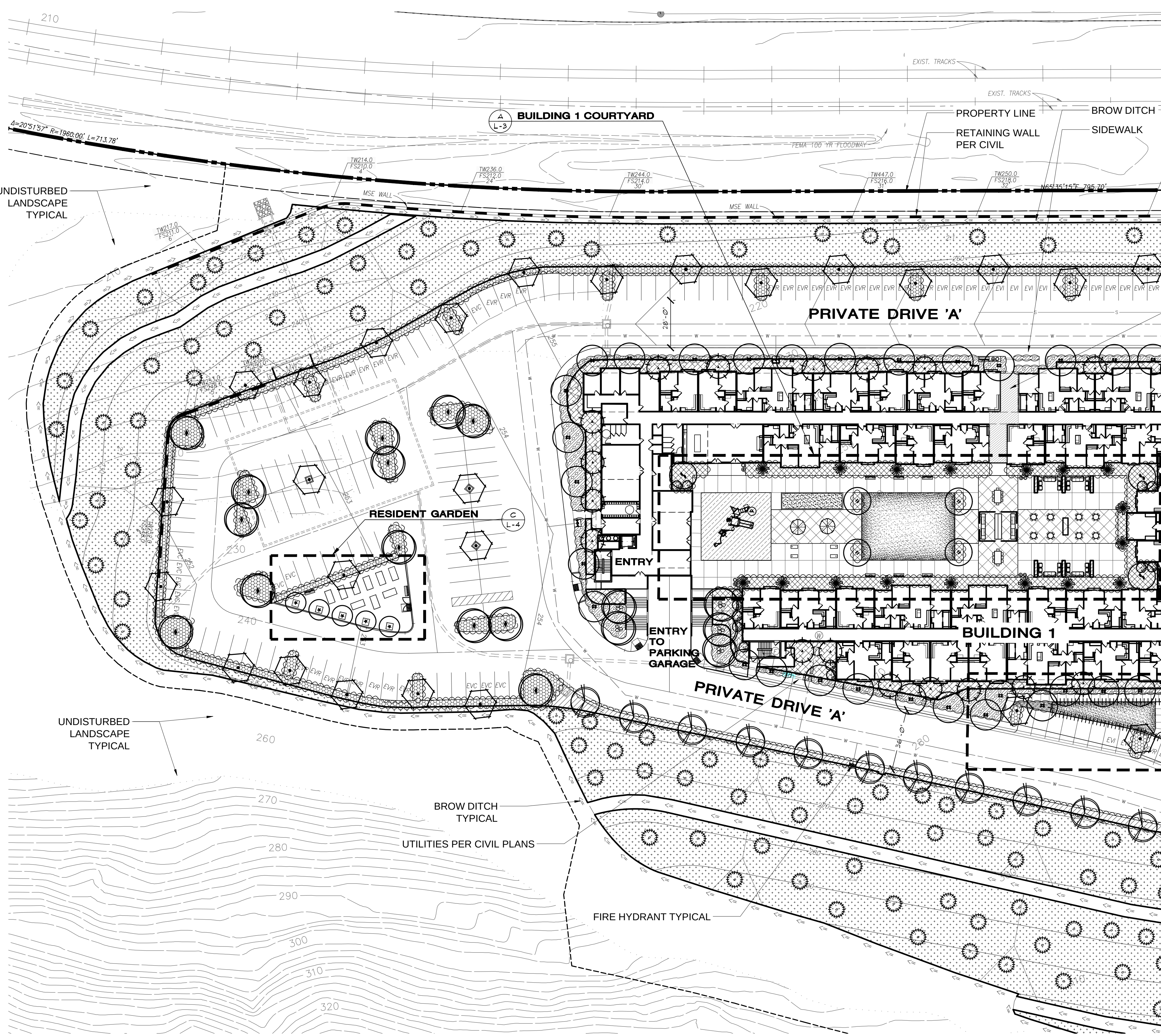
A1.11

August 9, 2024

www.stkarch.com

CONCEPTUAL LANDSCAPE PLAN

OLIVE PARK APARTMENTS
OCEANSIDE, CALIFORNIA



REFER TO SHEET L-6 FOR PLANT LEGEND

NOTE:
SITE FURNISHINGS ARE SHOWN FOR REFERENCE ONLY AND ARE USED TO ILLUSTRATE GRAPHIC AND PEDESTRIAN SCALE AS WELL AS SPATIAL QUALITIES OF THE PLAN AND DESIGN. FINAL TYPE, QUANTITY AND LAYOUT TO BE DETERMINED BY OWNER AT CONSTRUCTION PHASE.

DECORATIVE POTS. ALL DECORATIVE POTS TO BE SELF WATERING (TOURNESOL SITEWORK CWM CONTAINER IRRIGATION INSERT) OR BE PROVIDED WITH A DRIP IRRIGATION SYSTEM.

LANDSCAPE CONCEPT PLAN

SCALE: 1" = 30'-0"

0 30' 60' 90'

D24-00006, DB24-00004, P24-00002

THE LIGHTFOOT PLANNING GROUP
PLANNING
SITE DESIGN
LANDSCAPE ARCHITECTURE
2237 FARADAY AVE SUITE 120
CARLSBAD, CA 92008
(760) 692-1924
LIGHTFOOT@LIGHTFOOTPG.COM

LICENSED LANDSCAPE ARCHITECT JAMES L. TAYLOR No. 2960 Signature 10/31/24 Renewal Date Date STATE OF CALIFORNIA

CAPSTONE EQUITIES
OLIVE PARK APARTMENTS
OCEANSIDE, CA

Scale: 1"=30' (24X36)
Date: 2/28/24
Drawn By: EE
Revisions:
3/15/24
7/31/24
8/8/24
10/01/24

LANDSCAPE CONCEPT PLAN

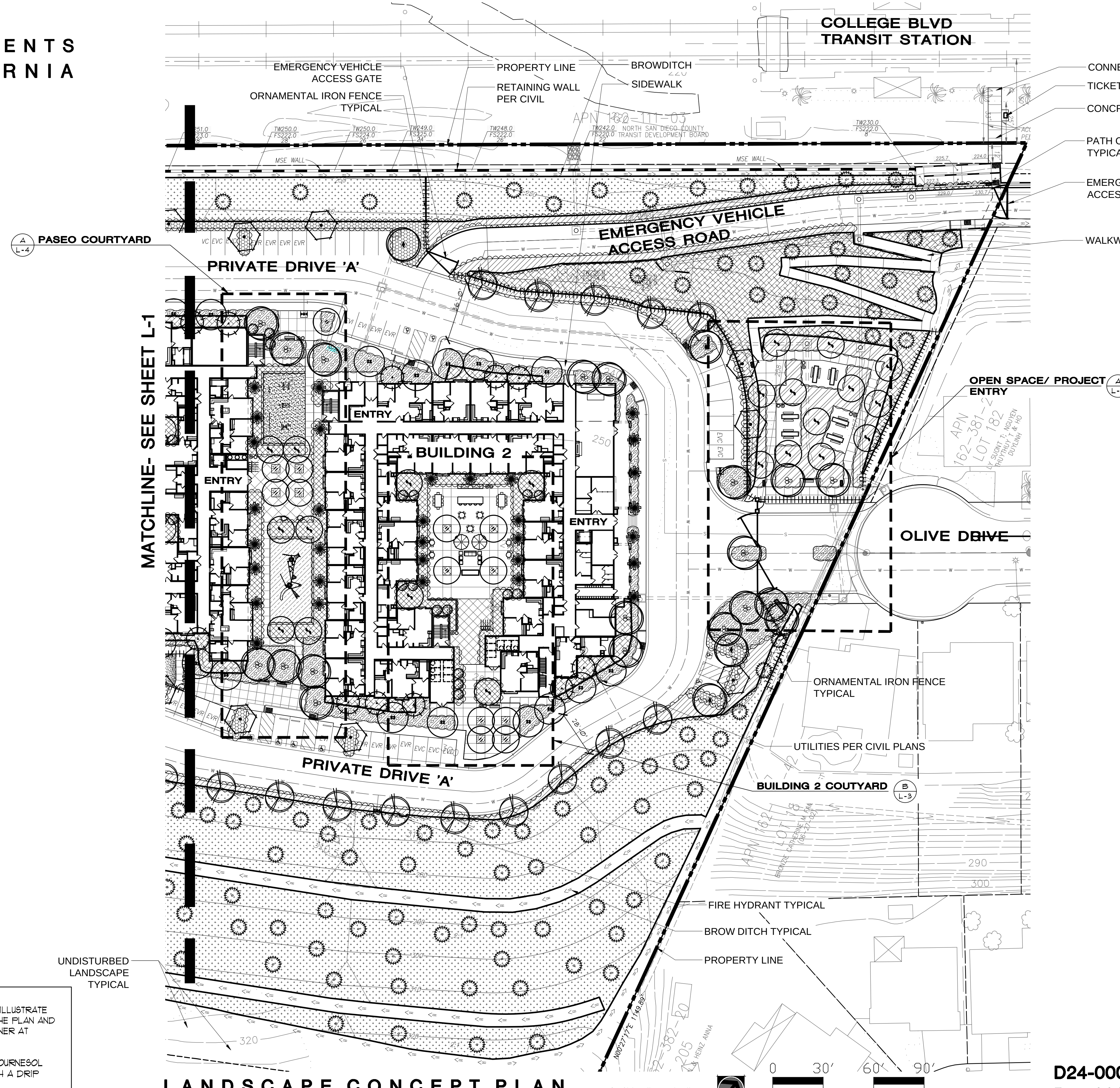
Job # 1717.012

L-1

6

CONCEPTUAL LANDSCAPE PLAN

OLIVE PARK APARTMENTS
OCEANSIDE, CALIFORNIA



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0 30' 60' 90'

D24-00006, DB24-00004, P24-00002

THE LIGHTFOOT PLANNING GROUP
PLANNING
SITE DESIGN
LANDSCAPE ARCHITECTURE
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CARLSBAD, CA 92008
(760) 692-1924
LIGHTFOOT@LIGHTFOOTPG.COM

LICENSED LANDSCAPE ARCHITECT JAMES L. TAYLOR No. 2861 Signature 10/31/24 Renewal Date Date STATE OF CALIFORNIA

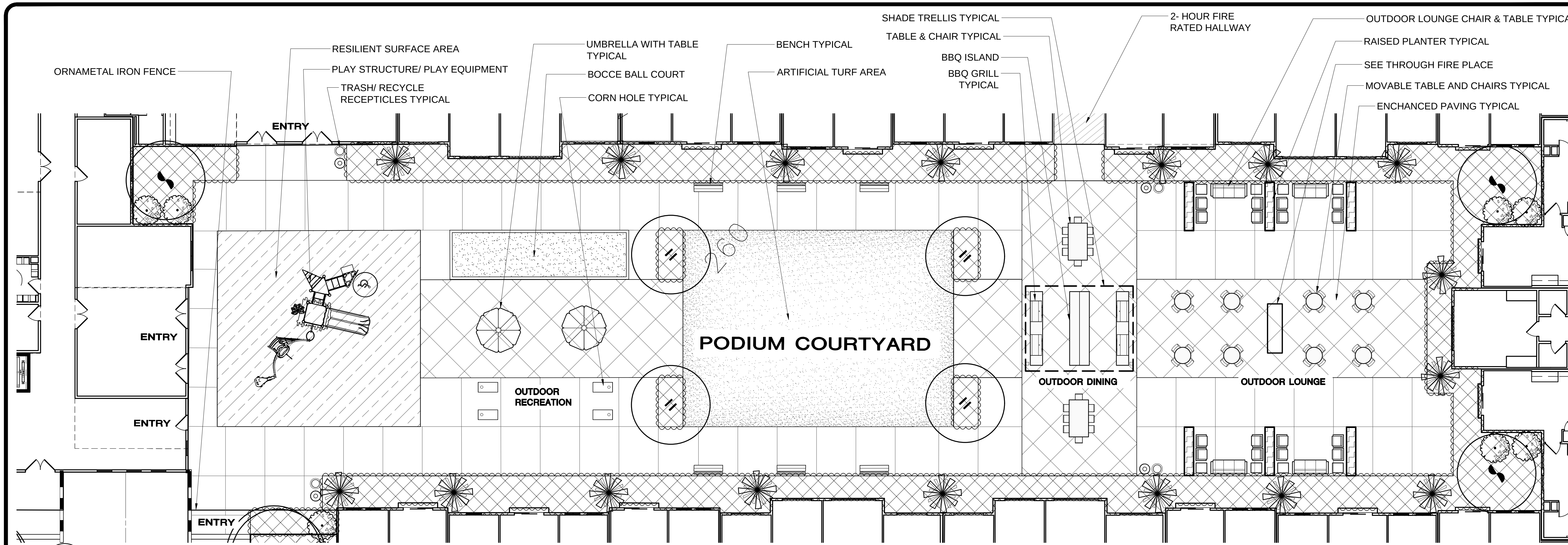
CAPSTONE EQUITIES
OLIVE PARK APARTMENTS
OCEANSIDE, CA

Scale:	1"=30' (24X36)
Date:	2/28/24
Drawn By:	EE
Revisions:	
	3/15/24
	7/31/24
	8/8/24
	10/01/24

LANDSCAPE CONCEPT PLAN

Job # 1717.012

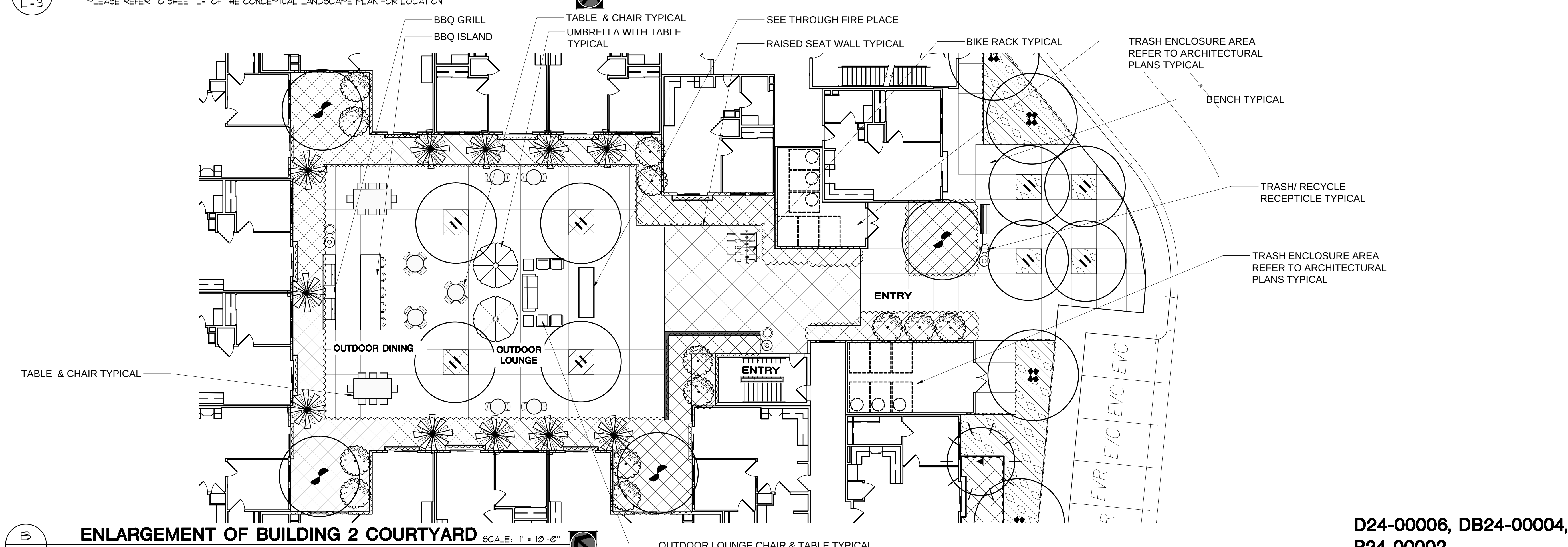
L-2
6



A
L-3

ENLARGEMENT OF BUILDING 1 COURTYARD SCALE: 1" = 10'-0"

PLEASE REFER TO SHEET L-1 OF THE CONCEPTUAL LANDSCAPE PLAN FOR LOCATION



B
L-3

ENLARGEMENT OF BUILDING 2 COURTYARD SCALE: 1" = 10'-0"

PLEASE REFER TO SHEET L-2 OF THE CONCEPTUAL LANDSCAPE PLAN FOR LOCATION

D24-00006, DB24-00004, P24-00002

THE LIGHTFOOT PLANNING GROUP

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(760) 692-1924

LIGHTFOOT@LIGHTFOOTPG.COM

LICENSED LANDSCAPE ARCHITECT
JAMES L. TAYLOR No. 2961
Signature
10/31/24
Renewal Date
Date
STATE OF CALIFORNIA

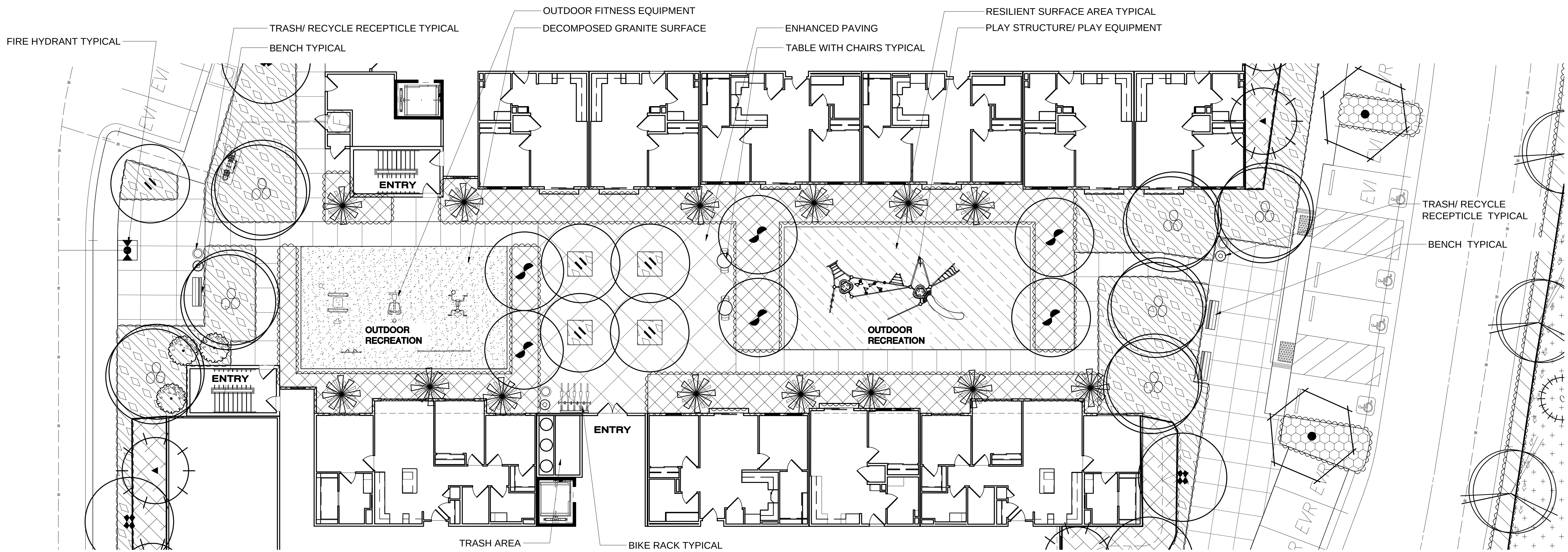
CAPSTONE EQUITIES
OLIVE PARK APARTMENTS
OCEANSIDE, CA

Scale: 1"=10' (24X36)
Date: 2/28/24
Drawn By: EE
Revisions:
3/15/24
7/31/24
8/8/24
10/01/24

LANDSCAPE CONCEPT PLAN

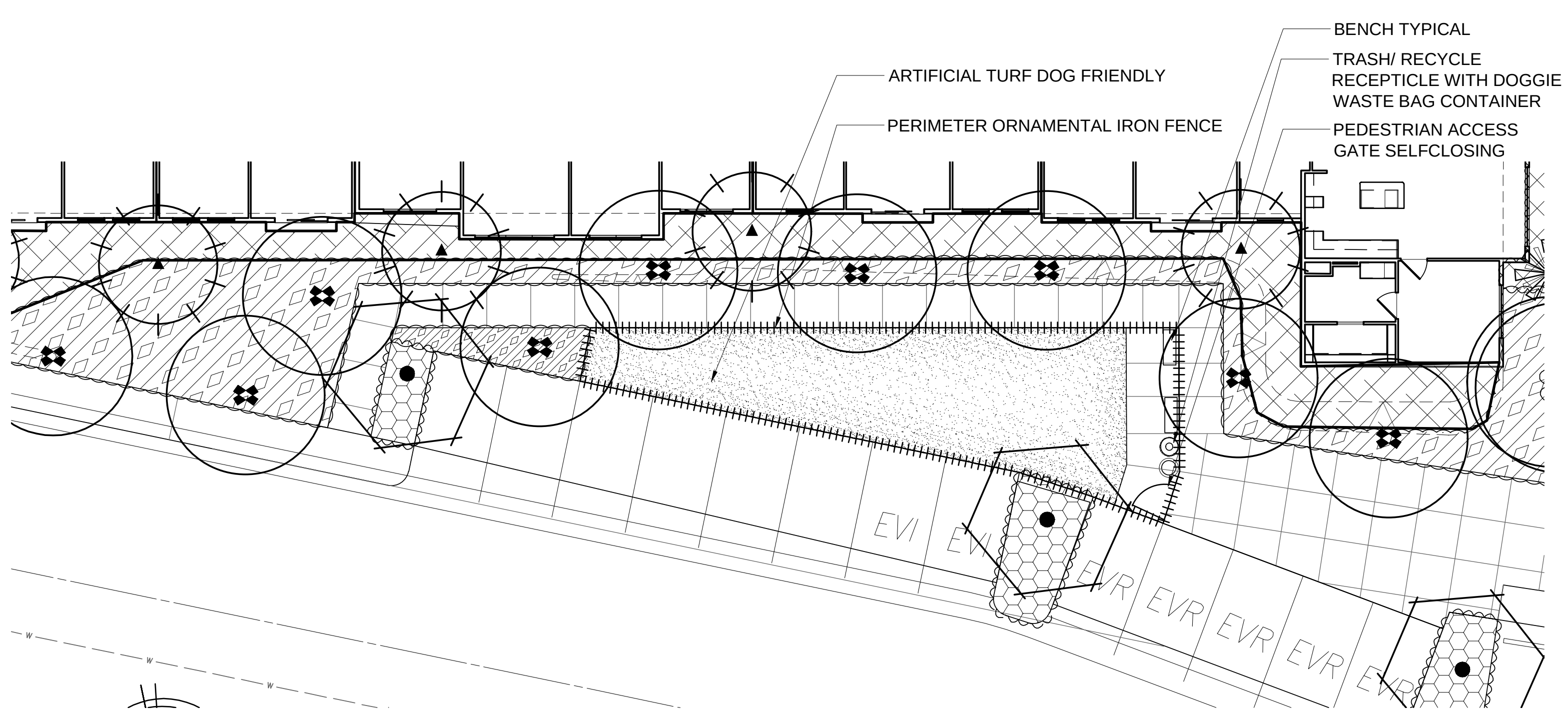
Job # 1717.012

L-3
6



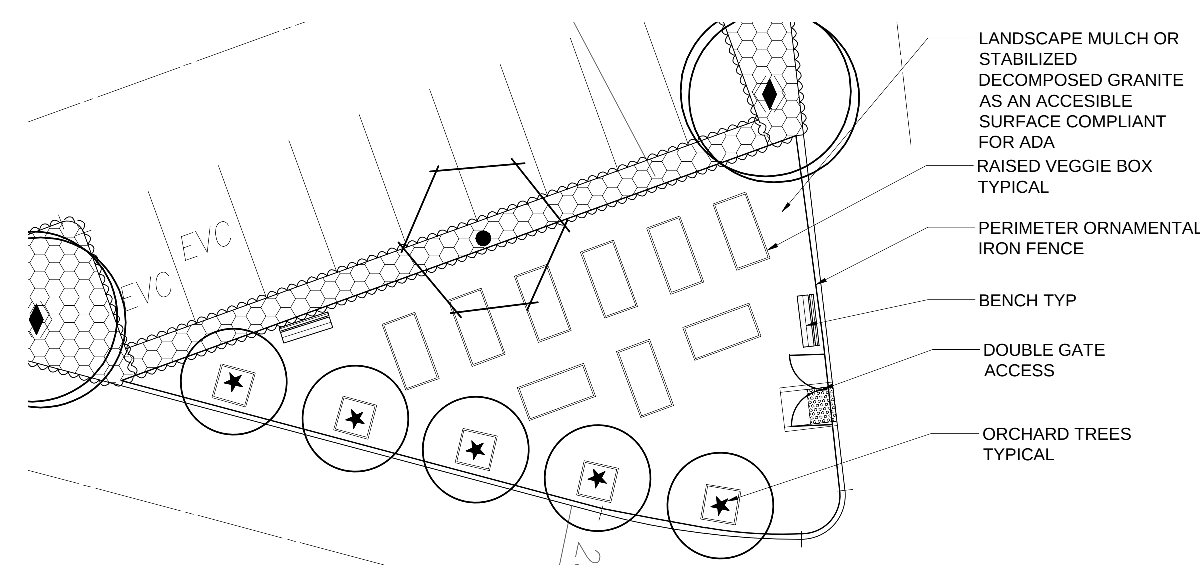
A L-4 **ENLARGEMENT OF PASEO COURTYARD** SCALE: 1" = 10'-0"

PLEASE REFER TO SHEET L-2 OF THE CONCEPTUAL LANDSCAPE PLAN FOR LOCATION



B L-4 **ENLARGEMENT OF DOG RUN** SCALE: 1" = 10'-0"

PLEASE REFER TO SHEET L-1 OF THE CONCEPTUAL LANDSCAPE PLAN FOR LOCATION



C L-4 **ENLARGEMENT OF RESIDENT GARDEN**

PLEASE REFER TO SHEET L-1 OF THE CONCEPTUAL LANDSCAPE PLAN FOR LOCATION
SCALE: 1" = 10'-0"

D24-00006, DB24-00004, P24-00002

THE LIGHTFOOT PLANNING GROUP

PLANNING
SITE DESIGN
LANDSCAPE ARCHITECTURE

2237 FARADAY AVE SUITE 120
CARLSBAD, CA 92008
(760) 692-1924

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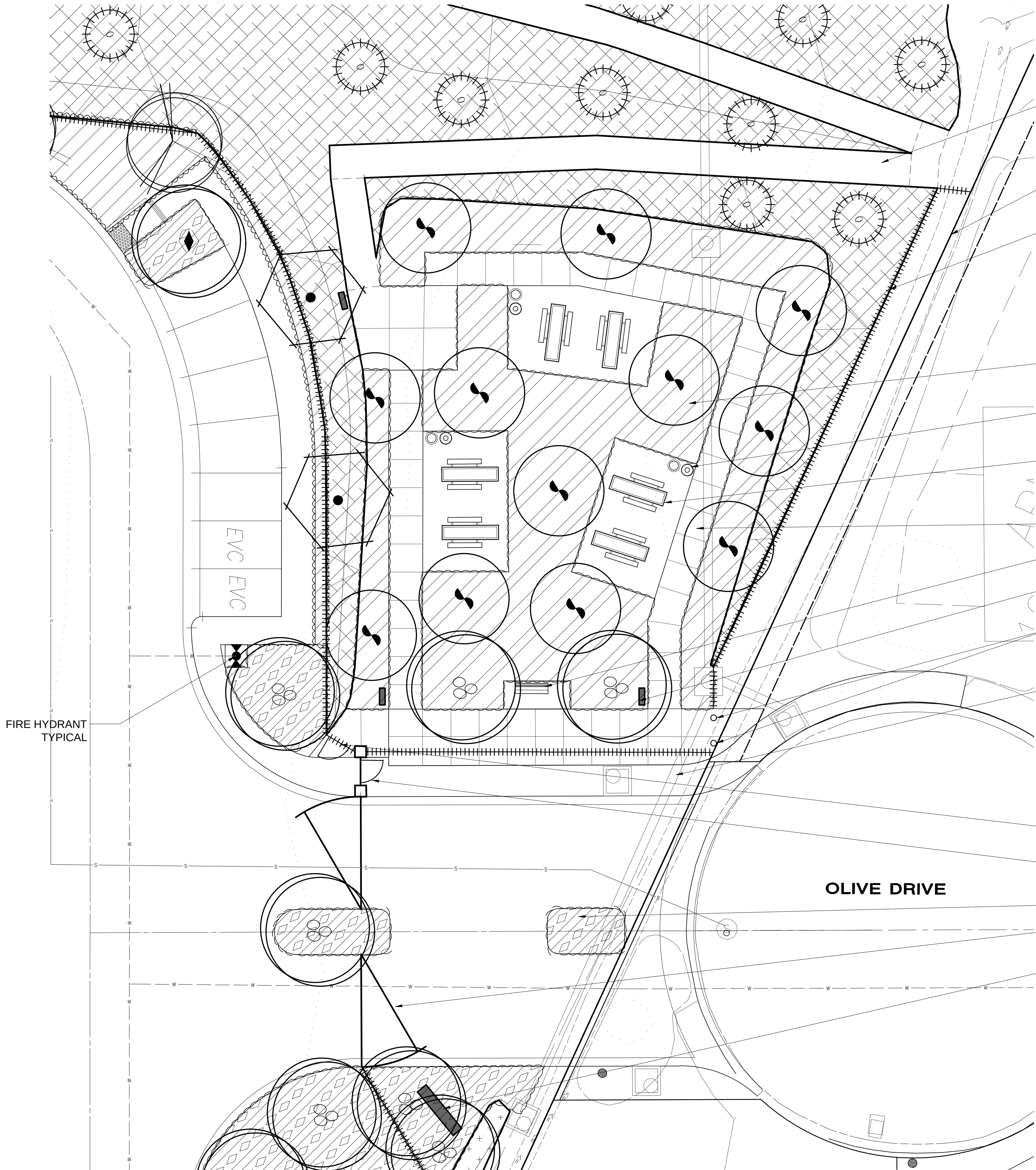
LANDSCAPE CONCEPT PLAN

Job # 1717.012

L-4
6

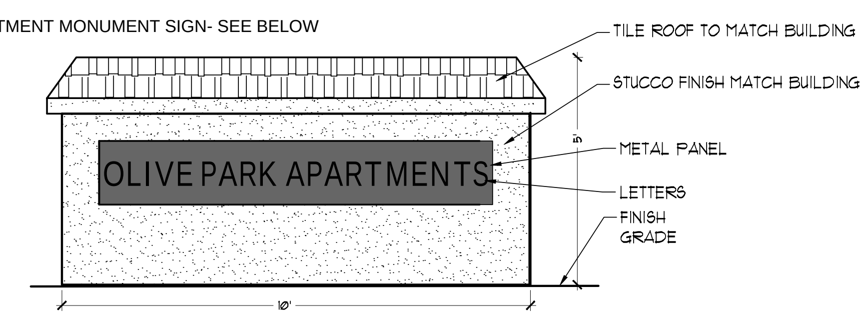


A
L-5

ENLARGEMENT OF OPEN SPACE/ PROJECT ENTRY

SCALE: 1' = 10'-0"

PLEASE REFER TO SHEET L-2 OF THE CONCEPTUAL LANDSCAPE PLAN FOR LOCATION



B
L-5

CONCEPTUAL MONUMENT SIGN

N.T.S.

D24-00006, DB24-00004, P24-00002

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LANDSCAPE CONCEPT PLAN

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L-5
6

CONCEPT PLANT PALETTE

SMALL PROJECT TREE (MIN. SIZE 15" GAL)
AGONIS FLEXUOSA / PEPPERMINT TREE
ARBUTUS X 'MARINA' / ARBUTUS STANDARD
ERYOBOTRYA DEFLEXA STD. / BROZE LOQUAT
RHAPHIOLEPIS " MAJESTIC BEAUTY" STD. /INDIAN HOWTHORN
CERCIS CANADENSIS/ EASTERN REDBUD

TRANSITIONAL SLOPE TREE (MIN. SIZE 1,5 & 15 GAL.)
PINUS TORREYANA / TORREY PINE
PRUNUS ILICIFOLIA / HOLLY LEAF CHERRY
QUERCUS AGRIFOLIA / COAST LIVE OAK
QUERCUS ENGLEMANNII / ENGELMANN OAK
QUERCUS WISLIZENII / INTERIOR LIVE OAK

NARROW TREE ACCENT CANOPY (MIN. SIZE 15" BOX)
MAGNOLIA GRANDIFLORA 'LITTLE GEM'/ LITTLE GEM MAGNOLIA
PODOCARPUS M. 'MAKI'/ SHRUBBY YEW
AGONIS FLEXUOSA 'BURGUNDY'/ BURGUNDY PEPPERMINT WILLOW
TECOMA STANS/ YELLOW BELLS

INTERIOR TREE ACCENT CANOPY (MIN. SIZE 15" BOX)
ARBUTUS X 'MARINA' / ARBUTUS STANDARD
MAGNOLIA GRANDIFLORA HYBRID / SO. MAGNOLIA HYBRID
ERYOBOTRYA DEFLEXA STD. / BROZE LOQUAT

NARROW CANOPY TREE (MIN. SIZE 15" BOX)
LYONOTHAMNUS F. ASPLENIFOLIUS / CATALINA IRONWOOD
LOPHOSTEMON CONFERTUS/ BRISBANE BOXTREE

STREET TREE (MIN. SIZE 24" BOX)
PODOCARPUS GRACILIOR/ FERN PINE
GEIJERA PARCIFLORA/ AUSTRALIAN WILLOW
LOPHOSTEMON CONFERTUS (TRISTANIA) / BRISBANE BOX
ARBUTUS X 'MARINA' / ARBUTUS STANDARD
PISTACIA CHINENSIS/ CHINESE PISTACHE

PROJECT TREE (MIN. SIZE 15" GAL)
ARBUTUS X 'MARINA' / ARBUTUS STANDARD
METROSIDEROS EXCELSA / NEW ZEALAND CHRISTMAS TREE
HYMENOSPORUM FLAVUM/ SWEETSHADE
PLATANUS RACEMOSA/ CALIFORNIA SYCAMORE

SCREEN TREE/ SHRUB (MIN. SIZE 15 GAL)
SCHEFFLERA SPECIES / UMBRELLA TREE
CALLISTEMON VIMINALIS 'SLIM' / SLIM WEEPING BOTTLEBRUSH
PODOCARPUS ELONGATUS 'MONMAL' / ICEE BLUE YELLOW WOOD
PITTOSPORUM T. 'SILVER SHEEN'/ VARIEGATED KOHUHU

RESIDENT GARDEN ORCHARD TREE (MIN. SIZE 15 GAL.)
VARIETY OF CITRUS SPECIES

STREET TREE (MIN. SIZE 24" BOX)
PODOCARPUS GRACILIOR/ FERN PINE
GEIJERA PARCIFLORA/ AUSTRALIAN WILLOW
LOPHOSTEMON CONFERTUS (TRISTANIA) / BRISBANE BOX
ARBUTUS X 'MARINA' / ARBUTUS STANDARD
PISTACIA CHINENSIS/ CHINESE PISTACHE

FOCAL POINT TREES AT INTERSECTIONS (MIN. SIZE 24" BOX)
TIPUANA TIPU / TIPU TREE
JACARANDA MIMOSIFOLIA / JACARANDA
TABEBUIA IMPETIGINOSA / PINK TRUMPET TREE
AGONIS FLEXUOSA ' BURGUNDY'/ BURGUNDY PEPPERMINT WILLOW
BAUHINIA VARIEGATA/ ORCHID TREE

ACCENT LANDSCAPE AREA (MIN. SIZE FLATS, 1, 5, 15 GAL.)
ALOE X 'ALWAYS RED' / ALOE
CARISSA MACROCARPA 'GREEN CARPET' / GREEN CARPET NATAL PLUM
CEANOTHUS THYRSIFLORUS 'DIAMOND HEIGHTS' / D.H. CEANOTHUS
DIANELLA CAERULEA 'CLARITY BLUE' / DIANELLA
DIANELLA TASMANICA 'VARIEGATA' / FLAX LILY
ERIGERON KARVINSKIANUS 'PROFUSION' / SANTA BARBARA DAISY
LANTANA SPP. / LANTANA
FURCRAEA FOETIDA 'MEDIOPICTA'/ GIANT FALSE AGAVE
SENECIO VITALIS / BLUE CHALK FINGERS
WESTRINGIA FRUTICOSA 'MUNDI' TM / LOW COAST ROSEMARY
YUCCA FILAMENTOSA 'COLOR GUARD' / ADAM'S NEEDLE
YUCCA PALLIDA / TWISTLEAF YUCCA
CAREX DIVULSA/ CAREX MEADOW SEDGE
MUHLENBERGIA SPP. / MUHLENBERGIA
SALVIA LEUCANTHA 'SANTA BARBARA'
CISTUS 'SUNSET' / SUNSET ROCKROSE

PARKING LOT LANDSCAPE AREA (MIN. SIZE FLATS, 1, 5, GAL.)
MUHLENBERGIA SPP. / MUHLENBERGIA
SENECIO VITALIS / BLUE CHALK FINGERS
LANTANA SPP. / LANTANA
DIETES VARIEGATA/ VARIEGATED DIETES

ARTIFICIAL TURF AS NOTED ON PLAN

MANUFACTURE SLOPE (MIN. SIZE SEED, FLATS, 1, 5, 15 GAL.)
ACACIA REDOLENS 'DESERT CARPET' TM / BANK CATCLAW
BACCHARIS PILULARIS 'TWIN PEAKS' / PROSTRATE COYOTE BRUSH
CEANOTHUS LEUCODERMIS / CHAPARRAL WHITETHORN
DENDROMECON HARFORDII / ISLAND BUSH POPPY
FREMONTODENDRON MEXICANUM / SOUTHERN FLANNEL BUSH
HETEROMELES ARBUTIFOLIA / TOYON
LANTANA X 'NEW GOLD' / NEW GOLD LANTANA
MALOSMA LAURINA / LAUREL SUMAC
ROMNEYA COULTERI 'WHITE CLOUD' / WHITE CLOUD MATILIJA POPPY
SALVIA X 'ALLEN CHICKERING' / SAGE
COTONEASTER DAMMERI 'LOWFAST' LOWFAST BEARBERRY COTONEASTER
SPHAERALCEA AMBIGUA / DESERT GLOBEMALLOW
TRICHOSTEMA LANATUM / WOOLLY BLUE CURLS
ENCELIA CALIFORNICA/ CALIFORNIA ENCELIA
DIPLACUS PUNICEUS/ STICKY MONKEYFLOWER
ACMISPON GLABER/ DEERWEED
EPILOBIUM CANUM 'EVERETT'S CHOICE'/ EVERETT'S CHOICE CALIFORNIA FUCHSIA
SALVIA X 'BEE'S BLISS'/ BEE BLISS SAGE
SALVIA SONOMENSIS X SALVIA MELLIFERA
CROCANTHEMUM SCOPARIUM/ PEAK RUSHROSE
EPILOBIUM CANUM/ CALIFORNIA FUCHSIA
ESCHSCHOLZIA CALIFORNICA/ CALIFORNIA POPPY
ACHILLEA MILLEFOLIUM/ COMMON YARROW
LASTHENIA GRACILIS/ NEEDLE GOLDFIELDS
LUPINUS BICOLOR/ MINIATURE LUPINE

PERIMETER PLANTING (MIN. SIZE FLATS, 1, 5, 15 GAL.)
CALLISTEMON VIMINALIS 'BETTER JOHN' / DWARF WEEPING BOTTLE BRUSH
BOUGAINVILLEA X 'ROSENKA' / BOUGAINVILLEA
HESPERALOE PARVIFLORA HYBRIDS / RED YUCCA HYBRIDS
CEANOTHUS GRISEUS HORIZONTALIS 'YANKEE POINT' / CALIFORNIA LILAC
EREMOPHILA GLABRA 'MINGENEW GOLD' / EMU BUSH
GALVEZIA SPECIOSA 'FIRECRACKER' / BUSH SNAPDRAGON
MALOSMA LAURINA / LAUREL SUMAC
WESTRINGIA FRUTICOSA 'WYNABBIE GEM' / WYNABBIE GEM COAST ROSEMARY
SENECIO SERPENS / BLUE CHALKSTICKS
LANTANA HYBRIDS / LANTANA
LOMANDRA BREEZE/ LOMANDRA

INTERIOR COURTYARD PLANTING (MIN. SIZE FLATS, 1, 5, 15 GAL.)
AGAVE DESMETTIANA 'VARIEGATA' / VARIEGATED AGAVE
DIANELLA CAERULEA 'CLARITY BLUE' / DIANELLA
SENECIO MANDRALISCAE / BLUE FINGER
DIANELLA TASMANICA VARIEGATA/ FLAX LILY
CARISSA MACROCARPA 'GREEN CARPET' / GREEN CARPET NATAL PLUM
CEANOTHUS THYRSIFLORUS 'DIAMOND HEIGHTS' / D.H CEANOTHUS
TRACHELOSPERMUM JASMINOIDES/ STAR JASMINE
VINCA MINOR 'VARIEGATA'/ VARIEGATED PERIWINKLE
LEYMUS CONDENSATUS 'CANYON PRINCE' / BLUE RYE'
LOMANDRA LONGIFOLIA 'BREEZE'/ DWARF MAT RUSH
ASPARAGUS DENSIFLORUS 'MYERS' / MYERS ASPARAGUS
LANTANA SPECIES/ LANTANA
PHORMIUM TENAX SPP/ NEW ZEALAND FLAX
FRAGARIA CHILOENSIS / ORNAMENTAL STRAWBERRY

SHRUBS FOR SCREENING (MIN. SIZE 1, 5 GAL.)
SANSEVIERIA TRIFASCIATA/ SNAKE PLANT
JUNCUS PATENS/ MEXICAN RUSH
EQUISETUM HYEMALE/ ROUGH HORSETAIL

OPENSPACE PLANTING (MIN. SIZE FLATS, 1, 5, 15 GAL.)
YUCCA PALLIDA / TWISTLEAF YUCCA
AGAVE ATTENUATA/ FOXTAIL AGAVE
AGAVE AMERICANA/ CENTURY PLANT
ALOE SPP/ ALOE,
CAREX DIVULSA/ CAREX
AGAVE SPP./ AGAVE SPECIES
HESPERALOE PARVIFLORA HYBRIDS / RED YUCCA HYBRIDS
LANTANA SPP.
CARISSA MACROCARPA 'GREEN CARPET' / GREEN CARPET NATAL PLUM
YUCCA FILAMENTOSA 'COLOR GUARD' / ADAM'S NEEDLE
MUHLENBERGIA SPP. / MUHLENBERGIA
SALVIA LEUCANTHA 'SANTA BARBARA'
CISTUS 'SUNSET' / SUNSET ROCKROSE

FOUNDATION PLANTING PERIMETER (MIN. SIZE FLATS, 1, 5, 15 GAL.
ACACIA REDOLENS 'DESERT CARPET' TM / BANK CATCLAW
BOUGAINVILLEA SPECIES / SHRUB FORM BOUGAINVILLEA
CEANOTHUS SPEICIES / CALIFORNIA LILAC
CISTUS PULVERULENTUS 'SUNSET' / ROCKROSE
LANTANA X 'NEW GOLD' / NEW GOLD LANTANA
MALOSMA LAURINA / LAUREL SUMAC
METROSIDEROS COLLINA 'SPRINGFIRE' / NEW ZEALAND CHRISTMAS TREE
SENECIO VITALIS / BLUE CHALK FINGERS
WESTRINGIA FRUTICOSA 'MUNDI' TM / LOW COAST ROSEMARY
PHORMIUM TENAX SPP. / NEW ZEALAND FLAX
PITTOSPORUM TENUIFOLIUM 'BEACH BALL' / TAWHIWHI
MUHLENBERGIA SPP. / MUHLENBERGIA

PERMEABLE SURFACE AREA SUMMARY	
DESCRIPTION	LANDSCAPE AREA (SF)
Landscape Areas	63,677
TOTAL PROJECT PERMEABLE AREA	63,677
PROJECT SITE AREA (6.11 a.c.) @ 266,151.6 S.F.	266,152
PERMEABLE SURFACE AREA	24%

Minimum Tree Canopy and Permeable Surface Area Requirements

Project Site Area	Minimum Tree Canopy Area	Minimum Permeable Surface Area
1 acre or more	12%	22%
1/3 acre to 1 acre	9%	16%
Less than 1/3 acre	7%	10%

LANDSCAPE CONCEPT DESIGN STATEMENT AND NOTES

THE LANDSCAPE EMBRACES THE DIVERSITY OF THE PROSPECTIVE RESIDENTS OF THE SITE AND AIMS TO PROVIDE CURB APPEAL FOR BOTH THE PROJECT AND THE NEIGHBORHOOD AROUND IT. THE ARCHITECTURE FEATURES CLEAN GEOMETRIC LINES, AND A SIMPLE COLOR PALETTE IN SUPPORT OF A SPANISH ARCHITECTURAL STYLE. THE POTENTIAL OF HILLSIDE VIEWS FROM SOME OF THE RESIDENTIAL APARTMENT WINDOWS WILL MAKE THESE APARTMENTS A PARADISE TO LIVE AND RELAX. RESIDENTS WILL ALSO BE ABLE TO ENJOY PROPOSED AMENITIES LOCATED WITHIN THE PROJECT SITE OR WALK TO NEIGHBORING COMMERCIAL BUILDINGS. THE SOME SITE INCLUDE AMENITIES LIKE RESIDENTIAL GARDENING, OUTDOOR RECREATION ACTITIVIES, OUTDOOR DINING, LOUNGE AND DOG RUN FOR PETS. OLIVE PARK APARTMENTS IS LOCATED NEAR OCEANSIDE BOULEVARD TRANSIT CENTER WHERE RESIDENTS CAN BE ABLE TO TAKE ADVANTAGE OF ECONOMICAL TRANSPORTATION WITHIN A COUPLE OF STEPS FROM THE SITE. THE SITE DESIGN FOR THE PROJECT EMBRACES LOW IMPACT DEVELOPMENT THAT COLLECT WATER UNDERGROUND. PLEASE REFER TO THE CIVIL ENGINEERING PLANS FOR INFORMATION.

THE LANDSCAPE DESIGN HELPS COMPLEMENT THE ARCHITECTURAL DESIGN. THE USE OF TREES AT FOCAL POINT HELPS ENGAGE RESIDENTS TO THE BEAUTY OF OLIVE PARK APARTMENTS. THE DUMPSTER ENCLOSURE ARE WITHIN THE INTERIOR TO THE BUILDINGS. BUILDING 1 DUMPSTER ENCLOSURE IS LOCATED AT THE GARAGE LEVEL PARKING. BUILDING 2 DUMPSTER ENCLOSURE IS LOCATED AT GROUND FLOOR LEVEL NEAR SOUTHSIDE OF THE BUILDING. PLEASE REFER TO DETAIL L-1, L-2 AND ARCHITECTURAL BUILDING PLAN SET FOR MORE INFORMATION.

TREES ARE AN IMPORTANT PART OF THE LANDSCAPE FOR THE PROJECT. TREE LOCATIONS HAVE BEEN CAREFULLY SELECTED TO PROVIDE ACCENT AND SELECTIVE SCREENING AND SCALE TO THE BUILDING. ALL TREES HAVE BEEN SELECTED FOR THEIR INUNDATION TOLERANCES AND TREATMENT QUALIFICATIONS AND ALL PROJECT TREES SHALL RESPECT CITY-REQUIRED ROOT BARRIER REQUIREMENTS AND CLEARANCES FOR FIRE APPARATUS, UTILITIES AND EASEMENTS.

ALL PLANTINGS WILL BE GROUPED BY HYDROZONES SO THAT THEY MAY BE IRRIGATED EFFICIENTLY AND IN ACCORDANCE WITH THE CITY'S WATER CONSERVATION ORDINANCE. THE LANDSCAPE IS DESIGNED WITH LOW MAINTENANCE IN MIND, WITH NO SHEARING REQUIRED AND ONLY HAND PRUNING TO SHAPE AND REMOVE DEAD FLOWERS AND CONTROL VIEWS AND SCREENING.

SUMMARY OF PROJECT DESIGN HIGHLIGHTS:

- PLANTS WITH HIGHER WATER REQUIREMENTS ARE SELECTIVELY PLACED IN HIGHLY VISIBLE AREAS.
- THE TREE PALETTE INCLUDES TREES SELECTED FOR THEIR SIZE, FORM AND ORNAMENTAL QUALITIES RELATIVE TO THE ARCHITECTURE.
- SITE AMENITIES INCLUDE, SEATING AREA FOR RESIDENTS, OUTDOOR GATHERING FOR RESIDENTS TO HANGOUT FROM A BUSY DAY
- TREES, SHRUBS AND VERTICAL ACCENT PLANTS WILL CONSIDER ACCENT, SCREENING AND SHADING QUALITIES (MICROCLIMATE MODIFICATION).
- TREE LOCATIONS SHALL OBSERVE ALL CLEARANCES TO UTILITIES AND EASEMENTS, AND ROOT BARRIERS SHALL BE EMPLOYED TO PROTECT HARDSCAPE AND UTILITIES PER OCEANSIDE STANDARDS. PROPOSED STORMWATER BMP PLANTER ARE HIGHLY ORNAMENTAL IN SPECIES COMPOSITION AND WILL BE IN CONFORMANCE WITH THE ENGINEER'S PLANS AND TREATMENT EXPECTATIONS.
- SPECIES WILL BE PLACED ACCORDING TO SOLAR EXPOSURE WINDOW LOCATIONS AND PLANTER SIZE AND LOCATION.

GENERAL NOTES:
THIS CONCEPTUAL LANDSCAPE PLAN DIAGRAMMATICALLY SHOWS PLACEMENT OF PROPOSED PROJECT LANDSCAPING. CONSTRUCTION LANDSCAPE PLANS SHOW PLACEMENT OF TREES, SHRUBS AND GROUND COVERS. FINAL LANDSCAPE PLANS SHALL ACCURATELY SHOW PLACEMENT OF TREES, SHRUBS AND GROUNDCOVERS AND REQUIRED ROOTBARRIERS FOR TREES.
THE LANDSCAPE ARCHITECT IS AWARE OF ALL UTILITY, SEWER AND STORM DRAIN EASEMENTS AND THE CITY OF OCEANSIDE POLICY WHICH PROHIBITS TREES AND STRUCTURES IN UTILITY EASEMENTS. TREE LOCATIONS SHALL BE PLACED ACCORDINGLY TO MEET THE CITY OF OCEANSIDE REQUIREMENTS.
ALL PERTINENT UTILITY EASEMENTS ARE PER THE CIVIL ENGINEERING PLAN AND BASE SHEET INFORMATION. LANDSCAPE CONSTRUCTION PLANS SHALL SHOW ALL EASEMENTS THAT MAY AFFECT FINAL PLACEMENT OF PROJECT TREES AND SHRUBS, BASED ON THE EASEMENT AND UTILITY INFORMATION RECEIVED FROM THE PROJECT ENGINEER.

EXISTING CONDITIONS, EASEMENTS, WALLS, FENCES & TRASH ENCLOSURES:
REFER TO CIVIL ENGINEERING PLAN FOR LOCATION AND TYPES OF PROPOSED WALLS, UTILITES, EASEMENTS AND PROPERTY LINES.

IRRIGATION NOTES: ALL PLANTING POTS SHALL BE SELF-WATERING OR BE PROVIDED WITH A DRIP IRRIGATION. A SEPARATE IRRIGATION METER WITH AUTOMATIC IRRIGATION SHALL BE INSTALLED AS REQUIRED TO PROVIDE COVERAGE FOR PLANTING AREAS SHOWN ON THE CONCEPTUAL PLAN. AUTOMATIC IRRIGATION SYSTEM SHALL BE INSTALLED AS REQUIRED TO PROVIDE COVERAGE FOR PLANTING AREAS SHOWN ON THE PLAN. LOW VOLUME IRRIGATION EQUIPMENT SHALL PROVIDE SUFFICIENT WATER FOR PLANT GROWTH WITH A MINIMUM WATER LOSS DUE TO WATER RUN-OFF. IRRIGATION SYSTEMS SHALL USE HIGH QUALITY, AUTOMATIC CONTROL VALVES, TIMERS AND OTHER NECESSARY EQUIPMENT FOR PROPER COVERAGE. CONTROLLER SHALL BE 'SMART' CONTROLLER. ALL COMPONENTS SHALL BE OF NON-CORROSIVE MATERIAL AND ANY DRIP SYSTEMS SHALL BE ADEQUATELY FILTERED AND REGULATED PER THE MANUFACTURER GUIDELINES. CLASS 315 PRESSURE OR SCHEDULE 40 MAINLINE SHALL BE BURIED TO A MINIMUM DEPTH OF 18". PVC LATERAL LINES SHALL BE BURIED 12" MINIMUM BELOW FINISH GRADE. ALL MAINLINE SHALL BE INSTALLED PER MANUFACTURER GUIDELINES, SPECIFICATIONS, AND ADHERE TO CODES AND GUIDELINES. ALL LANDSCAPE AND IRRIGATION IMPROVEMENTS SHALL BE INSTALLED PER THE PROVISIONS OF THE CITY OF OCEANSIDE WATER CONSERVATION ORDINANCE SECTION 3019, THE CITY OF OCEANSIDE LANDSCAPE DESIGN GUIDELINES AND SHALL BE CONSISTENT WITH CURRENT STORMWATER BMP'S.

PLANTING NOTES:
THE SELECTION OF PLANT MATERIAL IS BASED ON CULTURAL, AESTHETIC, ENVIRONMENTAL SENSITIVITY, WATER CONSERVATION AND MAINTENANCE CONSIDERATIONS. ALL PLANTING AREAS SHALL BE PREPARED WITH APPROPRIATE SOIL AMENDMENTS, FERTILIZERS, AND APPROPRIATE SUPPLEMENTS BASED UPON AN AGRICULTURAL SOILS ANALYSIS REPORT FROM SOIL SAMPLE TAKEN FROM THE SITE. GROUND COVERS OR BARK MULCH SHALL FILL IN BETWEEN THE SHRUBS TO PROTECT THE SOIL FROM EXCESSIVE SOLAR EXPOSURE, EVAPOTRANSPIRATION AND SURFACE WATER RUNOFF. ALL PLANTING AREAS SHALL BE MULCHED TO A DEPTH OF 3" TO HELP CONSERVE WATER, LOWER THE SOIL TEMPERATURE AND REDUCE WEED GROWTH. SHRUBS SHALL BE ALLOWED TO GROW INTO THEIR NATURAL FORMS WITHOUT SHEARING ALL LANDSCAPE IMPROVEMENTS SHALL CONFORM TO THE CURRENT CITY OF OCEANSIDE GUIDELINES AS WELL AS ALL STREET TREES AND OTHER TREES SHALL SPATIAL REQUIREMENTS AND CLEARANCES.

GENERAL MAINTENANCE AND COMPLIANCE WITH ORDINANCE CODE 3049 URBAN FORESTRY PROGRAM
THE PROPETY OWNER ASSOCIATION SHALL MAINTAIN THE COMMON LANDSCAPE AREAS, PROPOSED BMP'S, PUBLIC UTILITY EASEMENTS AND RIGHT OF WAY PLANTING. THE PROJECT SHALL COMPLY WITH CODE 3049 URBAN FORESTRY PROGRAM AND PROVIDE INFORMATION AND COMPLIANCE REGARDING REGULAR, SEASONAL AND EMERGENCY MAINTENANCE, TRASH ABATEMENT, IRRIGATION, TREE/PLANT CARE, TREE REPLACEMENT, INSECT AND DISEASE INFESTATION PREVENTION, INTEGRATED PEST MANAGEMENT AND APPROPRIATE RESPONSE PROCESSES. FAILURE TO COMPLY WITH MAINTENANCE IN A CONSISTENT MANNER WITH THE APPROVED (LTCMP) LANDSCAPE TREE CANOPY MANAGEMENT PLAN SHALL SUBJECT THE PROJECT TO CODE ENFORCEMENT ACTION. SEE ADDITIONAL NOTES FOR FIRE CODE COMPLIANCE.

PROJECT SPECIFIC MAINTENANCE NOTES:
ALL REQUIRED LANDSCAPE AREAS ON-SITE AND WITHIN THE PUBLIC RIGHT-OF-WAY ALONG SEAGAZE DRIVE AND N. NEVADA STREET SHALL BE MAINTAINED BY THE OWNER AND SHALL BE INCLUDED IN THE CC&Rs FOR THE PROJECT. LANDSCAPE AREAS SHALL BE MAINTAINED PER THE CITY OF OCEANSIDE REQUIREMENTS.

PROJECT STORM WATER MANAGEMENT PLAN (SWMP)
LANDSCAPING SHALL COMPLY WITH THE APPROVED STORMWATER MANAGEMENT PLAN AND MAINTENANCE SPECIFICATIONS AT CONSTRUCTION DRAWINGS, WITH ALL PLANTING SHOWN.

TREE PLACEMENT SHALL BE DETERMINED DURING THE CONSTRUCTION PHASE, BASED ON FINAL LOCATIONS OF UTILITIES, STREET LIGHTS AND EASEMENTS. STREET TREES AND OTHER TREES SHALL BE SPACED AS FOLLOWS:
A. 8' FROM TRANSFORMERS, CABLE AND PULL BOXES
B. 5' FROM MAILBOXES
C. 5' FROM FIRE HYDRANTS, ALL SIDES
D. 10' FROM CENTERLINE OF ALL UTILITY LINES (W/O EASEMENT) SEWER, WATER, STORM DRAINS, DBL. CHECK DETECTORS, AIR RELIEF VALVES AND GAS LINES
E. 10' FROM EASEMENT BOUNDARIES (SEWER, WATER, STORM DRAINS, ACCESS OR OTHER UTILITIES)
F. 10' FROM DRIVEWAYS (UNLESS LINE OF SIGHT DETERMINED BY TRAFFIC DIVISION IS OTHERWISE
G. 10' FROM DIRECTIONAL SIGNS
H. 15' FROM STREETLIGHTS, OTHER UTILITY POLES, AD DETERMINED BY SPECIFICATIONS
I. STREET TREES SHALL BE PLANTED 3' OUTSIDE RIGHT-OF-WAY IF IT DOES NOT PROVIDE SPACE, SUBJECT TO THE CITY ENGINEER'S APPROVAL
J. LINE OF SIGHT AT ARTERIALS, COLLECTOR AND LOCAL STREETS SHALL BE REVIEWED AND DETERMINED BY TRAFFIC ENGINEER. A MIN. OF 25' FROM STREET INTERSECTION SHOULD BE PROIVIDED OR AS OTHERWISE APPROVED BY THE TRAFFIC ENGINEER.
K. 15' STREETLIGHT AND STOP SIGN OR CLEARANCE AS DETERMINED BY SPECIFICATIONS
L. ALL CLEARANCES FOR FIRE VEHICLES SHALL BE MET AT CONSTRUCTION DWGS.

FIRE CODE COMPLIANCE
1. THE LANDSCAPE IMPROVEMENT PLAN SET AND INSTALLATION ARE REQUIRED TO IMPLEMENT APPROVED FIRE DEPARTMENT REGULATIONS, CODES AND STANDARDS AT THE TIME OF PROJECT APPROVAL.
2. TREES FOR THE PROJECT SHALL HAVE A MINIMUM VERTICAL CLEARANCE OF 13'-6" FROM TOP OF FIRE ACCESS ROADWAY TO LOWEST BRANCHES OF TREE AT MATURITY AND HAVE A MINIMUM OF 28' WIDTH CLEARANCE IN FIRE ACCESS ROADWAYS EXCEPT AS ACCEPTED BY THE OCEANSIDE FIRE DEPARTMENT.
3. ALL FDC LOCATIONS SHALL BE SHOWN ON PLANS FOR REFERENCE, AND SHALL BE INSTALLED FROM CIVIL IMPROVEMENT PLANS.
4. A CLEAR PATH TO THE FIRE EQUIPMENT SHALL BE MAINTAINED WITH A MINIMUM CLEARANCE OF 3' FROM ALL VEGETATION.

SITE FURNISHINGS:
SITE FURNISHINGS ARE SHOWN FOR REFERENCE ONLY AND ARE USED TO ILLUSTRATE GRAPHIC AND PEDESTRIAN SCALE AS WELL AS SPATIAL QUALITIES OF THE PLAN AND DESIGN. FINAL TYPE, QUANTITY AND LAYOUT TO BE DETERMINED BY OWNER AT CONSTRUCTION PHASE.

URBAN FORESTRY PROGRAM COMPLIANCE- CODE 3049

PROPOSED TREE CANOPY CALCULATION OLIVE APARTMENTS				
DESCRIPTION	CANOPY DIA. (FT)	CANOPY (SF.)	QUANTITY	EXTENSION (SF.)
Fruit Tree ✳	8	50	5	250
Narrow Tree ✳	8	50	49	2450
Large Trees ✳	25	490	158	77420
Medium Trees ✳	16	201	95	19095
Square Footage of Proposed Tree Canopy Area				99,215
Proposed Canopy Area Percentage of Project Site Area (6.11 ac.) @ 266,151 SF.				37%

✳ NOTE: INFORMATION ON MATURE DIMENSIONS OF TREE SPECIES WAS COLLECTED FROM UFEI SELECT TREE WEB SITE FROM CALIFORNIA POLYTECHNIC STATE UNIVERSITY. https://selectree.calpoly.edu/

(TREE CANOPY CALCULATIONS DOES NOT INCLUDE TREES PROPOSED IN MANUFACTURED SLOPE OUTSIDE OF LIMIT AREA)

D24-00006, DB24-00004, P24-00002

THE LIGHTFOOT PLANNING GROUP
PLANNING
SITE DESIGN
LANDSCAPE ARCHITECTURE
2237 FARADAY AVE SUITE 120
CARLSBAD, CA 92008
(760) 692-1924
LIGHTFOOT@LIGHTFOOTPG.COM

LICENSED LANDSCAPE ARCHITECT
JAMES L. TAYLOR No. 2981
Signature
10/31/24
Renewal Date
Date
STATE OF CALIFORNIA

CAPSTONE EQUITIES
OLIVE PARK APARTMENTS
OCEANSIDE, CA

Scale: AS NOTED (24X36)
Date: 2/28/24
Drawn By: EE
Revisions:
3/15/24
7/31/24
8/8/24
10/07/24

LANDSCAPE CONCEPT PLAN

Job # 1717.012

L-6
6

ATTACHMENT 5
Drainage Report

This is the cover sheet for Attachment 5.

HUNSAKER & ASSOCIATES
SAN DIEGO, INC.

PRELIMINARY DRAINAGE STUDY
for
OLIVE PARK APARTMENTS

W.O. 3785-0002

APN # 162-111-04-00

Permit No.: D24-00006

City of Oceanside, California

Prepared for:
Capstone Equities
5455 Wilshire Blvd., Suite #1012
Los Angeles, CA 90036

Prepared by:
Hunsaker & Associates – San Diego, inc.
9707 Waples St.
San Diego, CA 92121
(858) 558-4500

Preparation / Revision Date:

March 15, 2024, August 6, 2024, October 4, 2024

Hunsaker & Associates
San Diego, Inc.

Alisa S. Vialpando

Alisa S. Vialpando, R.C.E. 47945. EXP. 12/31/2025
President

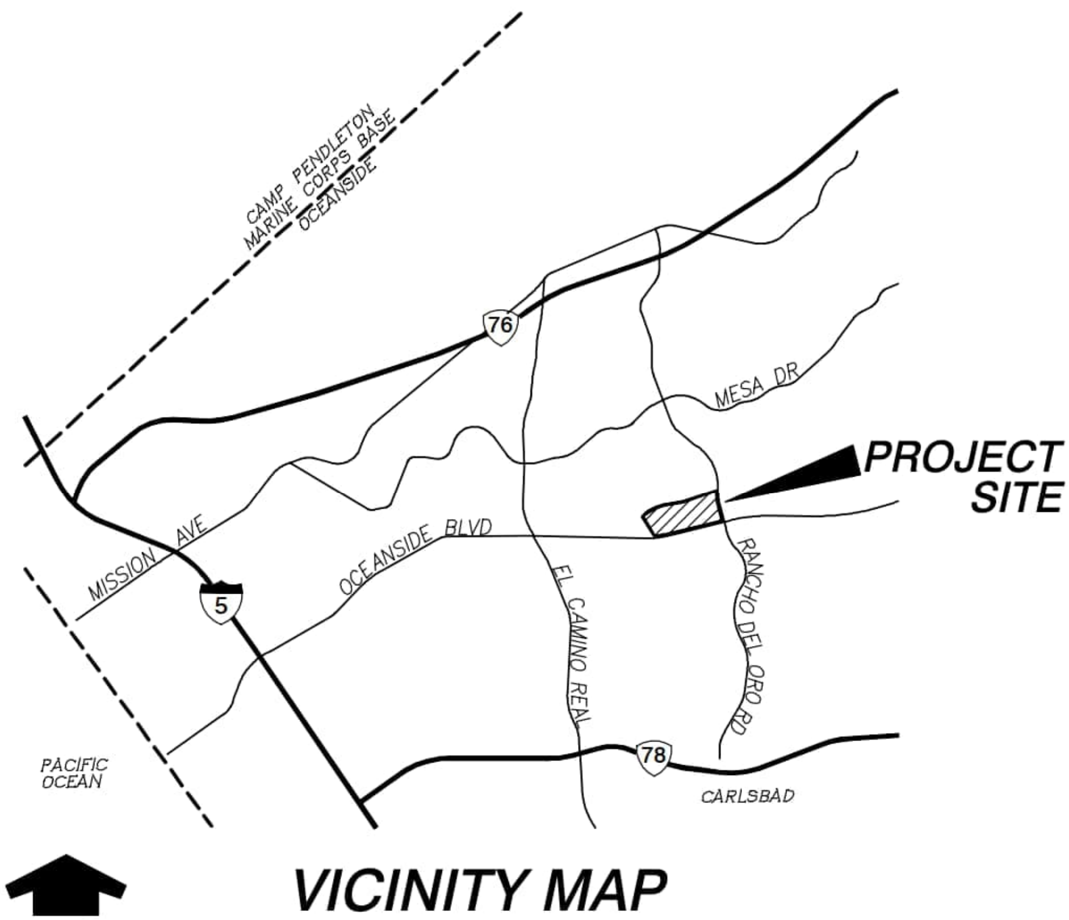
REGISTERED PROFESSIONAL ENGINEER
ALISA S. VIALPANDO
No. 47945
CIVIL
STATE OF CALIFORNIA

TABLE OF CONTENTS

CHAPTER 1 - EXECUTIVE SUMMARY

1.1 - Introduction

The project site is situated in the west of Olive Drive and north of Wooster Drive in Oceanside, California, as illustrated in the vicinity map below, designated by APN 162-111-04-00. Spanning roughly 43 acres, this semi-rectangular property extends east-west, featuring a curved northern edge adjacent to the SDNR rail line. It's flanked by undeveloped land to the west and residential subdivisions to the south and east, with the Olive Drive cul-de-sac meeting its northeast corner. The proposed development occupies the northeastern corner of the site, while the remainder of the site will remain undeveloped.



VICINITY MAP

NOT TO SCALE

This study aims to provide hydrology calculations to support the proposed residential development, focusing on estimating runoff for the 100-year frequency storm event and identifying the necessary storm drain infrastructure for safe stormwater conveyance. Stormwater runoff treatment is detailed in a separate document, the

'Stormwater Quality Management Plan for Oceanside Senior Affordable,' by Hunsaker & Associates, San Diego, dated October 2024."

1.2 – Summary of Existing Conditions

The site is situated on slopes descending northwest towards Loma Alta Creek, which borders the site's northern edge. The topographical contours show an increase in gradient from north to south. The creek, characterized by a gentle gradient, flows westward in a meandering pattern and features vertically incised embankments, with heights reaching up to 10 feet at certain points along its edges. A fill berm, constructed as part of railroad enhancements, is present along the site's northeast boundary. A level and graded pad in the southeast corner has been prepared to construct a residential development along Wooster Drive. The site's elevation ranges from approximately 185 feet above Mean Sea Level (MSL) at the northwest corner, near Loma Alta Creek, to 464 feet MSL at the graded pad.

Vegetation across the site varies significantly with the topography, including flat, intermediate, and steep slopes. In areas with flat slopes, the vegetation primarily consists of hydric (water-seeking) species, such as rushes and marsh-type plants, with several eucalyptus trees also dotting these areas. The intermediate slopes, which have undergone disking, are home to sparse, xeric (dry) vegetation. Meanwhile, the areas with steep slopes boast dense vegetation coverage, including species like mustard, sage, and cactuses.

The property can be accessed from College Boulevard via an existing unpaved driveway located to the northeast of the project. It is surrounded by residential developments to the east and south, an undeveloped property to the west, and the SDNR rail line along with Loma Alta Creek to the north. Loma Alta Creek, which flows in an east-west direction, enters the site to the west of the area slated for development, crossing under the rail lines and extending approximately 1280 feet through the property.

The proposed development occupies the northeastern corner of the site, while the remaining area is left undeveloped. The drainage study focuses on the eastern watersheds affected by the development. This analysis encompasses approximately 29.9 acres, featuring multiple points of discharge that converge at node 1, as identified in the maps, located near the north-central edge of the property boundary. The analysis further subdivides all areas tributary to node 1, as described below:

The project's hydrology includes approximately 7.8 acres of offsite run-on, originating from a neighboring single-family residential site to the east and a dirt access road off College Boulevard, south of the railroad. The single-family residential site drains westward through concrete street gutters, collecting runoff from an area of approximately 5.0 acres. The runoff gathers at a low point in an existing cul-de-sac and then enters the project through a curb opening, discharging into an existing ditch at node 106. This ditch flows northward and eventually merges with runoff from the dirt road at node 112.

Before reaching node 112, the ditch captures 1.18 acres of onsite runoff, converging with the flows from the neighboring residential site.

At node 114, a high point along College Boulevard divides the drainage areas, with runoff flowing both east and west.

The drainage flows westward, covering approximately 2.5 acres, and captures runoff from adjacent slopes before reaching node 112, where all flows converge.

From node 112, the drainage flows west along the railroad tracks toward node 1, which is part of the Loma Alta Creek Floodway. Along the way, it merges with onsite flows conveyed by the existing swales, slopes, and vegetation previously described, contributing approximately 20.9 acres to the analysis. The runoff continues westward through the undisturbed project boundary via earthen swales along the southern side of the railroad, ultimately flowing toward Loma Alta Creek's existing natural channel. This channel crosses beneath the railway line within the site and continues westward, eventually discharging into the Pacific Ocean at the mouth of Loma Alta Creek.

Runoff flowing east from node 114 contributes 0.24 acres to the analysis and is captured by an existing drainage structure located just south of the railroad tracks. The runoff is then conveyed via storm drain directly into Loma Alta Creek. For this drainage study, the area is modeled as being piped from node 137 (the structure) to node 1, ensuring that the analysis includes all contributing areas and assesses the overall impact of the development on the creek. See Appendix 4 for calculations of peak runoff in existing conditions.

According to the FEMA Flood Insurance Rate Map (FIRM 06073C0758G effective 05/16/2012) for this site, the disturbed area for the proposed project is in an unshaded Zone X, which is defined as "Areas determined to be outside the 500-year floodplain". Refer to the FIRMette Map in Appendix 1.

Per NRCS Soil report, the site consists of 10.7% Hydrologic Soil Group "A", 9.4% Hydrologic Soil Group "C", and 68.9% Hydrologic Soil Group "D". Refer to Appendix 2 for NRCS soils information, while the remaining area is impervious.

The runoff coefficient for each subarea was calculated based on soil type and impervious percentage using the formula from San Diego County Hydrology Manual Section 3.1.2

C= 0.90 x (% Impervious) + Cp x (1 - % Impervious)

Cp = Pervious Coefficient Runoff value for the soil type (per San Diego County Hydrology Manual Table 3.1)

Cp Soil A = 0.20, Cp Soil C = 0.30, Cp Soil D= 0.35 (soil type D has been used for areas that have been previously compacted)

Cp-Subarea = (Soil type A% * 0.20) + (Soil type C% * 0.3) + (Soil Type D%* 0.35)

Please refer to existing conditions AES Input Data spreadsheet in appendix 4 for each subarea runoff factor.

Table 1 below summarizes the 100-year existing condition peak flow at the downstream project boundary.

TABLE 1 - Summary of Existing Flows

Exhibit	Node Number on Exhibit	Discharge Location	Drainage Area (ac)	C Area-Average Runoff Coefficient	Tc (min)	Q100-Year Peak Flow (cfs)
1	1	Northwest of the site	29.86	0.390	14.20	49.81
1	118.10	Northeast of the site	14.06	0.457	11.81	28.13
1	138	East of ‘1’	13.41	0.351	10.37	22.41
1	137	College Blvd.	0.24	0.38	6.06	0.62

1.3 – Proposed Conditions

The proposed project will develop a single pad designated for two building structures, accommodating a total of 282 apartment units, complete with courtyards. The development plan includes private driveways, sidewalks, landscaping, parking spaces, and the necessary infrastructure and utilities typical for such a development. This infrastructure will have a dual storm drain system comprising pipes, inlets, catch basins, brow ditches, and cleanouts. One component of this dual system is designed to collect and convey the onsite 100-year runoff through the project area to the proposed underground storage facilities.

These facilities will attenuate and direct the runoff to the proposed structural pollutant control Best Management Practices (BMPs) to meet water quality requirements. The second component, the bypass storm drain system, aims to capture and convey the offsite flows along with a portion of the onsite flows from the undisturbed slopes directly to the existing northern channel.

To facilitate access to the site from College Blvd, the existing access road northeast of the site will be paved and improved as a gated emergency-only ingress/egress road. Additionally, a new connection to the cul-de-sac on Olive Drive, east of the site, is proposed.

The onsite runoff will be directed via a street curb and gutter system, captured by proposed inlets, and routed through the proposed storm drain system to the underground storage facilities (constructed of Corrugated Metal Pipe, CMP, or an approved equivalent). These facilities are designed to store the required water quality volume and to fulfill hydromodification and peak flow management requirements. Moreover, the underground storage will feature an outlet structure engineered to release the required water quality volume within the specified drawdown time to the downstream proprietary biofiltration BMPs. These outlet structures will attenuate the peak flows and aid in meeting flow control to address hydromodification requirements.

No development is proposed within the flood zone as designated by FEMA, except for an approximate 107-square-foot area allocated for an offsite, on-grade, publicly accessible concrete pedestrian connection to the existing concrete train station north of the site, which is situated within the floodway. This minor encroachment in the floodway has been evaluated, and it is considered to have a negligible impact due to its small footprint, the absence of hydraulic alterations, no offsite fill requirements, and its alignment with the existing grade.

The remainder of the accessible concrete pedestrian connection crosses an existing flow line outside the floodway and floodplain areas. Low-flow pipes will manage normal flows, while peak flows will overtop the crossing, following the natural drainage path.

A flow-based proprietary biofiltration BMP (Modular Wetlands System or equivalent) is planned for installation on the emergency-only ingress/egress road at its lowest point to address the water quality requirements for this area. Meanwhile, the proposed underground storage facilities will offer additional storage and over-detention capabilities to meet hydromodification and peak flow attenuation requirements at the point of compliance to mitigate the construction of the proposed emergency-only ingress/egress road.

Runoff from the northeast, small section of the emergency-only ingress/egress road will be directed to a flow-based MWS unit and an underground storage facility to address water quality, hydromodification, and peak flow attenuation for this area. The treated and mitigated flow from the underground storage facility will then connect to the existing storm drain, which leads to the catch basin located just south of the railroad tracks. From there, it will discharge into the existing storm drain that flows directly into Loma Alta Creek, similar to existing conditions, where it will travel west to merge with the treated and mitigated flows from the site.

For further details on the proposed water quality features of the site, refer to the Stormwater Quality Management Plan for the Olive Park Apartments (October 2024) prepared by Hunsaker & Associates San Diego, Inc.

The development occupies approximately 6.56 acres of the onsite area, which were existing slopes and swales and will now be streets and buildings. The drainage on the developed portions of the site will be conveyed via roof drains, curbs and gutters, area drains, curb inlets, and underground storm drains. As previously discussed, these flows will be mitigated before confluence with undisturbed flows.

Runoff from the western and southern undisturbed slopes will be diverted through proposed brow ditches directly into the northwestern discharge point. This system is tasked with conveying the aforementioned flows and the offsite flows (from Olive Drive) to their designated discharge points northeast and northwest of the site. They will combine with the onsite treated flows and proceed westerly to Loma Alta Creek. For calculations regarding the proposed condition runoff, see Appendix 4.

The total studied drainage area is 29.9 ac with 32% imperviousness. The runoff coefficient for each subarea was calculated based on soil type covering the area and impervious percentage using the formula from San Diego County Hydrology Manual Section 3.1.2 for the undisturbed areas, while the runoff coefficient for disturbed areas was calculated using soil type D and impervious percentage.

$$C = 0.90 \times (\%\ \text{Impervious}) + C_p \times (1 - \%\ \text{Impervious})$$

Cp = Pervious Coefficient Runoff value for the soil type (per San Diego County Hydrology Manual Table 3.1)

Cp Soil A = 0.20, Cp Soil C = 0.30, Cp Soil D= 0.35 (soil D for disturbed areas)

Cp-Subarea = (Soil type A% * 0.20) + (Soil type C% * 0.3) + (Soil Type D%* 0.35)

Please refer to the proposed conditions AES Input Data spreadsheet in Appendix 4 for each subarea runoff factor.

Table 2 below summarizes the unmitigated 100-year proposed condition peak flow at the downstream project boundary.

TABLE 2 - Summary of Proposed Unmitigated Flows

Exhibit	Node Number on Exhibit	Discharge Location	Drainage Area (ac)	C Area-Average Runoff Coefficient	Tc (min)	Q100-Year Peak Flow (cfs)
2	1	Northwest of the site	29.86	0.507	14.34	46.82
2	143	Northeast of the site	11.91	0.572	11.29	28.63
2	175	East of ‘1’	17.18	0.471	5.49	29.56
2	137	College Blvd.	0.24	0.475	5.00	0.87

Although the flow associated with the development of the *Olive Park Apartments project* did not increase at the very downstream discharge location, the proposed underground storage facilities required for hydromodification management will provide peak flow attenuation. The riser within these facilities has been designed with orifices along its height, maintaining a foot of freeboard above the 100-year water surface elevation (WSE).

Sizes and heights of orifices were determined to achieve outlet flow less than the pre-development flow shown in Table 1 above. Please refer to Chapter 2.2 for methodology and Appendix 5 for detention Analysis.

The resultant discharge at Node 1 will continue westerly to comingle with Loma Alta Creek and ultimately discharge into the Pacific Ocean.

Since this project is subject to compliance with hydromodification requirements, the design of the storage\detention facilities has been coordinated with those calculations, which are part of the *SWQMP for Olive Park Apartments.*

Table 3 below summarizes the Q100 Mitigated flow at Node 1.

TABLE 3 - Summary of Mitigated Developed Flows

Exhibit	Node Number on Exhibit	Discharge Location	Drainage Area (ac)	C Area-Average Runoff Coefficient	Tc (min)	Q100-Year Peak Flow (cfs)
2	1	Northwest of the site	29.86	0.507	14.39	36.88
2	143	Northeast of the site	11.91	0.572	11.29	27.37
2	175	East of ‘1’	17.18	0.471	26.12	17.11
2	137	College Blvd.	0.24	0.475	6.21	0.54

1.4 – Summary of Results

The conveyance of Q100 runoff flows through the proposed site required a dual storm drain system. One of the dual systems is an on-site storm drain system proposed to route flows to the proposed detention facilities to address water quality, hydromodification, and peak flow attenuation, while the second system is a bypassed storm drain to convey the offsite flows to the existing northern channel.

Storm drain system and hydraulic calculations will be conducted in the final engineering drainage study.

Rip rap is proposed at the storm drain discharge location to help dissipate outlet velocities to a non-erosive level. The design for the rip rap will be provided during final engineering. Preliminary sizing has been performed in Chapter 4 using the velocities determined with the Hydraflow Express extension.

Two volume-based proprietary biofiltration BMPs, along with two underground storage facilities, have been included in the site’s design to address hydromodification, peak flow attenuation, and water quality requirements. A flow-based proprietary biofiltration BMP is proposed at the emergency-only ingress/egress road to meet water quality requirements for the portion of the road that cannot be routed to the storage facility. A small northeastern portion of the emergency-only ingress/egress road, which drains away from the site, will be routed to a flow-based proprietary biofiltration unit to address water quality, and to an underground storage facility to manage hydromodification and peak flow attenuation. Per the hydrologic and detention analysis conducted in this study, the detention analysis for the vaults is included in Appendix 5 of this report. The table below summarizes the flow reductions at the discharge location.

The flow from the site is attenuated to ensure that the post-developed flows will not exceed the capacity of the existing downstream drainage facilities (post-development flows compared to the pre-development flows at the point of compliance southwest corner of the project (POC-1/ Node 1). See Table 4 below.

TABLE 4 – Pre-development Condition vs. Post-development Condition

Dis. Location	Pre- Area (ac)	Post- Area (ac)	Pre-: 100-Year Peak Flow (cfs)	Post-: 100-Year Unmit. Peak Flow (cfs)	Post-: 100-Year Mit. Peak Flow (cfs)	TC Pre (min)	TC Post Unmit (min)	TC Post Mit (min)	Q100 Flow Difference (cfs)
Northwest corner	29.86	29.86	49.81	47.35	36.88	14.20	14.34	14.39	-12.93
Northeast of the site	14.06	11.91	28.13	28.63	27.37	11.81	11.29	11.29	-0.76
East of ‘1’	13.41	17.18	22.41	29.56	17.11	10.37	5.49	26.12	-5.30
College Blvd.	0.24	0.24	0.62	0.89	0.54	6.06	5.00	6.21	-0.08

-Dis. Location: Discharge Location

-Pre : Pre-Developed Conditions

-Post. Unmit.: Post Developed Unmitigated Conditions

-Post. Mit.: Post Developed Mitigated Conditions

1.5 – Conclusion

The proposed development of *Olive Park Apartments* can be roughly graded and improved with a storm drain system to accommodate the expected ultimate flows from development. In addition, with the proposed drainage facilities such as curb inlets, storm drains, water quality, flow control, and detention facilities, runoff can be mitigated to accepted San Diego County and City of Oceanside standards.

The proposed project will not substantially alter the existing drainage pattern of the site. There will be a decrease in the peak discharge from the site. Therefore, the proposed project will not impact downstream properties or drainage facilities.

1.6 - References

San Diego County Hydrology Manual, County of San Diego Department of Public Works Flood Control Division, June 2003.

San Diego County Hydraulic Design Manual, County of San Diego Department of Public Works Flood Control Division, September 2014

San Diego County Drainage Design Manual, County of San Diego Department of Public Works Flood Control Division, July 2005

Stormwater Quality Management Plan for Olive Park Apartments, Hunsaker & Associates San Diego, Inc., October 2024.

CHAPTER 2

METHODOLOGY

Rational Method Hydrologic Analysis

The Rational Method as described in the San Diego County Hydrology Manual, was used for the hydrologic calculations for this project. The Rational Method formula is expressed as follows:

$Q = C\ I\ A$

$I = 7.44 P_6 T_c\text{-}0.645$

$T_c = T_t + T_i$

$T_t = D/V$*

Where:

Q = Peak discharge, in cubic feet per second (cfs).
C = Runoff coefficient, proportion of the rainfall that runs off the surface. The C coefficient was obtained from Table 3-1 of the SDCHM. It has no units and is based on the soil group and the development type for the drainage sub-area.
A = Drainage area contributing to the design location (ac).
I = Average rainfall intensity (in/hr). The formula can be found on Figure 3-2 of the SDCHM.
P_6 = 6-hour precipitation (in). This value was taken from the 6-hour isopluvial maps found in Appendix B of the SDCHM.
T = Time of concentration (min). The formula can be found on Figure 3-3 of the SDCHM.
T_i = Initial time of concentration, from Table 3-2 (min).
T_t = Travel time (min). Based on methods described in Chapter 3.1.4.2 of the SDCHM.
D = Longest flow path distance (ft).
S = Slope along the flow path (%).
V = Flow velocity(ft/sec).

*Assumed flow at top of 6” gutter.

To perform a node-link study, the total watershed area is divided into subareas which discharge at designated nodes.

The procedure for the subarea summation model is as follows:
(1) Subdivide the watershed into an initial subarea (generally 1 lot) and subsequent subareas, which are generally less than 10 acres in size. Assign upstream and downstream node numbers to each subarea.
(2) Estimate an initial Tc by using the appropriate nomograph or overland flow velocity estimation.
(3) Using the initial Tc, determine the corresponding values of I. Then Q = C I A.

(4) Using Q, estimate the travel time between this node and the next by Manning's equation as applied to the particular channel or conduit linking the two nodes. Then, repeat the calculation for Q based on the revised intensity (which is a function of the revised time of concentration)

The nodes are joined together by links, which may be street gutter flows, drainage swales, drainage ditches, pipe flow, or various channel flows. The AES-2010 computer subarea menu is as follows:

SUBAREA HYDROLOGIC PROCESS
1. Confluence analysis at node.
2. Initial subarea analysis (including time of concentration calculation).
3. Pipeflow travel time (computer estimated).
4. Pipeflow travel time (user specified).
5. Trapezoidal channel travel time.
6. Street flow analysis through subarea.
7. User - specified information at node.
8. Addition of subarea runoff to main line.
9. V-gutter flow through area.
10. Copy main stream data to memory bank
11. Confluence main stream data with a memory bank
12. Clear a memory bank

At the confluence point of two or more basins, the following procedure is used to combine peak flow rates to account for differences in the basin's times of concentration. This adjustment is based on the assumption that each basin's hydrographs are triangular in shape.

(1). If the collection streams have the same times of concentration, then the Q values are directly summed,

Qp = Qa + Qb; Tp = Ta = Tb

(2). If the collection streams have different times of concentration, the smaller of the tributary Q values may be adjusted as follows:

(i). The most frequent case is where the collection stream with the longer time of concentration has the larger Q. The smaller Q value is adjusted by the ratio of rainfall intensities.
Qp = Qa + Qb (Ia/Ib); Tp = Ta

(ii). In some cases, the collection stream with the shorter time of concentration has the larger Q. Then the smaller Q is adjusted by a ratio of the T values.

Qp = Qb + Qa (Tb/Ta); Tp = Tb

Design Storm - 100-year return interval

Land Use – Commercial;

Soil Type – Hydrologic soil groups A, C, and D are present within the drainage boundaries and a weighted average of the runoff coefficient is used based on drainage area and respective soil type.

Runoff Coefficient - In accordance with the County of San Diego standards, runoff coefficients were based on land use and soil type.

Rainfall Intensity - Initial time of concentration values were determined using the County of San Diego standards. The rainfall intensity-duration-frequency curve for the San Diego County was used to determine rainfall intensities

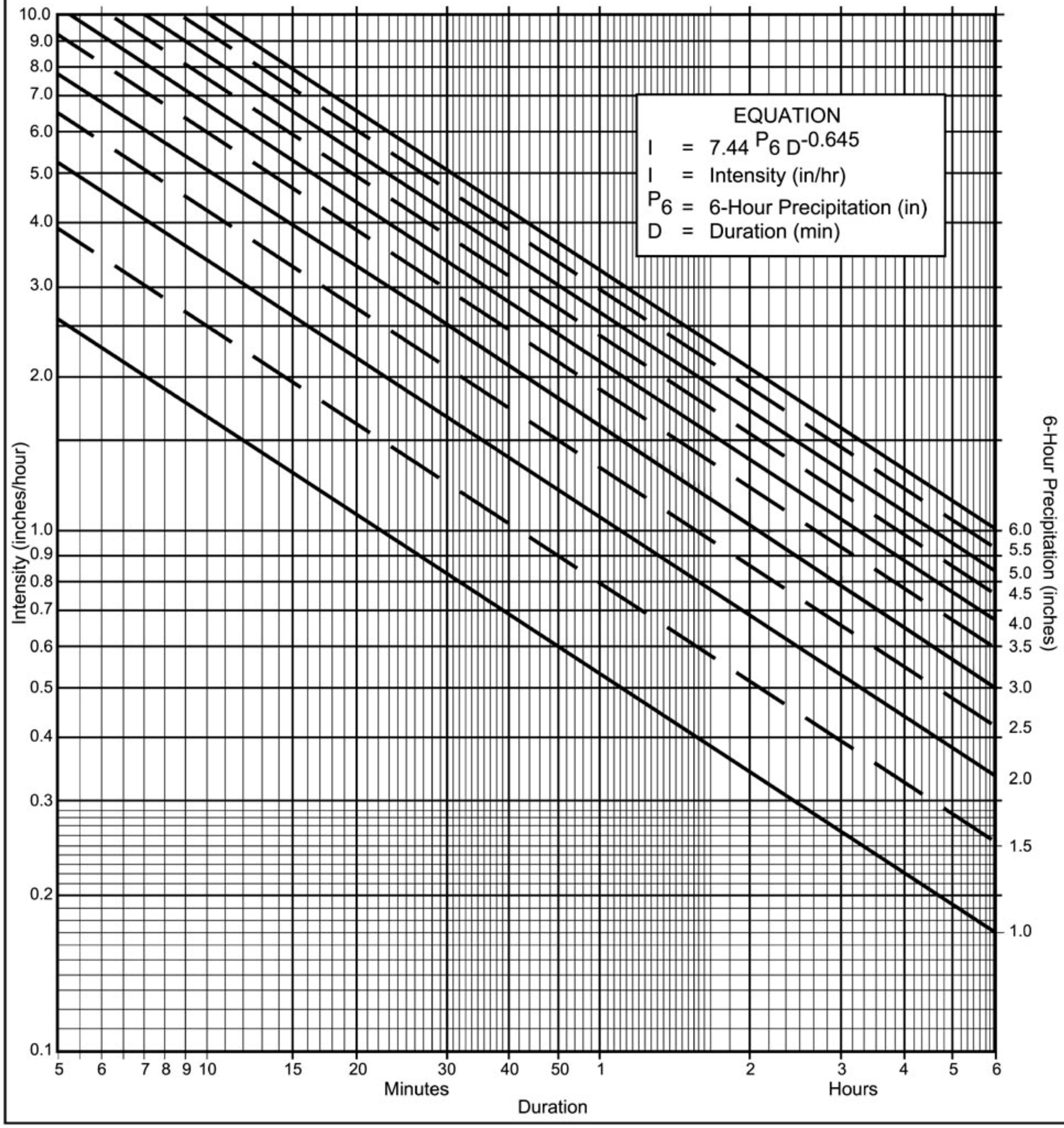
2.4 Detention

In order to provide adequate flood control, increases in peak flow rates at the outfall location for this site were mitigated using the proposed underground storage facilities (vaults).

The hydrology calculations discussed above provide peak flowrates for the vaults' inflow, which are entered into a separate program called RickRatHydro. The RickratHydro was used to produce an inflow hydrograph for the project drainage area to the vault, based on the area, time of concentration, P6 value, runoff coefficient, and peak flow rate.

Mitigation within the vault was modeled using SWMM 5.1. The Hydrograph that was generated from RickRatHydro was used as an input data for the inflows to the storage unit in the SWMM model. The riser was modeled using stage discharge table (Rating Curve in SWMM), and the volume was modeled using the storage stage table (Storage Curve), which represents the storage provided within the vault depth above excluding the water quality ponding depth.

The results from the SWMM model were used as input data (code 7) in the AES proposed condition model at the discharge location from the proposed vaults (Node 140 and 162), to generate the AES model for proposed mitigated flows.



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 applicable 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 $\boxed{100}$ year

(b) P_6 = $\boxed{2.90}$ in., P_{24} = $\boxed{5.25}$, $\frac{P_6}{P_{24}} = \frac{\boxed{2.90}}{\boxed{5.25}}$ %$^{(2)}$ $\boxed{55\%}$

(c) Adjusted $P_6{}^{(2)}$ = $\boxed{2.70}$ 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

FIGURE

3-1

Intensity-Duration Design Chart - Template

- The storm frequency of peak discharges is the same as that of I for the given T_c.

- The fraction of rainfall that becomes runoff (or the runoff coefficient, C) is independent of I or precipitation zone number (PZN) condition (PZN Condition is discussed in Section 4.1.2.4).

- The peak rate of runoff is the only information produced by using the RM.

3.1.2 Runoff Coefficient

Table 3-1 lists the estimated runoff coefficients for urban areas. The concepts related to the runoff coefficient were evaluated in a report entitled *Evaluation, Rational Method "C" Values* (Hill, 2002) that was reviewed by the Hydrology Manual Committee. The Report is available at San Diego County Department of Public Works, Flood Control Section and on the San Diego County Department of Public Works web page.

The runoff coefficients are based on land use and soil type. Soil type can be determined from the soil type map provided in Appendix A. An appropriate runoff coefficient (C) for each type of land use in the subarea should be selected from this table and multiplied by the percentage of the total area (A) included in that class. The sum of the products for all land uses is the weighted runoff coefficient ($\Sigma[CA]$). Good engineering judgment should be used when applying the values presented in Table 3-1, as adjustments to these values may be appropriate based on site-specific characteristics. In any event, the impervious percentage (% Impervious) as given in the table, for any area, shall govern the selected value for C. The runoff coefficient can also be calculated for an area based on soil type and impervious percentage using the following formula:

$$C = 0.90 \times (\% \text{ Impervious}) + C_p \times (1 - \% \text{ Impervious})$$

Where: C_p = Pervious Coefficient Runoff Value for the soil type (shown in Table 3-1 as Undisturbed Natural Terrain/Permanent Open Space, 0% Impervious). Soil type can be determined from the soil type map provided in Appendix A.

The values in Table 3-1 are typical for most urban areas. However, if the basin contains rural or agricultural land use, parks, golf courses, or other types of nonurban land use that are expected to be permanent, the appropriate value should be selected based upon the soil and cover and approved by the local agency.

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

CHAPTER 3

HYDROLOGIC MODEL FOR EXISTING CONDITIONS

CHAPTER 3

HYDROLOGIC MODEL FOR EXISTING CONDITIONS

3.1 – 100 Year Storm Event

Existing Condition

AES INPUT DATA

Node #		Code	Elevation		Length (ft)	Slope	Area (Ac)			imperviousness	Soil Type A Area (ac)	Soil Type C Area (ac)	Soil Type D Area (ac)	C value	If Channel			If memory
From	To		Up	Down			total	Pervious	impervious						Base (ft)	Z:1	maning	Bank #
102	104	2	464.0	432.0	100	32.0%	0.17	0.17	0.00	0.00%	0.00	0.00	0.17	0.35				
104	106	5	432.0	256.5	850	20.7%	1.01	1.01	0.00	0.00%	0.00	0.09	0.92	0.35	5	3	0.015	
106	106	1																1 of 2
108	110	2	264.3	263.6	65	1.1%	0.14	0.05	0.09	65.00%	0.03	0.00	0.02	0.68				
110	106	6	263.6	256.5	717	1.0%	4.90	1.87	3.03	61.94%	0.04	1.78	0.05	0.67				
106	106	1																2 of 2
106	118	5	256.5	219.0	255	14.7%									5	2	0.015	
118	118	1																1 of 3
114	116	2	248.0	240.0	100	8.0%	0.17	0.17	0.00	0.00%	0.00	0.00	0.17	0.35				
116	112	5	240.0	223.0	845	2.0%	2.33	2.18	0.15	6.30%	0.00	0.00	2.18	0.38	10	4	0.023	
112	118	5	223.0	219.0	260	1.5%	0.25	0.25	0.00	0.00%	0.25	0.00	0.00	0.20	10	8	0.023	
118	118	1																2 of 3
120	122	2	464.0	418.0	100	46.0%	0.10	0.10	0.00	0.00%	0.00	0.00	0.10	0.35				
122	124	5	418.0	280.0	624	22.1%	2.10	2.10	0.00	0.00%	0.00	0.00	2.10	0.35	20	40	0.03	
124	126	5	280.0	256.0	105	22.8%									18	8	0.04	
124	126	8					0.95	0.95	0.00	0.00%	0.00	0.00	0.95	0.35				
126	128	5	256.0	225.0	199	15.5%									10	8	0.04	
126	128	8					0.93	0.93	0.00	0.00%	0.00	0.93	0.00	0.30				
128	118	5	225.0	219.0	65	9.2%	0.41	0.41	0.00	0.00%	0.41	0.00	0.00	0.20	20	20	0.03	
118	118	1																3 of 3
118	118.1	5	219.0	217.0	180	1.1%	0.12	0.12	0.00	0.00%	0.12	0.00	0.00	0.20	10	8	0.023	
118.1	118.1	1																1 of 2
140	142	2	307.6	296.4	100	11.2%	0.05	0.05	0.00	0.00%	0.00	0.00	0.05	0.35				
142	144	5	296.4	246.0	250	20.2%	0.21	0.21	0.00	0.00%	0.00	0.00	0.21	0.35	20	8	0.04	
144	118.1	5	246.0	217.0	135	21.5%	0.22	0.22	0.00	0.00%	0.22	0.00	0.00	0.20	10	5	0.03	
118.1	118.1	1																2 of 2
118.1	1	5	217.0	204.0	750	1.7%									5	20	0.015	
1	1	1																1 of 3
114	137	2	245.0	235.0	100	10.0%	0.24	0.22	0.02	6.30%	0.00	0.00	0.22	0.38				
137	1	3	230.0	204.0	2400	1.1%												
137	1	1																2 of 3
132	134	2	463.8	448.0	100	15.8%	0.13	0.13	0.00	0.00%	0.00	0.00	0.13	0.35				
134	136	5	448.0	300.5	475	31.1%	7.66	7.64	0.02	0.31%	0.00	0.00	7.64	0.35	100	50	0.03	
136	138	5	300.5	229.3	338	21.0%									20	10	0.03	
136	138	8					5.62	5.62	0.00	0.00%	0.00	0.00	5.62	0.35				
138	1	5	229.3	204.0	610	4.1%	2.15	2.15	0.00	0.00%	2.15	0.00	0.00	0.20	20	50	0.023	
1	1	1																3 of 3
Total							29.86	26.55	3.31	11%	3.22	2.80	20.53	0.390				

Nodes correspond to existing dirt road. Although this subwatershed is within hydrologic soil types A and C, it is a man-made road and has been compacted. Soil type D has been assumed for these node processes.

```
____________________________________________________________________________
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2015 Advanced Engineering Software (aes)
             Ver. 22.0 Release Date: 07/01/2015  License ID 1239

                           Analysis prepared by:

                  Hunsaker & Associates San Diego, Inc.
                           9707 Waples Street
                          San Diego,  CA 92121


 ************************** DESCRIPTION OF STUDY **************************
* OLIVE PARK APARTMENTS                                                     *
* 100 YR EXISTING HYDROLOGY ANALYSIS                                        *
* DLN 1746 W.O. 3785-0002                                                   *
 **************************************************************************

  FILE NAME: R:\1746\HYD\TM\DR\CALCS\AES\EX\100EX.DAT
  TIME/DATE OF STUDY: 17:18 10/04/2024
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.900
  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   20.0     15.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  2   14.0      9.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0160
  3   12.0      6.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

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

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    464.00
  DOWNSTREAM ELEVATION(FEET) =    432.00
  ELEVATION DIFFERENCE(FEET) =     32.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.605
  SUBAREA RUNOFF(CFS) =      0.39
  TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.39

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    106.00 IS CODE =  51
```

```
--------------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    432.00  DOWNSTREAM(FEET) =    257.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   850.00   CHANNEL SLOPE =  0.2059
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.265
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.34
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.36
  AVERAGE FLOW DEPTH(FEET) =   0.05   TRAVEL TIME(MIN.) =   2.64
  Tc(MIN.) =    8.91
  SUBAREA AREA(ACRES) =     1.01       SUBAREA RUNOFF(CFS) =    1.86
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =        1.2         PEAK FLOW RATE(CFS) =       2.17

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.06   FLOW VELOCITY(FEET/SEC.) =   6.55
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE    106.00 =     950.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =   1
--------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
================================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.91
  RAINFALL INTENSITY(INCH/HR) =   5.26
  TOTAL STREAM AREA(ACRES) =     1.18
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.17

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    110.00 IS CODE =  21
--------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
================================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6800
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    264.30
  DOWNSTREAM ELEVATION(FEET) =    263.60
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.946
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.832
  SUBAREA RUNOFF(CFS) =      0.65
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.65

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    106.00 IS CODE =  62
--------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
================================================================================
  UPSTREAM ELEVATION(FEET) =  263.60  DOWNSTREAM ELEVATION(FEET) =  256.50
  STREET LENGTH(FEET) =   717.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  15.00
  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) =       8.52
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.38
    HALFSTREET FLOOD WIDTH(FEET) =   12.53
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.52
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.95
  STREET FLOW TRAVEL TIME(MIN.) =   4.74   Tc(MIN.) =   10.68
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.683
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6700
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.670
  SUBAREA AREA(ACRES) =    4.90      SUBAREA RUNOFF(CFS) =   15.37
  TOTAL AREA(ACRES) =        5.0        PEAK FLOW RATE(CFS) =      15.82

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.45   HALFSTREET FLOOD WIDTH(FEET) =  16.04
  FLOW VELOCITY(FEET/SEC.) =  2.94   DEPTH*VELOCITY(FT*FT/SEC.) =   1.31
  LONGEST FLOWPATH FROM NODE    108.00 TO NODE    106.00 =     782.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 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.) =   10.68
  RAINFALL INTENSITY(INCH/HR) =   4.68
  TOTAL STREAM AREA(ACRES) =     5.04
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     15.82

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        2.17     8.91       5.265         1.18
      2       15.82    10.68       4.683         5.04

  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       15.36     8.91      5.265
      2       17.75    10.68      4.683

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      17.75   Tc(MIN.) =   10.68
  TOTAL AREA(ACRES) =        6.2
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE    106.00 =     950.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    118.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    256.50  DOWNSTREAM(FEET) =    219.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   250.00   CHANNEL SLOPE =  0.1500
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =      17.75
  FLOW VELOCITY(FEET/SEC.) =  13.54   FLOW DEPTH(FEET) =   0.24
  TRAVEL TIME(MIN.) =   0.31   Tc(MIN.) =   10.99
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE    118.00 =    1200.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    118.00 TO NODE    118.00 IS CODE =   1
```

```
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.99
  RAINFALL INTENSITY(INCH/HR) =   4.60
  TOTAL STREAM AREA(ACRES) =     6.22
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     17.75

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    116.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    248.00
  DOWNSTREAM ELEVATION(FEET) =    240.00
  ELEVATION DIFFERENCE(FEET) =      8.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.750
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.296
  SUBAREA RUNOFF(CFS) =      0.37
  TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.37

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    112.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    240.00  DOWNSTREAM(FEET) =    223.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   845.00   CHANNEL SLOPE =  0.0201
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   4.000
  MANNING'S FACTOR = 0.023   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.991
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3800
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.20
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.03
  AVERAGE FLOW DEPTH(FEET) =   0.10   TRAVEL TIME(MIN.) =   6.94
  Tc(MIN.) =   13.69
  SUBAREA AREA(ACRES) =     2.33       SUBAREA RUNOFF(CFS) =    3.53
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.378
  TOTAL AREA(ACRES) =        2.5         PEAK FLOW RATE(CFS) =       3.77

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.15   FLOW VELOCITY(FEET/SEC.) =   2.41
  LONGEST FLOWPATH FROM NODE    114.00 TO NODE    112.00 =     945.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    118.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    223.00  DOWNSTREAM(FEET) =    219.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   260.00   CHANNEL SLOPE =  0.0154
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   8.000
  MANNING'S FACTOR = 0.023   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.656
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .2000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.86
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.18
  AVERAGE FLOW DEPTH(FEET) =   0.16   TRAVEL TIME(MIN.) =   1.99
  Tc(MIN.) =   15.67
```

```
  SUBAREA AREA(ACRES) =     0.25       SUBAREA RUNOFF(CFS) =    0.18
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.362
  TOTAL AREA(ACRES) =        2.8         PEAK FLOW RATE(CFS) =       3.77

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.16   FLOW VELOCITY(FEET/SEC.) =   2.16
  LONGEST FLOWPATH FROM NODE    114.00 TO NODE    118.00 =    1205.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    118.00 TO NODE    118.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.67
  RAINFALL INTENSITY(INCH/HR) =   3.66
  TOTAL STREAM AREA(ACRES) =     2.75
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.77

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    122.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    464.00
  DOWNSTREAM ELEVATION(FEET) =    418.00
  ELEVATION DIFFERENCE(FEET) =     46.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.605
  SUBAREA RUNOFF(CFS) =      0.23
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.23

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    124.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    418.00  DOWNSTREAM(FEET) =    280.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   624.00   CHANNEL SLOPE =  0.2212
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  40.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.848
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.04
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.70
  AVERAGE FLOW DEPTH(FEET) =   0.04   TRAVEL TIME(MIN.) =   3.86
  Tc(MIN.) =   10.12
  SUBAREA AREA(ACRES) =     2.10       SUBAREA RUNOFF(CFS) =    3.56
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =        2.2         PEAK FLOW RATE(CFS) =       3.73

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.06   FLOW VELOCITY(FEET/SEC.) =   2.98
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    124.00 =     724.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    126.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    280.00  DOWNSTREAM(FEET) =    256.00
```

```
  CHANNEL LENGTH THRU SUBAREA(FEET) =   105.00   CHANNEL SLOPE =  0.2286
  CHANNEL BASE(FEET) =   18.00   "Z" FACTOR =   8.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       3.73
  FLOW VELOCITY(FEET/SEC.) =   2.81   FLOW DEPTH(FEET) =   0.07
  TRAVEL TIME(MIN.) =   0.62   Tc(MIN.) =   10.75
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    126.00 =     829.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    126.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.664
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
  SUBAREA AREA(ACRES) =    0.95   SUBAREA RUNOFF(CFS) =    1.55
  TOTAL AREA(ACRES) =        3.1   TOTAL RUNOFF(CFS) =       5.14
  TC(MIN.) =   10.75

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    128.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    256.00  DOWNSTREAM(FEET) =    225.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   199.00   CHANNEL SLOPE =  0.1558
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   8.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       5.14
  FLOW VELOCITY(FEET/SEC.) =   3.51   FLOW DEPTH(FEET) =   0.13
  TRAVEL TIME(MIN.) =   0.95   Tc(MIN.) =   11.69
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    128.00 =    1028.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    128.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.418
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3386
  SUBAREA AREA(ACRES) =    0.93   SUBAREA RUNOFF(CFS) =    1.23
  TOTAL AREA(ACRES) =        4.1   TOTAL RUNOFF(CFS) =       6.10
  TC(MIN.) =   11.69

****************************************************************************
  FLOW PROCESS FROM NODE    128.00 TO NODE    118.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    225.00  DOWNSTREAM(FEET) =    219.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =    65.00   CHANNEL SLOPE =  0.0923
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.331
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .2000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.28
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.97
  AVERAGE FLOW DEPTH(FEET) =   0.10   TRAVEL TIME(MIN.) =   0.36
  Tc(MIN.) =   12.06
  SUBAREA AREA(ACRES) =     0.41       SUBAREA RUNOFF(CFS) =    0.36
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.326
```

```
  TOTAL AREA(ACRES) =        4.5         PEAK FLOW RATE(CFS) =       6.34

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.10   FLOW VELOCITY(FEET/SEC.) =   3.00
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    118.00 =    1093.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    118.00 TO NODE    118.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.06
  RAINFALL INTENSITY(INCH/HR) =   4.33
  TOTAL STREAM AREA(ACRES) =     4.49
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.34

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       17.75    10.99        4.598          6.22
      2        3.77    15.67        3.656          2.75
      3        6.34    12.06        4.331          4.49

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       26.17    10.99       4.598
      2       25.96    12.06       4.331
      3       23.24    15.67       3.656

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      26.17   Tc(MIN.) =   10.99
  TOTAL AREA(ACRES) =       13.5
  LONGEST FLOWPATH FROM NODE    114.00 TO NODE    118.00 =    1205.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    118.00 TO NODE    118.10 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    219.00  DOWNSTREAM(FEET) =    217.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   180.00   CHANNEL SLOPE =  0.0111
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   8.000
  MANNING'S FACTOR = 0.023   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.390
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .2000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      26.23
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.67
  AVERAGE FLOW DEPTH(FEET) =   0.51   TRAVEL TIME(MIN.) =   0.82
  Tc(MIN.) =   11.81
  SUBAREA AREA(ACRES) =     0.12       SUBAREA RUNOFF(CFS) =    0.11
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.462
  TOTAL AREA(ACRES) =       13.6         PEAK FLOW RATE(CFS) =      27.54

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.52   FLOW VELOCITY(FEET/SEC.) =   3.71
  LONGEST FLOWPATH FROM NODE    114.00 TO NODE    118.10 =    1385.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    118.10 TO NODE    118.10 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.) =   11.81
  RAINFALL INTENSITY(INCH/HR) =   4.39
  TOTAL STREAM AREA(ACRES) =    13.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     27.54

******************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    142.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    307.60
  DOWNSTREAM ELEVATION(FEET) =    296.40
  ELEVATION DIFFERENCE(FEET) =     11.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.605
  SUBAREA RUNOFF(CFS) =      0.12
  TOTAL AREA(ACRES) =      0.05   TOTAL RUNOFF(CFS) =      0.12

******************************************************************************
  FLOW PROCESS FROM NODE    142.00 TO NODE    144.00 IS CODE =  51
------------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    296.40  DOWNSTREAM(FEET) =    246.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   250.00   CHANNEL SLOPE =  0.2016
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =   8.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.933
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.29
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.16
  AVERAGE FLOW DEPTH(FEET) =   0.01   TRAVEL TIME(MIN.) =   3.59
  Tc(MIN.) =    9.85
  SUBAREA AREA(ACRES) =     0.21       SUBAREA RUNOFF(CFS) =    0.36
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =        0.3         PEAK FLOW RATE(CFS) =       0.45

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.02   FLOW VELOCITY(FEET/SEC.) =   1.23
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    144.00 =     350.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    144.00 TO NODE    118.10 IS CODE =  51
------------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    246.00  DOWNSTREAM(FEET) =    217.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   135.00   CHANNEL SLOPE =  0.2148
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.595
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .2000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.55
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.96
  AVERAGE FLOW DEPTH(FEET) =   0.03   TRAVEL TIME(MIN.) =   1.15
  Tc(MIN.) =   11.00
  SUBAREA AREA(ACRES) =     0.22       SUBAREA RUNOFF(CFS) =    0.20
```

```
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.281
  TOTAL AREA(ACRES) =        0.5         PEAK FLOW RATE(CFS) =       0.62

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.03   FLOW VELOCITY(FEET/SEC.) =   2.21
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    118.10 =     485.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    118.10 TO NODE    118.10 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.) =   11.00
  RAINFALL INTENSITY(INCH/HR) =   4.60
  TOTAL STREAM AREA(ACRES) =     0.48
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.62

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       27.54    11.81        4.390         13.58
      2        0.62    11.00        4.595          0.48

  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       26.93    11.00       4.595
      2       28.13    11.81       4.390

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      28.13   Tc(MIN.) =   11.81
  TOTAL AREA(ACRES) =       14.1
  LONGEST FLOWPATH FROM NODE    114.00 TO NODE    118.10 =    1385.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    118.10 TO NODE      1.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    217.00  DOWNSTREAM(FEET) =    204.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   750.00   CHANNEL SLOPE =  0.0173
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =      28.13
  FLOW VELOCITY(FEET/SEC.) =   5.22   FLOW DEPTH(FEET) =   0.41
  TRAVEL TIME(MIN.) =   2.40   Tc(MIN.) =   14.20
  LONGEST FLOWPATH FROM NODE    114.00 TO NODE      1.00 =    2135.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.20
  RAINFALL INTENSITY(INCH/HR) =   3.90
  TOTAL STREAM AREA(ACRES) =    14.06
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     28.13

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    137.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
==============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3800
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    245.00
  DOWNSTREAM ELEVATION(FEET) =    235.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.016
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.781
  SUBAREA RUNOFF(CFS) =      0.62
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      0.62

****************************************************************************
  FLOW PROCESS FROM NODE    137.00 TO NODE      1.00 IS CODE =  31
------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   230.00  DOWNSTREAM(FEET) =   204.00
  FLOW LENGTH(FEET) =  2400.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.23
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.62
  PIPE TRAVEL TIME(MIN.) =  12.40    Tc(MIN.) =   18.42
  LONGEST FLOWPATH FROM NODE    114.00 TO NODE      1.00 =    2500.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    137.00 TO NODE      1.00 IS CODE =   1
------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   18.42
  RAINFALL INTENSITY(INCH/HR) =   3.30
  TOTAL STREAM AREA(ACRES) =     0.24
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.62

****************************************************************************
  FLOW PROCESS FROM NODE    132.00 TO NODE    134.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    463.80
  DOWNSTREAM ELEVATION(FEET) =    448.00
  ELEVATION DIFFERENCE(FEET) =     15.80
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.605
  SUBAREA RUNOFF(CFS) =      0.30
  TOTAL AREA(ACRES) =      0.13   TOTAL RUNOFF(CFS) =      0.30

****************************************************************************
  FLOW PROCESS FROM NODE    134.00 TO NODE    136.00 IS CODE =  51
------------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    448.00  DOWNSTREAM(FEET) =    300.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   475.00   CHANNEL SLOPE =  0.3105
  CHANNEL BASE(FEET) =  100.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.105
```

```
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.21
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.57
 AVERAGE FLOW DEPTH(FEET) =   0.03   TRAVEL TIME(MIN.) =   3.08
 Tc(MIN.) =    9.34
 SUBAREA AREA(ACRES) =     7.66       SUBAREA RUNOFF(CFS) =   13.69
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
 TOTAL AREA(ACRES) =        7.8         PEAK FLOW RATE(CFS) =      13.92

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.04   FLOW VELOCITY(FEET/SEC.) =   3.33
 LONGEST FLOWPATH FROM NODE    132.00 TO NODE    136.00 =     575.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    136.00 TO NODE    138.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    300.50  DOWNSTREAM(FEET) =    229.30
 CHANNEL LENGTH THRU SUBAREA(FEET) =   338.00   CHANNEL SLOPE =  0.2107
 CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  10.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
 CHANNEL FLOW THRU SUBAREA(CFS) =      13.92
 FLOW VELOCITY(FEET/SEC.) =   5.51   FLOW DEPTH(FEET) =   0.12
 TRAVEL TIME(MIN.) =   1.02   Tc(MIN.) =   10.37
 LONGEST FLOWPATH FROM NODE    132.00 TO NODE    138.00 =     913.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    136.00 TO NODE    138.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.774
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
 SUBAREA AREA(ACRES) =    5.62   SUBAREA RUNOFF(CFS) =    9.39
 TOTAL AREA(ACRES) =       13.4   TOTAL RUNOFF(CFS) =      22.41
 TC(MIN.) =   10.37

****************************************************************************
 FLOW PROCESS FROM NODE    138.00 TO NODE      1.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    229.30  DOWNSTREAM(FEET) =    204.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   610.00   CHANNEL SLOPE =  0.0415
 CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  50.000
 MANNING'S FACTOR = 0.023   MAXIMUM DEPTH(FEET) =   2.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.117
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .2000
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      23.29
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.80
 AVERAGE FLOW DEPTH(FEET) =   0.20   TRAVEL TIME(MIN.) =   2.67
 Tc(MIN.) =   13.04
 SUBAREA AREA(ACRES) =     2.15       SUBAREA RUNOFF(CFS) =    1.77
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.329
 TOTAL AREA(ACRES) =       15.6         PEAK FLOW RATE(CFS) =      22.41

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.20   FLOW VELOCITY(FEET/SEC.) =   3.70
 LONGEST FLOWPATH FROM NODE    132.00 TO NODE      1.00 =    1523.00 FEET.

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

```
 FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
 TIME OF CONCENTRATION(MIN.) =   13.04
 RAINFALL INTENSITY(INCH/HR) =   4.12
 TOTAL STREAM AREA(ACRES) =    15.56
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     22.41

 ** CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       28.13    14.20        3.896        14.06
     2        0.62    18.42        3.295         0.24
     3       22.41    13.04        4.117        15.56

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

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       49.47    13.04       4.117
     2       49.81    14.20       3.896
     3       42.35    18.42       3.295

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      49.81   Tc(MIN.) =   14.20
 TOTAL AREA(ACRES) =       29.9
 LONGEST FLOWPATH FROM NODE    114.00 TO NODE      1.00 =    2500.00 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =       29.9  TC(MIN.) =     14.20
 PEAK FLOW RATE(CFS)   =      49.81
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

CHAPTER 4

HYDROLOGIC MODEL FOR DEVELOPED CONDITIONS

CHAPTER 4

HYDROLOGIC MODEL FOR DEVELOPED CONDITIONS

4.1 – 100 Year Storm Event

Proposed Condition

AES INPUT DATA

Node #		Code	Elevation		Length (ft)	Slope	Area (Ac)			imperviousness	Soil Type A Area (ac)	Soil Type C Area (ac)	Soil Type D Area (ac)	C value	If Channel			If memory
From	To		Up	Down			total	Pervious	impervious						Base (ft)	Z:1	maning	Bank #
102	104	2	464.0	453.0	65	16.9%	0.11	0.11	0.00	0.00%	0.00	0.00	0.11	0.35				
104	106	5	453.0	254.0	850	23.4%	1.32	1.32	0.00	0.00%	0.00	0.02	1.30	0.35	5	3	0.015	
106	112	3	244.0	243.4	61	1.1%												
112	112	1																1 of 2
108	110	2	264.3	263.6	65	1.1%	0.14	0.05	0.09	65.00%	0.03	0.00	0.02	0.68				
110	112	6	263.6	256.5	717	1.0%	4.89	1.86	3.03	61.96%	0.04	1.77	0.05	0.67				
112	112	1																2 of 2
112	113	3	238.0	222.5	176	8.8%												
113	113	10																1
120	122	2	264.0	263.3	65	1.1%	0.10	0.00	0.10	100.00%	0.00	0.00	0.00	0.90				
122	124	6	263.3	256.0	384	1.9%	0.60	0.18	0.42	70.00%	0.00	0.00	0.18	0.74				
124	125	3	246.0	244.0	101	2.0%												
126	125	8					0.21	0.06	0.15	70.00%	0.00	0.00	0.06	0.74				
125	127	3	244.0	242.9	55	2.0%												
128	127	8					0.22	0.07	0.15	70.00%	0.00	0.00	0.07	0.74				
127	142	3	242.9	227.0	208	7.6%												
142	142	1																1 of 3
130	132	2	264.0	262.7	65	2.0%	0.10	0.00	0.10	100.00%	0.00	0.00	0.00	0.90				
132	134	6	262.7	260.5	111	2.0%	0.30	0.09	0.21	70.00%	0.00	0.00	0.09	0.74				
134	135	3	250.5	249.7	74	1.0%												
136	135	8					0.15	0.05	0.11	70.00%	0.00	0.00	0.05	0.74				
135	142	3	249.7	227.0	296	7.7%												
142	142	1																2 of 3
138	140	2	263.0	262.3	65	1.1%	0.10	0.03	0.07	70.00%	0.00	0.00	0.03	0.74				
140	142	6	262.3	233.0	245	12.0%	0.55	0.17	0.39	70.00%	0.00	0.00	0.17	0.74				
142	142	1																3 of 3
142	145	3	222.0	221.5	10	5.0%												
145	145	10																2
114	116	2	242.7	242.0	65	1.0%	0.1	0.10	0.00	0.00%	0.00	0.10	0.00	0.30				
116	118	5	242.0	235.3	758	0.9%	1.29	1.14	0.15	11.63%	0.62	0.52	0.00	0.32	2	2	0.015	
118	119	3	225.0	224.8	25	0.8%												
118	119	8					0.53	0.03	0.50	95.00%	0.00	0.00	0.03	0.87				
119	113	3	224.8	223.0	180	1.0%												
119	113	8					0.27	0.27	0.00	0.00%	0.00	0.00	0.27	0.35				
113	113	11																1
113	113	12																1
113	145	3	223.0	221.5	140	1.1%												
145	145	11																2
145	145	12																2
145	143	3	221.5	220.0	90	1.7%												
143	143	1																1 of 2
139	141	2	238.0	234.0	100	4.0%	0.12	0.12	0.00	0.00%	0.12	0.00	0.00	0.20				
141	143	5	234.0	220.0	1080	1.3%	0.81	0.81	0.00	0.00%	0.81	0.00	0.00	0.20	10	8	0.023	
143	143	1																2 of 2
143	1	5	220.0	204.0	950	1.7%	0.53	0.53	0.00	0.00%	0.53	0.00	0.00	0.20	5	20	0.015	
1	1	10																1
146	148	2	264.0	262.5	65	2.3%	0.10	0.00	0.10	100.00%	0.00	0.00	0.00	0.90				
148	150	6	262.5	255.0	507	1.5%	1.47	0.15	1.32	90.00%	0.00	0.00	0.15	0.85				
150	151	3	245.0	244.0	88	1.1%												
152	151	8					0.25	0.03	0.23	90.00%	0.00	0.00	0.03	0.85				
151	160	3	244.0	242.4	131	1.3%												
160	160	1																1 of 3
162	164	2	264.0	263.4	65	1.0%	0.10	0.00	0.10	100.00%	0.00	0.00	0.00	0.90				
164	166	6	263.4	255.6	367	2.1%	0.72	0.07	0.65	90.00%	0.00	0.00	0.07	0.85				
166	167	3	245.6	245.2	17	2.4%												

Proposed Condition																		
AES INPUT DATA																		
Node #		Code	Elevation		Length (ft)	Slope	Area (Ac)			imperviousness	Soil Type A Area (ac)	Soil Type C Area (ac)	Soil Type D Area (ac)	C value	If Channel			If memory
From	To		Up	Down			total	Pervious	impervious						Base (ft)	Z:1	maning	Bank #
168	167	8					0.21	0.02	0.19	90.00%	0.00	0.00	0.02	0.85				
167	160	3	251.0	244.0	119	5.9%												
160	160	1																2 of 3
172	174	2	255.8	255.0	65	1.2%	0.09	0.01	0.08	90.00%	0.00	0.00	0.01	0.85				
174	176	6	255.0	252.0	305	1.0%	1.32	0.13	1.19	90.00%	0.00	0.00	0.13	0.85				
176	160	3	248.0	244.0	63	6.3%												
160	160	1																3 of 3
160	175	3	220.0	209.5	112	9.4%												
173	175	8					0.42	0.42	0.00	0.00%	0.00	0.00	0.42	0.35				
175	175	10																3
178	180	2	464.0	442.0	65	33.8%	0.10	0.10	0.00	0.00%	0.00	0.00	0.10	0.35				
180	182	5	442.0	312.0	394	33.0%									100	50	0.03	
180	182	8					2.08	2.08	0.00	0.00%	0.00	0.00	2.08	0.35				
184	182	8					0.16	0.16	0.00	0.00%	0.00	0.00	0.16	0.35				
182	182	1																1 of 2
186	188	2	464.2	463.5	65	1.1%	0.10	0.10	0.00	0.00%	0.00	0.00	0.10	0.35				
188	182	5	463.5	312.0	478	31.7%									100	50	0.03	
188	182	8					2.88	2.88	0.00	0.00%	0.00	0.00	2.88	0.35				
182	182	1																2 of 2
182	191	5	312.0	278.0	274	12.4%									3	3	0.015	
192	191	8					0.90	0.90	0.00	0.00%	0.00	0.00	0.90	0.35				
191	193	5	278.0	256.0	66	33.4%									3	3	0.015	
194	193	8					0.54	0.54	0.00	0.00%	0.00	0.00	0.54	0.35				
193	195	5	256.0	244.0	242	5.0%									3	3	0.015	
195	195	1																1 of 2
196	198	2	470.0	461.0	65	13.8%	0.10	0.08	0.02	15.46%	0.00	0.00	0.08	0.42				
198	195	5	461.0	244.0	550	39.5%									14	10	0.03	
198	195	8					2.50	2.50	0.00	0.00%	0.00	0.00	2.50	0.35				
195	195	1																2 of 2
195	175	5	244.0	209.5	333	10.4%									3	2	0.015	
199	175	8					0.50	0.50	0.00	0.00%	0.00	0.00	0.50	0.35				
175	175	1																1 of 2
200	202	2	448.5	426.0	65	34.6%	0.10	0.10	0.00	0.00%	0.00	0.00	0.10	0.35				
202	175	5	426.0	209.5	795	27.2%									80	50	0.03	
202	175	8					2.54	2.54	0.00	0.00%	0.28	0.00	2.26	0.33				
175	175	1																2 of 2
175	175	11																3
175	175	12																3
175	1	5	209.5	204.0	202	2.7%									10	8	0.03	
1	1	11																1
1	1	12																1
1	1	1																1 of 2
131	133	2	245.0	235.0	100	10.0%	0.06	0.01	0.05	90.00%	0.00	0.00	0.01	0.85				
133	137	3	231.0	230.0	35													
133	137	8					0.18	0.18	0.00	0.00%	0.00	0.00	0.18	0.35				
137	1	3	230.0	204.0	2400	1.1%												
137	1	1																2 of 2
Total							29.86	20.47	9.39	31.44%	2.52	2.33	15.64	0.507				

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2015 Advanced Engineering Software (aes)
             Ver. 22.0 Release Date: 07/01/2015  License ID 1239

                           Analysis prepared by:

                   Hunsaker & Associates San Diego, Inc.
                             9707 Waples Street
                            San Diego,  CA 92121


 ************************** DESCRIPTION OF STUDY **************************
* OLIVE PARK APARTMENTS                                                    *
* 100 YR PROPOSED DRAINAGE ANALYSIS                                        *
* DLN 1746 W.O. 3785-0002                                                  *
 **************************************************************************

  FILE NAME: R:\1746\HYD\TM\DR\CALCS\AES\PR\100PR.DAT
  TIME/DATE OF STUDY: 14:30 10/11/2024
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.900
  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   20.0     15.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  2   14.0      9.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  3   18.0     13.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  4   10.0      5.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

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

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    464.00
  DOWNSTREAM ELEVATION(FEET) =    453.00
  ELEVATION DIFFERENCE(FEET) =     11.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.052
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.590
  SUBAREA RUNOFF(CFS) =      0.29
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.29

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

```
 FLOW PROCESS FROM NODE    104.00 TO NODE    106.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    453.00  DOWNSTREAM(FEET) =    254.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   850.00   CHANNEL SLOPE =  0.2341
 CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   3.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.030
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.70
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   6.54
 AVERAGE FLOW DEPTH(FEET) =   0.05   TRAVEL TIME(MIN.) =   2.16
 Tc(MIN.) =    7.22
 SUBAREA AREA(ACRES) =     1.32       SUBAREA RUNOFF(CFS) =    2.79
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
 TOTAL AREA(ACRES) =        1.4         PEAK FLOW RATE(CFS) =       3.02

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.07   FLOW VELOCITY(FEET/SEC.) =   8.09
 LONGEST FLOWPATH FROM NODE    102.00 TO NODE    106.00 =     915.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    106.00 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) =   244.00  DOWNSTREAM(FEET) =   243.40
 FLOW LENGTH(FEET) =    61.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.91
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       3.02
 PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =    7.42
 LONGEST FLOWPATH FROM NODE    102.00 TO NODE    112.00 =     976.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.42
 RAINFALL INTENSITY(INCH/HR) =   5.92
 TOTAL STREAM AREA(ACRES) =     1.43
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.02

****************************************************************************
 FLOW PROCESS FROM NODE    108.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6800
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
 UPSTREAM ELEVATION(FEET) =    264.30
 DOWNSTREAM ELEVATION(FEET) =    263.60
 ELEVATION DIFFERENCE(FEET) =      0.70
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.946
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.832
 SUBAREA RUNOFF(CFS) =      0.65
 TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.65

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

```
  FLOW PROCESS FROM NODE    110.00 TO NODE    112.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  263.60  DOWNSTREAM ELEVATION(FEET) =  256.50
  STREET LENGTH(FEET) =   717.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  15.00
  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) =       8.51
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.38
    HALFSTREET FLOOD WIDTH(FEET) =   12.53
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.52
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.95
  STREET FLOW TRAVEL TIME(MIN.) =   4.74   Tc(MIN.) =   10.68
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.682
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6700
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.670
  SUBAREA AREA(ACRES) =    4.89      SUBAREA RUNOFF(CFS) =   15.34
  TOTAL AREA(ACRES) =        5.0        PEAK FLOW RATE(CFS) =      15.79

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.45   HALFSTREET FLOOD WIDTH(FEET) =  16.04
  FLOW VELOCITY(FEET/SEC.) =  2.93   DEPTH*VELOCITY(FT*FT/SEC.) =   1.31
  LONGEST FLOWPATH FROM NODE    108.00 TO NODE    112.00 =     782.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.68
  RAINFALL INTENSITY(INCH/HR) =   4.68
  TOTAL STREAM AREA(ACRES) =     5.03
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     15.79

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        3.02     7.42        5.921         1.43
      2       15.79    10.68        4.682         5.03

  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       13.99     7.42       5.921
      2       18.17    10.68       4.682

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      18.17   Tc(MIN.) =   10.68
  TOTAL AREA(ACRES) =        6.5
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE    112.00 =     976.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    113.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   238.00  DOWNSTREAM(FEET) =   222.50
  FLOW LENGTH(FEET) =   176.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.59
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      18.17
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =   10.85
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE    113.00 =    1152.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    122.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    264.00
  DOWNSTREAM ELEVATION(FEET) =    263.30
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.832
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.69
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.69

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    124.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  263.30  DOWNSTREAM ELEVATION(FEET) =  256.00
  STREET LENGTH(FEET) =   384.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  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) =       2.38
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.48
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.84
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.84
  STREET FLOW TRAVEL TIME(MIN.) =   2.25   Tc(MIN.) =    5.08
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.562
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7400
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.763
```

```
  SUBAREA AREA(ACRES) =    0.60      SUBAREA RUNOFF(CFS) =    3.36
  TOTAL AREA(ACRES) =        0.7        PEAK FLOW RATE(CFS) =       4.04

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.66
  FLOW VELOCITY(FEET/SEC.) =  3.22   DEPTH*VELOCITY(FT*FT/SEC.) =   1.09
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    124.00 =     449.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    125.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   246.00  DOWNSTREAM(FEET) =   244.00
  FLOW LENGTH(FEET) =   101.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.86
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.04
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =    5.33
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    125.00 =     550.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    125.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.335
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7400
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7576
  SUBAREA AREA(ACRES) =    0.21   SUBAREA RUNOFF(CFS) =    1.14
  TOTAL AREA(ACRES) =        0.9   TOTAL RUNOFF(CFS) =       5.06
  TC(MIN.) =    5.33

****************************************************************************
  FLOW PROCESS FROM NODE    125.00 TO NODE    127.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   244.00  DOWNSTREAM(FEET) =   242.90
  FLOW LENGTH(FEET) =    55.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.32
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.06
  PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =    5.45
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    127.00 =     605.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    128.00 TO NODE    127.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.226
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7400
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7542
  SUBAREA AREA(ACRES) =    0.22   SUBAREA RUNOFF(CFS) =    1.18
  TOTAL AREA(ACRES) =        1.1   TOTAL RUNOFF(CFS) =       6.16
  TC(MIN.) =    5.45

****************************************************************************
  FLOW PROCESS FROM NODE    127.00 TO NODE    142.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   242.90  DOWNSTREAM(FEET) =   227.00
  FLOW LENGTH(FEET) =   208.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.56
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.16
  PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =    5.73
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    142.00 =     813.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    142.00 TO NODE    142.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.73
  RAINFALL INTENSITY(INCH/HR) =   7.00
  TOTAL STREAM AREA(ACRES) =     1.13
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.16

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    132.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    264.00
  DOWNSTREAM ELEVATION(FEET) =    262.70
  ELEVATION DIFFERENCE(FEET) =      1.30
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.304
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.69
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.69

****************************************************************************
  FLOW PROCESS FROM NODE    132.00 TO NODE    134.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  262.70  DOWNSTREAM ELEVATION(FEET) =  260.45
  STREET LENGTH(FEET) =   111.00   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) =       1.54
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.26
    HALFSTREET FLOOD WIDTH(FEET) =    6.80
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.64
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.69
  STREET FLOW TRAVEL TIME(MIN.) =   0.70   Tc(MIN.) =    3.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
```

```
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7400
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.780
  SUBAREA AREA(ACRES) =    0.30      SUBAREA RUNOFF(CFS) =    1.70
  TOTAL AREA(ACRES) =        0.4        PEAK FLOW RATE(CFS) =       2.38

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.38
  FLOW VELOCITY(FEET/SEC.) =  2.91   DEPTH*VELOCITY(FT*FT/SEC.) =   0.85
  LONGEST FLOWPATH FROM NODE    130.00 TO NODE    134.00 =     176.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    134.00 TO NODE    135.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   250.45  DOWNSTREAM(FEET) =   249.70
  FLOW LENGTH(FEET) =    74.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.66
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.38
  PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =    3.27
  LONGEST FLOWPATH FROM NODE    130.00 TO NODE    135.00 =     250.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    136.00 TO NODE    135.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7718
  SUBAREA AREA(ACRES) =    0.15   SUBAREA RUNOFF(CFS) =    0.86
  TOTAL AREA(ACRES) =        0.6   TOTAL RUNOFF(CFS) =       3.24
  TC(MIN.) =    3.27

****************************************************************************
  FLOW PROCESS FROM NODE    135.00 TO NODE    142.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   249.70  DOWNSTREAM(FEET) =   227.00
  FLOW LENGTH(FEET) =   296.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.47
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.24
  PIPE TRAVEL TIME(MIN.) =   0.47    Tc(MIN.) =    3.74
  LONGEST FLOWPATH FROM NODE    130.00 TO NODE    142.00 =     546.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    142.00 TO NODE    142.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.74
  RAINFALL INTENSITY(INCH/HR) =   7.64
  TOTAL STREAM AREA(ACRES) =     0.55
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.24
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    138.00 TO NODE    140.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7400
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    263.00
  DOWNSTREAM ELEVATION(FEET) =    262.30
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.097
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.547
  SUBAREA RUNOFF(CFS) =      0.56
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.56

****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    142.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  262.30  DOWNSTREAM ELEVATION(FEET) =  233.00
  STREET LENGTH(FEET) =   245.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  15.00
  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) =       1.97
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.17
    HALFSTREET FLOOD WIDTH(FEET) =    2.35
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.68
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.98
  STREET FLOW TRAVEL TIME(MIN.) =   0.72   Tc(MIN.) =    5.82
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.931
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7400
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.740
  SUBAREA AREA(ACRES) =    0.55      SUBAREA RUNOFF(CFS) =    2.82
  TOTAL AREA(ACRES) =        0.7        PEAK FLOW RATE(CFS) =       3.33

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.21   HALFSTREET FLOOD WIDTH(FEET) =   4.21
  FLOW VELOCITY(FEET/SEC.) =  5.65   DEPTH*VELOCITY(FT*FT/SEC.) =   1.19
  LONGEST FLOWPATH FROM NODE    138.00 TO NODE    142.00 =     310.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    142.00 TO NODE    142.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.82
  RAINFALL INTENSITY(INCH/HR) =   6.93
  TOTAL STREAM AREA(ACRES) =     0.65
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.33

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
```

```
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        6.16     5.73        6.999         1.13
      2        3.24     3.74        7.641         0.55
      3        3.33     5.82        6.931         0.65

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        9.41     3.74       7.641
      2       12.41     5.73       6.999
      3       12.37     5.82       6.931

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      12.41   Tc(MIN.) =    5.73
  TOTAL AREA(ACRES) =        2.3
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    142.00 =     813.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    142.00 TO NODE    145.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   222.00  DOWNSTREAM(FEET) =   221.50
  FLOW LENGTH(FEET) =    10.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.95
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.41
  PIPE TRAVEL TIME(MIN.) =   0.01    Tc(MIN.) =    5.74
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    145.00 =     823.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    145.00 TO NODE    145.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    116.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    242.70
  DOWNSTREAM ELEVATION(FEET) =    242.00
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   11.326
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.509
  SUBAREA RUNOFF(CFS) =      0.14
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.14

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    118.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    242.00  DOWNSTREAM(FEET) =    235.30
  CHANNEL LENGTH THRU SUBAREA(FEET) =   758.00   CHANNEL SLOPE =  0.0088
  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) =  3.540
  *USER SPECIFIED(SUBAREA):
```

```
 USER-SPECIFIED RUNOFF COEFFICIENT = .3300
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.89
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.45
 AVERAGE FLOW DEPTH(FEET) =   0.16   TRAVEL TIME(MIN.) =   5.15
 Tc(MIN.) =   16.48
 SUBAREA AREA(ACRES) =     1.29       SUBAREA RUNOFF(CFS) =    1.51
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.328
 TOTAL AREA(ACRES) =        1.4         PEAK FLOW RATE(CFS) =       1.61

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.22   FLOW VELOCITY(FEET/SEC.) =   2.94
 LONGEST FLOWPATH FROM NODE    114.00 TO NODE    118.00 =     823.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    118.00 TO NODE    119.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   225.00  DOWNSTREAM(FEET) =   224.80
 FLOW LENGTH(FEET) =    25.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.84
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       1.61
 PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =   16.59
 LONGEST FLOWPATH FROM NODE    114.00 TO NODE    119.00 =     848.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    118.00 TO NODE    119.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.525
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8700
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.4775
 SUBAREA AREA(ACRES) =    0.53   SUBAREA RUNOFF(CFS) =    1.63
 TOTAL AREA(ACRES) =        1.9   TOTAL RUNOFF(CFS) =       3.23
 TC(MIN.) =   16.59

****************************************************************************
 FLOW PROCESS FROM NODE    119.00 TO NODE    113.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   224.80  DOWNSTREAM(FEET) =   223.00
 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   7.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.04
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       3.23
 PIPE TRAVEL TIME(MIN.) =   0.60    Tc(MIN.) =   17.18
 LONGEST FLOWPATH FROM NODE    114.00 TO NODE    113.00 =    1028.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    119.00 TO NODE    113.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.446
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.4618
 SUBAREA AREA(ACRES) =    0.27   SUBAREA RUNOFF(CFS) =    0.33
```

```
  TOTAL AREA(ACRES) =        2.2   TOTAL RUNOFF(CFS) =       3.49
  TC(MIN.) =   17.18

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 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        3.49    17.18       3.446        2.19
  LONGEST FLOWPATH FROM NODE    114.00 TO NODE    113.00 =    1028.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       18.17    10.85       4.635        6.46
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE    113.00 =    1152.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      20.37      10.85        4.635
      2      16.99      17.18        3.446

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      20.37   Tc(MIN.) =   10.85
  TOTAL AREA(ACRES) =        8.6

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    145.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   223.00  DOWNSTREAM(FEET) =   221.50
  FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.02
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      20.37
  PIPE TRAVEL TIME(MIN.) =   0.29    Tc(MIN.) =   11.14
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE    145.00 =    1292.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    145.00 TO NODE    145.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       20.37    11.14       4.557        8.65
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE    145.00 =    1292.00 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       12.41     5.74       6.989        2.33
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    145.00 =     823.00 FEET.

  ** PEAK FLOW RATE TABLE **
```

```
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      22.91       5.74        6.989
     2      28.47      11.14        4.557

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      28.47   Tc(MIN.) =   11.14
 TOTAL AREA(ACRES) =       11.0

****************************************************************************
 FLOW PROCESS FROM NODE    145.00 TO NODE    145.00 IS CODE =  12
----------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    145.00 TO NODE    143.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   221.50  DOWNSTREAM(FEET) =   220.00
 FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  10.47
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      28.47
 PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =   11.29
 LONGEST FLOWPATH FROM NODE    102.00 TO NODE    143.00 =    1382.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    143.00 TO NODE    143.00 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.) =   11.29
 RAINFALL INTENSITY(INCH/HR) =   4.52
 TOTAL STREAM AREA(ACRES) =    10.98
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     28.47

****************************************************************************
 FLOW PROCESS FROM NODE    139.00 TO NODE    141.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .2000
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =    238.00
 DOWNSTREAM ELEVATION(FEET) =    234.00
 ELEVATION DIFFERENCE(FEET) =      4.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.206
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.822
 SUBAREA RUNOFF(CFS) =      0.12
 TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.12

****************************************************************************
 FLOW PROCESS FROM NODE    141.00 TO NODE    143.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    234.00  DOWNSTREAM(FEET) =    220.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =  1080.00   CHANNEL SLOPE =  0.0130
 CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   8.000
 MANNING'S FACTOR = 0.023   MAXIMUM DEPTH(FEET) =   2.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.359
 *USER SPECIFIED(SUBAREA):
```

```
  USER-SPECIFIED RUNOFF COEFFICIENT = .2000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.32
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.87
  AVERAGE FLOW DEPTH(FEET) =   0.04   TRAVEL TIME(MIN.) =  20.71
  Tc(MIN.) =   30.92
  SUBAREA AREA(ACRES) =     0.81       SUBAREA RUNOFF(CFS) =    0.38
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.200
  TOTAL AREA(ACRES) =        0.9         PEAK FLOW RATE(CFS) =       0.44

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.05   FLOW VELOCITY(FEET/SEC.) =   0.87
  LONGEST FLOWPATH FROM NODE    139.00 TO NODE    143.00 =    1180.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    143.00 TO NODE    143.00 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.) =   30.92
  RAINFALL INTENSITY(INCH/HR) =   2.36
  TOTAL STREAM AREA(ACRES) =     0.93
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.44

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       28.47    11.29        4.520         10.98
      2        0.44    30.92        2.359          0.93

  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       28.63    11.29       4.520
      2       15.30    30.92       2.359

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      28.63   Tc(MIN.) =   11.29
  TOTAL AREA(ACRES) =       11.9
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE    143.00 =    1382.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    143.00 TO NODE      1.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    220.00  DOWNSTREAM(FEET) =    204.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   950.00   CHANNEL SLOPE =  0.0168
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.873
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .2000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      28.83
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.19
  AVERAGE FLOW DEPTH(FEET) =   0.42   TRAVEL TIME(MIN.) =   3.05
  Tc(MIN.) =   14.34
  SUBAREA AREA(ACRES) =     0.53       SUBAREA RUNOFF(CFS) =    0.41
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.557
  TOTAL AREA(ACRES) =       12.4         PEAK FLOW RATE(CFS) =      28.63

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.41   FLOW VELOCITY(FEET/SEC.) =   5.19
```

```
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE      1.00 =    2332.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    148.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    264.00
  DOWNSTREAM ELEVATION(FEET) =    262.50
  ELEVATION DIFFERENCE(FEET) =      1.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.196
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.69
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.69

****************************************************************************
  FLOW PROCESS FROM NODE    148.00 TO NODE    150.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  262.50  DOWNSTREAM ELEVATION(FEET) =  255.00
  STREET LENGTH(FEET) =   507.00   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) =       5.46
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.38
    HALFSTREET FLOOD WIDTH(FEET) =   12.74
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.13
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.19
  STREET FLOW TRAVEL TIME(MIN.) =   2.70   Tc(MIN.) =    4.89
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.853
  SUBAREA AREA(ACRES) =    1.47      SUBAREA RUNOFF(CFS) =    9.55
  TOTAL AREA(ACRES) =       1.6       PEAK FLOW RATE(CFS) =      10.23

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.45   HALFSTREET FLOOD WIDTH(FEET) =  16.40
  FLOW VELOCITY(FEET/SEC.) =  3.65   DEPTH*VELOCITY(FT*FT/SEC.) =   1.66
  LONGEST FLOWPATH FROM NODE    146.00 TO NODE    150.00 =     572.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    151.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```

```
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   245.00  DOWNSTREAM(FEET) =   244.00
  FLOW LENGTH(FEET) =    88.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  14.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.84
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.23
  PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =    5.11
  LONGEST FLOWPATH FROM NODE    146.00 TO NODE    151.00 =     660.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE    152.00 TO NODE    151.00 IS CODE =  81
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.538
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8527
  SUBAREA AREA(ACRES) =    0.25   SUBAREA RUNOFF(CFS) =    1.60
  TOTAL AREA(ACRES) =        1.8   TOTAL RUNOFF(CFS) =      11.70
  TC(MIN.) =    5.11

********************************************************************************
  FLOW PROCESS FROM NODE    151.00 TO NODE    160.00 IS CODE =  31
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   244.00  DOWNSTREAM(FEET) =   242.40
  FLOW LENGTH(FEET) =   131.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.48
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.70
  PIPE TRAVEL TIME(MIN.) =   0.29    Tc(MIN.) =    5.40
  LONGEST FLOWPATH FROM NODE    146.00 TO NODE    160.00 =     791.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    160.00 IS CODE =   1
--------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
================================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.40
  RAINFALL INTENSITY(INCH/HR) =   7.27
  TOTAL STREAM AREA(ACRES) =     1.82
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     11.70

********************************************************************************
  FLOW PROCESS FROM NODE    162.00 TO NODE    164.00 IS CODE =  21
--------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
================================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    264.00
  DOWNSTREAM ELEVATION(FEET) =    263.35
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.789
  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) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.69
```

```
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.69

****************************************************************************
  FLOW PROCESS FROM NODE    164.00 TO NODE    166.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  263.35  DOWNSTREAM ELEVATION(FEET) =  255.60
  STREET LENGTH(FEET) =   367.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  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) =       3.03
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.25
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.10
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.97
  STREET FLOW TRAVEL TIME(MIN.) =   1.97   Tc(MIN.) =    4.76
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.856
  SUBAREA AREA(ACRES) =    0.72      SUBAREA RUNOFF(CFS) =    4.68
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       5.36

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.79
  FLOW VELOCITY(FEET/SEC.) =  3.56   DEPTH*VELOCITY(FT*FT/SEC.) =   1.29
  LONGEST FLOWPATH FROM NODE    162.00 TO NODE    166.00 =     432.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    166.00 TO NODE    167.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   245.60  DOWNSTREAM(FEET) =   245.20
  FLOW LENGTH(FEET) =    17.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.89
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.36
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    4.79
  LONGEST FLOWPATH FROM NODE    162.00 TO NODE    167.00 =     449.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    168.00 TO NODE    167.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8549
  SUBAREA AREA(ACRES) =    0.21   SUBAREA RUNOFF(CFS) =    1.36
  TOTAL AREA(ACRES) =        1.0   TOTAL RUNOFF(CFS) =       6.73
```

```
  TC(MIN.) =    4.79

****************************************************************************
  FLOW PROCESS FROM NODE    167.00 TO NODE    160.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   251.00  DOWNSTREAM(FEET) =   244.00
  FLOW LENGTH(FEET) =   119.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.71
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.73
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =    4.96
  LONGEST FLOWPATH FROM NODE    162.00 TO NODE    160.00 =     568.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    160.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.96
  RAINFALL INTENSITY(INCH/HR) =   7.64
  TOTAL STREAM AREA(ACRES) =     1.03
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.73

****************************************************************************
  FLOW PROCESS FROM NODE    172.00 TO NODE    174.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    255.80
  DOWNSTREAM ELEVATION(FEET) =    255.00
  ELEVATION DIFFERENCE(FEET) =      0.80
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.315
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    62.31
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.58
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.58

****************************************************************************
  FLOW PROCESS FROM NODE    174.00 TO NODE    176.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  255.00  DOWNSTREAM ELEVATION(FEET) =  252.00
  STREET LENGTH(FEET) =   305.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  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) =      4.57
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.32
  HALFSTREET FLOOD WIDTH(FEET) =    9.61
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.19
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.70
STREET FLOW TRAVEL TIME(MIN.) =   2.32   Tc(MIN.) =    5.63
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.077
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .8500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
SUBAREA AREA(ACRES) =    1.32      SUBAREA RUNOFF(CFS) =    7.94
TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =      8.48

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.49
FLOW VELOCITY(FEET/SEC.) =  2.53   DEPTH*VELOCITY(FT*FT/SEC.) =   0.95
LONGEST FLOWPATH FROM NODE    172.00 TO NODE    176.00 =    370.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    176.00 TO NODE    160.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   248.00  DOWNSTREAM(FEET) =   244.00
  FLOW LENGTH(FEET) =    63.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.83
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.48
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    5.71
  LONGEST FLOWPATH FROM NODE    172.00 TO NODE    160.00 =    433.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    160.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.71
  RAINFALL INTENSITY(INCH/HR) =   7.01
  TOTAL STREAM AREA(ACRES) =     1.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.48

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       11.70     5.40       7.272          1.82
      2        6.73     4.96       7.641          1.03
      3        8.48     5.71       7.011          1.41

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       24.85     4.96       7.641
      2       26.12     5.40       7.272
      3       25.93     5.71       7.011

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      26.12   Tc(MIN.) =    5.40
  TOTAL AREA(ACRES) =        4.3
  LONGEST FLOWPATH FROM NODE    146.00 TO NODE    160.00 =    791.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    175.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   220.00  DOWNSTREAM(FEET) =   209.50
  FLOW LENGTH(FEET) =   112.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  19.40
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      26.12
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    5.49
  LONGEST FLOWPATH FROM NODE    146.00 TO NODE    175.00 =     903.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    173.00 TO NODE    175.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.190
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8073
  SUBAREA AREA(ACRES) =    0.42   SUBAREA RUNOFF(CFS) =    1.06
  TOTAL AREA(ACRES) =        4.7   TOTAL RUNOFF(CFS) =      27.16
  TC(MIN.) =    5.49

****************************************************************************
  FLOW PROCESS FROM NODE    175.00 TO NODE    175.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    178.00 TO NODE    180.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    464.00
  DOWNSTREAM ELEVATION(FEET) =    442.00
  ELEVATION DIFFERENCE(FEET) =     22.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.052
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.590
  SUBAREA RUNOFF(CFS) =      0.27
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.27

****************************************************************************
  FLOW PROCESS FROM NODE    180.00 TO NODE    182.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    442.00  DOWNSTREAM(FEET) =    312.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   394.00   CHANNEL SLOPE =  0.3299
  CHANNEL BASE(FEET) =  100.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.27
  FLOW VELOCITY(FEET/SEC.) =   0.56   FLOW DEPTH(FEET) =   0.00
  TRAVEL TIME(MIN.) =  11.82   Tc(MIN.) =   16.87
  LONGEST FLOWPATH FROM NODE    178.00 TO NODE    182.00 =     459.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    180.00 TO NODE    182.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.487
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
  SUBAREA AREA(ACRES) =    2.08   SUBAREA RUNOFF(CFS) =    2.54
  TOTAL AREA(ACRES) =        2.2   TOTAL RUNOFF(CFS) =       2.66
  TC(MIN.) =   16.87

****************************************************************************
  FLOW PROCESS FROM NODE    184.00 TO NODE    182.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.487
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
  SUBAREA AREA(ACRES) =    0.16   SUBAREA RUNOFF(CFS) =    0.20
  TOTAL AREA(ACRES) =        2.3   TOTAL RUNOFF(CFS) =       2.86
  TC(MIN.) =   16.87

****************************************************************************
  FLOW PROCESS FROM NODE    182.00 TO NODE    182.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   16.87
  RAINFALL INTENSITY(INCH/HR) =   3.49
  TOTAL STREAM AREA(ACRES) =     2.34
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.86

****************************************************************************
  FLOW PROCESS FROM NODE    186.00 TO NODE    188.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    464.20
  DOWNSTREAM ELEVATION(FEET) =    463.50
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.618
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.701
  SUBAREA RUNOFF(CFS) =      0.16
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.16

****************************************************************************
  FLOW PROCESS FROM NODE    188.00 TO NODE    182.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    463.50  DOWNSTREAM(FEET) =    312.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   478.00   CHANNEL SLOPE =  0.3169
  CHANNEL BASE(FEET) =  100.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.16
  FLOW VELOCITY(FEET/SEC.) =   0.57   FLOW DEPTH(FEET) =   0.00
  TRAVEL TIME(MIN.) =  13.87   Tc(MIN.) =   24.49
  LONGEST FLOWPATH FROM NODE    186.00 TO NODE    182.00 =     543.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    188.00 TO NODE    182.00 IS CODE =  81
```

```
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.742
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
  SUBAREA AREA(ACRES) =    2.88   SUBAREA RUNOFF(CFS) =    2.76
  TOTAL AREA(ACRES) =        3.0   TOTAL RUNOFF(CFS) =       2.86
  TC(MIN.) =   24.49

****************************************************************************
  FLOW PROCESS FROM NODE    182.00 TO NODE    182.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   24.49
  RAINFALL INTENSITY(INCH/HR) =   2.74
  TOTAL STREAM AREA(ACRES) =     2.98
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.86

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        2.86    16.87        3.487          2.34
     2        2.86    24.49        2.742          2.98

  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        4.83    16.87       3.487
     2        5.11    24.49       2.742

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       5.11   Tc(MIN.) =   24.49
  TOTAL AREA(ACRES) =        5.3
  LONGEST FLOWPATH FROM NODE    186.00 TO NODE    182.00 =     543.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    182.00 TO NODE    191.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    312.00  DOWNSTREAM(FEET) =    278.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   274.00   CHANNEL SLOPE =  0.1241
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       5.11
  FLOW VELOCITY(FEET/SEC.) =   9.34   FLOW DEPTH(FEET) =   0.16
  TRAVEL TIME(MIN.) =   0.49   Tc(MIN.) =   24.98
  LONGEST FLOWPATH FROM NODE    186.00 TO NODE    191.00 =     817.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    192.00 TO NODE    191.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.707
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
  SUBAREA AREA(ACRES) =    0.90   SUBAREA RUNOFF(CFS) =    0.85
```

```
 TOTAL AREA(ACRES) =       6.2   TOTAL RUNOFF(CFS) =      5.89
 TC(MIN.) =   24.98

****************************************************************************
 FLOW PROCESS FROM NODE    191.00 TO NODE    193.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    278.00  DOWNSTREAM(FEET) =    256.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =    66.00   CHANNEL SLOPE =  0.3333
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
 CHANNEL FLOW THRU SUBAREA(CFS) =       5.89
 FLOW VELOCITY(FEET/SEC.) =  13.74   FLOW DEPTH(FEET) =   0.13
 TRAVEL TIME(MIN.) =   0.08   Tc(MIN.) =   25.06
 LONGEST FLOWPATH FROM NODE    186.00 TO NODE    193.00 =     883.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    194.00 TO NODE    193.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.702
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
 SUBAREA AREA(ACRES) =    0.54   SUBAREA RUNOFF(CFS) =    0.51
 TOTAL AREA(ACRES) =       6.8   TOTAL RUNOFF(CFS) =      6.39
 TC(MIN.) =   25.06

****************************************************************************
 FLOW PROCESS FROM NODE    193.00 TO NODE    195.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    256.00  DOWNSTREAM(FEET) =    244.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   242.00   CHANNEL SLOPE =  0.0496
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
 CHANNEL FLOW THRU SUBAREA(CFS) =       6.39
 FLOW VELOCITY(FEET/SEC.) =   7.39   FLOW DEPTH(FEET) =   0.23
 TRAVEL TIME(MIN.) =   0.55   Tc(MIN.) =   25.61
 LONGEST FLOWPATH FROM NODE    186.00 TO NODE    195.00 =    1125.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    195.00 TO NODE    195.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   25.61
 RAINFALL INTENSITY(INCH/HR) =   2.66
 TOTAL STREAM AREA(ACRES) =     6.76
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.39

****************************************************************************
 FLOW PROCESS FROM NODE    196.00 TO NODE    198.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .4200
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
 UPSTREAM ELEVATION(FEET) =    470.00
 DOWNSTREAM ELEVATION(FEET) =    461.00
 ELEVATION DIFFERENCE(FEET) =      9.00
```

```
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.581
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.32
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.32

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    195.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    461.00  DOWNSTREAM(FEET) =    244.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   550.00   CHANNEL SLOPE =  0.3945
  CHANNEL BASE(FEET) =   14.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.32
  FLOW VELOCITY(FEET/SEC.) =   1.83   FLOW DEPTH(FEET) =   0.01
  TRAVEL TIME(MIN.) =   5.00   Tc(MIN.) =    9.58
  LONGEST FLOWPATH FROM NODE    196.00 TO NODE    195.00 =     615.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    195.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.022
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3527
  SUBAREA AREA(ACRES) =    2.50   SUBAREA RUNOFF(CFS) =    4.39
  TOTAL AREA(ACRES) =        2.6   TOTAL RUNOFF(CFS) =       4.61
  TC(MIN.) =    9.58

****************************************************************************
  FLOW PROCESS FROM NODE    195.00 TO NODE    195.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.58
  RAINFALL INTENSITY(INCH/HR) =   5.02
  TOTAL STREAM AREA(ACRES) =     2.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.61

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        6.39    25.61        2.664          6.76
      2        4.61     9.58        5.022          2.60

  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        8.00     9.58       5.022
      2        8.84    25.61       2.664

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       8.84   Tc(MIN.) =   25.61
  TOTAL AREA(ACRES) =        9.4
  LONGEST FLOWPATH FROM NODE    186.00 TO NODE    195.00 =    1125.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    195.00 TO NODE    175.00 IS CODE =  51
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    244.00  DOWNSTREAM(FEET) =    209.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   333.00   CHANNEL SLOPE =  0.1036
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       8.84
  FLOW VELOCITY(FEET/SEC.) =  10.91   FLOW DEPTH(FEET) =   0.23
  TRAVEL TIME(MIN.) =   0.51   Tc(MIN.) =   26.12
  LONGEST FLOWPATH FROM NODE    186.00 TO NODE    175.00 =    1458.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    199.00 TO NODE    175.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.631
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3507
  SUBAREA AREA(ACRES) =    0.50   SUBAREA RUNOFF(CFS) =    0.46
  TOTAL AREA(ACRES) =        9.9   TOTAL RUNOFF(CFS) =       9.10
  TC(MIN.) =   26.12

****************************************************************************
  FLOW PROCESS FROM NODE    175.00 TO NODE    175.00 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.) =   26.12
  RAINFALL INTENSITY(INCH/HR) =   2.63
  TOTAL STREAM AREA(ACRES) =     9.86
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.10

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    202.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    448.50
  DOWNSTREAM ELEVATION(FEET) =    426.00
  ELEVATION DIFFERENCE(FEET) =     22.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.052
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.590
  SUBAREA RUNOFF(CFS) =      0.27
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.27

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    175.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    426.00  DOWNSTREAM(FEET) =    209.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   795.00   CHANNEL SLOPE =  0.2723
  CHANNEL BASE(FEET) =   80.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.27
  FLOW VELOCITY(FEET/SEC.) =   0.69   FLOW DEPTH(FEET) =   0.00
  TRAVEL TIME(MIN.) =  19.08   Tc(MIN.) =   24.14
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    175.00 =     860.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    175.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.768
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3300
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3308
  SUBAREA AREA(ACRES) =    2.54   SUBAREA RUNOFF(CFS) =    2.32
  TOTAL AREA(ACRES) =        2.6   TOTAL RUNOFF(CFS) =       2.42
  TC(MIN.) =   24.14

****************************************************************************
  FLOW PROCESS FROM NODE    175.00 TO NODE    175.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   24.14
  RAINFALL INTENSITY(INCH/HR) =   2.77
  TOTAL STREAM AREA(ACRES) =     2.64
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.42

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        9.10    26.12        2.631          9.86
      2        2.42    24.14        2.768          2.64

  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       11.06    24.14       2.768
      2       11.39    26.12       2.631

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      11.39   Tc(MIN.) =   26.12
  TOTAL AREA(ACRES) =       12.5
  LONGEST FLOWPATH FROM NODE    186.00 TO NODE    175.00 =    1458.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    175.00 TO NODE    175.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       11.39    26.12       2.631       12.50
  LONGEST FLOWPATH FROM NODE    186.00 TO NODE    175.00 =    1458.00 FEET.

  ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       27.16     5.49       7.190        4.68
  LONGEST FLOWPATH FROM NODE    146.00 TO NODE    175.00 =     903.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      29.56       5.49        7.190
      2      21.33      26.12        2.631
```

```
  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      29.56   Tc(MIN.) =    5.49
  TOTAL AREA(ACRES) =       17.2

****************************************************************************
  FLOW PROCESS FROM NODE    175.00 TO NODE    175.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    175.00 TO NODE      1.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    209.50  DOWNSTREAM(FEET) =    204.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   202.00   CHANNEL SLOPE =  0.0272
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   8.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =      29.56
  FLOW VELOCITY(FEET/SEC.) =   4.30   FLOW DEPTH(FEET) =   0.49
  TRAVEL TIME(MIN.) =   0.78   Tc(MIN.) =    6.28
  LONGEST FLOWPATH FROM NODE    186.00 TO NODE      1.00 =    1660.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 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       29.56     6.28       6.598       17.18
  LONGEST FLOWPATH FROM NODE    186.00 TO NODE      1.00 =    1660.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       28.63    14.34       3.873       12.44
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE      1.00 =    2332.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      42.09       6.28        6.598
     2      45.98      14.34        3.873

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      45.98   Tc(MIN.) =   14.34
  TOTAL AREA(ACRES) =       29.6

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.34
  RAINFALL INTENSITY(INCH/HR) =   3.87
  TOTAL STREAM AREA(ACRES) =    29.62
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     45.98
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    131.00 TO NODE    133.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    245.00
  DOWNSTREAM ELEVATION(FEET) =    235.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.089
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.39
  TOTAL AREA(ACRES) =      0.06   TOTAL RUNOFF(CFS) =      0.39

****************************************************************************
  FLOW PROCESS FROM NODE    133.00 TO NODE    137.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   231.00  DOWNSTREAM(FEET) =   230.00
  FLOW LENGTH(FEET) =    35.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   1.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.96
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.39
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =    2.24
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE    137.00 =     135.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    133.00 TO NODE    137.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4750
  SUBAREA AREA(ACRES) =    0.18   SUBAREA RUNOFF(CFS) =    0.48
  TOTAL AREA(ACRES) =        0.2   TOTAL RUNOFF(CFS) =       0.87
  TC(MIN.) =    2.24

****************************************************************************
  FLOW PROCESS FROM NODE    137.00 TO NODE      1.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   230.00  DOWNSTREAM(FEET) =   204.00
  FLOW LENGTH(FEET) =  2400.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.56
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.87
  PIPE TRAVEL TIME(MIN.) =  11.24    Tc(MIN.) =   13.47
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE      1.00 =    2535.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    137.00 TO NODE      1.00 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.) =   13.47
  RAINFALL INTENSITY(INCH/HR) =   4.03
  TOTAL STREAM AREA(ACRES) =     0.24
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.87

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       45.98    14.34        3.873        29.62
      2        0.87    13.47        4.031         0.24

  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       44.08    13.47       4.031
      2       46.82    14.34       3.873

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      46.82   Tc(MIN.) =   14.34
  TOTAL AREA(ACRES) =       29.9
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE      1.00 =    2535.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       29.9  TC(MIN.) =     14.34
  PEAK FLOW RATE(CFS)   =      46.82
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

CHAPTER 4

HYDROLOGIC MODEL FOR DEVELOPED CONDITIONS

4.2 – Mitigated 100 Year Storm Event

Proposed Mitigated Condition																		
AES INPUT DATA																		
Node #		Code	Elevation		Length (ft)	Slope	Area (Ac)			imperviousness	Soil Type A Area (ac)	Soil Type C Area (ac)	Soil Type D Area (ac)	C value	If Channel			If memory
From	To		Up	Down			total	Pervious	impervious						Base (ft)	Z:1	maning	Bank #
102	104	2	464.0	453.0	65	16.9%	0.11	0.11	0.00	0.00%	0.00	0.00	0.11	0.35				
104	106	5	453.0	254.0	850	23.4%	1.32	1.32	0.00	0.00%	0.00	0.02	1.30	0.35	5	3	0.015	
106	112	3	244.0	243.4	61	1.1%												
112	112	1																1 of 2
108	110	2	264.3	263.6	65	1.1%	0.14	0.05	0.09	65.00%	0.03	0.00	0.02	0.68				
110	112	6	263.6	256.5	717	1.0%	4.89	1.86	3.03	61.96%	0.04	1.77	0.05	0.67				
112	112	1																2 of 2
112	113	3	238.0	222.5	176	8.8%												
113	113	10																1
120	122	2	264.0	263.3	65	1.1%	0.10	0.00	0.10	100.00%	0.00	0.00	0.00	0.90				
122	124	6	263.3	256.0	384	1.9%	0.60	0.18	0.42	70.00%	0.00	0.00	0.18	0.74				
124	125	3	246.0	244.0	101	2.0%												
126	125	8					0.21	0.06	0.15	70.00%	0.00	0.00	0.06	0.74				
125	127	3	244.0	242.9	55	2.0%												
128	127	8					0.22	0.07	0.15	70.00%	0.00	0.00	0.07	0.74				
127	142	3	242.9	227.0	208	7.6%												
142	142	1																1 of 3
130	132	2	264.0	262.7	65	2.0%	0.10	0.00	0.10	100.00%	0.00	0.00	0.00	0.90				
132	134	6	262.7	260.5	111	2.0%	0.30	0.09	0.21	70.00%	0.00	0.00	0.09	0.74				
134	135	3	250.5	249.7	74	1.0%												
136	135	8					0.15	0.05	0.11	70.00%	0.00	0.00	0.05	0.74				
135	142	3	249.7	227.0	296	7.7%												
142	142	1																2 of 3
138	140	2	263.0	262.3	65	1.1%	0.10	0.03	0.07	70.00%	0.00	0.00	0.03	0.74				
140	142	6	262.3	233.0	245	12.0%	0.55	0.17	0.39	70.00%	0.00	0.00	0.17	0.74				
142	142	1																3 of 3
			Q (CFS)		A (AC)		TC (MIN)											
142	142	7	8.65		2.33		=5.73+2											
142	145	3	222.0	221.5	10	5.0%												
145	145	10																2
114	116	2	242.7	242.0	65	1.0%	0.1	0.10	0.00	0.00%	0.00	0.10	0.00	0.30				
116	118	5	242.0	235.3	758	0.9%									2	2	0.015	
116	118	8					1.29	1.14	0.15	11.63%	0.62	0.52	0.00	0.32				
118	119	3	225.0	224.8	25	0.8%												
118	119	8					0.53	0.03	0.50	95.00%	0.00	0.00	0.03	0.87				
119	113	3	224.8	223.0	180	1.0%												
119	113	8					0.27	0.27	0.00	0.00%	0.00	0.00	0.27	0.35				
113	113	11																1
113	113	12																1
113	145	3	223.0	221.5	140	1.1%												
145	145	11																2
145	145	12																2
145	143	3	221.5	220.0	90	1.7%												
143	143	1																1 of 2
139	141	2	238.0	234.0	100	4.0%	0.12	0.12	0.00	0.00%	0.12	0.00	0.00	0.20				
141	143	5	234.0	220.0	1080	1.3%	0.81	0.81	0.00	0.00%	0.81	0.00	0.00	0.20	10	8	0.023	
143	143	1																2 of 2
143	1	5	220.0	204.0	950	1.7%	0.53	0.53	0.00	0.00%	0.53	0.00	0.00	0.20	5	20	0.015	
1	1	10																1
146	148	2	264.0	262.5	65	2.3%	0.10	0.00	0.10	100.00%	0.00	0.00	0.00	0.90				
148	150	6	262.5	255.0	507	1.5%	1.47	0.15	1.32	90.00%	0.00	0.00	0.15	0.85				
150	151	3	245.0	244.0	88	1.1%												
152	151	8					0.25	0.03	0.23	90.00%	0.00	0.00	0.03	0.85				
151	160	3	244.0	242.4	131	1.3%												
160	160	1																1 of 3
162	164	2	264.0	263.4	65	1.0%	0.10	0.00	0.10	100.00%	0.00	0.00	0.00	0.90				
164	166	6	263.4	255.6	367	2.1%	0.72	0.07	0.65	90.00%	0.00	0.00	0.07	0.85				
166	167	3	245.6	245.2	17	2.4%												

Proposed Mitigated Condition

AES INPUT DATA

Node #		Code	Elevation		Length (ft)	Slope	Area (Ac)			imperviousness	Soil Type A Area (ac)	Soil Type C Area (ac)	Soil Type D Area (ac)	C value	If Channel			If memory
From	To		Up	Down			total	Pervious	impervious						Base (ft)	Z:1	maning	Bank #
168	167	8					0.21	0.02	0.19	90.00%	0.00	0.00	0.02	0.85				
167	160	3	251.0	244.0	119	5.9%												
160	160	1																2 of 3
172	174	2	255.8	255.0	65	1.2%	0.09	0.01	0.08	90.00%	0.00	0.00	0.01	0.85				
174	176	6	255.0	252.0	305	1.0%	1.32	0.13	1.19	90.00%	0.00	0.00	0.13	0.85				
176	160	3	248.0	244.0	63	6.3%												
160	160	1																3 of 3
			Q (CFS)		A (AC)		TC (MIN)											
160	160	7	9.65		4.26		=5.40+5											
160	175	3	220.0	209.5	112	9.4%												
173	175	8					0.42	0.42	0.00	0.00%	0.00	0.00	0.42	0.35				
175	175	10																3
178	180	2	464.0	442.0	65	33.8%	0.10	0.10	0.00	0.00%	0.00	0.00	0.10	0.35				
180	182	5	442.0	312.0	394	33.0%									100	50	0.03	
180	182	8					2.08	2.08	0.00	0.00%	0.00	0.00	2.08	0.35				
184	182	8					0.16	0.16	0.00	0.00%	0.00	0.00	0.16	0.35				
182	182	1																1 of 2
186	188	2	464.2	463.5	65	1.1%	0.10	0.10	0.00	0.00%	0.00	0.00	0.10	0.35				
188	182	5	463.5	312.0	478	31.7%									100	50	0.03	
188	182	8					2.88	2.88	0.00	0.00%	0.00	0.00	2.88	0.35				
182	182	1																2 of 2
182	191	5	312.0	278.0	274	12.4%									3	3	0.015	
192	191	8					0.90	0.90	0.00	0.00%	0.00	0.00	0.90	0.35				
191	193	5	278.0	256.0	66	33.4%									3	3	0.015	
194	193	8					0.54	0.54	0.00	0.00%	0.00	0.00	0.54	0.35				
193	195	5	256.0	244.0	242	5.0%									3	3	0.015	
195	195	1																1 of 2
196	198	2	470.0	461.0	65	13.8%	0.10	0.08	0.02	15.46%	0.00	0.00	0.08	0.42				
198	195	5	461.0	244.0	550	39.5%									14	10	0.03	
198	195	8					2.50	2.50	0.00	0.00%	0.00	0.00	2.50	0.35				
195	195	1																2 of 2
195	175	5	244.0	209.5	333	10.4%									3	2	0.015	
199	175	8					0.50	0.50	0.00	0.00%	0.00	0.00	0.50	0.35				
175	175	1																1 of 2
200	202	2	448.5	426.0	65	34.6%	0.10	0.10	0.00	0.00%	0.00	0.00	0.10	0.35				
202	175	5	426.0	209.5	795	27.2%									80	50	0.03	
202	175	8					2.54	2.54	0.00	0.00%	0.28	0.00	2.26	0.33				
175	175	1																2 of 2
175	175	11																3
175	175	12																3
175	1	5	209.5	204.0	202	2.7%									10	8	0.03	
1	1	11																1
1	1	12																1
1	1	1																1 of 2
131	133	2	245.0	235.0	100	10.0%	0.06	0.01	0.05	90.00%	0.00	0.00	0.01	0.85				
			Q (CFS)		A (AC)		TC (MIN)											
133	133	7	0.12		0.06		=2+4											
133	137	3	231.0	230.0	35													
133	137	8					0.18	0.18	0.00	0.00%	0.00	0.00	0.18	0.35				
137	1	3	230.0	204.0	2400	1.1%												
137	1	1																2 of 2
Total							29.86	20.47	9.39	31.44%	2.52	2.33	15.63	0.506				

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            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2015 Advanced Engineering Software (aes)
             Ver. 22.0 Release Date: 07/01/2015  License ID 1239

                           Analysis prepared by:

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                              9707 Waples Street
                             San Diego,  CA 92121


 ************************** DESCRIPTION OF STUDY **************************
* OLIVE PARK APARTMENTS                                                    *
* 100 YR PROPOSED MITIGATED DRAINAGE ANALYSIS                              *
* DLN 1746 W.O. 3785-0002                                                  *
 **************************************************************************

  FILE NAME: R:\1746\HYD\TM\DR\CALCS\AES\MIT\100MIT.DAT
  TIME/DATE OF STUDY: 15:12 10/11/2024
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.900
  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   20.0     15.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  2   14.0      9.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  3   18.0     13.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  4   10.0      5.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

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

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    464.00
  DOWNSTREAM ELEVATION(FEET) =    453.00
  ELEVATION DIFFERENCE(FEET) =     11.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.052
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.590
  SUBAREA RUNOFF(CFS) =      0.29
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.29

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

```
 FLOW PROCESS FROM NODE    104.00 TO NODE    106.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    453.00  DOWNSTREAM(FEET) =    254.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   850.00   CHANNEL SLOPE =  0.2341
 CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   3.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.030
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.70
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   6.54
 AVERAGE FLOW DEPTH(FEET) =   0.05   TRAVEL TIME(MIN.) =   2.16
 Tc(MIN.) =    7.22
 SUBAREA AREA(ACRES) =     1.32       SUBAREA RUNOFF(CFS) =    2.79
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
 TOTAL AREA(ACRES) =        1.4         PEAK FLOW RATE(CFS) =       3.02

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.07   FLOW VELOCITY(FEET/SEC.) =   8.09
 LONGEST FLOWPATH FROM NODE    102.00 TO NODE    106.00 =     915.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    106.00 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) =   244.00  DOWNSTREAM(FEET) =   243.40
 FLOW LENGTH(FEET) =    61.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.91
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       3.02
 PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =    7.42
 LONGEST FLOWPATH FROM NODE    102.00 TO NODE    112.00 =     976.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.42
 RAINFALL INTENSITY(INCH/HR) =   5.92
 TOTAL STREAM AREA(ACRES) =     1.43
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.02

****************************************************************************
 FLOW PROCESS FROM NODE    108.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6800
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
 UPSTREAM ELEVATION(FEET) =    264.30
 DOWNSTREAM ELEVATION(FEET) =    263.60
 ELEVATION DIFFERENCE(FEET) =      0.70
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.946
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.832
 SUBAREA RUNOFF(CFS) =      0.65
 TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.65

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```
  FLOW PROCESS FROM NODE    110.00 TO NODE    112.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  263.60  DOWNSTREAM ELEVATION(FEET) =  256.50
  STREET LENGTH(FEET) =   717.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  15.00
  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) =       8.51
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.38
    HALFSTREET FLOOD WIDTH(FEET) =   12.53
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.52
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.95
  STREET FLOW TRAVEL TIME(MIN.) =   4.74   Tc(MIN.) =   10.68
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.682
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6700
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.670
  SUBAREA AREA(ACRES) =    4.89      SUBAREA RUNOFF(CFS) =   15.34
  TOTAL AREA(ACRES) =        5.0        PEAK FLOW RATE(CFS) =      15.79

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.45   HALFSTREET FLOOD WIDTH(FEET) =  16.04
  FLOW VELOCITY(FEET/SEC.) =  2.93   DEPTH*VELOCITY(FT*FT/SEC.) =   1.31
  LONGEST FLOWPATH FROM NODE    108.00 TO NODE    112.00 =     782.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.68
  RAINFALL INTENSITY(INCH/HR) =   4.68
  TOTAL STREAM AREA(ACRES) =     5.03
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     15.79

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        3.02     7.42        5.921         1.43
      2       15.79    10.68        4.682         5.03

  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       13.99     7.42       5.921
      2       18.17    10.68       4.682

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      18.17   Tc(MIN.) =   10.68
  TOTAL AREA(ACRES) =        6.5
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE    112.00 =     976.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    113.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   238.00  DOWNSTREAM(FEET) =   222.50
  FLOW LENGTH(FEET) =   176.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.59
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      18.17
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =   10.85
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE    113.00 =    1152.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    122.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    264.00
  DOWNSTREAM ELEVATION(FEET) =    263.30
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.832
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.69
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.69

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    124.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  263.30  DOWNSTREAM ELEVATION(FEET) =  256.00
  STREET LENGTH(FEET) =   384.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  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) =       2.38
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.48
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.84
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.84
  STREET FLOW TRAVEL TIME(MIN.) =   2.25   Tc(MIN.) =    5.08
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.562
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7400
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.763
```

```
  SUBAREA AREA(ACRES) =    0.60      SUBAREA RUNOFF(CFS) =    3.36
  TOTAL AREA(ACRES) =        0.7        PEAK FLOW RATE(CFS) =       4.04

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.66
  FLOW VELOCITY(FEET/SEC.) =  3.22   DEPTH*VELOCITY(FT*FT/SEC.) =   1.09
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    124.00 =     449.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    125.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   246.00  DOWNSTREAM(FEET) =   244.00
  FLOW LENGTH(FEET) =   101.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.86
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.04
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =    5.33
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    125.00 =     550.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    125.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.335
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7400
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7576
  SUBAREA AREA(ACRES) =    0.21   SUBAREA RUNOFF(CFS) =    1.14
  TOTAL AREA(ACRES) =        0.9   TOTAL RUNOFF(CFS) =       5.06
  TC(MIN.) =    5.33

****************************************************************************
  FLOW PROCESS FROM NODE    125.00 TO NODE    127.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   244.00  DOWNSTREAM(FEET) =   242.90
  FLOW LENGTH(FEET) =    55.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.32
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.06
  PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =    5.45
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    127.00 =     605.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    128.00 TO NODE    127.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.226
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7400
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7542
  SUBAREA AREA(ACRES) =    0.22   SUBAREA RUNOFF(CFS) =    1.18
  TOTAL AREA(ACRES) =        1.1   TOTAL RUNOFF(CFS) =       6.16
  TC(MIN.) =    5.45

****************************************************************************
  FLOW PROCESS FROM NODE    127.00 TO NODE    142.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   242.90  DOWNSTREAM(FEET) =   227.00
  FLOW LENGTH(FEET) =   208.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.56
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.16
  PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =    5.73
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    142.00 =     813.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    142.00 TO NODE    142.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.73
  RAINFALL INTENSITY(INCH/HR) =   7.00
  TOTAL STREAM AREA(ACRES) =     1.13
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.16

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    132.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    264.00
  DOWNSTREAM ELEVATION(FEET) =    262.70
  ELEVATION DIFFERENCE(FEET) =      1.30
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.304
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.69
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.69

****************************************************************************
  FLOW PROCESS FROM NODE    132.00 TO NODE    134.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  262.70  DOWNSTREAM ELEVATION(FEET) =  260.45
  STREET LENGTH(FEET) =   111.00   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) =       1.54
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.26
    HALFSTREET FLOOD WIDTH(FEET) =    6.80
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.64
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.69
  STREET FLOW TRAVEL TIME(MIN.) =   0.70   Tc(MIN.) =    3.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
```

```
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .7400
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.780
 SUBAREA AREA(ACRES) =    0.30      SUBAREA RUNOFF(CFS) =    1.70
 TOTAL AREA(ACRES) =        0.4        PEAK FLOW RATE(CFS) =       2.38

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.38
 FLOW VELOCITY(FEET/SEC.) =  2.91   DEPTH*VELOCITY(FT*FT/SEC.) =   0.85
 LONGEST FLOWPATH FROM NODE    130.00 TO NODE    134.00 =     176.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    134.00 TO NODE    135.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   250.45  DOWNSTREAM(FEET) =   249.70
 FLOW LENGTH(FEET) =    74.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.66
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.38
 PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =    3.27
 LONGEST FLOWPATH FROM NODE    130.00 TO NODE    135.00 =     250.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    136.00 TO NODE    135.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.7718
 SUBAREA AREA(ACRES) =    0.15   SUBAREA RUNOFF(CFS) =    0.86
 TOTAL AREA(ACRES) =        0.6   TOTAL RUNOFF(CFS) =       3.24
 TC(MIN.) =    3.27

****************************************************************************
 FLOW PROCESS FROM NODE    135.00 TO NODE    142.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   249.70  DOWNSTREAM(FEET) =   227.00
 FLOW LENGTH(FEET) =   296.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  10.47
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       3.24
 PIPE TRAVEL TIME(MIN.) =   0.47    Tc(MIN.) =    3.74
 LONGEST FLOWPATH FROM NODE    130.00 TO NODE    142.00 =     546.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    142.00 TO NODE    142.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    3.74
 RAINFALL INTENSITY(INCH/HR) =   7.64
 TOTAL STREAM AREA(ACRES) =     0.55
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.24
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    138.00 TO NODE    140.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7400
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    263.00
  DOWNSTREAM ELEVATION(FEET) =    262.30
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.097
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.547
  SUBAREA RUNOFF(CFS) =      0.56
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.56

****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    142.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  262.30  DOWNSTREAM ELEVATION(FEET) =  233.00
  STREET LENGTH(FEET) =   245.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  15.00
  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) =       1.97
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.17
    HALFSTREET FLOOD WIDTH(FEET) =    2.35
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.68
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.98
  STREET FLOW TRAVEL TIME(MIN.) =   0.72   Tc(MIN.) =    5.82
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.931
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7400
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.740
  SUBAREA AREA(ACRES) =    0.55      SUBAREA RUNOFF(CFS) =    2.82
  TOTAL AREA(ACRES) =       0.7       PEAK FLOW RATE(CFS) =       3.33

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.21   HALFSTREET FLOOD WIDTH(FEET) =   4.21
  FLOW VELOCITY(FEET/SEC.) =  5.65   DEPTH*VELOCITY(FT*FT/SEC.) =   1.19
  LONGEST FLOWPATH FROM NODE    138.00 TO NODE    142.00 =     310.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    142.00 TO NODE    142.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.82
  RAINFALL INTENSITY(INCH/HR) =   6.93
  TOTAL STREAM AREA(ACRES) =     0.65
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.33

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
```

```
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        6.16     5.73       6.999          1.13
     2        3.24     3.74       7.641          0.55
     3        3.33     5.82       6.931          0.65

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

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1        9.41     3.74      7.641
     2       12.41     5.73      6.999
     3       12.37     5.82      6.931

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      12.41   Tc(MIN.) =    5.73
 TOTAL AREA(ACRES) =        2.3
 LONGEST FLOWPATH FROM NODE    120.00 TO NODE    142.00 =     813.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    142.00 TO NODE    142.00 IS CODE =   7
----------------------------------------------------------------------------
 >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
 USER-SPECIFIED VALUES ARE AS FOLLOWS:
 TC(MIN) =   7.73   RAIN INTENSITY(INCH/HOUR) =  5.77
 TOTAL AREA(ACRES) =     2.33   TOTAL RUNOFF(CFS) =      8.65

****************************************************************************
 FLOW PROCESS FROM NODE    142.00 TO NODE    145.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   222.00  DOWNSTREAM(FEET) =   221.50
 FLOW LENGTH(FEET) =    10.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  11.81
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       8.65
 PIPE TRAVEL TIME(MIN.) =   0.01    Tc(MIN.) =    7.74
 LONGEST FLOWPATH FROM NODE    120.00 TO NODE    145.00 =     823.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    145.00 TO NODE    145.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    114.00 TO NODE    116.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3000
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
 UPSTREAM ELEVATION(FEET) =    242.70
 DOWNSTREAM ELEVATION(FEET) =    242.00
 ELEVATION DIFFERENCE(FEET) =      0.70
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =   11.326
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.509
 SUBAREA RUNOFF(CFS) =      0.14
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.14

****************************************************************************
 FLOW PROCESS FROM NODE    116.00 TO NODE    118.00 IS CODE =  51
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    242.00  DOWNSTREAM(FEET) =    235.30
  CHANNEL LENGTH THRU SUBAREA(FEET) =   758.00   CHANNEL SLOPE =  0.0088
  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) =  3.540
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3300
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.89
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.45
  AVERAGE FLOW DEPTH(FEET) =   0.16   TRAVEL TIME(MIN.) =   5.15
  Tc(MIN.) =   16.48
  SUBAREA AREA(ACRES) =     1.29       SUBAREA RUNOFF(CFS) =    1.51
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.328
  TOTAL AREA(ACRES) =        1.4         PEAK FLOW RATE(CFS) =       1.61

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.22   FLOW VELOCITY(FEET/SEC.) =   2.94
  LONGEST FLOWPATH FROM NODE    114.00 TO NODE    118.00 =     823.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    118.00 TO NODE    119.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   225.00  DOWNSTREAM(FEET) =   224.80
  FLOW LENGTH(FEET) =    25.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.84
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.61
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =   16.59
  LONGEST FLOWPATH FROM NODE    114.00 TO NODE    119.00 =     848.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    118.00 TO NODE    119.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.525
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4775
  SUBAREA AREA(ACRES) =    0.53   SUBAREA RUNOFF(CFS) =    1.63
  TOTAL AREA(ACRES) =        1.9   TOTAL RUNOFF(CFS) =      3.23
  TC(MIN.) =   16.59

****************************************************************************
  FLOW PROCESS FROM NODE    119.00 TO NODE    113.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   224.80  DOWNSTREAM(FEET) =   223.00
  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   7.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.04
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.23
  PIPE TRAVEL TIME(MIN.) =   0.60    Tc(MIN.) =   17.18
  LONGEST FLOWPATH FROM NODE    114.00 TO NODE    113.00 =    1028.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    119.00 TO NODE    113.00 IS CODE =  81
```

```
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.446
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4618
  SUBAREA AREA(ACRES) =    0.27   SUBAREA RUNOFF(CFS) =    0.33
  TOTAL AREA(ACRES) =        2.2   TOTAL RUNOFF(CFS) =       3.49
  TC(MIN.) =   17.18

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 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        3.49    17.18       3.446        2.19
  LONGEST FLOWPATH FROM NODE    114.00 TO NODE    113.00 =    1028.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       18.17    10.85       4.635        6.46
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE    113.00 =    1152.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      20.37      10.85        4.635
     2      16.99      17.18        3.446

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      20.37   Tc(MIN.) =   10.85
  TOTAL AREA(ACRES) =        8.6

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    145.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   223.00  DOWNSTREAM(FEET) =   221.50
  FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.02
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      20.37
  PIPE TRAVEL TIME(MIN.) =   0.29    Tc(MIN.) =   11.14
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE    145.00 =    1292.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    145.00 TO NODE    145.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       20.37    11.14       4.557        8.65
```

```
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE    145.00 =    1292.00 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        8.65     7.74       5.762        2.33
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    145.00 =     823.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      22.81       7.74        5.762
      2      27.21      11.14        4.557

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      27.21   Tc(MIN.) =   11.14
  TOTAL AREA(ACRES) =       11.0

****************************************************************************
  FLOW PROCESS FROM NODE    145.00 TO NODE    145.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    145.00 TO NODE    143.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   221.50  DOWNSTREAM(FEET) =   220.00
  FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  19.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.05
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      27.21
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =   11.29
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE    143.00 =    1382.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    143.00 TO NODE    143.00 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.) =   11.29
  RAINFALL INTENSITY(INCH/HR) =   4.52
  TOTAL STREAM AREA(ACRES) =    10.98
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     27.21

****************************************************************************
  FLOW PROCESS FROM NODE    139.00 TO NODE    141.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .2000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    238.00
  DOWNSTREAM ELEVATION(FEET) =    234.00
  ELEVATION DIFFERENCE(FEET) =      4.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.206
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.822
  SUBAREA RUNOFF(CFS) =      0.12
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.12

****************************************************************************
  FLOW PROCESS FROM NODE    141.00 TO NODE    143.00 IS CODE =  51
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    234.00  DOWNSTREAM(FEET) =    220.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1080.00   CHANNEL SLOPE =  0.0130
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   8.000
  MANNING'S FACTOR = 0.023   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.359
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .2000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.32
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.87
  AVERAGE FLOW DEPTH(FEET) =   0.04   TRAVEL TIME(MIN.) =  20.71
  Tc(MIN.) =   30.92
  SUBAREA AREA(ACRES) =     0.81       SUBAREA RUNOFF(CFS) =    0.38
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.200
  TOTAL AREA(ACRES) =        0.9         PEAK FLOW RATE(CFS) =       0.44

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.05   FLOW VELOCITY(FEET/SEC.) =   0.87
  LONGEST FLOWPATH FROM NODE    139.00 TO NODE    143.00 =    1180.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    143.00 TO NODE    143.00 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.) =   30.92
  RAINFALL INTENSITY(INCH/HR) =   2.36
  TOTAL STREAM AREA(ACRES) =     0.93
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.44

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       27.21    11.29        4.518         10.98
      2        0.44    30.92        2.359          0.93

  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       27.37    11.29       4.518
      2       14.65    30.92       2.359

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      27.37   Tc(MIN.) =   11.29
  TOTAL AREA(ACRES) =       11.9
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE    143.00 =    1382.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    143.00 TO NODE      1.00 IS CODE =  51
------------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    220.00  DOWNSTREAM(FEET) =    204.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   950.00   CHANNEL SLOPE =  0.0168
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.864
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .2000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      27.58
```

```
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.11
  AVERAGE FLOW DEPTH(FEET) =   0.41   TRAVEL TIME(MIN.) =   3.10
  Tc(MIN.) =   14.39
  SUBAREA AREA(ACRES) =     0.53       SUBAREA RUNOFF(CFS) =    0.41
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.537
  TOTAL AREA(ACRES) =       12.4         PEAK FLOW RATE(CFS) =      27.37

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.41   FLOW VELOCITY(FEET/SEC.) =   5.11
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE      1.00 =    2332.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    148.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    264.00
  DOWNSTREAM ELEVATION(FEET) =    262.50
  ELEVATION DIFFERENCE(FEET) =      1.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.196
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.69
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.69

****************************************************************************
  FLOW PROCESS FROM NODE    148.00 TO NODE    150.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  262.50  DOWNSTREAM ELEVATION(FEET) =  255.00
  STREET LENGTH(FEET) =   507.00   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) =       5.46
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.38
    HALFSTREET FLOOD WIDTH(FEET) =   12.74
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.13
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.19
  STREET FLOW TRAVEL TIME(MIN.) =   2.70   Tc(MIN.) =    4.89
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.853
  SUBAREA AREA(ACRES) =    1.47      SUBAREA RUNOFF(CFS) =    9.55
  TOTAL AREA(ACRES) =       1.6        PEAK FLOW RATE(CFS) =      10.23

  END OF SUBAREA STREET FLOW HYDRAULICS:
```

```
  DEPTH(FEET) = 0.45   HALFSTREET FLOOD WIDTH(FEET) =  16.40
  FLOW VELOCITY(FEET/SEC.) =  3.65   DEPTH*VELOCITY(FT*FT/SEC.) =   1.66
  LONGEST FLOWPATH FROM NODE    146.00 TO NODE    150.00 =     572.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    151.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   245.00  DOWNSTREAM(FEET) =   244.00
  FLOW LENGTH(FEET) =    88.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  14.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.84
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.23
  PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =    5.11
  LONGEST FLOWPATH FROM NODE    146.00 TO NODE    151.00 =     660.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    152.00 TO NODE    151.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.538
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8527
  SUBAREA AREA(ACRES) =    0.25   SUBAREA RUNOFF(CFS) =    1.60
  TOTAL AREA(ACRES) =        1.8   TOTAL RUNOFF(CFS) =      11.70
  TC(MIN.) =    5.11

****************************************************************************
  FLOW PROCESS FROM NODE    151.00 TO NODE    160.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   244.00  DOWNSTREAM(FEET) =   242.40
  FLOW LENGTH(FEET) =   131.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.48
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.70
  PIPE TRAVEL TIME(MIN.) =   0.29    Tc(MIN.) =    5.40
  LONGEST FLOWPATH FROM NODE    146.00 TO NODE    160.00 =     791.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    160.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.40
  RAINFALL INTENSITY(INCH/HR) =   7.27
  TOTAL STREAM AREA(ACRES) =     1.82
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     11.70

****************************************************************************
  FLOW PROCESS FROM NODE    162.00 TO NODE    164.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    264.00
  DOWNSTREAM ELEVATION(FEET) =    263.35
```

```
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.789
  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) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.69
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.69

****************************************************************************
  FLOW PROCESS FROM NODE    164.00 TO NODE    166.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  263.35  DOWNSTREAM ELEVATION(FEET) =  255.60
  STREET LENGTH(FEET) =   367.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  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) =       3.03
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.25
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.10
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.97
  STREET FLOW TRAVEL TIME(MIN.) =   1.97   Tc(MIN.) =    4.76
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.856
  SUBAREA AREA(ACRES) =    0.72      SUBAREA RUNOFF(CFS) =    4.68
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       5.36

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.79
  FLOW VELOCITY(FEET/SEC.) =  3.56   DEPTH*VELOCITY(FT*FT/SEC.) =   1.29
  LONGEST FLOWPATH FROM NODE    162.00 TO NODE    166.00 =     432.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    166.00 TO NODE    167.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   245.60  DOWNSTREAM(FEET) =   245.20
  FLOW LENGTH(FEET) =    17.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.89
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.36
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    4.79
  LONGEST FLOWPATH FROM NODE    162.00 TO NODE    167.00 =     449.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    168.00 TO NODE    167.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

```
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8549
  SUBAREA AREA(ACRES) =    0.21   SUBAREA RUNOFF(CFS) =    1.36
  TOTAL AREA(ACRES) =        1.0   TOTAL RUNOFF(CFS) =       6.73
  TC(MIN.) =    4.79

****************************************************************************
  FLOW PROCESS FROM NODE    167.00 TO NODE    160.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   251.00  DOWNSTREAM(FEET) =   244.00
  FLOW LENGTH(FEET) =   119.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.71
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.73
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =    4.96
  LONGEST FLOWPATH FROM NODE    162.00 TO NODE    160.00 =     568.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    160.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.96
  RAINFALL INTENSITY(INCH/HR) =   7.64
  TOTAL STREAM AREA(ACRES) =     1.03
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.73

****************************************************************************
  FLOW PROCESS FROM NODE    172.00 TO NODE    174.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    255.80
  DOWNSTREAM ELEVATION(FEET) =    255.00
  ELEVATION DIFFERENCE(FEET) =      0.80
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.315
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    62.31
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.58
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.58

****************************************************************************
  FLOW PROCESS FROM NODE    174.00 TO NODE    176.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  255.00  DOWNSTREAM ELEVATION(FEET) =  252.00
  STREET LENGTH(FEET) =   305.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00
```

```
  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  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) =       4.57
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.61
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.19
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.70
  STREET FLOW TRAVEL TIME(MIN.) =   2.32   Tc(MIN.) =    5.63
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.077
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
  SUBAREA AREA(ACRES) =    1.32      SUBAREA RUNOFF(CFS) =    7.94
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       8.48

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.49
  FLOW VELOCITY(FEET/SEC.) =  2.53   DEPTH*VELOCITY(FT*FT/SEC.) =   0.95
  LONGEST FLOWPATH FROM NODE    172.00 TO NODE    176.00 =     370.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    176.00 TO NODE    160.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   248.00  DOWNSTREAM(FEET) =   244.00
  FLOW LENGTH(FEET) =    63.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.83
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.48
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    5.71
  LONGEST FLOWPATH FROM NODE    172.00 TO NODE    160.00 =     433.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    160.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.71
  RAINFALL INTENSITY(INCH/HR) =   7.01
  TOTAL STREAM AREA(ACRES) =     1.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.48

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       11.70     5.40        7.272         1.82
      2        6.73     4.96        7.641         1.03
      3        8.48     5.71        7.011         1.41

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
```

```
     1       24.85     4.96       7.641
     2       26.12     5.40       7.272
     3       25.93     5.71       7.011

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      26.12   Tc(MIN.) =    5.40
  TOTAL AREA(ACRES) =        4.3
  LONGEST FLOWPATH FROM NODE    146.00 TO NODE    160.00 =     791.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    160.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  10.40   RAIN INTENSITY(INCH/HOUR) =  4.76
  TOTAL AREA(ACRES) =     4.26   TOTAL RUNOFF(CFS) =      9.65

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    175.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   220.00  DOWNSTREAM(FEET) =   209.50
  FLOW LENGTH(FEET) =   112.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.31
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.65
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =   10.52
  LONGEST FLOWPATH FROM NODE    146.00 TO NODE    175.00 =     903.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    173.00 TO NODE    175.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.728
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4642
  SUBAREA AREA(ACRES) =    0.42   SUBAREA RUNOFF(CFS) =    0.70
  TOTAL AREA(ACRES) =        4.7   TOTAL RUNOFF(CFS) =      10.27
  TC(MIN.) =   10.52

****************************************************************************
  FLOW PROCESS FROM NODE    175.00 TO NODE    175.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    178.00 TO NODE    180.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    464.00
  DOWNSTREAM ELEVATION(FEET) =    442.00
  ELEVATION DIFFERENCE(FEET) =     22.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.052
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.590
  SUBAREA RUNOFF(CFS) =      0.27
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.27
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    180.00 TO NODE    182.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    442.00  DOWNSTREAM(FEET) =    312.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   394.00   CHANNEL SLOPE =  0.3299
  CHANNEL BASE(FEET) =  100.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.27
  FLOW VELOCITY(FEET/SEC.) =   0.56   FLOW DEPTH(FEET) =   0.00
  TRAVEL TIME(MIN.) =  11.82   Tc(MIN.) =   16.87
  LONGEST FLOWPATH FROM NODE    178.00 TO NODE    182.00 =     459.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    180.00 TO NODE    182.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.487
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
  SUBAREA AREA(ACRES) =    2.08   SUBAREA RUNOFF(CFS) =    2.54
  TOTAL AREA(ACRES) =        2.2   TOTAL RUNOFF(CFS) =       2.66
  TC(MIN.) =   16.87

****************************************************************************
  FLOW PROCESS FROM NODE    184.00 TO NODE    182.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.487
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
  SUBAREA AREA(ACRES) =    0.16   SUBAREA RUNOFF(CFS) =    0.20
  TOTAL AREA(ACRES) =        2.3   TOTAL RUNOFF(CFS) =       2.86
  TC(MIN.) =   16.87

****************************************************************************
  FLOW PROCESS FROM NODE    182.00 TO NODE    182.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   16.87
  RAINFALL INTENSITY(INCH/HR) =   3.49
  TOTAL STREAM AREA(ACRES) =     2.34
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.86

****************************************************************************
  FLOW PROCESS FROM NODE    186.00 TO NODE    188.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    464.20
  DOWNSTREAM ELEVATION(FEET) =    463.50
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.618
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.701
  SUBAREA RUNOFF(CFS) =      0.16
```

```
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.16

****************************************************************************
 FLOW PROCESS FROM NODE    188.00 TO NODE    182.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    463.50  DOWNSTREAM(FEET) =    312.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   478.00   CHANNEL SLOPE =  0.3169
 CHANNEL BASE(FEET) =  100.00   "Z" FACTOR =  50.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
 CHANNEL FLOW THRU SUBAREA(CFS) =       0.16
 FLOW VELOCITY(FEET/SEC.) =   0.57   FLOW DEPTH(FEET) =   0.00
 TRAVEL TIME(MIN.) =  13.87   Tc(MIN.) =   24.49
 LONGEST FLOWPATH FROM NODE    186.00 TO NODE    182.00 =     543.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    188.00 TO NODE    182.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.742
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
 SUBAREA AREA(ACRES) =    2.88   SUBAREA RUNOFF(CFS) =    2.76
 TOTAL AREA(ACRES) =        3.0   TOTAL RUNOFF(CFS) =       2.86
 TC(MIN.) =   24.49

****************************************************************************
 FLOW PROCESS FROM NODE    182.00 TO NODE    182.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   24.49
 RAINFALL INTENSITY(INCH/HR) =   2.74
 TOTAL STREAM AREA(ACRES) =     2.98
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.86

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        2.86    16.87        3.487          2.34
     2        2.86    24.49        2.742          2.98

 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        4.83    16.87       3.487
     2        5.11    24.49       2.742

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       5.11   Tc(MIN.) =   24.49
 TOTAL AREA(ACRES) =        5.3
 LONGEST FLOWPATH FROM NODE    186.00 TO NODE    182.00 =     543.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    182.00 TO NODE    191.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    312.00  DOWNSTREAM(FEET) =    278.00
```

```
  CHANNEL LENGTH THRU SUBAREA(FEET) =   274.00   CHANNEL SLOPE =  0.1241
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       5.11
  FLOW VELOCITY(FEET/SEC.) =   9.34   FLOW DEPTH(FEET) =   0.16
  TRAVEL TIME(MIN.) =   0.49   Tc(MIN.) =   24.98
  LONGEST FLOWPATH FROM NODE    186.00 TO NODE    191.00 =     817.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    192.00 TO NODE    191.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.707
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
  SUBAREA AREA(ACRES) =    0.90   SUBAREA RUNOFF(CFS) =    0.85
  TOTAL AREA(ACRES) =        6.2   TOTAL RUNOFF(CFS) =       5.89
  TC(MIN.) =   24.98

****************************************************************************
  FLOW PROCESS FROM NODE    191.00 TO NODE    193.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    278.00  DOWNSTREAM(FEET) =    256.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =    66.00   CHANNEL SLOPE =  0.3333
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       5.89
  FLOW VELOCITY(FEET/SEC.) =  13.74   FLOW DEPTH(FEET) =   0.13
  TRAVEL TIME(MIN.) =   0.08   Tc(MIN.) =   25.06
  LONGEST FLOWPATH FROM NODE    186.00 TO NODE    193.00 =     883.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    194.00 TO NODE    193.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.702
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
  SUBAREA AREA(ACRES) =    0.54   SUBAREA RUNOFF(CFS) =    0.51
  TOTAL AREA(ACRES) =        6.8   TOTAL RUNOFF(CFS) =       6.39
  TC(MIN.) =   25.06

****************************************************************************
  FLOW PROCESS FROM NODE    193.00 TO NODE    195.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    256.00  DOWNSTREAM(FEET) =    244.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   242.00   CHANNEL SLOPE =  0.0496
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       6.39
  FLOW VELOCITY(FEET/SEC.) =   7.39   FLOW DEPTH(FEET) =   0.23
  TRAVEL TIME(MIN.) =   0.55   Tc(MIN.) =   25.61
  LONGEST FLOWPATH FROM NODE    186.00 TO NODE    195.00 =    1125.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    195.00 TO NODE    195.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
```

```
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   25.61
  RAINFALL INTENSITY(INCH/HR) =   2.66
  TOTAL STREAM AREA(ACRES) =     6.76
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.39

****************************************************************************
  FLOW PROCESS FROM NODE    196.00 TO NODE    198.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4200
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    470.00
  DOWNSTREAM ELEVATION(FEET) =    461.00
  ELEVATION DIFFERENCE(FEET) =      9.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.581
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.32
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.32

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    195.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    461.00  DOWNSTREAM(FEET) =    244.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   550.00   CHANNEL SLOPE =  0.3945
  CHANNEL BASE(FEET) =   14.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.32
  FLOW VELOCITY(FEET/SEC.) =   1.83   FLOW DEPTH(FEET) =   0.01
  TRAVEL TIME(MIN.) =   5.00   Tc(MIN.) =    9.58
  LONGEST FLOWPATH FROM NODE    196.00 TO NODE    195.00 =     615.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    195.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.022
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3527
  SUBAREA AREA(ACRES) =    2.50   SUBAREA RUNOFF(CFS) =    4.39
  TOTAL AREA(ACRES) =        2.6   TOTAL RUNOFF(CFS) =       4.61
  TC(MIN.) =    9.58

****************************************************************************
  FLOW PROCESS FROM NODE    195.00 TO NODE    195.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.58
  RAINFALL INTENSITY(INCH/HR) =   5.02
  TOTAL STREAM AREA(ACRES) =     2.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.61

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
```

```
     1        6.39   25.61       2.664          6.76
     2        4.61    9.58       5.022          2.60

 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        8.00     9.58       5.022
     2        8.84    25.61       2.664

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       8.84   Tc(MIN.) =   25.61
 TOTAL AREA(ACRES) =        9.4
 LONGEST FLOWPATH FROM NODE    186.00 TO NODE    195.00 =    1125.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    195.00 TO NODE    175.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    244.00  DOWNSTREAM(FEET) =    209.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   333.00   CHANNEL SLOPE =  0.1036
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
 CHANNEL FLOW THRU SUBAREA(CFS) =       8.84
 FLOW VELOCITY(FEET/SEC.) =  10.91   FLOW DEPTH(FEET) =   0.23
 TRAVEL TIME(MIN.) =   0.51   Tc(MIN.) =   26.12
 LONGEST FLOWPATH FROM NODE    186.00 TO NODE    175.00 =    1458.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    199.00 TO NODE    175.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.631
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3507
 SUBAREA AREA(ACRES) =    0.50   SUBAREA RUNOFF(CFS) =    0.46
 TOTAL AREA(ACRES) =        9.9   TOTAL RUNOFF(CFS) =       9.10
 TC(MIN.) =   26.12

****************************************************************************
 FLOW PROCESS FROM NODE    175.00 TO NODE    175.00 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.) =   26.12
 RAINFALL INTENSITY(INCH/HR) =   2.63
 TOTAL STREAM AREA(ACRES) =     9.86
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.10

****************************************************************************
 FLOW PROCESS FROM NODE    200.00 TO NODE    202.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
 UPSTREAM ELEVATION(FEET) =    448.50
 DOWNSTREAM ELEVATION(FEET) =    426.00
 ELEVATION DIFFERENCE(FEET) =     22.50
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.052
```

```
 WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.590
 SUBAREA RUNOFF(CFS) =      0.27
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.27

****************************************************************************
 FLOW PROCESS FROM NODE    202.00 TO NODE    175.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    426.00  DOWNSTREAM(FEET) =    209.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   795.00   CHANNEL SLOPE =  0.2723
 CHANNEL BASE(FEET) =   80.00   "Z" FACTOR =  50.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
 CHANNEL FLOW THRU SUBAREA(CFS) =       0.27
 FLOW VELOCITY(FEET/SEC.) =   0.69   FLOW DEPTH(FEET) =   0.00
 TRAVEL TIME(MIN.) =  19.08   Tc(MIN.) =   24.14
 LONGEST FLOWPATH FROM NODE    200.00 TO NODE    175.00 =     860.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    202.00 TO NODE    175.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.768
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3300
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3308
 SUBAREA AREA(ACRES) =    2.54   SUBAREA RUNOFF(CFS) =    2.32
 TOTAL AREA(ACRES) =        2.6   TOTAL RUNOFF(CFS) =      2.42
 TC(MIN.) =   24.14

****************************************************************************
 FLOW PROCESS FROM NODE    175.00 TO NODE    175.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   24.14
 RAINFALL INTENSITY(INCH/HR) =   2.77
 TOTAL STREAM AREA(ACRES) =     2.64
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.42

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        9.10    26.12        2.631         9.86
     2        2.42    24.14        2.768         2.64

 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       11.06    24.14       2.768
     2       11.39    26.12       2.631

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      11.39   Tc(MIN.) =   26.12
 TOTAL AREA(ACRES) =       12.5
 LONGEST FLOWPATH FROM NODE    186.00 TO NODE    175.00 =    1458.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    175.00 TO NODE    175.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
```

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

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       11.39    26.12       2.631       12.50
  LONGEST FLOWPATH FROM NODE    186.00 TO NODE    175.00 =    1458.00 FEET.

  ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       10.27    10.52       4.728        4.68
  LONGEST FLOWPATH FROM NODE    146.00 TO NODE    175.00 =     903.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      14.86      10.52        4.728
      2      17.11      26.12        2.631

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      17.11   Tc(MIN.) =   26.12
  TOTAL AREA(ACRES) =       17.2

****************************************************************************
  FLOW PROCESS FROM NODE    175.00 TO NODE    175.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 3 <<<<<
==============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    175.00 TO NODE      1.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    209.50  DOWNSTREAM(FEET) =    204.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   202.00   CHANNEL SLOPE =  0.0272
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   8.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =      17.11
  FLOW VELOCITY(FEET/SEC.) =   3.65   FLOW DEPTH(FEET) =   0.36
  TRAVEL TIME(MIN.) =   0.92   Tc(MIN.) =   27.04
  LONGEST FLOWPATH FROM NODE    186.00 TO NODE      1.00 =    1660.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 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       17.11    27.04       2.572       17.18
  LONGEST FLOWPATH FROM NODE    186.00 TO NODE      1.00 =    1660.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       27.37    14.39       3.864       12.44
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE      1.00 =    2332.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      36.48      14.39        3.864
      2      35.33      27.04        2.572

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      36.48   Tc(MIN.) =   14.39
```

```
  TOTAL AREA(ACRES) =      29.6

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.39
  RAINFALL INTENSITY(INCH/HR) =   3.86
  TOTAL STREAM AREA(ACRES) =    29.62
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     36.48

****************************************************************************
  FLOW PROCESS FROM NODE    131.00 TO NODE    133.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    245.00
  DOWNSTREAM ELEVATION(FEET) =    235.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.089
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.39
  TOTAL AREA(ACRES) =      0.06   TOTAL RUNOFF(CFS) =      0.39

****************************************************************************
  FLOW PROCESS FROM NODE    133.00 TO NODE    133.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   6.00   RAIN INTENSITY(INCH/HOUR) =  6.79
  TOTAL AREA(ACRES) =     0.06   TOTAL RUNOFF(CFS) =      0.12

****************************************************************************
  FLOW PROCESS FROM NODE    133.00 TO NODE    137.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   231.00  DOWNSTREAM(FEET) =   230.00
  FLOW LENGTH(FEET) =    35.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   1.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.77
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.12
  PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =    6.21
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE    137.00 =     135.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    133.00 TO NODE    137.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.643
  *USER SPECIFIED(SUBAREA):
```

```
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3361
  SUBAREA AREA(ACRES) =    0.18   SUBAREA RUNOFF(CFS) =    0.42
  TOTAL AREA(ACRES) =        0.2   TOTAL RUNOFF(CFS) =       0.54
  TC(MIN.) =    6.21

****************************************************************************
  FLOW PROCESS FROM NODE    137.00 TO NODE      1.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   230.00  DOWNSTREAM(FEET) =   204.00
  FLOW LENGTH(FEET) =  2400.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.07
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.54
  PIPE TRAVEL TIME(MIN.) =  13.01    Tc(MIN.) =   19.22
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE      1.00 =    2535.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    137.00 TO NODE      1.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   19.22
  RAINFALL INTENSITY(INCH/HR) =   3.21
  TOTAL STREAM AREA(ACRES) =     0.24
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.54

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       36.48    14.39        3.864        29.62
      2        0.54    19.22        3.206         0.24

  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       36.88    14.39       3.864
      2       30.80    19.22       3.206

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      36.88   Tc(MIN.) =   14.39
  TOTAL AREA(ACRES) =       29.9
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE      1.00 =    2535.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       29.9  TC(MIN.) =     14.39
  PEAK FLOW RATE(CFS)   =      36.88
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

CHAPTER 4

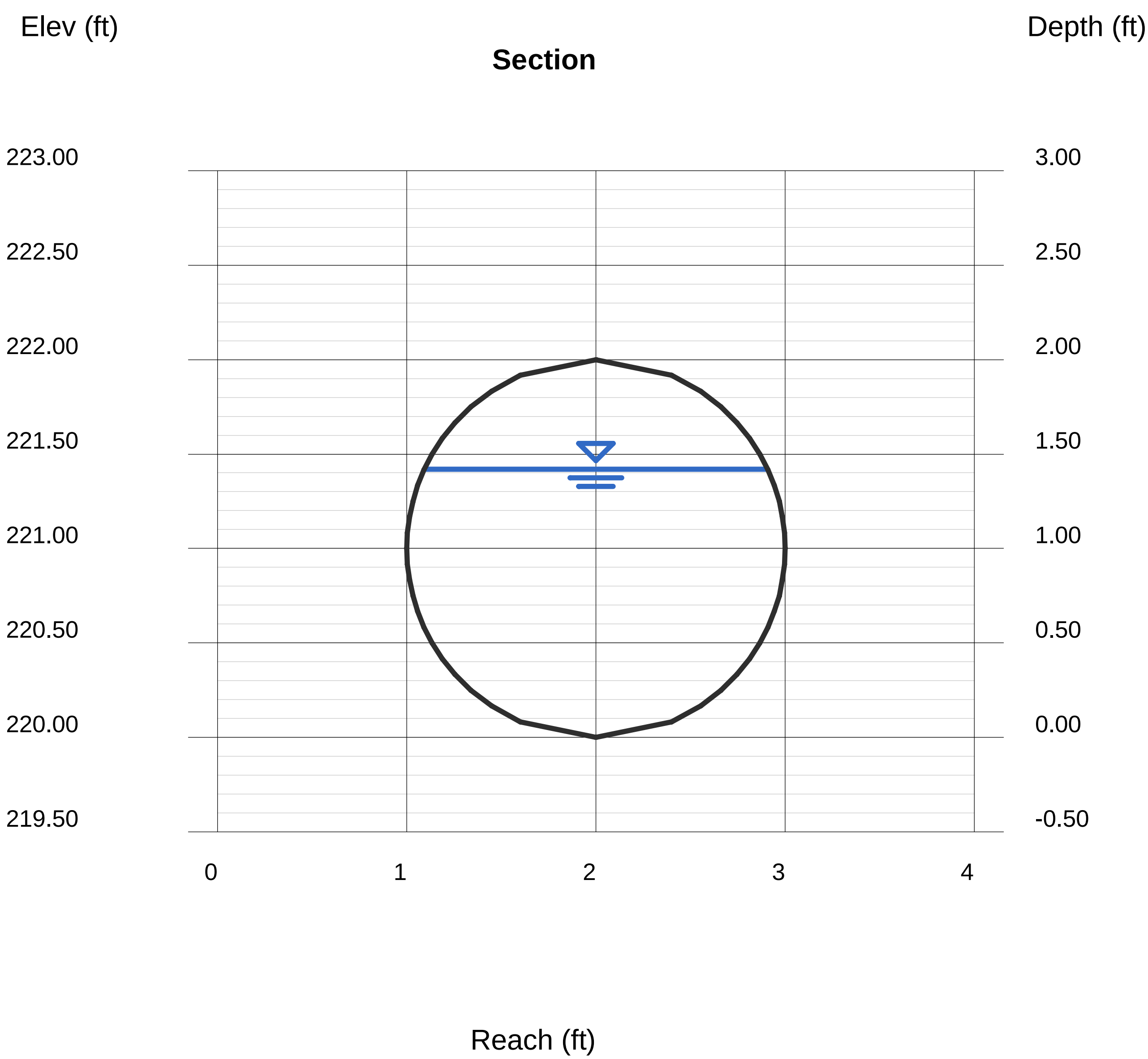
HYDROLOGIC MODEL FOR DEVELOPED CONDITIONS

4.3 – Preliminary Rip Rap Sizing

Channel Report

Outfall @ Node 143 from 145

Circular		**Highlighted**	
Diameter (ft)	= 2.00	Depth (ft)	= 1.42
		Q (cfs)	= 27.21
		Area (sqft)	= 2.39
Invert Elev (ft)	= 220.00	Velocity (ft/s)	= 11.40
Slope (%)	= 2.00	Wetted Perim (ft)	= 4.01
N-Value	= 0.013	Crit Depth, Yc (ft)	= 1.82
		Top Width (ft)	= 1.81
Calculations		EGL (ft)	= 3.44
Compute by:	Known Q		
Known Q (cfs)	= 27.21		



Channel Report

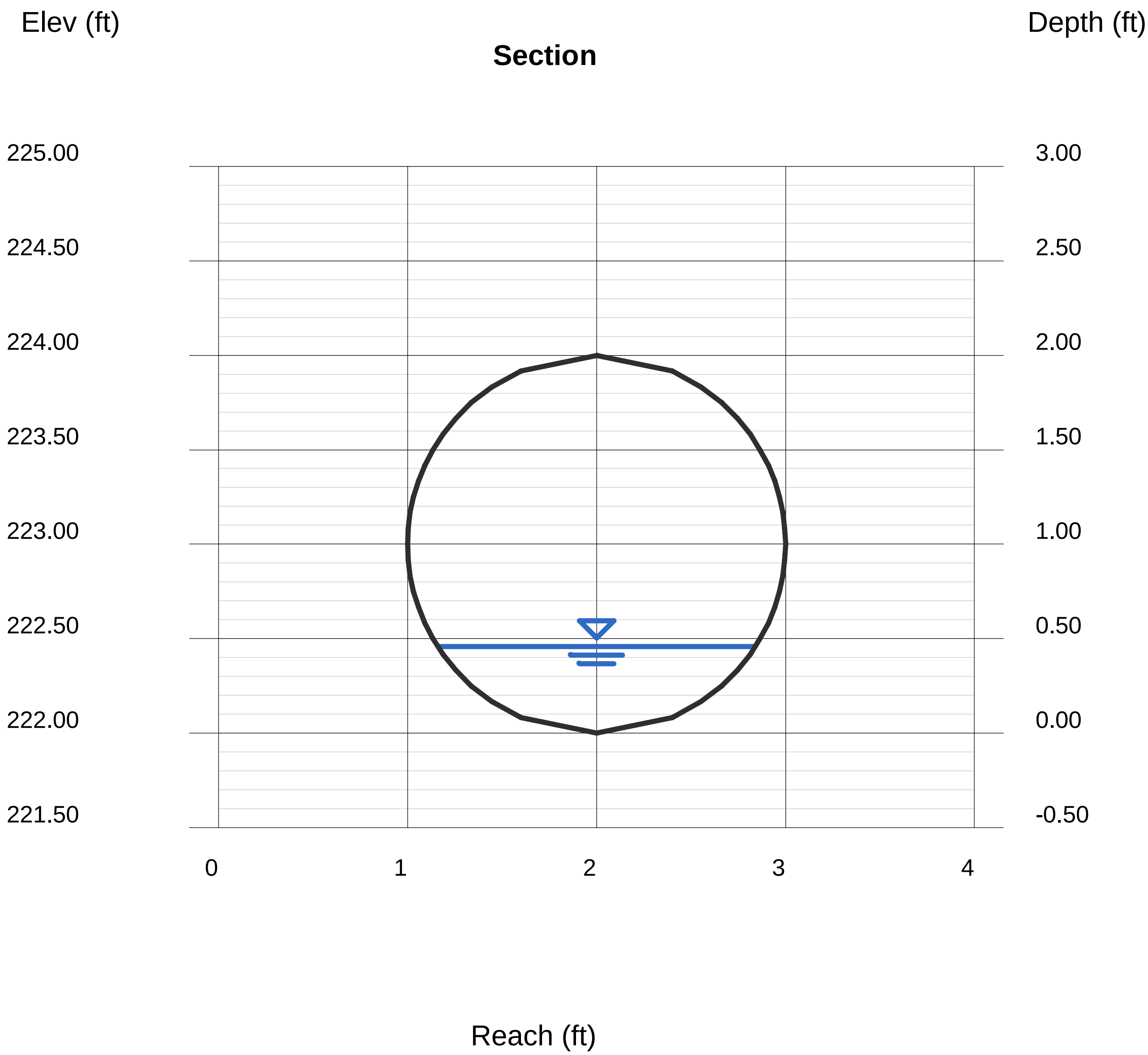
Outfall @ Node 175 from 160

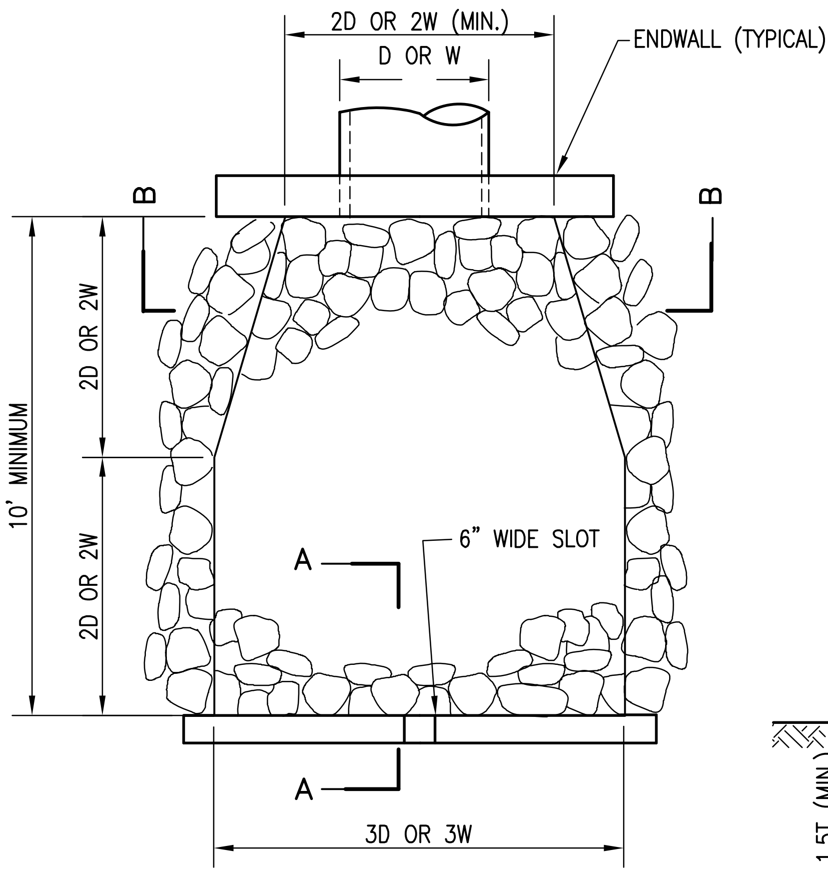
Circular
Diameter (ft) = 2.00

Invert Elev (ft) = 222.00
Slope (%) = 14.00
N-Value = 0.013

Calculations
Compute by: Known Q
Known Q (cfs) = 9.65

Highlighted
Depth (ft) = 0.46
Q (cfs) = 9.650
Area (sqft) = 0.55
Velocity (ft/s) = 17.47
Wetted Perim (ft) = 2.01
Crit Depth, Yc (ft) = 1.11
Top Width (ft) = 1.69
EGL (ft) = 5.20





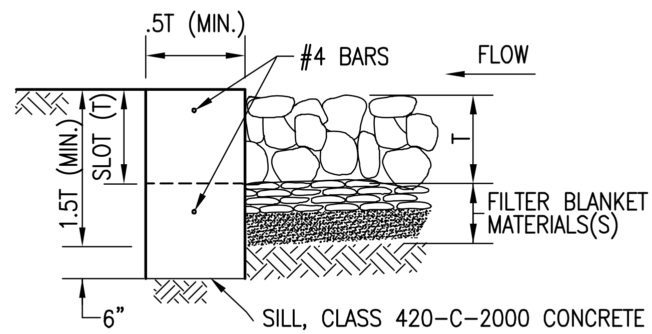
PLAN

TABLE 7-1 (BELOW) PER JULY 2005
SAN DIEGO COUNTY DRAINAGE DESIGN MANUAL

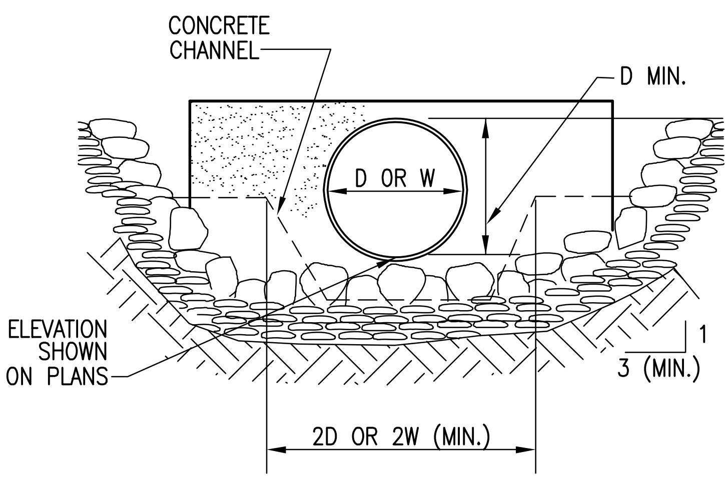
DESIGN VELOCITY (FT/SEC) *	ROCK CLASS	RIP-RAP THICKNESS "T" (MIN)
6-10	NO. 2 BACKING	1.1 FT
10-12	1/4 TON	2.7 FT
12-14	1/2 TON	3.5 FT
14-16	1 TON	4.4 FT
16-18	2 TON	5.4 FT

* OVER 20 FT/SEC REQUIRES SPECIAL DESIGN

D = PIPE DIAMETER ø
W = BOTTOM WIDTH OF CHANNEL



SECTION A-A



SECTION B-B

NOTES

1. PLANS SHALL SPECIFY:
   (A) ROCK CLASS AND RIP-RAP THICKNESS (T). T SHALL BE AT LEAST 1.5 TIMES THE NOMINAL EQUIVALENT DIAMETER OF STONE (d_{50}) OF THE SPECIFIED RIP-RAP.
   (B) FILTER BLANKET MATERIAL, NUMBER OF LAYERS AND THICKNESS.
2. RIP-RAP SHALL BE EITHER QUARRY STONE OR BROKEN CONCRETE (IF SHOWN ON PLANS). COBBLES ARE NOT ACCEPTABLE.
3. RIP-RAP SHALL BE PLACED OVER FILTER BLANKET MATERIAL, WHICH MAY BE EITHER GRANULAR MATERIAL OR NON-WOVEN GEOTEXTILE FILTER FABRIC; MATERIAL AT WEIGHT SPECIFIED IN PLANS OR SPECIFICATIONS.
4. SEE TABLE 200-1.7 IN THE SAN DIEGO REGIONAL SUPPLEMENT TO GREENBOOK FOR SELECTION OF FILTER BLANKET.
5. RIP-RAP ENERGY DISSIPATERS SHALL BE DESIGNATED AS EITHER TYPE 1 OR TYPE 2. TYPE 1 SHALL BE WITH CONCRETE SILL; TYPE 2 SHALL BE WITHOUT SILL.

Revision	By	Approved	Date
ORIGINAL		Kercheval	12/75
Add Rip Rap Table		S. Brady	04/06
Edited	S.S.	T. Regello	03/11
Edited	T.R.	T. Regello	10/15
Edited	M.W.	M. Widelski	10/18

SAN DIEGO REGIONAL STANDARD DRAWING

RIP RAP
ENERGY DISSIPATER

RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE

10/25/2018
Chairperson R.C.E. 19246 Date

DRAWING NUMBER D-40

CHAPTER 5

Basin Attenuation Calculations

STORAGE FACILITY 1 HYDROGRAPH

RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 8/8/2024
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 6 MIN.
6 HOUR RAINFALL 2.9 INCHES
BASIN AREA 4.26 ACRES
RUNOFF COEFFICIENT 0.848
PEAK DISCHARGE 26.12 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 6	DISCHARGE (CFS) = 0.6
TIME (MIN) = 12	DISCHARGE (CFS) = 0.6
TIME (MIN) = 18	DISCHARGE (CFS) = 0.6
TIME (MIN) = 24	DISCHARGE (CFS) = 0.7
TIME (MIN) = 30	DISCHARGE (CFS) = 0.7
TIME (MIN) = 36	DISCHARGE (CFS) = 0.7
TIME (MIN) = 42	DISCHARGE (CFS) = 0.7
TIME (MIN) = 48	DISCHARGE (CFS) = 0.7
TIME (MIN) = 54	DISCHARGE (CFS) = 0.7
TIME (MIN) = 60	DISCHARGE (CFS) = 0.7
TIME (MIN) = 66	DISCHARGE (CFS) = 0.8
TIME (MIN) = 72	DISCHARGE (CFS) = 0.8
TIME (MIN) = 78	DISCHARGE (CFS) = 0.8
TIME (MIN) = 84	DISCHARGE (CFS) = 0.8
TIME (MIN) = 90	DISCHARGE (CFS) = 0.8
TIME (MIN) = 96	DISCHARGE (CFS) = 0.8
TIME (MIN) = 102	DISCHARGE (CFS) = 0.9
TIME (MIN) = 108	DISCHARGE (CFS) = 0.9
TIME (MIN) = 114	DISCHARGE (CFS) = 0.9
TIME (MIN) = 120	DISCHARGE (CFS) = 0.9
TIME (MIN) = 126	DISCHARGE (CFS) = 1
TIME (MIN) = 132	DISCHARGE (CFS) = 1
TIME (MIN) = 138	DISCHARGE (CFS) = 1.1
TIME (MIN) = 144	DISCHARGE (CFS) = 1.1
TIME (MIN) = 150	DISCHARGE (CFS) = 1.1
TIME (MIN) = 156	DISCHARGE (CFS) = 1.2
TIME (MIN) = 162	DISCHARGE (CFS) = 1.2
TIME (MIN) = 168	DISCHARGE (CFS) = 1.3
TIME (MIN) = 174	DISCHARGE (CFS) = 1.4
TIME (MIN) = 180	DISCHARGE (CFS) = 1.4
TIME (MIN) = 186	DISCHARGE (CFS) = 1.6
TIME (MIN) = 192	DISCHARGE (CFS) = 1.6
TIME (MIN) = 198	DISCHARGE (CFS) = 1.8
TIME (MIN) = 204	DISCHARGE (CFS) = 1.9
TIME (MIN) = 210	DISCHARGE (CFS) = 2.2
TIME (MIN) = 216	DISCHARGE (CFS) = 2.4
TIME (MIN) = 222	DISCHARGE (CFS) = 2.9
TIME (MIN) = 228	DISCHARGE (CFS) = 3.3
TIME (MIN) = 234	DISCHARGE (CFS) = 4.9
TIME (MIN) = 240	DISCHARGE (CFS) = 5.3
TIME (MIN) = 246	DISCHARGE (CFS) = 26.12
TIME (MIN) = 252	DISCHARGE (CFS) = 3.9
TIME (MIN) = 258	DISCHARGE (CFS) = 2.6
TIME (MIN) = 264	DISCHARGE (CFS) = 2
TIME (MIN) = 270	DISCHARGE (CFS) = 1.7
TIME (MIN) = 276	DISCHARGE (CFS) = 1.5
TIME (MIN) = 282	DISCHARGE (CFS) = 1.3
TIME (MIN) = 288	DISCHARGE (CFS) = 1.2
TIME (MIN) = 294	DISCHARGE (CFS) = 1.1
TIME (MIN) = 300	DISCHARGE (CFS) = 1
TIME (MIN) = 306	DISCHARGE (CFS) = 1
TIME (MIN) = 312	DISCHARGE (CFS) = 0.9
TIME (MIN) = 318	DISCHARGE (CFS) = 0.9
TIME (MIN) = 324	DISCHARGE (CFS) = 0.8
TIME (MIN) = 330	DISCHARGE (CFS) = 0.8
TIME (MIN) = 336	DISCHARGE (CFS) = 0.7
TIME (MIN) = 342	DISCHARGE (CFS) = 0.7
TIME (MIN) = 348	DISCHARGE (CFS) = 0.7
TIME (MIN) = 354	DISCHARGE (CFS) = 0.7
TIME (MIN) = 360	DISCHARGE (CFS) = 0.6
TIME (MIN) = 366	DISCHARGE (CFS) = 0

CMP-1 Discharge to MWS BF-3-1

Discharge vs Elevation Table

Low orifice:	0.5625 "	Top orifice:	0.625 "
Number:	8	Number:	0
Cg-low:	0.61	Cg-low:	0.61
invert elev:	0.00 ft	invert elev:	0.40 ft

h	H/D-low	H/D-mid	H/D-top	Qlow-orif	Qlow-weir	Qtot-low	Qmid-orif	Qmid-weir	Qtot-med	Qtop-orif	Qtop-weir	Qtot-top	Qpeak-top	Qtot
(ft)	-	-	-	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
0.17	3.56	0.00	0.00	0.026	0.031	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0256
0.33	7.11	0.00	0.00	0.038	2.023	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0376
0.50	10.67	0.00	1.92	0.047	23.644	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0467
0.67	14.22	2.42	5.12	0.054	118.943	0.054	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0542
0.83	17.78	4.85	8.32	0.061	399.127	0.061	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0608
1.00	21.33	7.27	11.52	0.067	1053.340	0.067	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0668
1.17	24.89	9.70	14.72	0.072	2369.442	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0723
1.33	28.44	12.12	17.92	0.077	4754.788	0.077	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0773
1.50	32.00	14.55	21.12	0.082	8757.006	0.082	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0821
1.67	35.56	16.97	24.32	0.087	15084.775	0.087	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0866
1.83	39.11	19.39	27.52	0.091	24628.607	0.091	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0909
2.00	42.67	21.82	30.72	0.095	38481.619	0.095	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0950
2.17	46.22	24.24	33.92	0.099	57960.320	0.099	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0989
2.33	49.78	26.67	37.12	0.103	84625.382	0.103	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1027
2.50	53.33	29.09	40.32	0.106	120302.423	0.106	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1064
2.67	56.89	31.52	43.52	0.110	167102.785	0.110	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1099
2.83	60.44	33.94	46.72	0.113	227444.312	0.113	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1133
3.00	64.00	36.36	49.92	0.117	304072.128	0.117	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1166
3.17	67.56	38.79	53.12	0.120	400079.417	0.120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1198
3.33	71.11	41.21	56.32	0.123	518928.201	0.123	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1230
3.50	74.67	43.64	59.52	0.126	664470.120	0.126	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1260
3.67	78.29	46.11	62.78	0.129	844844.376	0.129	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1291
3.83	81.78	48.48	65.92	0.132	1053112.667	0.132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1319
4.00	85.33	50.91	69.12	0.135	1306051.664	0.135	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1348
4.17	88.89	53.33	72.32	0.138	1605402.088	0.138	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1376
4.33	92.44	55.76	75.52	0.140	1957275.340	0.140	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1403
4.50	96.00	58.18	78.72	0.143	2368297.110	0.143	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1430
4.67	99.56	60.61	81.92	0.146	2845628.153	0.146	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1456
4.83	103.11	63.03	85.12	0.148	3396985.073	0.148	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1482
5.00	106.67	65.45	88.32	0.151	4030661.095	0.151	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1508
5.17	110.22	67.88	91.52	0.153	4755546.849	0.153	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1533
5.33	113.78	70.30	94.72	0.156	5581151.145	0.156	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1557
5.50	117.33	72.73	97.92	0.158	6517621.754	0.158	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1582
5.67	120.89	75.15	101.12	0.161	7575766.186	0.161	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1605
5.83	124.44	77.58	104.32	0.163	8767072.466	0.163	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1629
6.00	128.00	80.00	107.52	0.165	10103729.919	0.165	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1652
6.17	131.56	82.42	110.72	0.168	11598649.940	0.168	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1675
6.33	135.11	84.85	113.92	0.170	13265486.781	0.170	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1698
6.50	138.67	87.27	117.12	0.172	15118658.325	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1720
6.67	142.22	89.70	120.32	0.174	17173366.863	0.174	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1742
6.83	145.78	92.12	123.52	0.176	19445619.877	0.176	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1764
7.00	149.33	94.55	126.72	0.179	21952250.818	0.179	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1785
7.17	152.89	96.97	129.92	0.181	24710939.881	0.181	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1806
7.33	156.44	99.39	133.12	0.183	27740234.786	0.183	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1827
7.50	160.00	101.82	136.32	0.185	31059571.558	0.185	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1848

CMP #1 Stage Storage					
Input DCV			7,569		
Input Factor			2		
WQ Ponding Depth			2.833	ft	
Note: Find out the elevation value in relation to required WQ volume					
HMP-2-A Stage Storage					
depth	area	area (ac)	elevation	volume (cf)	volume (acft)
0.00	3008.4	0.0691	0.00	0.0	0.00000
0.17	3990.6	0.0916	0.17	611.1	0.01403
0.33	4380.5	0.1006	0.33	1,310.7	0.03009
0.50	4667.7	0.1072	0.50	2,065.7	0.04742
0.67	4899.6	0.1125	0.67	2,863.6	0.06574
0.83	5094.9	0.1170	0.83	3,696.9	0.08487
1.00	5262.9	0.1208	1.00	4,560.4	0.10469
1.17	5409.5	0.1242	1.17	5,450.0	0.12512
1.33	5538.3	0.1271	1.33	6,362.6	0.14606
1.50	5652.0	0.1298	1.50	7,295.3	0.16748
1.67	5752.5	0.1321	1.67	8,245.8	0.18930
1.83	5841.1	0.1341	1.83	9,212.1	0.21148
2.00	5919.0	0.1359	2.00	10,192.3	0.23398
2.17	5986.9	0.1374	2.17	11,184.6	0.25676
2.33	6045.6	0.1388	2.33	12,187.4	0.27978
2.50	6095.5	0.1399	2.50	13,199.3	0.30301
2.67	6137.2	0.1409	2.67	14,218.8	0.32642
2.83	6170.8	0.1417	2.83	15,244.5	0.34997
3.00	6196.8	0.1423	3.00	16,275.3	0.37363
3.17	6215.2	0.1427	3.17	17,309.7	0.39738
3.33	6226.1	0.1429	3.33	18,346.6	0.42118
3.50	6229.8	0.1430	3.50	19,384.7	0.44501
3.67	6226.1	0.1429	3.67	20,422.8	0.46884
3.83	6215.2	0.1427	3.83	21,459.7	0.49265
4.00	6196.8	0.1423	4.00	22,494.1	0.51639
4.17	6170.8	0.1417	4.17	23,524.8	0.54006
4.33	6137.2	0.1409	4.33	24,550.6	0.56360
4.50	6095.5	0.1399	4.50	25,570.1	0.58701
4.67	6045.6	0.1388	4.67	26,582.0	0.61024
4.83	5986.9	0.1374	4.83	27,584.8	0.63326
5.00	5919.0	0.1359	5.00	28,577.1	0.65604
5.17	5841.1	0.1341	5.17	29,557.2	0.67854
5.33	5752.5	0.1321	5.33	30,523.5	0.70072
5.50	5652.0	0.1298	5.50	31,474.1	0.72255
5.67	5538.3	0.1271	5.67	32,406.8	0.74396
5.83	5409.5	0.1242	5.83	33,319.4	0.76491
6.00	5262.9	0.1208	6.00	34,209.0	0.78533
6.17	5094.9	0.1170	6.17	35,072.5	0.80515
6.33	4899.6	0.1125	6.33	35,905.8	0.82428
6.50	4667.7	0.1072	6.50	36,703.7	0.84260
6.67	4380.5	0.1006	6.67	37,458.6	0.85993
6.83	3990.6	0.0916	6.83	38,158.3	0.87599
7.00	3008.4	0.0691	7.00	38,769.4	0.89002
7.17	3008.4	0.0691	7.17	39,270.8	0.90153
7.33	3008.4	0.0691	7.33	39,772.2	0.91304
7.50	3008.4	0.0691	7.50	40,273.6	0.92455

CONTECH ENGINEERED SOLUTIONS

CMP: Underground Detention System Storage Volume Estimation

=Adjustable Input Cells

Date: 8/7/2024
Project Name: West Storage-1 - 47951 (8-7-2024 21-27-19)

City / County:
State:

Designed By:
Company:
Telephone:

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular applicaton and are subject to verification of the Engineer of Record. This tool is only applicable for rectangular shaped systems.

Summary of Inputs

System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	**107.0**	**Backfill Porosity (%):**	**40%**	**System Diameter (in):**	**84**
Out-to-out width (ft):	**67.0**	**Depth Above Pipe (in):**	**6.0**	**Pipe Spacing (in):**	**36**
Number of Manifolds (ea):	**1.0**	**Depth Below Pipe (in):**	**0.0**	**Incremental Analysis (in):**	**2**
Number of Barrels (ea):	**7.0**	**Width At Ends (ft):**	**1.0**	**System Invert (Elevation):**	**0**
		Width At Sides (ft):	**1.0**		

Storage Volume Estimation

System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	**Elevation (ft)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Percent Open Storage (%)**	**Ave. Surface Area (sf)**
0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	3,008.4
0.17	0.16	182.8	182.8	428.3	428.3	611.1	611.1	29.9%	3,990.6
0.33	0.33	330.4	513.2	369.2	797.5	699.7	1,310.7	39.2%	4,380.5
0.50	0.50	422.6	935.8	332.3	1,129.9	755.0	2,065.7	45.3%	4,667.7
0.67	0.66	494.1	1,430.0	303.7	1,433.6	797.9	2,863.6	49.9%	4,899.6
0.83	0.83	553.2	1,983.2	280.1	1,713.7	833.3	3,696.9	53.6%	5,094.9
1.00	1.00	603.5	2,586.6	260.0	1,973.7	863.5	4,560.4	56.7%	5,262.9
1.17	1.16	647.1	3,233.7	242.6	2,216.3	889.6	5,450.0	59.3%	5,409.5
1.33	1.33	685.2	3,918.9	227.3	2,443.6	912.5	6,362.6	61.6%	5,538.3
1.50	1.50	718.9	4,637.8	213.8	2,657.5	932.7	7,295.3	63.6%	5,652.0
1.67	1.66	748.6	5,386.4	202.0	2,859.4	950.6	8,245.8	65.3%	5,752.5
1.83	1.83	774.8	6,161.2	191.5	3,050.9	966.3	9,212.1	66.9%	5,841.1
2.00	2.00	797.9	6,959.1	182.2	3,233.1	980.1	10,192.3	68.3%	5,919.0
2.17	2.16	818.1	7,777.3	174.1	3,407.3	992.3	11,184.6	69.5%	5,986.9
2.33	2.33	835.7	8,613.0	167.1	3,574.4	1,002.8	12,187.4	70.7%	6,045.6
2.50	2.50	850.8	9,463.8	161.1	3,735.5	1,011.9	13,199.3	71.7%	6,095.5
2.67	2.66	863.5	10,327.3	156.0	3,891.5	1,019.5	14,218.8	72.6%	6,137.2
2.83	2.83	874.0	11,201.2	151.8	4,043.3	1,025.8	15,244.5	73.5%	6,170.8
3.00	3.00	882.2	12,083.5	148.5	4,191.8	1,030.7	16,275.3	74.2%	6,196.8
3.17	3.16	888.4	12,971.9	146.0	4,337.9	1,034.4	17,309.7	74.9%	6,215.2
3.33	3.33	892.5	13,864.3	144.4	4,482.3	1,036.9	18,346.6	75.6%	6,226.1
3.50	3.50	894.5	14,758.8	143.6	4,625.9	1,038.1	19,384.7	76.1%	6,229.8
3.67	3.66	894.5	15,653.3	143.6	4,769.5	1,038.1	20,422.8	76.6%	6,226.1
3.83	3.83	892.5	16,545.8	144.4	4,913.9	1,036.9	21,459.7	77.1%	6,215.2
4.00	4.00	888.4	17,434.2	146.0	5,059.9	1,034.4	22,494.1	77.5%	6,196.8
4.17	4.16	882.2	18,316.4	148.5	5,208.4	1,030.7	23,524.8	77.9%	6,170.8
4.33	4.33	874.0	19,190.3	151.8	5,360.3	1,025.8	24,550.6	78.2%	6,137.2
4.50	4.50	863.5	20,053.8	156.0	5,516.3	1,019.5	25,570.1	78.4%	6,095.5
4.67	4.66	850.8	20,904.6	161.1	5,677.3	1,011.9	26,582.0	78.6%	6,045.6
4.83	4.83	835.7	21,740.3	167.1	5,844.5	1,002.8	27,584.8	78.8%	5,986.9
5.00	5.00	818.1	22,558.5	174.1	6,018.6	992.3	28,577.1	78.9%	5,919.0
5.17	5.16	797.9	23,356.4	182.2	6,200.8	980.1	29,557.2	79.0%	5,841.1
5.33	5.33	774.8	24,131.2	191.5	6,392.3	966.3	30,523.5	79.1%	5,752.5
5.50	5.50	748.6	24,879.8	202.0	6,594.3	950.6	31,474.1	79.0%	5,652.0
5.67	5.66	718.9	25,598.7	213.8	6,808.1	932.7	32,406.8	79.0%	5,538.3
5.83	5.83	685.2	26,283.9	227.3	7,035.4	912.5	33,319.4	78.9%	5,409.5
6.00	6.00	647.1	26,931.0	242.6	7,278.0	889.6	34,209.0	78.7%	5,262.9
6.17	6.16	603.5	27,534.5	260.0	7,538.0	863.5	35,072.5	78.5%	5,094.9
6.33	6.33	553.2	28,087.6	280.1	7,818.1	833.3	35,905.8	78.2%	4,899.6
6.50	6.50	494.1	28,581.8	303.7	8,121.9	797.9	36,703.7	77.9%	4,667.7
6.67	6.66	422.6	29,004.4	332.3	8,454.2	755.0	37,458.6	77.4%	4,380.5
6.83	6.83	330.4	29,334.8	369.2	8,823.5	699.7	38,158.3	76.9%	3,990.6
7.00	7.00	182.8	29,517.6	428.3	9,251.8	611.1	38,769.4	76.1%	3,008.4
7.17	7.16	0.0	29,517.6	501.4	9,753.2	501.4	39,270.8	75.2%	3,008.4
7.33	7.33	0.0	29,517.6	501.4	10,254.6	501.4	39,772.2	74.2%	3,008.4
7.50	7.50	0.0	29,517.6	501.4	10,756.0	501.4	40,273.6	73.3%	3,008.4

WQ Drawdown @		2.83	ft=	62.68
Elevation	Q_{AVG} (CFS)	∆V (CF)	∆T (HR)	Total T
0.00	0.026	611	6.64	62.68
0.17	0.032	700	6.15	56.05
0.33	0.042	755	4.98	49.90
0.50	0.050	798	4.40	44.92
0.67	0.058	833	4.02	40.52
0.83	0.064	863	3.76	36.50
1.00	0.070	890	3.55	32.74
1.17	0.075	913	3.39	29.19
1.33	0.080	933	3.25	25.80
1.50	0.084	951	3.13	22.55
1.67	0.089	966	3.02	19.42
1.83	0.093	980	2.93	16.40
2.00	0.097	992	2.84	13.47
2.17	0.101	1003	2.76	10.62
2.33	0.105	1012	2.69	7.86
2.50	0.108	1020	2.62	5.17
2.67	0.112	1026	2.55	2.55
2.83				

CMP #1 Discharge HMP Riser

Discharge vs Elevation Table

Low orifice:	0.50 "	Top orifice:	4 "
Number:	1	Number:	12
Cg-low:	0.61	Cg-low:	0.61
invert elev:	2.83 ft	invert elev:	5.00 ft
Middle orifice:	2 "	Emergency inlet:	
number of orif:	10	Rim height:	6.40 ft
Cg-middle:	0.61	Riser Box D	3x4
invert elev:	4.75 ft	Weir Length	14.00 ft

h	H/D-low	H/D-mid	H/D-top	Qlow-orif	Qlow-weir	Qtot-low	Qmid-orif	Qmid-weir	Qtot-med	Qtop-orif	Qtop-weir	Qtot-top	Qpeak-top	Qtot	Peak Flow WQ+HMP Qtot
(ft)	-	-	-	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
0.17	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0256
0.33	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0376
0.50	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0467
0.67	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0542
0.83	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0608
1.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0668
1.17	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0723
1.33	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0773
1.50	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0821
1.67	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0866
1.83	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0909
2.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0950
2.17	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0989
2.33	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1027
2.50	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1064
2.67	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1099
2.83	0.08	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1133
3.00	4.08	0.00	0.00	0.003	0.005	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.1192
3.17	8.08	0.00	0.00	0.004	0.422	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.1236
3.33	12.08	0.00	0.00	0.005	4.470	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.1276
3.50	16.08	0.00	0.00	0.005	21.637	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.1314
3.67	20.16	0.00	0.00	0.006	72.690	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.1351
3.83	24.08	0.00	0.00	0.007	185.564	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.1385
4.00	28.08	0.00	0.00	0.007	414.035	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.1419
4.17	32.08	0.00	0.00	0.008	826.024	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.1452
4.33	36.08	0.00	0.00	0.008	1514.674	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.1484
4.50	40.08	0.00	0.00	0.009	2600.318	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.1516
4.67	44.08	0.00	0.00	0.009	4233.968	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.1546
4.83	48.08	0.50	0.00	0.009	6600.799	0.009	0.000	0.087	0.087	0.000	0.000	0.000	0.000	0.096	0.2445
5.00	52.08	1.50	0.00	0.010	9923.637	0.010	0.436	0.530	0.436	0.000	0.000	0.000	0.000	0.446	0.5965
5.17	56.08	2.50	0.50	0.010	14466.445	0.010	0.617	0.788	0.617	0.000	0.590	0.590	0.000	1.217	1.3701
5.33	60.08	3.50	1.00	0.011	20537.809	0.011	0.755	0.888	0.755	2.093	1.999	1.999	0.000	2.765	2.9209
5.50	64.08	4.50	1.50	0.011	28494.427	0.011	0.872	2.617	0.872	2.960	3.599	2.960	0.000	3.843	4.0007
5.67	68.08	5.50	2.00	0.011	38744.594	0.011	0.975	10.607	0.975	3.625	4.814	3.625	0.000	4.611	4.7715
5.83	72.08	6.50	2.50	0.012	51751.690	0.012	1.068	33.432	1.068	4.186	5.351	4.186	0.000	5.265	5.4280
6.00	76.08	7.50	3.00	0.012	68037.662	0.012	1.154	84.691	1.154	4.680	5.434	4.680	0.000	5.845	6.0102
6.17	80.08	8.50	3.50	0.012	88186.518	0.012	1.233	184.101	1.233	5.126	6.031	5.126	0.000	6.372	6.5391
6.33	84.08	9.50	4.00	0.012	112847.808	0.012	1.308	358.584	1.308	5.537	9.089	5.537	0.000	6.857	7.0272
6.50	88.08	10.50	4.50	0.013	142740.112	0.013	1.379	643.360	1.379	5.919	17.762	5.919	1.474	8.785	8.9570
6.67	92.08	11.50	5.00	0.013	178654.529	0.013	1.446	1083.034	1.446	6.278	36.645	6.278	6.420	14.157	14.3315
6.83	96.08	12.50	5.50	0.013	221458.160	0.013	1.510	1732.686	1.510	6.618	72.003	6.618	13.299	21.440	21.6166
7.00	100.08	13.50	6.00	0.014	272097.598	0.014	1.572	2658.962	1.572	6.941	132.003	6.941	21.667	30.194	30.3721
7.17	104.08	14.50	6.50	0.014	331602.411	0.014	1.631	3941.161	1.631	7.250	226.944	7.250	31.296	40.190	40.3710
7.33	108.08	15.50	7.00	0.014	401088.632	0.014	1.689	5672.326	1.689	7.546	369.491	7.546	42.037	51.285	51.4677
7.50	112.08	16.50	7.50	0.014	481762.245	0.014	1.744	7960.336	1.744	7.831	574.902	7.831	53.785	63.374	63.5587

HMP-2A Drawdown @		7.5	ft=	91.23
Elevation	Q_{AVG} (CFS)	ΔV (CF)	ΔT (HR)	Total T
0.00	0.019	611	9.02	91.23
0.17	0.032	700	6.15	82.20
0.33	0.042	755	4.98	76.05
0.50	0.050	798	4.40	71.07
0.67	0.058	833	4.02	66.68
0.83	0.064	863	3.76	62.65
1.00	0.070	890	3.55	58.90
1.17	0.075	913	3.39	55.34
1.33	0.080	933	3.25	51.95
1.50	0.084	951	3.13	48.70
1.67	0.089	966	3.02	45.57
1.83	0.093	980	2.93	42.55
2.00	0.097	992	2.84	39.62
2.17	0.101	1003	2.76	36.78
2.33	0.105	1012	2.69	34.02
2.50	0.108	1020	2.62	31.33
2.67	0.112	1026	2.55	28.71
2.83	0.116	1031	2.46	26.15
3.00	0.121	1034	2.37	23.69
3.17	0.126	1037	2.29	21.32
3.33	0.129	1038	2.23	19.03
3.50	0.133	1038	2.16	16.80
3.67	0.137	1037	2.11	14.64
3.83	0.140	1034	2.05	12.53
4.00	0.144	1031	1.99	10.49
4.17	0.147	1026	1.94	8.49
4.33	0.150	1020	1.89	6.55
4.50	0.153	1012	1.84	4.66
4.67	0.200	1003	1.40	2.83
4.83	0.421	992	0.66	1.43
5.00	0.983	980	0.28	0.78
5.17	2.145	966	0.13	0.50
5.33	3.461	951	0.08	0.37
5.50	4.386	933	0.06	0.30
5.67	5.100	913	0.05	0.24
5.83	5.719	890	0.04	0.19
6.00	6.275	863	0.04	0.14
6.17	6.783	833	0.03	0.11
6.33	7.992	798	0.03	0.07
6.50	11.644	755	0.02	0.04
6.67	17.974	700	0.01	0.03
6.83	25.994	611	0.01	0.02
7.00	35.372	501	0.00	0.01
7.17	45.919	501	0.00	0.01
7.33	57.513	501	0.00	0.00
7.50	31.779			

STORAGE FACILITY 2 HYDROGRAPH

RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 10/7/2024
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 6 MIN.
6 HOUR RAINFALL 2.9 INCHES
BASIN AREA 2.33 ACRES
RUNOFF COEFFICIENT 0.75
PEAK DISCHARGE 12.41 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 6	DISCHARGE (CFS) = 0.3
TIME (MIN) = 12	DISCHARGE (CFS) = 0.3
TIME (MIN) = 18	DISCHARGE (CFS) = 0.3
TIME (MIN) = 24	DISCHARGE (CFS) = 0.3
TIME (MIN) = 30	DISCHARGE (CFS) = 0.3
TIME (MIN) = 36	DISCHARGE (CFS) = 0.3
TIME (MIN) = 42	DISCHARGE (CFS) = 0.3
TIME (MIN) = 48	DISCHARGE (CFS) = 0.3
TIME (MIN) = 54	DISCHARGE (CFS) = 0.3
TIME (MIN) = 60	DISCHARGE (CFS) = 0.4
TIME (MIN) = 66	DISCHARGE (CFS) = 0.4
TIME (MIN) = 72	DISCHARGE (CFS) = 0.4
TIME (MIN) = 78	DISCHARGE (CFS) = 0.4
TIME (MIN) = 84	DISCHARGE (CFS) = 0.4
TIME (MIN) = 90	DISCHARGE (CFS) = 0.4
TIME (MIN) = 96	DISCHARGE (CFS) = 0.4
TIME (MIN) = 102	DISCHARGE (CFS) = 0.4
TIME (MIN) = 108	DISCHARGE (CFS) = 0.4
TIME (MIN) = 114	DISCHARGE (CFS) = 0.4
TIME (MIN) = 120	DISCHARGE (CFS) = 0.5
TIME (MIN) = 126	DISCHARGE (CFS) = 0.5
TIME (MIN) = 132	DISCHARGE (CFS) = 0.5
TIME (MIN) = 138	DISCHARGE (CFS) = 0.5
TIME (MIN) = 144	DISCHARGE (CFS) = 0.5
TIME (MIN) = 150	DISCHARGE (CFS) = 0.6
TIME (MIN) = 156	DISCHARGE (CFS) = 0.6
TIME (MIN) = 162	DISCHARGE (CFS) = 0.6
TIME (MIN) = 168	DISCHARGE (CFS) = 0.6
TIME (MIN) = 174	DISCHARGE (CFS) = 0.7
TIME (MIN) = 180	DISCHARGE (CFS) = 0.7
TIME (MIN) = 186	DISCHARGE (CFS) = 0.8
TIME (MIN) = 192	DISCHARGE (CFS) = 0.8
TIME (MIN) = 198	DISCHARGE (CFS) = 0.9
TIME (MIN) = 204	DISCHARGE (CFS) = 0.9
TIME (MIN) = 210	DISCHARGE (CFS) = 1.1
TIME (MIN) = 216	DISCHARGE (CFS) = 1.1
TIME (MIN) = 222	DISCHARGE (CFS) = 1.4
TIME (MIN) = 228	DISCHARGE (CFS) = 1.6
TIME (MIN) = 234	DISCHARGE (CFS) = 2.4
TIME (MIN) = 240	DISCHARGE (CFS) = 2.8
TIME (MIN) = 246	DISCHARGE (CFS) = 12.41
TIME (MIN) = 252	DISCHARGE (CFS) = 1.9
TIME (MIN) = 258	DISCHARGE (CFS) = 1.3
TIME (MIN) = 264	DISCHARGE (CFS) = 1
TIME (MIN) = 270	DISCHARGE (CFS) = 0.8
TIME (MIN) = 276	DISCHARGE (CFS) = 0.7
TIME (MIN) = 282	DISCHARGE (CFS) = 0.6
TIME (MIN) = 288	DISCHARGE (CFS) = 0.6
TIME (MIN) = 294	DISCHARGE (CFS) = 0.5
TIME (MIN) = 300	DISCHARGE (CFS) = 0.5
TIME (MIN) = 306	DISCHARGE (CFS) = 0.5
TIME (MIN) = 312	DISCHARGE (CFS) = 0.4
TIME (MIN) = 318	DISCHARGE (CFS) = 0.4
TIME (MIN) = 324	DISCHARGE (CFS) = 0.4
TIME (MIN) = 330	DISCHARGE (CFS) = 0.4
TIME (MIN) = 336	DISCHARGE (CFS) = 0.4
TIME (MIN) = 342	DISCHARGE (CFS) = 0.3
TIME (MIN) = 348	DISCHARGE (CFS) = 0.3
TIME (MIN) = 354	DISCHARGE (CFS) = 0.3
TIME (MIN) = 360	DISCHARGE (CFS) = 0.3
TIME (MIN) = 366	DISCHARGE (CFS) = 0

CMP-2 Discharge to MWS BF-3-2

Discharge vs Elevation Table

Low orifice:	0.525 "	Top orifice:	0.75 "
Number:	4	Number:	0
Cg-low:	0.61	Cg-low:	0.61
invert elev:	0.00 ft	invert elev:	0.75 ft

h	H/D-low	H/D-mid	H/D-top	Qlow-orif	Qlow-weir	Qtot-low	Qmid-orif	Qmid-weir	Qtot-med	Qtop-orif	Qtop-weir	Qtot-top	Qpeak-top	Qtot
(ft)	-	-	-	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
0.17	3.81	0.00	0.00	0.011	0.016	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0112
0.33	7.62	0.00	0.00	0.016	1.321	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0164
0.50	11.43	0.00	0.00	0.020	14.762	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0204
0.67	15.24	2.42	0.00	0.024	73.005	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0236
0.83	19.05	4.85	1.33	0.027	242.879	0.027	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0265
1.00	22.86	7.27	4.00	0.029	637.724	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0291
1.17	26.67	9.70	6.67	0.031	1429.734	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0315
1.33	30.48	12.12	9.33	0.034	2862.302	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0337
1.50	34.29	14.55	12.00	0.036	5262.368	0.036	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0358
1.67	38.10	16.97	14.67	0.038	9052.761	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0378
1.83	41.90	19.39	17.33	0.040	14764.544	0.040	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0396
2.00	45.71	21.82	20.00	0.041	23049.363	0.041	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0414
2.17	49.52	24.24	22.67	0.043	34691.785	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0431
2.33	53.33	26.67	25.33	0.045	50621.653	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0448
2.50	57.14	29.09	28.00	0.046	71926.420	0.046	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0463
2.67	60.95	31.52	30.67	0.048	99863.503	0.048	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0479
2.83	64.76	33.94	33.33	0.049	135872.625	0.049	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0494
3.00	68.57	36.36	36.00	0.051	181588.157	0.051	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0508
3.17	72.38	38.79	38.67	0.052	238851.469	0.052	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0522

CMP #HMP-2 Stage Storage					
Input DCV			3,285		
Input Factor			2.05		
WQ Ponding Depth			3.000	ft	
Note: Find out the elevation value in relation to required WQ volume					
HMP-2-A Stage Storage					
depth	Average Surface area	area (ac)	elevation	Comulative volume (cf)	volume (acft)
0.00	1244.4	0.0286	0.00	0.0	0.0
0.17	1650.4	0.0379	0.17	252.7	0.00580
0.33	1811.9	0.0416	0.33	542.1	0.01244
0.50	1931.4	0.0443	0.50	854.4	0.01961
0.67	2028.1	0.0466	0.67	1,184.6	0.02720
0.83	2109.9	0.0484	0.83	1,529.6	0.03512
1.00	2180.6	0.0501	1.00	1,887.3	0.04333
1.17	2242.5	0.0515	1.17	2,256.0	0.05179
1.33	2297.3	0.0527	1.33	2,634.4	0.06048
1.50	2346.0	0.0539	1.50	3,021.5	0.06936
1.67	2389.3	0.0549	1.67	3,416.1	0.07842
1.83	2428.0	0.0557	1.83	3,817.6	0.08764
2.00	2462.3	0.0565	2.00	4,225.2	0.09700
2.17	2492.6	0.0572	2.17	4,638.2	0.10648
2.33	2519.4	0.0578	2.33	5,055.9	0.11607
2.50	2542.6	0.0584	2.50	5,477.8	0.12575
2.67	2562.7	0.0588	2.67	5,903.3	0.13552
2.83	2579.6	0.0592	2.83	6,331.8	0.14536
3.00	2593.6	0.0595	3.00	6,763.0	0.15526
3.17	2604.6	0.0598	3.17	7,196.2	0.16520
3.33	2612.9	0.0600	3.33	7,631.0	0.17518
3.50	2618.3	0.0601	3.50	8,067.0	0.18519
3.67	2621.1	0.0602	3.67	8,503.7	0.19522
3.83	2621.1	0.0602	3.83	8,940.5	0.20525
4.00	2618.3	0.0601	4.00	9,377.2	0.21527
4.17	2612.9	0.0600	4.17	9,813.2	0.22528
4.33	2604.6	0.0598	4.33	10,248.0	0.23526
4.50	2593.6	0.0595	4.50	10,681.2	0.24521
4.67	2579.6	0.0592	4.67	11,112.4	0.25510
4.83	2562.7	0.0588	4.83	11,540.9	0.26494
5.00	2542.6	0.0584	5.00	11,966.4	0.27471
5.17	2519.4	0.0578	5.17	12,388.3	0.28440
5.33	2492.6	0.0572	5.33	12,806.0	0.29399
5.50	2462.3	0.0565	5.50	13,219.0	0.30347
5.67	2428.0	0.0557	5.67	13,626.6	0.31282
5.83	2389.3	0.0549	5.83	14,028.1	0.32204
6.00	2346.0	0.0539	6.00	14,422.7	0.33110
6.17	2297.3	0.0527	6.17	14,809.8	0.33999
6.33	2242.5	0.0515	6.33	15,188.2	0.34867
6.50	2180.6	0.0501	6.50	15,556.9	0.35714
6.67	2109.9	0.0484	6.67	15,914.6	0.36535
6.83	2028.1	0.0466	6.83	16,259.6	0.37327
7.00	1931.4	0.0443	7.00	16,589.8	0.38085
7.17	1811.9	0.0416	7.17	16,902.1	0.38802
7.33	1650.4	0.0379	7.33	17,191.5	0.39466
7.50	1244.4	0.0286	7.50	17,444.2	0.40046
7.67	1244.4	0.0286	7.67	17,651.6	0.40522
7.83	1244.4	0.0286	7.83	17,859.0	0.40999
8.00	1244.4	0.0286	8.00	18,066.4	0.41475
8.17	1244.4	0.0286	8.17	18,273.8	0.41951

CONTECH ENGINEERED SOLUTIONS

Date: 8/7/2024
Project Name: East Storage-2 - 47954 (8-7-2024 0-5-24)

City / County:
State:

Designed By:
Company:
Telephone:

CMP: Underground Detention System
Storage Volume Estimation

=Adjustable Input Cells

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular applicaton and are subject to verification of the Engineer of Record. This tool is only applicable for rectangular shaped systems.

Summary of Inputs

System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	**100.0**	**Backfill Porosity (%):**	**40%**	**System Diameter (in):**	**90**
Out-to-out width (ft):	**28.5**	**Depth Above Pipe (in):**	**9.0**	**Pipe Spacing (in):**	**36**
Number of Manifolds (ea):	**1.0**	**Depth Below Pipe (in):**	**0.0**	**Incremental Analysis (in):**	**2**
Number of Barrels (ea):	**3.0**	**Width At Ends (ft):**	**1.0**	**System Invert (Elevation):**	**0**
		Width At Sides (ft):	**1.0**		

Storage Volume Estimation

System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	**Elevation (ft)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Percent Open Storage (%)**	**Ave. Surface Area (sf)**
0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	1,244.4
0.17	0.16	75.5	75.5	177.2	177.2	252.7	252.7	29.9%	1,650.4
0.33	0.33	136.6	212.1	152.7	329.9	289.4	542.1	39.1%	1,811.9
0.50	0.50	174.9	387.0	137.4	467.4	312.3	854.4	45.3%	1,931.4
0.67	0.66	204.7	591.7	125.5	592.9	330.2	1,184.6	49.9%	2,028.1
0.83	0.83	229.4	821.1	115.7	708.6	345.0	1,529.6	53.7%	2,109.9
1.00	1.00	250.5	1,071.5	107.2	815.8	357.7	1,887.3	56.8%	2,180.6
1.17	1.16	268.8	1,340.4	99.9	915.7	368.7	2,256.0	59.4%	2,242.5
1.33	1.33	285.0	1,625.4	93.4	1,009.0	378.4	2,634.4	61.7%	2,297.3
1.50	1.50	299.4	1,924.8	87.7	1,096.7	387.0	3,021.5	63.7%	2,346.0
1.67	1.66	312.1	2,236.9	82.5	1,179.2	394.7	3,416.1	65.5%	2,389.3
1.83	1.83	323.5	2,560.4	78.0	1,257.2	401.5	3,817.6	67.1%	2,428.0
2.00	2.00	333.6	2,894.0	74.0	1,331.2	407.6	4,225.2	68.5%	2,462.3
2.17	2.16	342.6	3,236.6	70.4	1,401.5	413.0	4,638.2	69.8%	2,492.6
2.33	2.33	350.5	3,587.2	67.2	1,468.7	417.7	5,055.9	71.0%	2,519.4
2.50	2.50	357.5	3,944.6	64.4	1,533.1	421.9	5,477.8	72.0%	2,542.6
2.67	2.66	363.5	4,308.1	62.0	1,595.2	425.5	5,903.3	73.0%	2,562.7
2.83	2.83	368.6	4,676.7	60.0	1,655.1	428.6	6,331.8	73.9%	2,579.6
3.00	3.00	372.9	5,049.6	58.2	1,713.3	431.1	6,763.0	74.7%	2,593.6
3.17	3.16	376.4	5,426.0	56.9	1,770.2	433.2	7,196.2	75.4%	2,604.6
3.33	3.33	379.1	5,805.1	55.8	1,826.0	434.8	7,631.0	76.1%	2,612.9
3.50	3.50	381.0	6,186.0	55.0	1,881.0	436.0	8,067.0	76.7%	2,618.3
3.67	3.66	382.1	6,568.1	54.6	1,935.6	436.7	8,503.7	77.2%	2,621.1
3.83	3.83	382.5	6,950.6	54.4	1,990.0	436.9	8,940.5	77.7%	2,621.1
4.00	4.00	382.1	7,332.7	54.6	2,044.5	436.7	9,377.2	78.2%	2,618.3
4.17	4.16	381.0	7,713.6	55.0	2,099.6	436.0	9,813.2	78.6%	2,612.9
4.33	4.33	379.1	8,092.7	55.8	2,155.3	434.8	10,248.0	79.0%	2,604.6
4.50	4.50	376.4	8,469.0	56.9	2,212.2	433.2	10,681.2	79.3%	2,593.6
4.67	4.66	372.9	8,841.9	58.2	2,270.4	431.1	11,112.4	79.6%	2,579.6
4.83	4.83	368.6	9,210.6	60.0	2,330.4	428.6	11,540.9	79.8%	2,562.7
5.00	5.00	363.5	9,574.0	62.0	2,392.4	425.5	11,966.4	80.0%	2,542.6
5.17	5.16	357.5	9,931.5	64.4	2,456.8	421.9	12,388.3	80.2%	2,519.4
5.33	5.33	350.5	10,282.0	67.2	2,524.0	417.7	12,806.0	80.3%	2,492.6
5.50	5.50	342.6	10,624.6	70.4	2,594.3	413.0	13,219.0	80.4%	2,462.3
5.67	5.66	333.6	10,958.3	74.0	2,668.3	407.6	13,626.6	80.4%	2,428.0
5.83	5.83	323.5	11,281.8	78.0	2,746.3	401.5	14,028.1	80.4%	2,389.3
6.00	6.00	312.1	11,593.9	82.5	2,828.8	394.7	14,422.7	80.4%	2,346.0
6.17	6.16	299.4	11,893.3	87.7	2,916.5	387.0	14,809.8	80.3%	2,297.3
6.33	6.33	285.0	12,178.3	93.4	3,009.9	378.4	15,188.2	80.2%	2,242.5
6.50	6.50	268.8	12,447.1	99.9	3,109.7	368.7	15,556.9	80.0%	2,180.6
6.67	6.66	250.5	12,697.6	107.2	3,217.0	357.7	15,914.6	79.8%	2,109.9
6.83	6.83	229.4	12,926.9	115.7	3,332.6	345.0	16,259.6	79.5%	2,028.1
7.00	7.00	204.7	13,131.6	125.5	3,458.2	330.2	16,589.8	79.2%	1,931.4
7.17	7.16	174.9	13,306.5	137.4	3,595.6	312.3	16,902.1	78.7%	1,811.9
7.33	7.33	136.6	13,443.1	152.7	3,748.3	289.4	17,191.5	78.2%	1,650.4
7.50	7.50	75.5	13,518.7	177.2	3,925.5	252.7	17,444.2	77.5%	1,244.4
7.67	7.66	0.0	13,518.7	207.4	4,132.9	207.4	17,651.6	76.6%	1,244.4
7.83	7.83	0.0	13,518.7	207.4	4,340.3	207.4	17,859.0	75.7%	1,244.4
8.00	8.00	0.0	13,518.7	207.4	4,547.7	207.4	18,066.4	74.8%	1,244.4
8.17	8.16	0.0	13,518.7	207.4	4,755.1	207.4	18,273.8	74.0%	1,244.4

WQ Drawdown @		3.00	ft=	62.00
Elevation	Q_{AVG} (CFS)	ΔV (CF)	ΔT (HR)	Total T
0.00	0.011	253	6.27	62.00
0.17	0.014	289	5.82	55.74
0.33	0.018	312	4.72	49.92
0.50	0.022	330	4.17	45.20
0.67	0.025	345	3.82	41.03
0.83	0.028	358	3.57	37.21
1.00	0.030	369	3.38	33.64
1.17	0.033	378	3.22	30.26
1.33	0.035	387	3.09	27.03
1.50	0.037	395	2.98	23.94
1.67	0.039	402	2.88	20.96
1.83	0.041	408	2.79	18.07
2.00	0.042	413	2.71	15.28
2.17	0.044	418	2.64	12.56
2.33	0.046	422	2.57	9.92
2.50	0.047	425	2.51	7.35
2.67	0.049	429	2.45	4.84
2.83	0.050	431	2.39	2.39
3.00				

CMP #HMP-2 Discharge HMP Riser

Discharge vs Elevation Table

Bottom orifice:	0.50 "		
Number:	1		
Cg-low:	0.61		
invert elev:	3.00 ft		
Low orifice:	1 "	Top orifice:	3 "
Number:	4	Number:	16
Cg-low:	0.61	Cg-low:	0.61
invert elev:	5.50 ft	invert elev:	6.60 ft
Middle orifice:	3 "	Emergency inlet:	
number of orif:	12	Rim height:	7.00 ft
Cg-middle:	0.61	Riser Box D	3x4
invert elev:	6.00 ft	Weir Length	14.00 ft

h	H/D-bot	H/D-low	H/D-mid	H/D-top	Qbot-orif	Qbot-weir	Qtot-bot	Qlow-orif	Qlow-weir	Qtot-low	Qmid-orif	Qmid-weir	Qtot-med	Qtop-orif	Qtop-weir	Qtot-top	Qpeak-top	Qtot	Peak Flow WQ+HMP Qtot
(ft)		-	-	-	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
0.17	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0112
0.33	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0164
0.50	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0204
0.67	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0236
0.83	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0265
1.00	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0291
1.17	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0315
1.33	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0337
1.50	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0358
1.67	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0378
1.83	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0396
2.00	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0414
2.17	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0431
2.33	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0448
2.50	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0463
2.67	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0479
2.83	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0494
3.00	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0508
3.17	4.00	0.00	0.00	0.00	0.003	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0522
3.33	8.00	0.00	0.00	0.00	0.004	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0536
3.50	12.00	0.00	0.00	0.00	0.005	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0549
3.67	16.00	0.00	0.00	0.00	0.005	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0562
3.83	20.00	0.00	0.00	0.00	0.006	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0575
4.00	24.00	0.00	0.00	0.00	0.007	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0587
4.17	28.00	0.00	0.00	0.00	0.007	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0599
4.33	32.00	0.00	0.00	0.00	0.008	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0611
4.50	36.00	0.00	0.00	0.00	0.008	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0623
4.67	40.00	0.00	0.00	0.00	0.009	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0634
4.83	44.00	0.00	0.00	0.00	0.009	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0646
5.00	48.00	0.00	0.00	0.00	0.009	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0657
5.17	52.00	0.00	0.00	0.00	0.010	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0668
5.33	56.00	0.00	0.00	0.00	0.010	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0678
5.50	60.00	0.00	0.00	0.00	0.011	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0689
5.67	64.00	2.00	0.00	0.00	0.011	0.00	0.002	0.038	0.050	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.040	0.1099
5.83	68.00	4.00	0.00	0.00	0.011	0.00	0.004	0.058	0.095	0.058	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.062	0.1328
6.00	72.00	6.00	0.00	0.00	0.012	0.06	0.012	0.072	1.375	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.084	0.1558
6.17	76.00	8.00	0.67	0.00	0.012	0.40	0.012	0.084	8.971	0.084	0.589	0.486	0.486	0.000	0.000	0.000	0.000	0.583	0.6556
6.33	80.00	10.00	1.33	0.00	0.012	1.51	0.012	0.095	34.269	0.095	1.316	1.502	1.316	0.000	0.000	0.000	0.000	1.423	1.4973
6.50	84.00	12.00	2.00	0.00	0.012	4.31	0.012	0.105	97.420	0.105	1.766	2.345	1.766	0.000	0.000	0.000	0.000	1.883	1.9577
6.67	88.00	14.00	2.67	0.27	0.013	10.16	0.013	0.113	229.816	0.113	2.122	2.630	2.122	0.000	0.116	0.116	0.000	2.364	2.4401
6.83	92.00	16.00	3.33	0.93	0.013	21.06	0.013	0.121	476.546	0.121	2.427	2.766	2.427	1.265	1.160	1.160	0.000	3.722	3.7983
7.00	96.00	18.00	4.00	1.60	0.013	39.72	0.013	0.129	898.865	0.129	2.697	4.427	2.697	2.016	2.525	2.016	0.000	4.856	4.9335
7.17	100.00	20.00	4.67	2.27	0.014	69.68	0.014	0.136	1576.661	0.136	2.943	11.033	2.943	2.555	3.368	2.555	3.172	8.820	8.8986
7.33	104.00	22.00	5.33	2.93	0.014	115.39	0.014	0.143	2610.918	0.143	3.170	28.217	3.170	2.999	3.522	2.999	8.972	15.297	15.3768
7.50	108.00	24.00	6.00	3.60	0.014	182.35	0.014	0.149	4126.181	0.149	3.381	64.304	3.381	3.385	4.133	3.385	16.483	23.412	23.4926
7.67	112.08	26.04	6.68	4.28	0.014	279.47	0.014	0.156	6323.584	0.156	3.584	132.520	3.584	3.737	8.441	3.737	25.567	33.059	33.0591
7.83	115.92	27.96	7.32	4.92	0.015	404.91	0.015	0.162	9162.119	0.162	3.765	239.982	3.765	4.042	21.240	4.042	35.252	43.235	43.2353
8.00	120.00	30.00	8.00	5.60	0.015	583.75	0.015	0.167	13208.685	0.167	3.948	419.555	3.948	4.341	53.088	4.341	46.620	55.092	55.0921
8.17	124.08	32.04	8.68	6.28	0.015	820.71	0.015	0.173	18570.570	0.173	4.124	691.324	4.124	4.622	116.986	4.622	59.000	67.933	67.9333

HMP-2A Drawdown @		8.17	ft=	95.50
Elevation	Q_{AVG} (CFS)	∆V (CF)	∆T (HR)	Total T
0.00	0.011	253	6.27	95.50
0.17	0.014	289	5.82	89.23
0.33	0.018	312	4.72	83.41
0.50	0.022	330	4.17	78.69
0.67	0.025	345	3.82	74.52
0.83	0.028	358	3.57	70.70
1.00	0.030	369	3.38	67.13
1.17	0.033	378	3.22	63.75
1.33	0.035	387	3.09	60.52
1.50	0.037	395	2.98	57.43
1.67	0.039	402	2.88	54.45
1.83	0.041	408	2.79	51.57
2.00	0.042	413	2.71	48.77
2.17	0.044	418	2.64	46.06
2.33	0.046	422	2.57	43.41
2.50	0.047	425	2.51	40.84
2.67	0.049	429	2.45	38.33
2.83	0.050	431	2.39	35.88
3.00	0.051	433	2.34	33.49
3.17	0.053	435	2.28	31.16
3.33	0.054	436	2.23	28.87
3.50	0.056	437	2.18	26.64
3.67	0.057	437	2.14	24.45
3.83	0.058	437	2.09	22.32
4.00	0.059	436	2.04	20.23
4.17	0.061	435	2.00	18.19
4.33	0.062	433	1.95	16.19
4.50	0.063	431	1.91	14.24
4.67	0.064	429	1.86	12.34
4.83	0.065	425	1.81	10.48
5.00	0.066	422	1.77	8.66
5.17	0.067	418	1.72	6.89
5.33	0.068	413	1.68	5.17
5.50	0.089	408	1.27	3.49
5.67	0.121	402	0.92	2.23
5.83	0.144	395	0.76	1.31
6.00	0.406	387	0.26	0.55
6.17	1.076	378	0.10	0.28
6.33	1.727	369	0.06	0.18
6.50	2.199	358	0.05	0.13
6.67	3.119	345	0.03	0.08
6.83	4.366	330	0.02	0.05
7.00	6.916	312	0.01	0.03
7.17	12.138	289	0.01	0.02
7.33	19.435	253	0.00	0.01
7.50	28.276	207	0.00	0.01
7.67	38.147	207	0.00	0.00
7.83	49.164	207	0.00	0.00
8.00	61.513	207	0.00	0.00
8.17				

Rational Method Hydrograph Calculations
for
Storage Facility #4

		Q_{100}=	0.39	cfs				
		Tc=	5	min		C=	0.85	
#= 72		$P_{100,6}$=	2.9	in		A=	0.06	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 (CFS)**
0	0	0.00	0.00	0.64	7.64	0.39	117	
1	5	7.64	0.64	0.18	2.13	0.11	33	0.009
2	10	4.89	0.81	0.13	1.51	0.08	23	0.009
3	15	3.76	0.94	0.10	1.21	0.06	19	0.009
4	20	3.12	1.04	0.09	1.03	0.05	16	0.009
5	25	2.71	1.13	0.08	0.90	0.05	14	0.009
6	30	2.41	1.20	0.07	0.81	0.04	12	0.009
7	35	2.18	1.27	0.06	0.74	0.04	11	0.010
8	40	2.00	1.33	0.06	0.68	0.03	10	0.010
9	45	1.85	1.39	0.05	0.64	0.03	10	0.010
10	50	1.73	1.44	0.05	0.60	0.03	9	0.010
11	55	1.63	1.49	0.05	0.56	0.03	9	0.010
12	60	1.54	1.54	0.04	0.53	0.03	8	0.010
13	65	1.46	1.58	0.04	0.51	0.03	8	0.011
14	70	1.39	1.62	0.04	0.48	0.02	7	0.011
15	75	1.33	1.67	0.04	0.46	0.02	7	0.011
16	80	1.28	1.70	0.04	0.44	0.02	7	0.011
17	85	1.23	1.74	0.04	0.43	0.02	7	0.011
18	90	1.18	1.78	0.03	0.41	0.02	6	0.012
19	95	1.14	1.81	0.03	0.40	0.02	6	0.012
20	100	1.11	1.84	0.03	0.39	0.02	6	0.012
21	105	1.07	1.88	0.03	0.37	0.02	6	0.013
22	110	1.04	1.91	0.03	0.36	0.02	6	0.013
23	115	1.01	1.94	0.03	0.35	0.02	5	0.013
24	120	0.98	1.97	0.03	0.34	0.02	5	0.013
25	125	0.96	2.00	0.03	0.34	0.02	5	0.014
26	130	0.93	2.02	0.03	0.33	0.02	5	0.014
27	135	0.91	2.05	0.03	0.32	0.02	5	0.015
28	140	0.89	2.08	0.03	0.31	0.02	5	0.015
29	145	0.87	2.10	0.03	0.31	0.02	5	0.016
30	150	0.85	2.13	0.02	0.30	0.02	5	0.016
31	155	0.83	2.15	0.02	0.29	0.01	4	0.017
32	160	0.82	2.18	0.02	0.29	0.01	4	0.017
33	165	0.80	2.20	0.02	0.28	0.01	4	0.018
34	170	0.79	2.23	0.02	0.28	0.01	4	0.019
35	175	0.77	2.25	0.02	0.27	0.01	4	0.020
36	180	0.76	2.27	0.02	0.27	0.01	4	0.020
37	185	0.74	2.29	0.02	0.26	0.01	4	0.022
38	190	0.73	2.32	0.02	0.26	0.01	4	0.023
39	195	0.72	2.34	0.02	0.25	0.01	4	0.025
40	200	0.71	2.36	0.02	0.25	0.01	4	0.026
41	205	0.70	2.38	0.02	0.25	0.01	4	0.029

Rational Method Hydrograph Calculations
for
Storage Facility #4

42	210	0.69	2.40	0.02	0.24	0.01	4	0.030
43	215	0.68	2.42	0.02	0.24	0.01	4	0.035
44	220	0.67	2.44	0.02	0.23	0.01	4	0.038
45	225	0.66	2.46	0.02	0.23	0.01	4	0.046
46	230	0.65	2.48	0.02	0.23	0.01	3	0.053
47	235	0.64	2.50	0.02	0.22	0.01	3	0.077
48	240	0.63	2.52	0.02	0.22	0.01	3	0.109
49	245	0.62	2.53	0.02	0.22	0.01	3	***0.390***
50	250	0.61	2.55	0.02	0.22	0.01	3	0.062
51	255	0.60	2.57	0.02	0.21	0.01	3	0.041
52	260	0.60	2.59	0.02	0.21	0.01	3	0.032
53	265	0.59	2.61	0.02	0.21	0.01	3	0.027
54	270	0.58	2.62	0.02	0.21	0.01	3	0.024
55	275	0.58	2.64	0.02	0.20	0.01	3	0.021
56	280	0.57	2.66	0.02	0.20	0.01	3	0.019
57	285	0.56	2.67	0.02	0.20	0.01	3	0.018
58	290	0.56	2.69	0.02	0.20	0.01	3	0.016
59	295	0.55	2.71	0.02	0.19	0.01	3	0.015
60	300	0.54	2.72	0.02	0.19	0.01	3	0.014
61	305	0.54	2.74	0.02	0.19	0.01	3	0.014
62	310	0.53	2.76	0.02	0.19	0.01	3	0.013
63	315	0.53	2.77	0.02	0.19	0.01	3	0.012
64	320	0.52	2.79	0.02	0.18	0.01	3	0.012
65	325	0.52	2.80	0.02	0.18	0.01	3	0.011
66	330	0.51	2.82	0.02	0.18	0.01	3	0.011
67	335	0.51	2.83	0.01	0.18	0.01	3	0.010
68	340	0.50	2.85	0.01	0.18	0.01	3	0.010
69	345	0.50	2.86	0.01	0.18	0.01	3	0.010
70	350	0.49	2.88	0.01	0.17	0.01	3	0.010
71	355	0.49	2.89	0.01	0.17	0.01	3	0.009
72	360	0.48	2.91	0.00	0.00	0.00	0	0.009
						SUM=	**367**	**cubic feet**
							0.01	**acre-feet**

CMP #4 Discharge HMP Riser

Discharge vs Elevation Table

Low orifice:	0.25	"	Top orifice:	1	"
Number:	1		Number:	0	
Cg-low:	0.61		Cg-low:	3	
invert elev:	0.00	ft	invert elev:	1.00	ft
Middle orifice:	2	"	Emergency inlet:		
number of orif:	0		Rim height:	2.90	ft
Cg-middle:	0.61		Riser Box D	3x4	
invert elev:	1.00	ft	Weir Length	3.14	ft

h	H/D-low	H/D-mid	H/D-top	Qlow-orif	Qlow-weir	Qtot-low	Qmid-orif	Qmid-weir	Qtot-med	Qtop-orif	Qtop-weir	Qtot-top	Qpeak-top	Qtot
(ft)	-	-	-	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.17	8.00	0.00	0.00	0.001	0.070	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
0.33	16.00	0.00	0.00	0.001	3.723	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
0.50	24.00	0.00	0.00	0.001	32.236	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
0.67	32.00	0.00	0.00	0.001	144.148	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
0.83	40.00	0.00	0.00	0.002	454.986	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
1.00	48.00	0.00	0.00	0.002	1156.986	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
1.17	56.00	1.00	2.00	0.002	2538.816	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
1.33	64.00	2.00	4.00	0.002	5005.303	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
1.50	72.00	3.00	6.00	0.002	9097.150	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
1.67	80.00	4.00	8.00	0.002	15510.669	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
1.83	88.00	5.00	10.00	0.002	25117.495	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
2.00	96.00	6.00	12.00	0.002	38984.315	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
2.17	104.00	7.00	14.00	0.002	58392.588	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
2.33	112.00	8.00	16.00	0.003	84858.274	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
2.50	120.00	9.00	18.00	0.003	120151.551	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
2.67	128.00	10.00	20.00	0.003	166316.542	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
2.83	136.00	11.00	22.00	0.003	225691.037	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
3.00	144.00	12.00	24.00	0.003	300926.219	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.331	0.334
3.17	152.00	13.00	26.00	0.003	395006.385	0.003	0.000	0.000	0.000	0.000	0.000	0.000	1.440	1.443
3.33	160.00	14.00	28.00	0.003	511268.668	0.003	0.000	0.000	0.000	0.000	0.000	0.000	2.983	2.986
3.50	168.00	15.00	30.00	0.003	653422.765	0.003	0.000	0.000	0.000	0.000	0.000	0.000	4.860	4.863
3.67	176.16	16.02	32.04	0.003	829349.841	0.003	0.000	0.000	0.000	0.000	0.000	0.000	7.065	7.068
3.83	184.00	17.00	34.00	0.003	1032226.336	0.003	0.000	0.000	0.000	0.000	0.000	0.000	9.428	9.431
4.00	192.00	18.00	36.00	0.003	1278335.521	0.003	0.000	0.000	0.000	0.000	0.000	0.000	12.063	12.067
4.17	200.00	19.00	38.00	0.003	1569295.390	0.003	0.000	0.000	0.000	0.000	0.000	0.000	14.906	14.910
4.33	208.00	20.00	40.00	0.003	1910974.299	0.003	0.000	0.000	0.000	0.000	0.000	0.000	17.943	17.946
4.50	216.00	21.00	42.00	0.004	2309731.506	0.004	0.000	0.000	0.000	0.000	0.000	0.000	21.162	21.165
4.67	224.00	22.00	44.00	0.004	2772436.895	0.004	0.000	0.000	0.000	0.000	0.000	0.000	24.553	24.557
4.83	232.00	23.00	46.00	0.004	3306490.700	0.004	0.000	0.000	0.000	0.000	0.000	0.000	28.108	28.112
5.00	240.00	24.00	48.00	0.004	3919843.227	0.004	0.000	0.000	0.000	0.000	0.000	0.000	31.820	31.824

CMP #4 Stage Storage					
HMP Volume			350		
HMP Ponding Depth			2.667	ft	
Note: Find out the elevation value in relation to required WQ volume					
HMP-2-A Stage Storage					
depth	area	area (ac)	elevation	volume (cf)	volume (acft)
0.00	74.4	0.0017	0.00	0.0	0.00000
0.17	102.2	0.0023	0.17	15.5	0.00036
0.33	112.9	0.0026	0.33	33.5	0.00077
0.50	120.4	0.0028	0.50	53.0	0.00122
0.67	126.3	0.0029	0.67	73.6	0.00169
0.83	130.9	0.0030	0.83	95.0	0.00218
1.00	134.7	0.0031	1.00	117.1	0.00269
1.17	137.7	0.0032	1.17	139.9	0.00321
1.33	140.0	0.0032	1.33	163.0	0.00374
1.50	141.8	0.0033	1.50	186.5	0.00428
1.67	143.0	0.0033	1.67	210.2	0.00483
1.83	143.8	0.0033	1.83	234.1	0.00538
2.00	144.0	0.0033	2.00	258.1	0.00593
2.17	143.8	0.0033	2.17	282.1	0.00648
2.33	143.0	0.0033	2.33	306.0	0.00703
2.50	141.8	0.0033	2.50	329.8	0.00757
2.67	140.0	0.0032	2.67	353.3	0.00811
2.83	137.7	0.0032	2.83	376.4	0.00864
3.00	134.7	0.0031	3.00	399.1	0.00916
3.17	130.9	0.0030	3.17	421.3	0.00967
3.33	126.3	0.0029	3.33	442.7	0.01016
3.50	120.4	0.0028	3.50	463.3	0.01064
3.67	112.9	0.0026	3.67	482.8	0.01108
3.83	102.2	0.0023	3.83	500.7	0.01150
4.00	74.4	0.0017	4.00	516.3	0.01185
4.17	74.4	0.0017	4.17	528.7	0.01214
4.33	74.4	0.0017	4.33	541.1	0.01242
4.50	74.4	0.0017	4.50	553.5	0.01271
4.67	74.4	0.0017	4.67	565.9	0.01299
4.83	74.4	0.0017	4.83	578.3	0.01327
5.00	74.4	0.0017	5.00	590.7	0.01356

CONTECH ENGINEERED SOLUTIONS

Date: 10/10/2024
Project Name: East Storage-2 - COPY - 61024 (10-10-2024 18-3-52)

City / County:
State:

Designed By:
Company:
Telephone:

CMP: Underground Detention System Storage Volume Estimation

=Adjustable Input Cells

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular applicaton and are subject to verification of the Engineer of Record. This tool is only applicable for rectangular shaped systems.

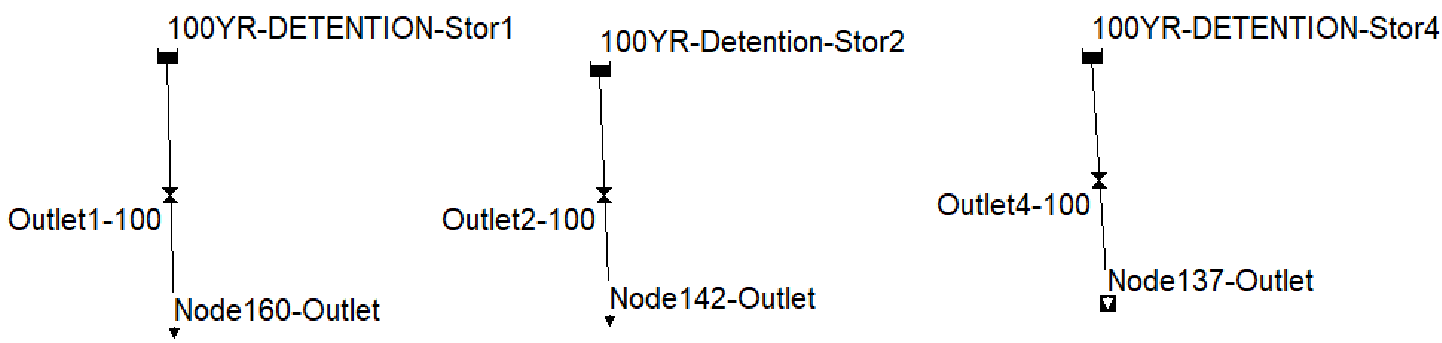
Summary of Inputs

System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	**29.0**	**Backfill Porosity (%):**	**40%**	**System Diameter (in):**	**48**
Out-to-out width (ft):	**4.0**	**Depth Above Pipe (in):**	**12.0**	**Pipe Spacing (in):**	**24**
Number of Manifolds (ea):	**1.0**	**Depth Below Pipe (in):**	**0.0**	**Incremental Analysis (in):**	**2**
Number of Barrels (ea):	**1.0**	**Width At Ends (ft):**	**1.0**	**System Invert (Elevation):**	**331**
		Width At Sides (ft):	**1.0**		

Storage Volume Estimation

System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	**Elevation (ft)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Incremental Storage (cf)**	**Cumulative Storage (cf)**	**Percent Open Storage (%)**	**Ave. Surface Area (sf)**
0.00	331.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	74.4
0.17	331.16	5.2	5.2	10.3	10.3	15.5	15.5	33.5%	102.2
0.33	331.33	9.3	14.5	8.7	19.0	18.0	33.5	43.3%	112.9
0.50	331.50	11.8	26.3	7.7	26.7	19.5	53.0	49.6%	120.4
0.67	331.66	13.6	39.9	6.9	33.6	20.6	73.6	54.3%	126.3
0.83	331.83	15.1	55.0	6.4	40.0	21.4	95.0	57.9%	130.9
1.00	332.00	16.2	71.2	5.9	45.9	22.1	117.1	60.8%	134.7
1.17	332.16	17.2	88.4	5.5	51.4	22.7	139.9	63.2%	137.7
1.33	332.33	17.9	106.3	5.2	56.7	23.1	163.0	65.2%	140.0
1.50	332.50	18.5	124.8	5.0	61.7	23.5	186.5	66.9%	141.8
1.67	332.66	18.9	143.7	4.8	66.5	23.7	210.2	68.4%	143.0
1.83	332.83	19.2	162.9	4.7	71.2	23.9	234.1	69.6%	143.8
2.00	333.00	19.3	182.2	4.7	75.9	24.0	258.1	70.6%	144.0
2.17	333.16	19.3	201.5	4.7	80.6	24.0	282.1	71.4%	143.8
2.33	333.33	19.2	220.7	4.7	85.3	23.9	306.0	72.1%	143.0
2.50	333.50	18.9	239.6	4.8	90.2	23.7	329.8	72.7%	141.8
2.67	333.66	18.5	258.1	5.0	95.2	23.5	353.3	73.1%	140.0
2.83	333.83	17.9	276.0	5.2	100.4	23.1	376.4	73.3%	137.7
3.00	334.00	17.2	293.2	5.5	105.9	22.7	399.1	73.5%	134.7
3.17	334.16	16.2	309.4	5.9	111.8	22.1	421.3	73.5%	130.9
3.33	334.33	15.1	324.5	6.4	118.2	21.4	442.7	73.3%	126.3
3.50	334.50	13.6	338.1	6.9	125.1	20.6	463.3	73.0%	120.4
3.67	334.66	11.8	349.9	7.7	132.8	19.5	482.8	72.5%	112.9
3.83	334.83	9.3	359.2	8.7	141.5	18.0	500.7	71.7%	102.2
4.00	335.00	5.2	364.4	10.3	151.8	15.5	516.3	70.6%	74.4
4.17	335.16	0.0	364.4	12.4	164.2	12.4	528.7	68.9%	74.4
4.33	335.33	0.0	364.4	12.4	176.6	12.4	541.1	67.4%	74.4
4.50	335.50	0.0	364.4	12.4	189.0	12.4	553.5	65.8%	74.4
4.67	335.66	0.0	364.4	12.4	201.4	12.4	565.9	64.4%	74.4
4.83	335.83	0.0	364.4	12.4	213.8	12.4	578.3	63.0%	74.4
5.00	336.00	0.0	364.4	12.4	226.2	12.4	590.7	61.7%	74.4

HMP-4 Drawdown @		5	ft=	85.68
Elevation	Q_{AVG} (CFS)	ΔV (CF)	ΔT (HR)	Total T
0.00	0.000	16	13.07	85.68
0.17	0.000	18	15.15	72.61
0.33	0.001	19	6.73	57.46
0.50	0.001	21	5.40	50.73
0.67	0.001	21	4.73	45.33
0.83	0.001	22	4.29	40.60
1.00	0.002	23	3.97	36.30
1.17	0.002	23	3.72	32.33
1.33	0.002	23	3.51	28.61
1.50	0.002	24	3.33	25.09
1.67	0.002	24	3.17	21.76
1.83	0.002	24	3.03	18.58
2.00	0.002	24	2.89	15.56
2.17	0.002	24	2.76	12.66
2.33	0.002	24	2.64	9.90
2.50	0.003	23	2.52	7.26
2.67	0.003	23	2.40	4.74
2.83	0.003	23	2.28	2.33
3.00	0.168	22	0.04	0.05
3.17	0.888	21	0.01	0.01
3.33	2.214	21	0.00	0.01
3.50	3.924	19	0.00	0.00
3.67	5.965	18	0.00	0.00
3.83	8.250	16	0.00	0.00
4.00	10.749	12	0.00	0.00
4.17	13.488	12	0.00	0.00
4.33	16.428	12	0.00	0.00
4.50	19.556	12	0.00	0.00
4.67	22.861	12	0.00	0.00
4.83	26.334	12	0.00	0.00
5.00	29.968			



100YR-DETENTION-Stor1
Outlet1-100
Node160-Outlet
100YR-Detention-Stor2
Outlet2-100
Node142-Outlet
100YR-DETENTION-Stor4
Outlet4-100
Node137-Outlet

```
[TITLE]
;;Project Title/Notes
OLIVE PARK APARTMENTS - POC1 PRE-DEVELOPED

[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           08/28/1951
START_TIME           00:00:00
REPORT_START_DATE    08/28/1951
REPORT_START_TIME    00:00:00
END_DATE             08/28/1951
END_TIME             23:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:12:00
DRY_STEP             03:00:00
ROUTING_STEP         0:01:00
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         12.557
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
;;-------------- ----------------
MONTHLY          0.06   0.08   0.11   0.15   0.17   0.19   0.19   0.18   0.15   0.11   0.08   0.06
DRY_ONLY         NO

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
Node160-Outlet   0          FREE                        NO
Node142-Outlet   0          FREE                        NO
Node137-Outlet   0          FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            N/A      Fevap    Psi
  Ksat     IMD
;;-------------- -------- ---------- ----------- ---------- ---------------------------- -------- --------
   -------- --------
100YR-DETENTION-Stor1 0        7.5        2.83       TABULAR    Stor1                        0        0
100YR-Detention-Stor2 0        7.5        3          TABULAR    Stor2                        0        0
100YR-DETENTION-Stor4 0        5          0          TABULAR    Stor4                        0        0

[OUTLETS]
;;Name           From Node        To Node          Offset     Type            QTable/Qcoeff    Qexpon     Gated

;;-------------- ---------------- ---------------- ---------- --------------- ---------------- ----------
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Outlet1-100      100YR-DETENTION-Stor1 Node160-Outlet   0          TABULAR/DEPTH   Outlet1
NO
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Outlet2-100      100YR-Detention-Stor2 Node142-Outlet   0          TABULAR/DEPTH   Outlet2
NO
Outlet4-100      100YR-DETENTION-Stor4 Node137-Outlet   0          TABULAR/DEPTH   Outlet4
NO

[INFLOWS]
;;Node           Constituent      Time Series      Type     Mfactor  Sfactor  Baseline Pattern
;;-------------- ---------------- ---------------- -------- -------- -------- -------- --------
100YR-DETENTION-Stor1 FLOW             100YR-Node160-inflow FLOW     1.0      1.0
100YR-Detention-Stor2 FLOW             100YR-Node142-Inflow FLOW     1.0      1.0
100YR-DETENTION-Stor4 FLOW             100YR-Node137-Inflow FLOW     1.0      1.0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
Outlet1          Rating     0.00       0.0000
Outlet1                     0.17       0.0256
Outlet1                     0.33       0.0376
Outlet1                     0.50       0.0467
Outlet1                     0.67       0.0542
Outlet1                     0.83       0.0608
Outlet1                     1.00       0.0668
Outlet1                     1.17       0.0723
Outlet1                     1.33       0.0773
Outlet1                     1.50       0.0821
Outlet1                     1.67       0.0866
Outlet1                     1.83       0.0909
Outlet1                     2.00       0.0950
Outlet1                     2.17       0.0989
Outlet1                     2.33       0.1027
Outlet1                     2.50       0.1064
Outlet1                     2.67       0.1099
Outlet1                     2.83       0.1133
Outlet1                     3.00       0.1192
Outlet1                     3.17       0.1236
Outlet1                     3.33       0.1276
Outlet1                     3.50       0.1314
Outlet1                     3.67       0.1351
Outlet1                     3.83       0.1385
Outlet1                     4.00       0.1419
Outlet1                     4.17       0.1452
Outlet1                     4.33       0.1484
Outlet1                     4.50       0.1516
Outlet1                     4.67       0.1546
Outlet1                     4.83       0.2445
Outlet1                     5.00       0.5965
Outlet1                     5.17       1.3701
Outlet1                     5.33       2.9209
Outlet1                     5.50       4.0007
Outlet1                     5.67       4.7715
Outlet1                     5.83       5.4280
Outlet1                     6.00       6.0102
Outlet1                     6.17       6.5391
Outlet1                     6.33       7.0272
Outlet1                     6.50       8.9570
Outlet1                     6.67       14.3315
Outlet1                     6.83       21.6166
Outlet1                     7.00       30.3721
Outlet1                     7.17       40.3710
Outlet1                     7.33       51.4677
Outlet1                     7.50       63.5587
;
Outlet2          Rating     0.00       0.0000
Outlet2                     0.17       0.0112
Outlet2                     0.33       0.0164
Outlet2                     0.50       0.0204
Outlet2                     0.67       0.0236
Outlet2                     0.83       0.0265
Outlet2                     1.00       0.0291
Outlet2                     1.17       0.0315
Outlet2                     1.33       0.0337
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Outlet2                    1.50       0.0358
Outlet2                    1.67       0.0378
Outlet2                    1.83       0.0396
Outlet2                    2.00       0.0414
Outlet2                    2.17       0.0431
Outlet2                    2.33       0.0448
Outlet2                    2.50       0.0463
Outlet2                    2.67       0.0479
Outlet2                    2.83       0.0494
Outlet2                    3.00       0.0508
Outlet2                    3.17       0.0522
Outlet2                    3.33       0.0536
Outlet2                    3.50       0.0549
Outlet2                    3.67       0.0562
Outlet2                    3.83       0.0575
Outlet2                    4.00       0.0587
Outlet2                    4.17       0.0599
Outlet2                    4.33       0.0611
Outlet2                    4.50       0.0623
Outlet2                    4.67       0.0634
Outlet2                    4.83       0.0646
Outlet2                    5.00       0.0657
Outlet2                    5.17       0.0668
Outlet2                    5.33       0.0678
Outlet2                    5.50       0.0689
Outlet2                    5.67       0.1099
Outlet2                    5.83       0.1328
Outlet2                    6.00       0.1558
Outlet2                    6.17       0.6556
Outlet2                    6.33       1.4973
Outlet2                    6.50       1.9577
Outlet2                    6.67       2.4401
Outlet2                    6.83       3.7983
Outlet2                    7.00       4.9335
Outlet2                    7.17       8.8986
Outlet2                    7.33       15.3768
Outlet2                    7.50       23.4926
Outlet2                    7.67       33.0591
Outlet2                    7.83       43.2353
Outlet2                    8.00       55.0921
Outlet2                    8.17       67.9333
;
Outlet4          Rating    0.00       0.000
Outlet4                    0.17       0.001
Outlet4                    0.33       0.001
Outlet4                    0.50       0.001
Outlet4                    0.67       0.001
Outlet4                    0.83       0.002
Outlet4                    1.00       0.002
Outlet4                    1.17       0.002
Outlet4                    1.33       0.002
Outlet4                    1.50       0.002
Outlet4                    1.67       0.002
Outlet4                    1.83       0.002
Outlet4                    2.00       0.002
Outlet4                    2.17       0.002
Outlet4                    2.33       0.003
Outlet4                    2.50       0.003
Outlet4                    2.67       0.003
Outlet4                    2.83       0.003
Outlet4                    3.00       0.334
Outlet4                    3.17       1.443
Outlet4                    3.33       2.986
Outlet4                    3.50       4.863
Outlet4                    3.67       7.068
Outlet4                    3.83       9.431
Outlet4                    4.00       12.067
Outlet4                    4.17       14.910
Outlet4                    4.33       17.946
Outlet4                    4.50       21.165
Outlet4                    4.67       24.557
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Outlet4                      4.83       28.112
Outlet4                      5.00       31.824
;
Stor1            Storage     0.00       3008.4
Stor1                        0.17       3990.6
Stor1                        0.33       4380.5
Stor1                        0.50       4667.7
Stor1                        0.67       4899.6
Stor1                        0.83       5094.9
Stor1                        1.00       5262.9
Stor1                        1.17       5409.5
Stor1                        1.33       5538.3
Stor1                        1.50       5652.0
Stor1                        1.67       5752.5
Stor1                        1.83       5841.1
Stor1                        2.00       5919.0
Stor1                        2.17       5986.9
Stor1                        2.33       6045.6
Stor1                        2.50       6095.5
Stor1                        2.67       6137.2
Stor1                        2.83       6170.8
Stor1                        3.00       6196.8
Stor1                        3.17       6215.2
Stor1                        3.33       6226.1
Stor1                        3.50       6229.8
Stor1                        3.67       6226.1
Stor1                        3.83       6215.2
Stor1                        4.00       6196.8
Stor1                        4.17       6170.8
Stor1                        4.33       6137.2
Stor1                        4.50       6095.5
Stor1                        4.67       6045.6
Stor1                        4.83       5986.9
Stor1                        5.00       5919.0
Stor1                        5.17       5841.1
Stor1                        5.33       5752.5
Stor1                        5.50       5652.0
Stor1                        5.67       5538.3
Stor1                        5.83       5409.5
Stor1                        6.00       5262.9
Stor1                        6.17       5094.9
Stor1                        6.33       4899.6
Stor1                        6.50       4667.7
Stor1                        6.67       4380.5
Stor1                        6.83       3990.6
Stor1                        7.00       3008.4
Stor1                        7.17       3008.4
Stor1                        7.33       3008.4
Stor1                        7.50       3008.4
;
Stor2            Storage     0.00       1244.4
Stor2                        0.17       1650.4
Stor2                        0.33       1811.9
Stor2                        0.50       1931.4
Stor2                        0.67       2028.1
Stor2                        0.83       2109.9
Stor2                        1.00       2180.6
Stor2                        1.17       2242.5
Stor2                        1.33       2297.3
Stor2                        1.50       2346.0
Stor2                        1.67       2389.3
Stor2                        1.83       2428.0
Stor2                        2.00       2462.3
Stor2                        2.17       2492.6
Stor2                        2.33       2519.4
Stor2                        2.50       2542.6
Stor2                        2.67       2562.7
Stor2                        2.83       2579.6
Stor2                        3.00       2593.6
Stor2                        3.17       2604.6
Stor2                        3.33       2612.9
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Stor2                       3.50       2618.3
Stor2                       3.67       2621.1
Stor2                       3.83       2621.1
Stor2                       4.00       2618.3
Stor2                       4.17       2612.9
Stor2                       4.33       2604.6
Stor2                       4.50       2593.6
Stor2                       4.67       2579.6
Stor2                       4.83       2562.7
Stor2                       5.00       2542.6
Stor2                       5.17       2519.4
Stor2                       5.33       2492.6
Stor2                       5.50       2462.3
Stor2                       5.67       2428.0
Stor2                       5.83       2389.3
Stor2                       6.00       2346.0
Stor2                       6.17       2297.3
Stor2                       6.33       2242.5
Stor2                       6.50       2180.6
Stor2                       6.67       2109.9
Stor2                       6.83       2028.1
Stor2                       7.00       1931.4
Stor2                       7.17       1811.9
Stor2                       7.33       1650.4
Stor2                       7.50       1244.4
Stor2                       7.67       1244.4
Stor2                       7.83       1244.4
Stor2                       8.00       1244.4
Stor2                       8.17       1244.4
;
Stor4            Storage    0.00       74.4
Stor4                       0.17       102.2
Stor4                       0.33       112.9
Stor4                       0.50       120.4
Stor4                       0.67       126.3
Stor4                       0.83       130.9
Stor4                       1.00       134.7
Stor4                       1.17       137.7
Stor4                       1.33       140.0
Stor4                       1.50       141.8
Stor4                       1.67       143.0
Stor4                       1.83       143.8
Stor4                       2.00       144.0
Stor4                       2.17       143.8
Stor4                       2.33       143.0
Stor4                       2.50       141.8
Stor4                       2.67       140.0
Stor4                       2.83       137.7
Stor4                       3.00       134.7
Stor4                       3.17       130.9
Stor4                       3.33       126.3
Stor4                       3.50       120.4
Stor4                       3.67       112.9
Stor4                       3.83       102.2
Stor4                       4.00       74.4
Stor4                       4.17       74.4
Stor4                       4.33       74.4
Stor4                       4.50       74.4
Stor4                       4.67       74.4
Stor4                       4.83       74.4
Stor4                       5.00       74.4

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
100YR-Node142-Inflow 8/28/1951  5:00       0
100YR-Node142-Inflow 8/28/1951  5:06       0.3
100YR-Node142-Inflow 8/28/1951  5:12       0.3
100YR-Node142-Inflow 8/28/1951  5:18       0.3
100YR-Node142-Inflow 8/28/1951  5:24       0.3
100YR-Node142-Inflow 8/28/1951  5:30       0.3
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100YR-Node142-Inflow 8/28/1951  5:36       0.3
100YR-Node142-Inflow 8/28/1951  5:42       0.3
100YR-Node142-Inflow 8/28/1951  5:48       0.3
100YR-Node142-Inflow 8/28/1951  5:54       0.3
100YR-Node142-Inflow 8/28/1951  6:00       0.4
100YR-Node142-Inflow 8/28/1951  6:06       0.4
100YR-Node142-Inflow 8/28/1951  6:12       0.4
100YR-Node142-Inflow 8/28/1951  6:18       0.4
100YR-Node142-Inflow 8/28/1951  6:24       0.4
100YR-Node142-Inflow 8/28/1951  6:30       0.4
100YR-Node142-Inflow 8/28/1951  6:36       0.4
100YR-Node142-Inflow 8/28/1951  6:42       0.4
100YR-Node142-Inflow 8/28/1951  6:48       0.4
100YR-Node142-Inflow 8/28/1951  6:54       0.4
100YR-Node142-Inflow 8/28/1951  7:00       0.5
100YR-Node142-Inflow 8/28/1951  7:06       0.5
100YR-Node142-Inflow 8/28/1951  7:12       0.5
100YR-Node142-Inflow 8/28/1951  7:18       0.5
100YR-Node142-Inflow 8/28/1951  7:24       0.5
100YR-Node142-Inflow 8/28/1951  7:30       0.6
100YR-Node142-Inflow 8/28/1951  7:36       0.6
100YR-Node142-Inflow 8/28/1951  7:42       0.6
100YR-Node142-Inflow 8/28/1951  7:48       0.6
100YR-Node142-Inflow 8/28/1951  7:54       0.7
100YR-Node142-Inflow 8/28/1951  8:00       0.7
100YR-Node142-Inflow 8/28/1951  8:06       0.8
100YR-Node142-Inflow 8/28/1951  8:12       0.8
100YR-Node142-Inflow 8/28/1951  8:18       0.9
100YR-Node142-Inflow 8/28/1951  8:24       0.9
100YR-Node142-Inflow 8/28/1951  8:30       1.1
100YR-Node142-Inflow 8/28/1951  8:36       1.1
100YR-Node142-Inflow 8/28/1951  8:42       1.4
100YR-Node142-Inflow 8/28/1951  8:48       1.6
100YR-Node142-Inflow 8/28/1951  8:54       2.4
100YR-Node142-Inflow 8/28/1951  9:00       2.8
100YR-Node142-Inflow 8/28/1951  9:06       12.41
100YR-Node142-Inflow 8/28/1951  9:12       1.9
100YR-Node142-Inflow 8/28/1951  9:18       1.3
100YR-Node142-Inflow 8/28/1951  9:24       1
100YR-Node142-Inflow 8/28/1951  9:30       0.8
100YR-Node142-Inflow 8/28/1951  9:36       0.7
100YR-Node142-Inflow 8/28/1951  9:42       0.6
100YR-Node142-Inflow 8/28/1951  9:48       0.6
100YR-Node142-Inflow 8/28/1951  9:54       0.5
100YR-Node142-Inflow 8/28/1951  10:00      0.5
100YR-Node142-Inflow 8/28/1951  10:06      0.5
100YR-Node142-Inflow 8/28/1951  10:12      0.4
100YR-Node142-Inflow 8/28/1951  10:18      0.4
100YR-Node142-Inflow 8/28/1951  10:24      0.4
100YR-Node142-Inflow 8/28/1951  10:30      0.4
100YR-Node142-Inflow 8/28/1951  10:36      0.4
100YR-Node142-Inflow 8/28/1951  10:42      0.3
100YR-Node142-Inflow 8/28/1951  10:48      0.3
100YR-Node142-Inflow 8/28/1951  10:54      0.3
100YR-Node142-Inflow 8/28/1951  11:00      0.3
100YR-Node142-Inflow 8/28/1951  11:06      0
;
100YR-Node160-inflow 8/28/1951  5:00       0
100YR-Node160-inflow 8/28/1951  5:06       0.6
100YR-Node160-inflow 8/28/1951  5:12       0.6
100YR-Node160-inflow 8/28/1951  5:18       0.6
100YR-Node160-inflow 8/28/1951  5:24       0.7
100YR-Node160-inflow 8/28/1951  5:30       0.7
100YR-Node160-inflow 8/28/1951  5:36       0.7
100YR-Node160-inflow 8/28/1951  5:42       0.7
100YR-Node160-inflow 8/28/1951  5:48       0.7
100YR-Node160-inflow 8/28/1951  5:54       0.7
100YR-Node160-inflow 8/28/1951  6:00       0.7
100YR-Node160-inflow 8/28/1951  6:06       0.8
100YR-Node160-inflow 8/28/1951  6:12       0.8
100YR-Node160-inflow 8/28/1951  6:18       0.8
```

```
100YR-Node160-inflow 8/28/1951  6:24       0.8
100YR-Node160-inflow 8/28/1951  6:30       0.8
100YR-Node160-inflow 8/28/1951  6:36       0.8
100YR-Node160-inflow 8/28/1951  6:42       0.9
100YR-Node160-inflow 8/28/1951  6:48       0.9
100YR-Node160-inflow 8/28/1951  6:54       0.9
100YR-Node160-inflow 8/28/1951  7:00       0.9
100YR-Node160-inflow 8/28/1951  7:06       1
100YR-Node160-inflow 8/28/1951  7:12       1
100YR-Node160-inflow 8/28/1951  7:18       1.1
100YR-Node160-inflow 8/28/1951  7:24       1.1
100YR-Node160-inflow 8/28/1951  7:30       1.1
100YR-Node160-inflow 8/28/1951  7:36       1.2
100YR-Node160-inflow 8/28/1951  7:42       1.2
100YR-Node160-inflow 8/28/1951  7:48       1.3
100YR-Node160-inflow 8/28/1951  7:54       1.4
100YR-Node160-inflow 8/28/1951  8:00       1.4
100YR-Node160-inflow 8/28/1951  8:06       1.6
100YR-Node160-inflow 8/28/1951  8:12       1.6
100YR-Node160-inflow 8/28/1951  8:18       1.8
100YR-Node160-inflow 8/28/1951  8:24       1.9
100YR-Node160-inflow 8/28/1951  8:30       2.2
100YR-Node160-inflow 8/28/1951  8:36       2.4
100YR-Node160-inflow 8/28/1951  8:42       2.9
100YR-Node160-inflow 8/28/1951  8:48       3.3
100YR-Node160-inflow 8/28/1951  8:54       4.9
100YR-Node160-inflow 8/28/1951  9:00       5.3
100YR-Node160-inflow 8/28/1951  9:06       26.12
100YR-Node160-inflow 8/28/1951  9:12       3.9
100YR-Node160-inflow 8/28/1951  9:18       2.6
100YR-Node160-inflow 8/28/1951  9:24       2
100YR-Node160-inflow 8/28/1951  9:30       1.7
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100YR-Node160-inflow 8/28/1951  9:48       1.2
100YR-Node160-inflow 8/28/1951  9:54       1.1
100YR-Node160-inflow 8/28/1951  10:00      1
100YR-Node160-inflow 8/28/1951  10:06      1
100YR-Node160-inflow 8/28/1951  10:12      0.9
100YR-Node160-inflow 8/28/1951  10:18      0.9
100YR-Node160-inflow 8/28/1951  10:24      0.8
100YR-Node160-inflow 8/28/1951  10:30      0.8
100YR-Node160-inflow 8/28/1951  10:36      0.7
100YR-Node160-inflow 8/28/1951  10:42      0.7
100YR-Node160-inflow 8/28/1951  10:48      0.7
100YR-Node160-inflow 8/28/1951  10:54      0.7
100YR-Node160-inflow 8/28/1951  11:00      0.6
100YR-Node160-inflow 8/28/1951  11:06      0
;
100YR-Node137-Inflow 8/28/1951  5:00       0
100YR-Node137-Inflow 8/28/1951  5:05       0.009
100YR-Node137-Inflow 8/28/1951  5:10       0.009
100YR-Node137-Inflow 8/28/1951  5:15       0.009
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100YR-Node137-Inflow 8/28/1951  5:30       0.010
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100YR-Node137-Inflow 8/28/1951  5:50       0.010
100YR-Node137-Inflow 8/28/1951  5:55       0.010
100YR-Node137-Inflow 8/28/1951  6:00       0.011
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100YR-Node137-Inflow 8/28/1951  6:10       0.011
100YR-Node137-Inflow 8/28/1951  6:15       0.011
100YR-Node137-Inflow 8/28/1951  6:20       0.011
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```

```
100YR-Node137-Inflow 8/28/1951  6:50       0.013
100YR-Node137-Inflow 8/28/1951  6:55       0.013
100YR-Node137-Inflow 8/28/1951  7:00       0.014
100YR-Node137-Inflow 8/28/1951  7:05       0.014
100YR-Node137-Inflow 8/28/1951  7:10       0.015
100YR-Node137-Inflow 8/28/1951  7:15       0.015
100YR-Node137-Inflow 8/28/1951  7:20       0.016
100YR-Node137-Inflow 8/28/1951  7:25       0.016
100YR-Node137-Inflow 8/28/1951  7:30       0.017
100YR-Node137-Inflow 8/28/1951  7:35       0.017
100YR-Node137-Inflow 8/28/1951  7:40       0.018
100YR-Node137-Inflow 8/28/1951  7:45       0.019
100YR-Node137-Inflow 8/28/1951  7:50       0.020
100YR-Node137-Inflow 8/28/1951  7:55       0.020
100YR-Node137-Inflow 8/28/1951  8:00       0.022
100YR-Node137-Inflow 8/28/1951  8:05       0.023
100YR-Node137-Inflow 8/28/1951  8:10       0.025
100YR-Node137-Inflow 8/28/1951  8:15       0.026
100YR-Node137-Inflow 8/28/1951  8:20       0.029
100YR-Node137-Inflow 8/28/1951  8:25       0.030
100YR-Node137-Inflow 8/28/1951  8:30       0.035
100YR-Node137-Inflow 8/28/1951  8:35       0.038
100YR-Node137-Inflow 8/28/1951  8:40       0.046
100YR-Node137-Inflow 8/28/1951  8:45       0.053
100YR-Node137-Inflow 8/28/1951  8:50       0.077
100YR-Node137-Inflow 8/28/1951  8:55       0.109
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100YR-Node137-Inflow 8/28/1951  9:15       0.032
100YR-Node137-Inflow 8/28/1951  9:20       0.027
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100YR-Node137-Inflow 8/28/1951  9:30       0.021
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100YR-Node137-Inflow 8/28/1951  9:40       0.018
100YR-Node137-Inflow 8/28/1951  9:45       0.016
100YR-Node137-Inflow 8/28/1951  9:50       0.015
100YR-Node137-Inflow 8/28/1951  9:55       0.014
100YR-Node137-Inflow 8/28/1951  10:00      0.014
100YR-Node137-Inflow 8/28/1951  10:05      0.013
100YR-Node137-Inflow 8/28/1951  10:10      0.012
100YR-Node137-Inflow 8/28/1951  10:15      0.012
100YR-Node137-Inflow 8/28/1951  10:20      0.011
100YR-Node137-Inflow 8/28/1951  10:25      0.011
100YR-Node137-Inflow 8/28/1951  10:30      0.010
100YR-Node137-Inflow 8/28/1951  10:35      0.010
100YR-Node137-Inflow 8/28/1951  10:40      0.010
100YR-Node137-Inflow 8/28/1951  10:45      0.010
100YR-Node137-Inflow 8/28/1951  10:50      0.009
100YR-Node137-Inflow 8/28/1951  10:55      0.009
100YR-Node137-Inflow 8/28/1951  11:00      0.009

[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
;;-------------- ------------------ ------------------
Node160-Outlet   10749.559          5634.921
Node142-Outlet   13166.954          5697.074
Node137-Outlet   15920.826          5800.344
100YR-DETENTION-Stor1 10705.467          7169.312
```

```
100YR-Detention-Stor2 13106.713          7091.222
100YR-DETENTION-Stor4 15834.768          7168.675

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.014)
--------------------------------------------------------------

OLIVE PARK APARTMENTS - POC1 PRE-DEVELOPED


*********************************************************
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 ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ 08/28/1951 00:00:00
Ending Date .............. 08/28/1951 23:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Routing Time Step ........ 60.00 sec


**************************        Volume         Volume
Flow Routing Continuity        acre-feet       10^6 gal
**************************      ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........         1.300          0.424
External Outflow .........         1.050          0.342
Flooding Loss ............         0.000          0.000
Evaporation Loss .........         0.000          0.000
Exfiltration Loss ........         0.000          0.000
Initial Stored Volume ....         0.504          0.164
Final Stored Volume ......         0.752          0.245
Continuity Error (%) .....         0.113


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :    59.00 sec
Average Time Step           :    60.00 sec
Maximum Time Step           :    60.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.00
Percent Not Converging      :     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
Node160-Outlet	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
Node142-Outlet	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
Node137-Outlet	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
100YR-DETENTION-Stor1	STORAGE	3.90	6.52	6.52	0 09:12	5.18
100YR-Detention-Stor2	STORAGE	4.53	7.16	7.16	0 09:09	6.15
100YR-DETENTION-Stor4	STORAGE	1.62	2.89	2.89	0 09:05	2.84

****
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
Node160-Outlet	OUTFALL	0.00	9.65	0 09:12	0	0.236	0.000
Node142-Outlet	OUTFALL	0.00	8.65	0 09:09	0	0.104	0.000
Node137-Outlet	OUTFALL	0.00	0.12	0 09:05	0	0.00202	0.000
100YR-DETENTION-Stor1	STORAGE	26.12	26.12	0 09:07	0.283	0.396	0.097
100YR-Detention-Stor2	STORAGE	12.41	12.41	0 09:07	0.137	0.187	0.140
100YR-DETENTION-Stor4	STORAGE	0.39	0.39	0 09:01	0.00398	0.00398	0.389

****
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
100YR-DETENTION-Stor1	21.801	54	0	0	36.780	91	0 09:11	9.65
100YR-Detention-Stor2	10.703	61	0	0	16.876	97	0 09:09	8.65
100YR-DETENTION-Stor4	0.211	36	0	0	0.383	65	0 09:05	0.12

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
Node160-Outlet	100.00	0.38	9.65	0.236
Node142-Outlet	100.00	0.17	8.65	0.104
Node137-Outlet	75.87	0.00	0.12	0.002
System	91.96	0.55	0.12	0.342

****
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
Outlet1-100	DUMMY	9.65	0 09:12			
Outlet2-100	DUMMY	8.65	0 09:09			
Outlet4-100	DUMMY	0.12	0 09:05			

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Fri Oct 11 15:11:38 2024
Analysis ended on: Fri Oct 11 15:11:38 2024
Total elapsed time: < 1 sec

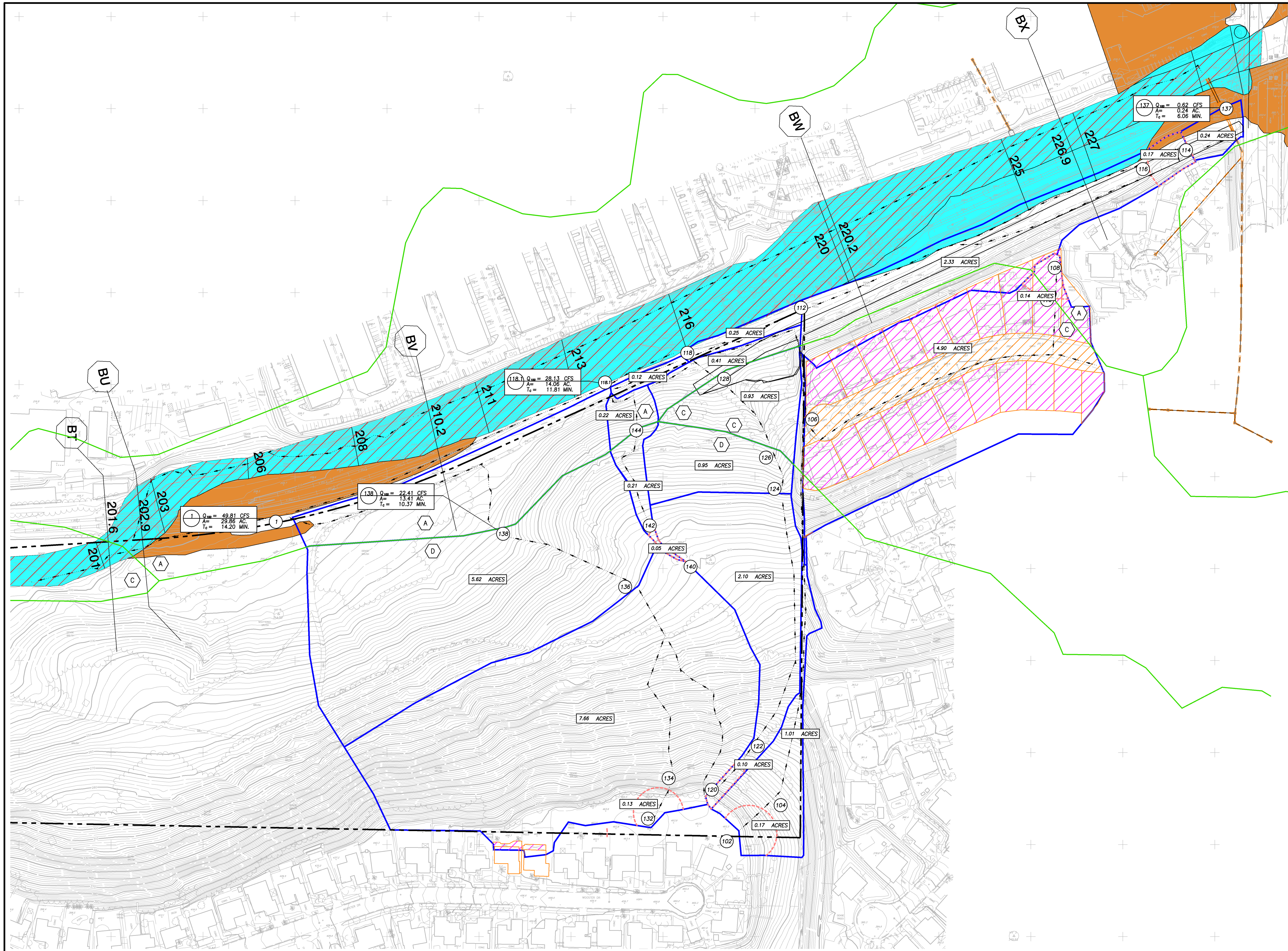
CHAPTER 6

HYDROLOGY MAPS

CHAPTER 6

HYDROLOGY MAPS

6.1 – Existing Condition Hydrology Map



LEGEND

	PROJECT BOUNDARY
	DRAINAGE BOUNDARY
	INITIAL SUBAREA
	FLOW DIRECTION
00.00 ACRES	AREA
X	HYDROLOGIC SOIL TYPE
406	NODE NUMBER
	EXISTING STORM DRAIN SYSTEM
	EXISTING SINGLE FAMILY DEVELOPMENT 65% IMPERVIOUSNESS
	EXISTING ROADS 90% IMPERVIOUSNESS
	HYDROLOGIC SOIL GROUP BOUNDARY
	100-YEAR FLOOD WAY PER FEMA FIRM
	100-YEAR FLOOD PLAIN PER FEMA FIRM\ ZONE AE
	500-YEAR FLOOD PLAIN PER FEMA FIRM\ ZONE X
BW 220.2	FEMA CROSS SECTION

H&A

100 0 100 200 300

SCALE 1" = 100'

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SAN DIEGO, INC

PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 · FX(858)558-1414

EXISTING
DRAINAGE MAP

OLIVE PARK APARTMENTS

CITY OF OCEANSIDE, CALIFORNIA

MAP
1
OF
1

W.O.# 3785-0002

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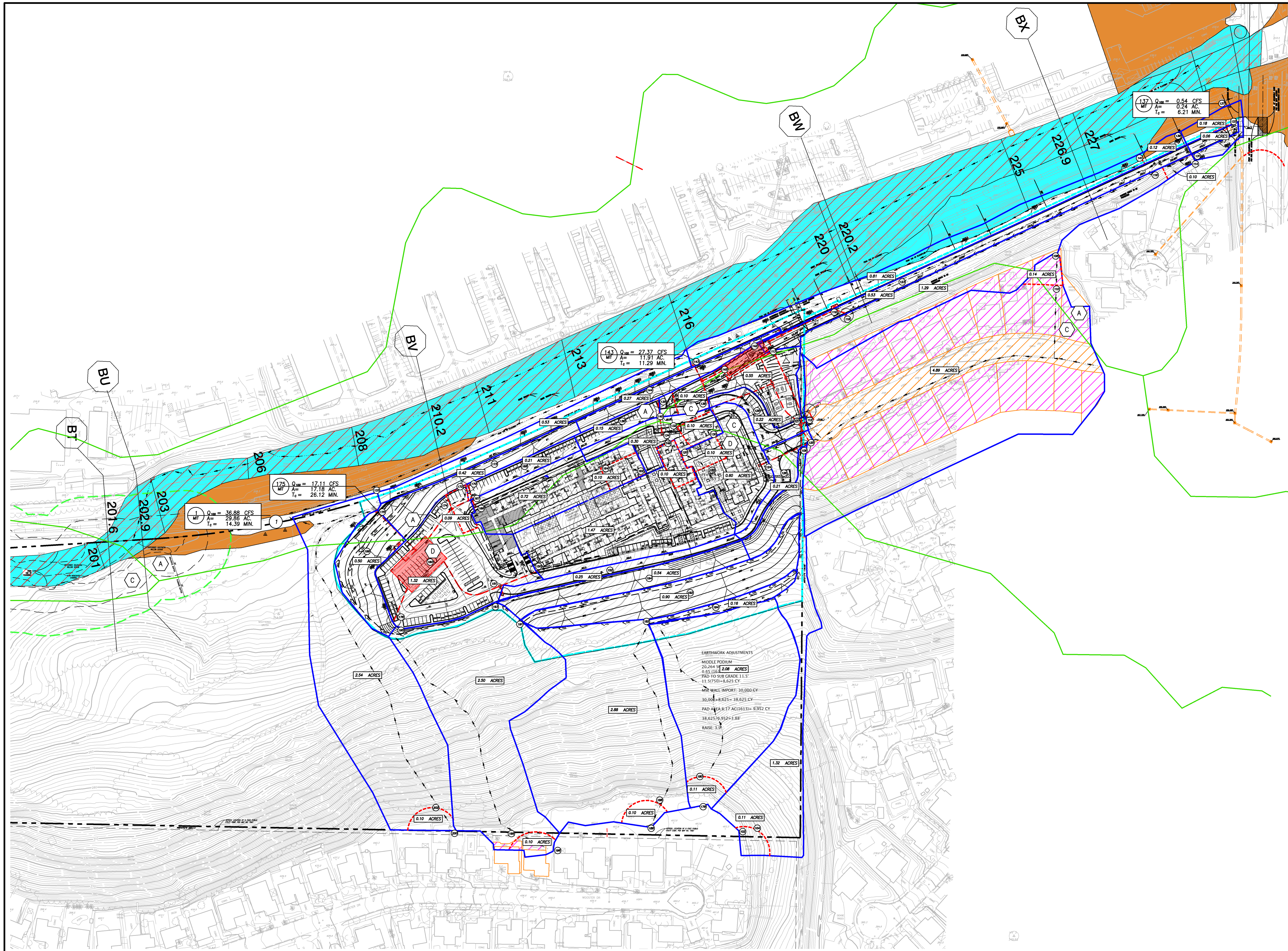
CHAPTER 6

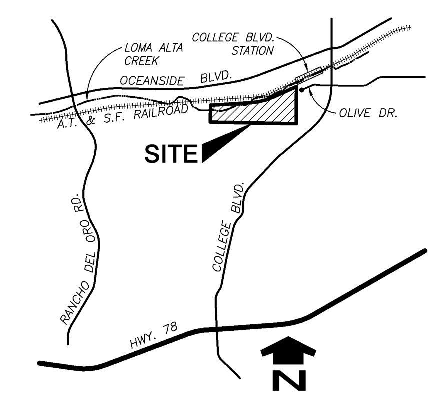
HYDROLOGY MAPS

6.2 – Developed Condition Hydrology Map



LEGEND

- PROJECT BOUNDARY
- DRAINAGE BOUNDARY
- INITIAL SUBAREA
- FLOW DIRECTION
- 00.00 ACRES — AREA
- X — HYDROLOGIC SOIL TYPE
- 406 — NODE NUMBER
- EXISTING STORM DRAIN SYSTEM
- PROPOSED STORM DRAIN SYSTEM
- DETENTION STORAGE FACILITY
- EXISTING SINGLE FAMILY DEVELOPMENT 65% IMPERVIOUSNESS
- EXISTING ROADS 90% IMPERVIOUSNESS
- HYDROLOGIC SOIL GROUP BOUNDARY
- 100-YEAR FLOOD WAY PER FEMA FIRM
- 100-YEAR FLOOD PLAIN PER FEMA FIRM\ ZONE AE
- 500-YEAR FLOOD PLAIN PER FEMA FIRM\ ZONE X
- BW 220.2 — FEMA CROSS SECTION
- INLET LOCATIONS



VICINITY MAP

NOT TO SCALE

100 0 100 200 300

SCALE 1"= 100'

PREPARED BY:

HUNSAKER & ASSOCIATES SAN DIEGO, INC

PLANNING ENGINEERING SURVEYING
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San Diego, Ca 92121
PH(858)558-4500 · FX(858)558-1414

PROPOSED DRAINAGE MAP

OLIVE PARK APARTMENTS

CITY OF OCEANSIDE, CALIFORNIA

MAP 1 OF 1

W.O.# 3785-0002

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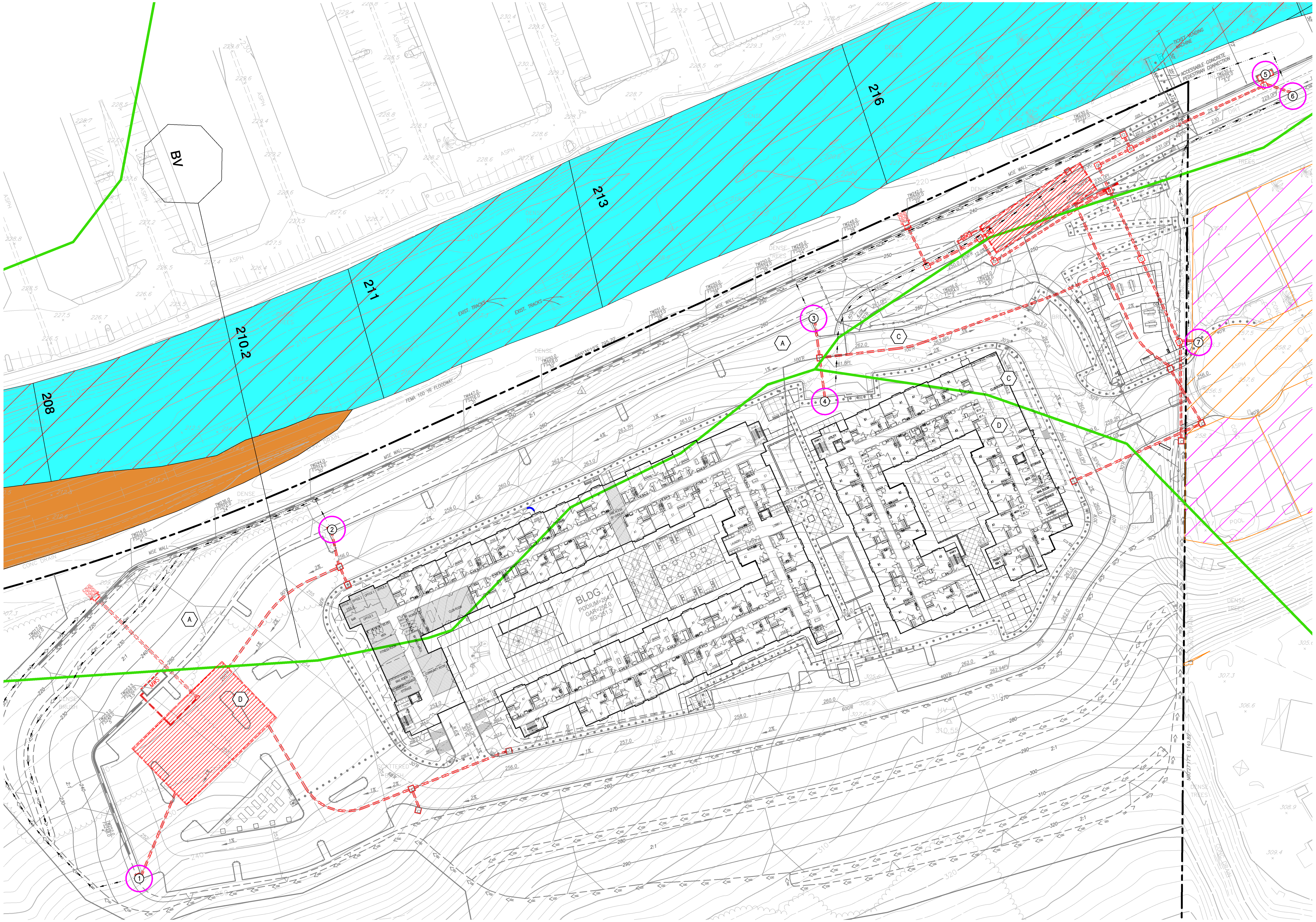
CHAPTER 6

HYDROLOGY MAPS

6.3 – Sump Inlet Location Map



LEGEND

	PROJECT BOUNDARY
	EMERGENCY FLOW PATH
X	HYDROLOGIC SOIL TYPE
	EXISTING STORM DRAIN SYSTEM
	PROPOSED STORM DRAIN SYSTEM
	DETENTION STORAGE FACILITY
	EXISTING SINGLE FAMILY DEVELOPMENT 65% IMPERVIOUSNESS
	EXISTING ROADS 90% IMPERVIOUSNESS
	HYDROLOGIC SOIL GROUP BOUNDARY
	100-YEAR FLOOD WAY PER FEMA FIRM
	100-YEAR FLOOD PLAIN PER FEMA FIRM\ ZONE AE
	500-YEAR FLOOD PLAIN PER FEMA FIRM\ ZONE X
BW 220.2	FEMA CROSS SECTION
1	PROPOSED SUMP INLET LOCATIONS

SUMP LOCATION AND EMERGENCY PATH DESCRIPTION:

1. THIS SUMP COLLECTS 8.48 CFS. THIS RUNOFF WILL OVERTOP THE CURB AND DRAIN INTO THE BROW DITCH DOWNSTREAM BEFORE IMPACTING ANY SURROUNDING STRUCTURES.

2. THIS SUMP COLLECTS 1.36 CFS. THE RUNOFF IS NOT LARGE ENOUGH TO OVERTOP THE CURB OR THE STREET CROWN. PONDING IN THIS AREA WOULD NOT AFFECT ANY SURROUNDING STRUCTURES. IF ADDITIONAL RUNOFF REACHED THIS POINT, THE FLOWS WOULD DRAIN DOWN THE SLOPE AND DISCHARGE INTO THE BROW DITCH, AS SHOWN.

3. THIS SUMP COLLECTS 0.86 CFS. LIKE SUMP #2, THE RUNOFF WOULD POND IN THIS LOCATION WITHOUT NEGATIVELY IMPACTING NEARBY STRUCTURES. ANY ADDITIONAL RUNOFF WOULD DRAIN DOWN THE SLOPE, AS SHOWN.

4. THIS SUMP COLLECTS 2.38 CFS. WHILE THE RUNOFF IS NOT ENOUGH TO OVERTOP THE CURB, A PORTION WOULD FLOW OVER THE ROAD'S CROWN AND COULD EITHER ENTER SUMP #3 OR DRAIN TO A DOWNSTREAM ON-GRADE INLET, AS SHOWN.

5. THIS SUMP COLLECTS 1.63 CFS. THIS RUNOFF IS INSUFFICIENT TO OVERTOP THE CURB OR THE STREET CROWN. PONDING IN THIS AREA WOULD NOT IMPACT ANY SURROUNDING STRUCTURES. IF ADDITIONAL RUNOFF REACHED THIS POINT, THE FLOWS WOULD OVERTOP THE CURB AND BEGIN FLOWING INTO THE CATCH BASIN AT SUMP #6.

6. THIS SUMP COLLECTS 1.61 CFS. THE RUNOFF IS NOT LARGE ENOUGH TO OVERTOP THE DITCH. STORMWATER WOULD POND AT THIS LOCATION WITHOUT IMPACTING NEARBY STRUCTURES. IF ANY ADDITIONAL FLOWS LARGE ENOUGH TO OVERTOP THE DITCH REACH THIS LOCATION, THE RUNOFF WILL DRAIN INTO THE STREET. THE PROPOSED MWS UNITS WOULD NOT HAVE ENOUGH CAPACITY TO CAPTURE THIS RUNOFF, RESULTING IN PONDING THAT COULD OVERTOP THE CURB AND DISCHARGE THROUGH AN EMERGENCY OPENING ON THE PROPOSED RETAINING WALL.

7. THIS SUMP COLLECTS 15.79 CFS FROM THE EXISTING DEVELOPMENT. THE EXISTING CUL-DE-SAC AND PROPOSED SUMP INLET WILL HAVE SUFFICIENT CAPACITY TO CAPTURE THIS RUNOFF. IF THE INLET WERE TO FAIL, THE FLOWS WOULD OVERTOP THE CURB AND DRAIN INTO THE EXISTING BROW DITCH, LIKE CURRENT CONDITIONS. THE EXISTING DITCH WILL BE REMOVED AND REROUTED WITH A PROPOSED DITCH OF THE SAME HYDRAULIC GEOMETRY. THIS NEW DITCH WILL DIRECT ALL FLOWS TO A PROPOSED CATCH BASIN WITH TWO OPENINGS, AS SHOWN.

40 0 40 80 120
SCALE 1" = 40'

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PROPOSED
SUMP INLET LOCATIONS

OLIVE PARK APARTMENTS

CITY OF OCEANSIDE, CALIFORNIA

MAP 1 OF 1

W.O.# 3785-0002

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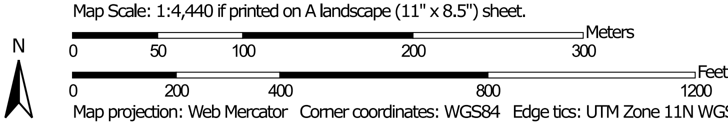
CHAPTER 7

APPENDICES

APPENDIX 1
Hydrologic Soil Information

Hydrologic Soil Group—San Diego County Area, California
(BND_PG)

Map Scale: 1:4,440 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 19, Aug 30, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 14, 2022—Mar 17, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CsB	Corralitos loamy sand, 0 to 5 percent slopes	A	3.7	8.5%
DaE2	Diablo clay, 15 to 30 percent slopes, eroded, warm MAAT	C	1.0	2.3%
DaF	Diablo clay, 30 to 50 percent slopes, warm MAAT, MLRA 20	C	0.9	2.0%
GaF	Gaviota fine sandy loam, 30 to 50 percent slopes	D	14.2	32.3%
LeC2	Las Flores loamy fine sand, 5 to 9 percent slopes, eroded	D	0.3	0.7%
LeD2	Las Flores loamy fine sand, 9 to 15 percent slopes, eroded	D	15.6	35.6%
SbA	Salinas clay loam, 0 to 2 percent slopes, warm MAAT, MLRA 19	C	8.2	18.6%
Totals for Area of Interest			**43.9**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

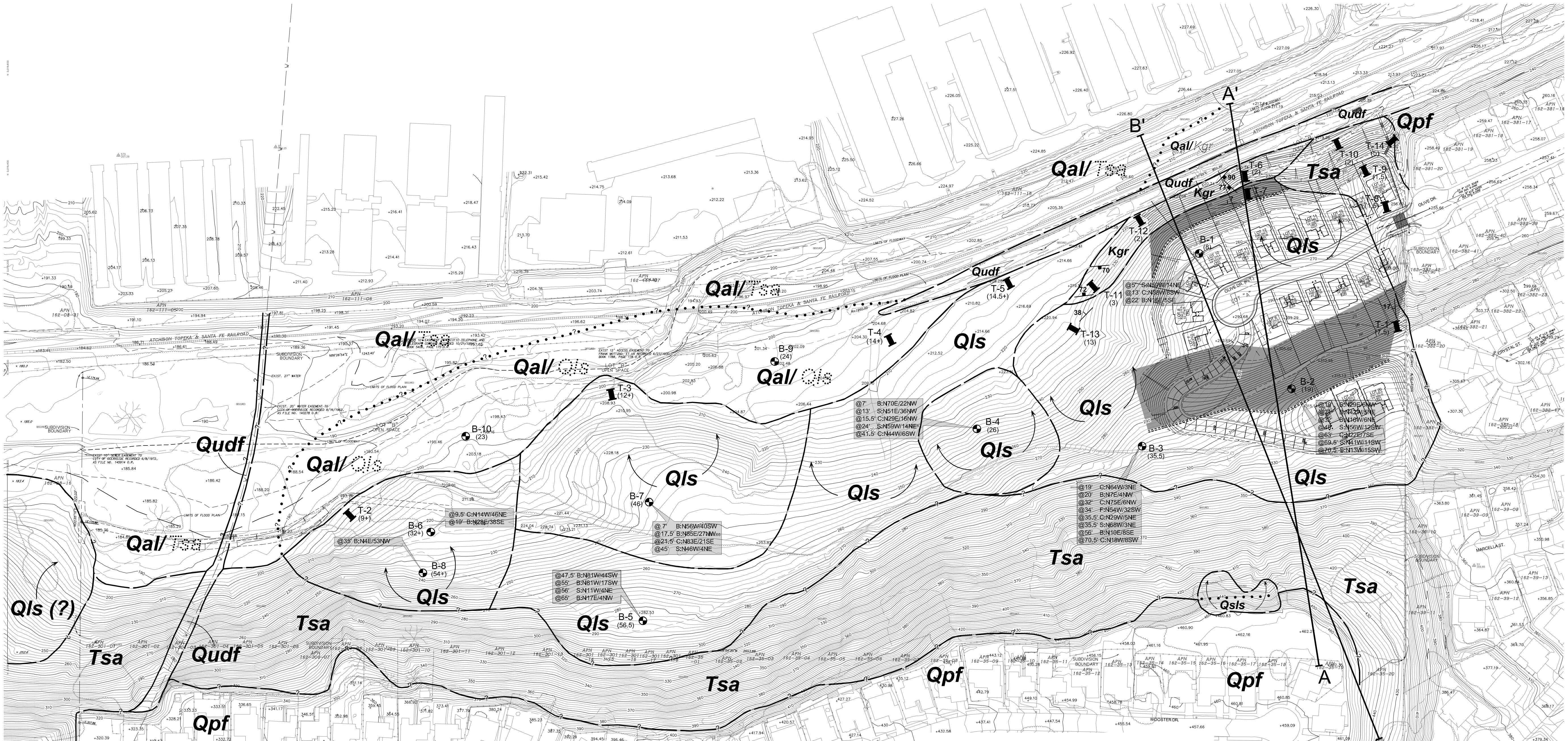
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



GEOCON LEGEND

Qudf ........UNDOCUMENTED FILL

Qpf ....PREVIOUSLY PLACED FILL

Qal ....ALLUVIUM

Qsls ....SURFICIAL LANDSLIDE DEBRIS

Qls ....LANDSLIDE DEBRIS (Dotted Where Buried; Queried Where Uncertain)

Tsa ....SANTIAGO FORMATION (Dotted Where Buried)

Kgr ....GRANITIC ROCK (Dotted Where Buried)

B-10 ....APPROX. LOCATION OF EXPLORATORY BORINGS

T-14 ....APPROX. LOCATION OF EXPLORATORY TRENCHES

(56.5) ....APPROX. DEPTH TO FORMATIONAL MATERIAL

77 ....APPROX. ORIENTATION OF GEOLOGIC STRUCTURE

@35' B:N4E/53NW ....APPROX. DEPTH AND ORIENTATION OF GEOLOGIC FEATURE IN BORING

........APPROX. LOCATION OF PROPOSED WIDTH OF BUTTRESS

B B' ....APPROX. LOCATION OF GEOLOGIC CROSS SECTION

........APPROX. LOCATION OF GEOLOGIC CONTACT (Dotted Where Buried; Queried Where Uncertain)

........APPROX. LOCATION OF BUTTRESS DRAIN

GEOLOGIC MAP

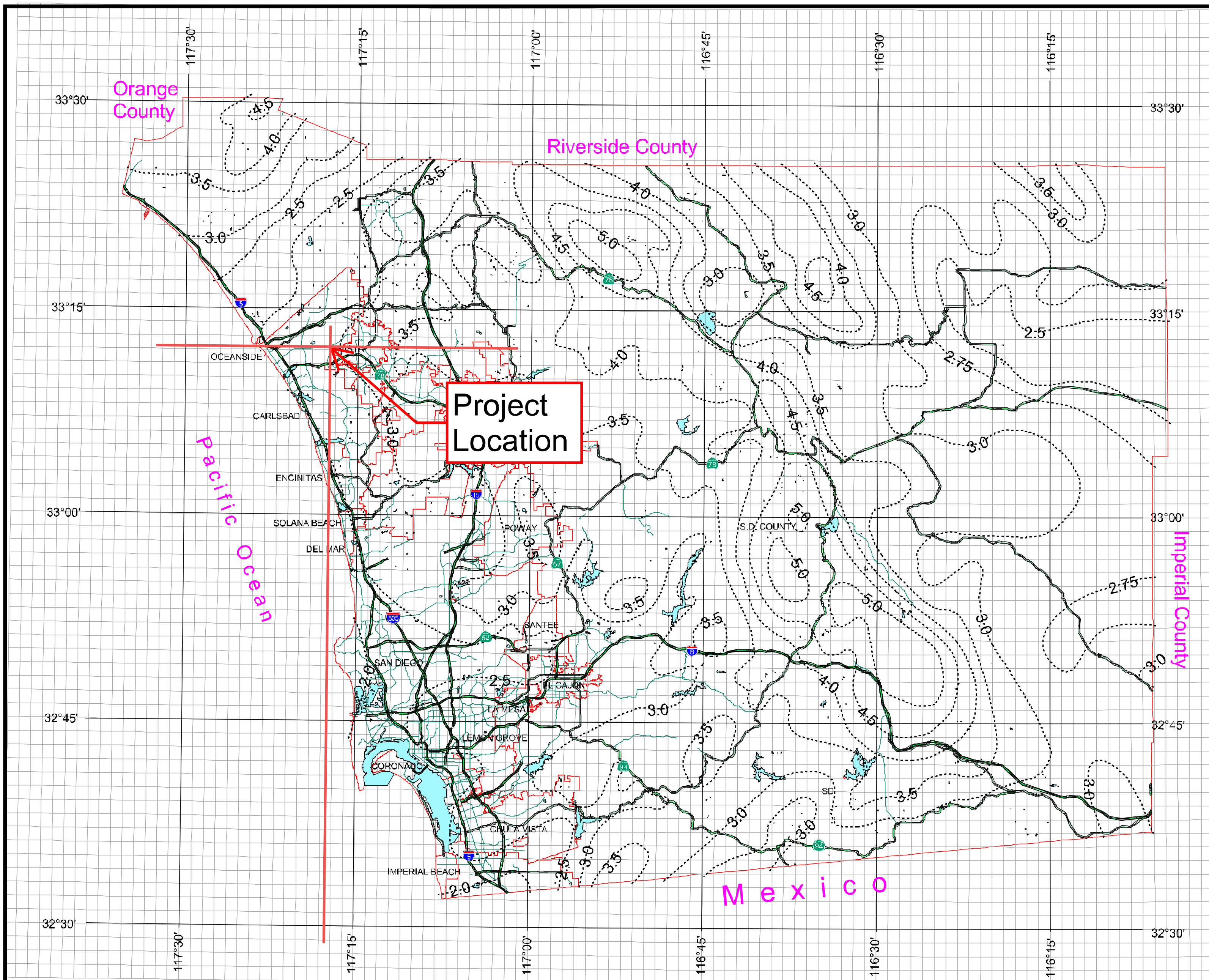
OCEANSIDE VISTA
OCEANSIDE, CALIFORNIA

GEOCON INCORPORATED
GEOTECHNICAL CONSULTANTS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SCALE 1" = 100'	DATE 10 - 12 - 2005	
PROJECT NO. 07227 - 52 - 02		FIGURE 2
SHEET 1 OF 1		

X:\07227-52-02\RAINA_7227 NEW COLORED GEOLOGIC MAP (UPGRADED 10-10-2005).DWG.

APPENDIX 2
Rainfall Isopluvial Map



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

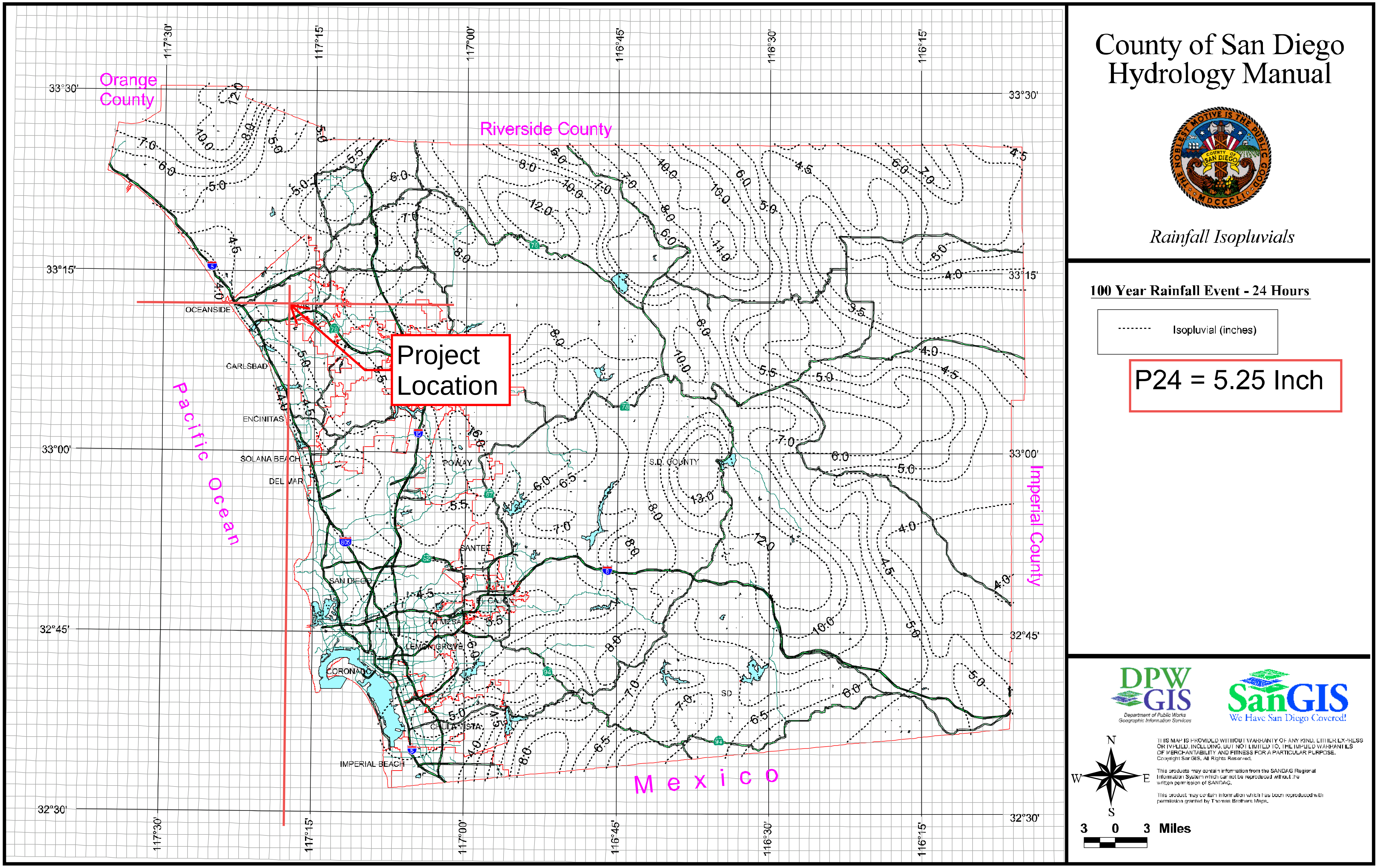
Isopluvial (inches)

P6 = 2.90 Inch

Department of Public Works Geographic Information Services

We Have San Diego Covered!

3 0 3 Miles



County of San Diego
Hydrology Manual
Rainfall Isopluvials
100 Year Rainfall Event - 24 Hours
Isopluvial (inches)
P24 = 5.25 Inch
Project Location
Orange County
Riverside County
Imperial County
Pacific Ocean
Mexico
OCEANSIDE
CARLSBAD
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
CHULA VISTA
IMPERIAL BEACH
33°30'
33°15'
33°00'
32°45'
32°30'
117°30'
117°15'
117°00'
116°45'
116°30'
116°15'
DPW GIS
Department of Public Works
Geographic Information Services
SanGIS
We Have San Diego Covered!
THIS MAP IS PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.
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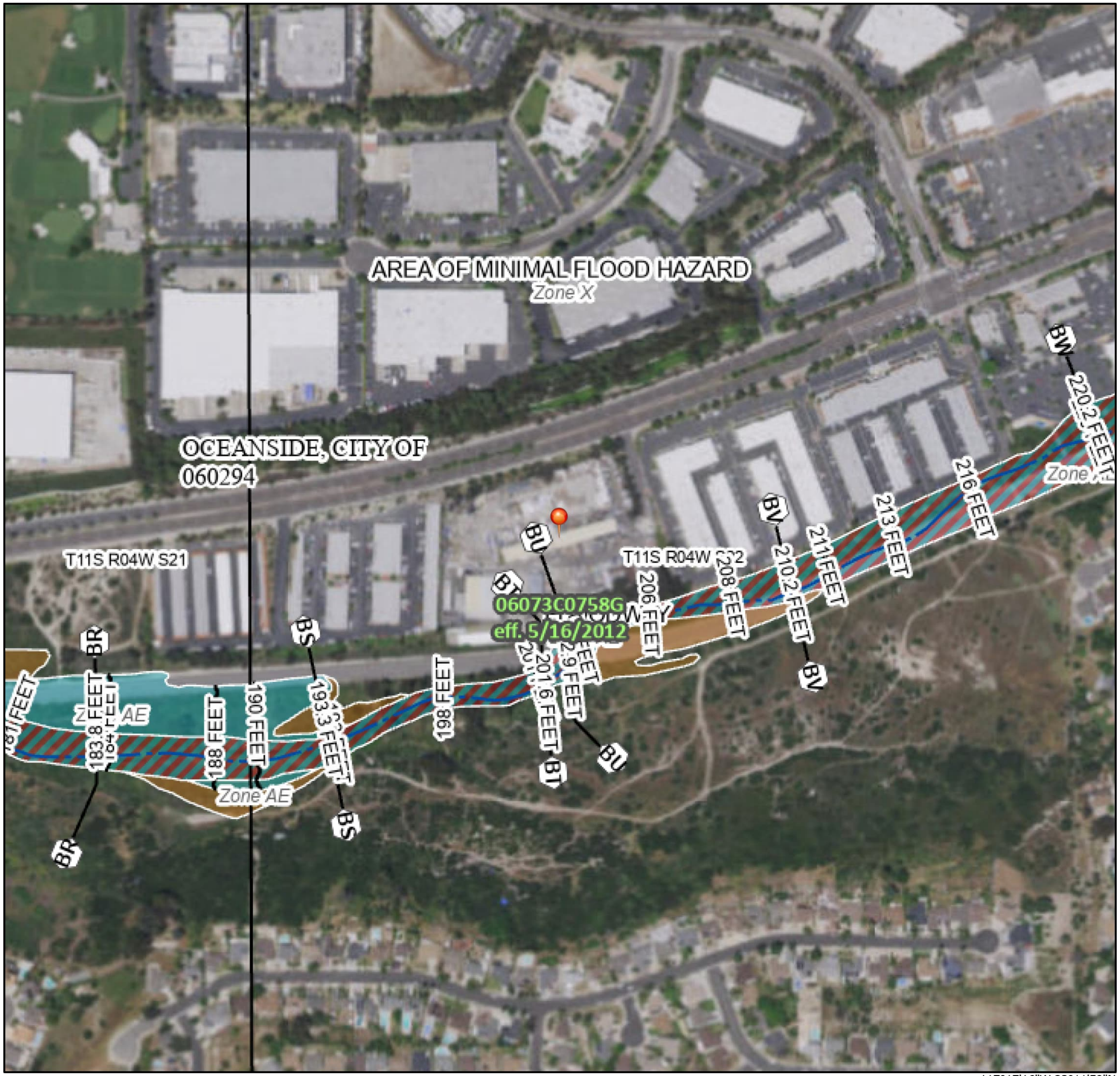
This product may contain information which has been reproduced with permission granted by Thomas Brothers Maps.
N
S
E
W
3 0 3 Miles

APPENDIX 3
FEMA FIRMette

National Flood Hazard Layer FIRMette

FEMA

117°17'53"W 33°12'29"N



117°17'16"W 33°11'59"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/15/2024 at 8:56 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

ATTACHMENT 6
Geotechnical and Groundwater Investigation Report

This is the cover sheet for Attachment 6.

GEOCON

UPDATE GEOTECHNICAL INVESTIGATION

OLIVE PARK APARTMENTS
OLIVE DRIVE
OCEANSIDE, CALIFORNIA

MARCH 12, 2024
REVISED OCTOBER 21, 2024
PROJECT NO. G3035-52-01

PREPARED FOR:

CAPSTONE EQUITIES

Project No. G3035-52-01
March 12, 2024
Revised October 21, 2024

Capstone Equities
5600 W Jefferson Boulevard
Los Angeles, California 90016

Attention: Mr. Brian Mikail

Subject: UPDATE GEOTECHNICAL INVESTIGATION
OLIVE PARK APARTMENTS
OLIVE DRIVE
OCEANSIDE, CALIFORNIA

Dear Mr. Mikail:

In accordance with your request and authorization of our original Proposal No. LG-22452 dated September 22, 2022 and subsequent change orders, we herein submit the results of our update geotechnical investigation for the subject project. We performed our investigation to evaluate the underlying soil and geologic conditions and potential geologic hazards, and to assist in the design of the proposed building and associated improvements.

The accompanying report contains the results of our study and conclusions and recommendations pertaining to geotechnical aspects of the proposed project. The site is suitable for the proposed buildings and improvements provided the recommendations of this report are incorporated into the design and construction of the planned project.

Should you have questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Nikolas Garcia, EIT
Senior Staff Engineer

Matt Love
GE 3238

REGISTERED PROFESSIONAL ENGINEER MATTHEW R. LOVE C84154 CIVIL STATE OF CALIFORNIA

Rupert S. Adams
CEG 2561

PROFESSIONAL GEOLOGIST RUPERT S. ADAMS NO. 2561 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

Shawn Foy Weedon
GE 2714

REGISTERED PROFESSIONAL ENGINEER SHAWN WEEDON No. 2714 GEOTECHNICAL STATE OF CALIFORNIA

NG:ML:RSA:SFW:kv

(e-mail) Addressee

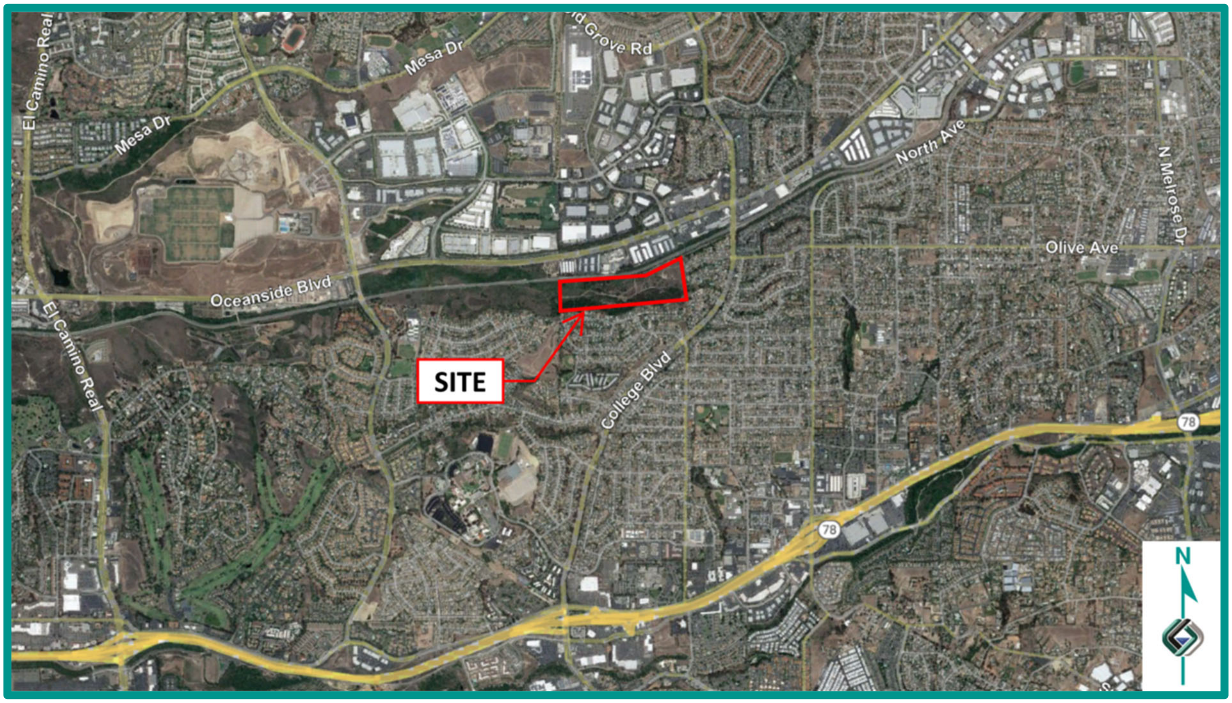
TABLE OF CONTENTS

TABLE OF CONTENTS (CONCLUDED)

UPDATE GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report contains the results of our update geotechnical investigation for the proposed affordable housing project located west of Olive Drive and north of Wooster Drive in the City of Oceanside, California (see Vicinity Map).



Vicinity Map

The purpose of this update geotechnical investigation is to evaluate the surface and subsurface soil conditions and general site geology, and to identify geotechnical constraints that may affect development of the property including faulting, liquefaction and seismic shaking based on the 2022 CBC seismic design criteria. In addition, we provided recommendations for remedial grading, shallow foundations, concrete slab-on-grade, concrete flatwork, pavement and retaining walls. We also reviewed the following plans and reports during preparation of this report:

1. *Site Plan, Olive Drive, Oceanside, California,* prepared by Hunsaker & Associates, dated March 7, 2024.

2. *Soil and Geologic Investigation for: Westwind, Oceanside, California,* prepared by Geocon Incorporated, dated July 1, 1985 (File No. D-3453-M02).

3. *Geotechnical Investigation, Oceanside Vista, Oceanside, California,* prepared by Geocon Incorporated, dated October 12, 2005 (Project No. 07227-52-02).

4. *Preliminary Geotechnical Evaluation for: Oceanside Vista Residential Development, Oceanside, California,* prepared by GeoTek, Inc., dated March 21, 2007 (Project No. 3129SD3)

The scope of this update investigation included reviewing readily available published and unpublished geologic literature (see List of References), performing engineering analyses and preparing this report. We also drilled 3 large diameter borings to a maximum depth of 100 feet and excavated 5 exploratory trenches to a maximum depth of approximately 8 feet. Appendix A presents the exploratory boring and trench logs and details of the field investigation. The details of the laboratory tests and a summary of the test results are shown in Appendix B and on the boring logs in Appendix A. Appendix C presents previous exploratory excavations and laboratory data. Appendix D presents our slope stability analysis.

2. SITE AND PROJECT DESCRIPTION

The site is an approximately 43-acre, east-west oriented, semi-rectangular-shaped property. The site is south of Oceanside Boulevard and the North County Transit District (NCTD) Sprinter line, east of an undeveloped property, and north and west of existing residential subdivisions. The Existing Site Plan shows the current site conditions.

Existing Site Plan

Topographically, the site is located on slopes that descend northwest to Loma Alta Creek located along the north margin of the site. The Geologic Map, Figure 1, depicts the topography of the site with ascending natural slopes to the south with a maximum height of approximately 200 feet. The site is steeper on the south and becomes flatter to the north. The gentle-gradient creek has a general west-flowing meandering orientation and has locally incised vertical embankments up to 10 feet high at the stream margins. A fill berm related to railroad improvements has been constructed along the northeast margin of the site. Elevations on site vary from a low of approximately 185 feet above Mean Sea Level (MSL) at Loma Alta Creek in the northwest corner of the site to 460 feet MSL at the top of the southeast slope.

We understand the project will consist of constructing a new affordable housing complex that includes two 4-story buildings, surface parking with accommodating flatwork, utilities and landscaping. Storm water BMPs are planned on the west side of the property within the proposed parking lot.

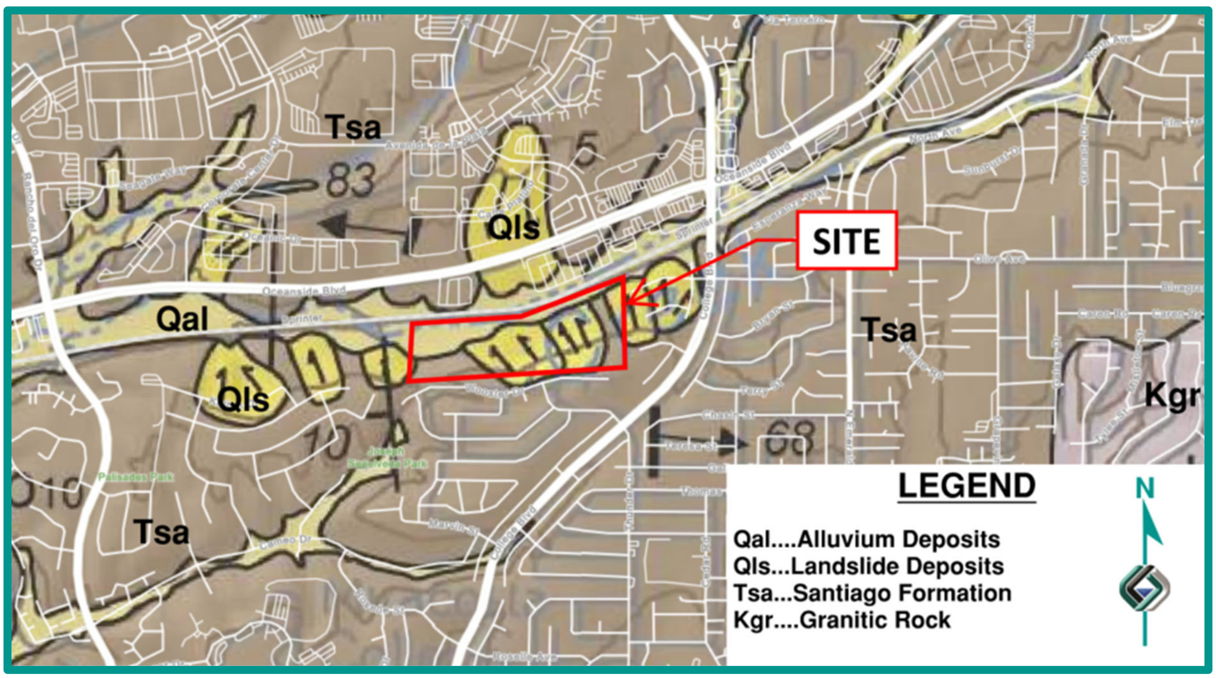
The locations, site descriptions, and proposed development are based on our site reconnaissance, review of published geologic literature, field investigations, and discussions with project personnel. If development plans differ from those described herein, Geocon Incorporated should be contacted for review of the plans and possible revisions to this report.

3. GEOLOGIC SETTING

Regionally, the site is in the Peninsular Ranges geomorphic province. The province is bounded by the Transverse Ranges to the north, the San Jacinto Fault Zone on the east, the Pacific Ocean coastline on the west, and the Baja California on the south. The province is characterized by elongated northwest-trending mountain ridges separated by straight-sided sediment-filled valleys. The northwest trend is further reflected in the direction of the dominant geologic structural features of the province that are northwest to west-northwest trending folds and faults, such as the nearby Rose Canyon fault zone.

Locally, the site is within the coastal plain of San Diego County. The coastal plain is underlain by a thick sequence of relatively undisturbed and non-conformable sedimentary bedrock units that thicken to the west and range in age from Upper Cretaceous age through the Pleistocene age which have been deposited on Cretaceous to Jurassic age igneous and volcanic bedrock. Geomorphically, the coastal plain is characterized by a series of 21, stair-stepped marine terraces (younger to the west) that have been dissected by west flowing rivers. The coastal plain is a relatively stable block that is dissected by relatively few faults consisting of the potentially active La Nacion Fault Zone and the active Rose Canyon Fault Zone.

The site is located on the western portion of the coastal plain. Marine sedimentary units make up the geologic sequence encountered on the site overlain by surficial deposits. Geomorphically, the site is located within the southern limits of an east-west flowing drainage channel. The Eocene-age Santiago Formation is mapped within the upper slopes in the southern portion of the site and underlies the landslide deposits in the central portion of the site and the alluvium in the northern portion the site. Cretaceous-age granitic rock is exposed in limited areas along the northern property boundary and is documented as underlying the Santiago Formation in some large diameter borings. The Regional Geologic Map shows the geologic units in the area of the site.



Regional Geologic Map

4. SOIL AND GEOLOGIC CONDITIONS

We encountered six surficial soil units (consisting of undocumented fill, previously placed fill, topsoil, alluvium, colluvium and landslide debris) and two formational units (consisting of the Santiago Formation and granitic rock) at the site. The occurrence, distribution, and description of each unit encountered is shown on the Geologic Map, Figure 1 and on the boring and trench logs in Appendix A.

The Geologic Cross-Sections, Figure 2, show the approximate subsurface relationship between the geologic units. We prepared the geologic cross-sections using interpolation between exploratory excavations and observations; therefore, actual geotechnical conditions may vary from those illustrated and should be considered approximate. The surficial soil and geologic units are described herein in order of increasing age.

4.1 Undocumented Fill (Qudf)

Undocumented fill underlies the northern and western portions of the site. The northern fill areas are associated with a berm that was apparently graded to control water flow in Loma Alta Creek and support the existing rail line. The western undocumented fill area is associated with waterline backfill that traverses the site in a north-south direction. The fill material generally consists of soft, fine to medium, sandy clay with silt and has an estimated maximum thickness of 10 feet. The fill is not considered suitable for support of site development in its present condition and will require remedial grading.

4.2 Previously Placed Fill (Qpf)

Previously placed fill is present on the south and northeast portions of the property. The southern fill underlies residential building pads that bound the southern margin of the property along Wooster Drive. The southern fill likely consists of loose, silty, fine- to medium-grained sand, and is estimated to have a maximum thickness of about 25 feet at the top of slope. Improvements are not planned in the vicinity of the southern fill areas. Previously placed fill also underlies the residential development along Olive Drive adjacent to the northeastern corner of the site (as observed in Trench T-14). The fill consists of loose, moist, clayey sand and is underlain by relatively thick topsoil. The fill is not considered suitable for support of the proposed fill and structural loads.

4.3 Topsoil (Unmapped)

Topsoil typically blankets the site and consists of brown, sandy clay to sandy silt. Topsoil is generally on the order of 1 to 4 feet thick, but localized areas with greater thicknesses may exist. The topsoil is unsuitable for support of site development in its present condition and will require remedial grading.

4.4 Colluvium (Qcol)

Colluvium, coincident with thinner topsoil deposits, consisting of brown to reddish brown, clayey sand and sandy clay, is mapped along toe of slope areas capping landslide deposits, weathered Santiago

Formation or alluvium. Colluvium up to 10 feet thick was also logged by several authors in some large diameter borings, where it was interpreted as post-landslide graben infill. Colluvium is unsuitable for support of site development in its present condition and will require remedial grading.

4.5 Alluvium (Qal)

Alluvium is mapped on the northern portion of the site in the Loma Alta Creek drainage. The alluvial soil consists of soft, sandy to silty clay and loose silty to clayey sand. The alluvium is locally underlain by and interfingered with landslide deposits and colluvium. We encountered alluvial materials up to approximately 15½ feet deep and likely extend deeper toward the north. A shallow groundwater table is likely to exist approximately 3 to 5 feet below existing grade in the area of the streambed at the northern portion of the site. The alluvium is compressible, possesses a “very low” to “high” expansion potential (expansion index of 130 or less), possibly subject to liquefaction, and may have low to high permeability. The alluvium is not considered suitable for support of site development in its present condition and will require remedial grading. We expect some alluvium will remain in place on the western portion of the property due to grading limitations.

4.6 Landslide Deposits (Qls)

We encountered and observed landslide deposits in the exploratory borings and trenches performed for this update report. Landslide deposits are mapped underlying most of the central and eastern portions of the site, including the areas of proposed development. Based on our review of previous boring logs by Geocon (1985, 2005) and by Geotek (2007), and logging of new large diameter borings (B-11 through B-13) and exploratory trenches (T-15A-F through T-19), landslide deposits generally consist of disturbed to relatively intact blocks of sandstone, siltstone, and claystone. Due to weathering, this stratigraphy is less apparent in test pits excavated around the perimeter of mapped landslides or in low lying areas where landslide deposits are capped by colluvium or alluvium.

Landslide deposits are typically unstable within cut slopes and may be susceptible to significant settlement. Therefore, the highly compressible portions of the landslide debris within the proposed development areas should be removed and recompacted during the remedial grading of the site. In general, landslide debris is suitable for reuse as compacted fill provided potentially expansive clay is properly mixed with sandy material where located within about 5 feet of proposed grade.

4.7 Santiago Formation (Tsa)

We encountered the middle Eocene-age Santiago Formation underlying surficial soil in the majority of the exploratory excavations performed at the site. The Santiago Formation underlies the majority of the steep slope areas located to the south of the proposed development. The Santiago Formation is generally composed of light colored, massive to poorly bedded, fine- to medium-grained sandstone interbedded with weak siltstone and claystone layers. Claystone beds within the Santiago Formation contain bedding plane shears and internal shearing, some of which displayed out-of-slope bedding orientations. Bedding plane shears can be a contributing factor to slope instability. Cut slopes exposing out-of-slope bedding plane shears will require slope stabilization measures.

The Santiago Formation is considered suitable for foundation and/or fill support. However, the claystone and siltstone units may be susceptible to landsliding and slope instability. Additionally, some sandstone units of the Santiago Formation are poorly cemented and susceptible to erosion. Materials generated from excavations within the silty and sandy portions of the Santiago Formation are suitable for reuse as compacted fill. Claystone that is potentially expansive should be mixed with sandy material, as discussed herein.

4.8 Granitic Rock (Kgr)

Cretaceous-age granitic rock is mapped in the general vicinity of the site by Tan and Kennedy (1996) as the Green Valley Tonalite. We encountered granitic rock in Borings B-1 and B-2 (Geocon, 1985), Boring B-1 (Geocon, 2005) and in Trenches T-6, T-7, T-11 through T-13, and T-15 through T-19. Granitic rock was also encountered (but incorrectly identified on the boring logs) in borings GTB-1, GTB-2, GTB-7, and GTB-8 (Geotek, 2007). Based on drill rig performance, it is likely that refusal occurred on granitic rock in Borings B-11 and B-13 (Geocon, 2024) even though it was not logged or identified in cuttings.

The granitic rock consists of yellowish brown to gray, moderately weak to moderately strong, highly to moderately weathered, and displayed a fine-to coarse-grained crystalline texture. Granitic rock is considered suitable for the support of structures and/or compacted fill.

5. GROUNDWATER

We encountered groundwater during the previous field investigation in several of our borings at depths ranging from 9 to 45 feet below existing grade (elevation 183 to 199 feet MSL) as shown in the following table.

RECORDED GROUNDWATER ELEVATION

Boring No.	Date Recorded	Approximate Depth of Groundwater Below Existing Grade (feet)	Approximate Elevation of Groundwater (feet, MSL)
B-6	5/23/2005	24	199
B-7	5/20/2005	44	197
B-8	5/24/2005	45	189
B-9	5/25/2005	13	189
B-10	5/25/2005	15	183
T-3	5/09/2005	10	194
T-4	5/09/2005	9	198

However, we did not encounter groundwater within the proposed development area of the subject site but expect possible groundwater on the north side of the proposed west parking lot near Trench T-4. The use of dewatering techniques may be necessary if heavy seepage or excavations below the groundwater elevation occur. It is not uncommon for groundwater or seepage conditions to develop where none previously existed. Groundwater and seepage is dependent on seasonal precipitation, irrigation, land use, among other factors, and varies as a result. Proper surface drainage will be important to future performance of the project.

Groundwater could have potentially changed over the past 20 years. However, the proposed development is situated within the higher elevation side of the site and groundwater was not encountered within the proposed development during the current and previous field studies. Additionally, within the proposed buildings the landslide debris is going to be removed and replaced with properly compacted fill.

6. GEOLOGIC STRUCTURE

Mapping by Tan and Kennedy (1996) indicates that on a regional basis, the Santiago Formation in the vicinity of the site is inclined down to the west and northwest between 5 to 10 degrees. This orientation is unfavorable for north-facing slopes. Review of available structural data collected in new and historical borings generally confirms mapping by Tan and Kennedy (1996); however, for reasons discussed herein, use of some of the previous structural data recorded at the site has resulted in mis-interpretation of site geology.

6.1 Landslide Stratigraphy

The primary mechanism for landsliding at the site is deep-seated block failure along weakened planes (i.e., bedding plane shears [BPSs]) that are present within claystone beds. Utilizing the new, 100-foot-deep boring B-12 as a 'type section', three, relatively continuous, moderately fissured claystone beds with associated BPSs, varying between approximately 2 and 5 feet thick, can be correlated with older borings across the site to help define subsurface landslide geometry. Our current geologic model identifies the claystone bed occurring at a depth of 34 feet (elevation 277 feet MSL) as containing the basal rupture surface of the large landslide mass underlying the proposed building areas. Some older boring logs identify a claystone bed logged in B-12 (Geocon, 2024) at 22 feet (elevation 285 feet MSL) as the bottom of the landslide, as there is evidence of shearing and movement along remolded clay seam at the higher elevation. The lowest claystone bed at 78 feet (elevation 231 feet MSL) does not correlate with other borings drilled in the main landslide area. However, the claystone bed at 78 feet does correlate with the basal rupture surface of the smaller landslide underlying the parking area, identified in borings B-3 and B-4 (Geocon, 2005) and GTB-3 (Geotek, 2007).

Geologic interpretation previously presented by Geocon (1985) suggested that shearing at the bottom of the landslide also occurred in some areas along the contact between the Santiago Formation and the underlying granitic rock. This was not observed in recent large diameter borings; however, landslide deposits overlie granitic rock in some areas along the northern property boundary. The shape of the angular unconformity between the granitic rock and the Santiago Formation is not clearly defined, but field evidence indicates that the shape and inclination of the unconformity may have partially controlled landsliding in the eastern portion of the site.

6.2 Landslide Geometry

Previous efforts to model site geologic structure and landslide geometry have utilized apparent dips derived from bed-specific measurements taken in large diameter borings to draw geologic cross-sections. This method is better suited for use in well-bedded geologic formations dipping more than 10 degrees where accurate structural attitudes can be collected. Bedding attitudes recorded on undulatory beds that are close to horizontal are usually incorrect, as the dip or the dip direction cannot be properly identified in a 30-inch diameter hole. The preferred method for defining landslide geometry (and geologic structure below the landslide) in massive to poorly bedded formations with dips less than 10 degrees, is to create structure contours from multiple piercing points through the basal slide surface. Utilizing the structure contouring technique, the local geologic structure under the site generally dips northwards (plus or minus 20 degrees from north) at inclinations between 4 and 8 degrees. This interpretation is supported by calculating the mean apparent dip along Geologic Cross-Sections 1-1’ through 3-3’, using only structural measurements taken below the basal slide plane.

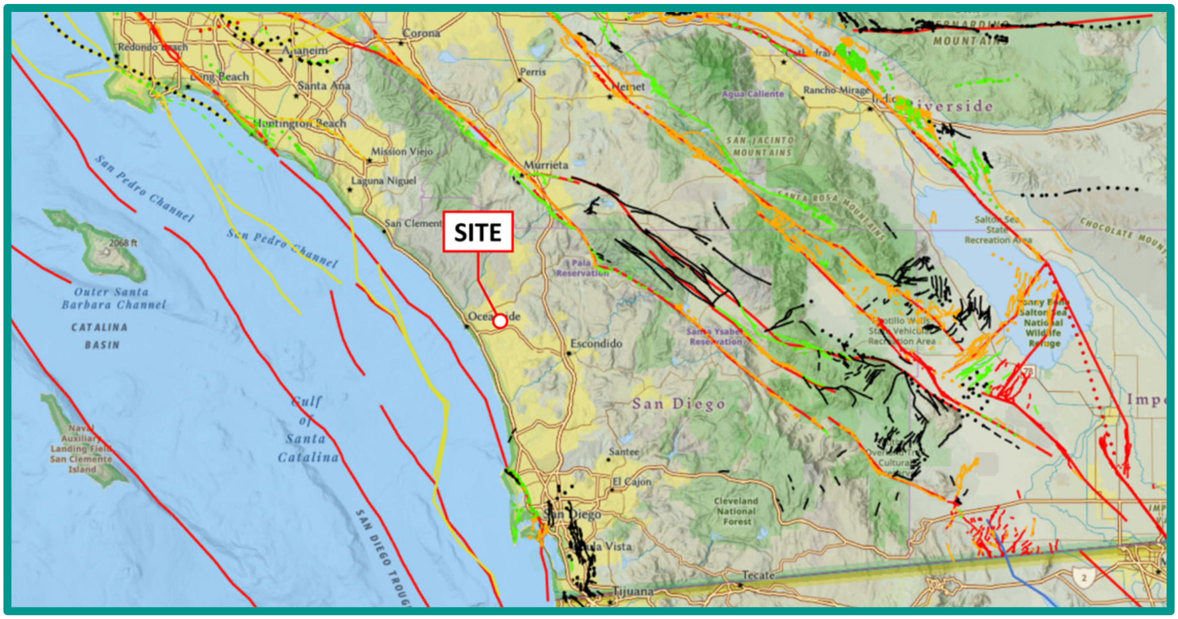
We prepared Geologic Cross-Sections 1-1’ through 4-4’ to help show correlations between the claystone beds identified in Boring B-12 (Geocon 2024) and the bottom of landslides underlying the proposed development area using the structural geology principals discussed herein. Some historical borings were terminated at elevations too shallow to pierce the bottom of the landslide including Borings B-5 and B-6 (Geocon, 1985).

7. GEOLOGIC HAZARDS

7.1 Regional Faulting and Seismicity

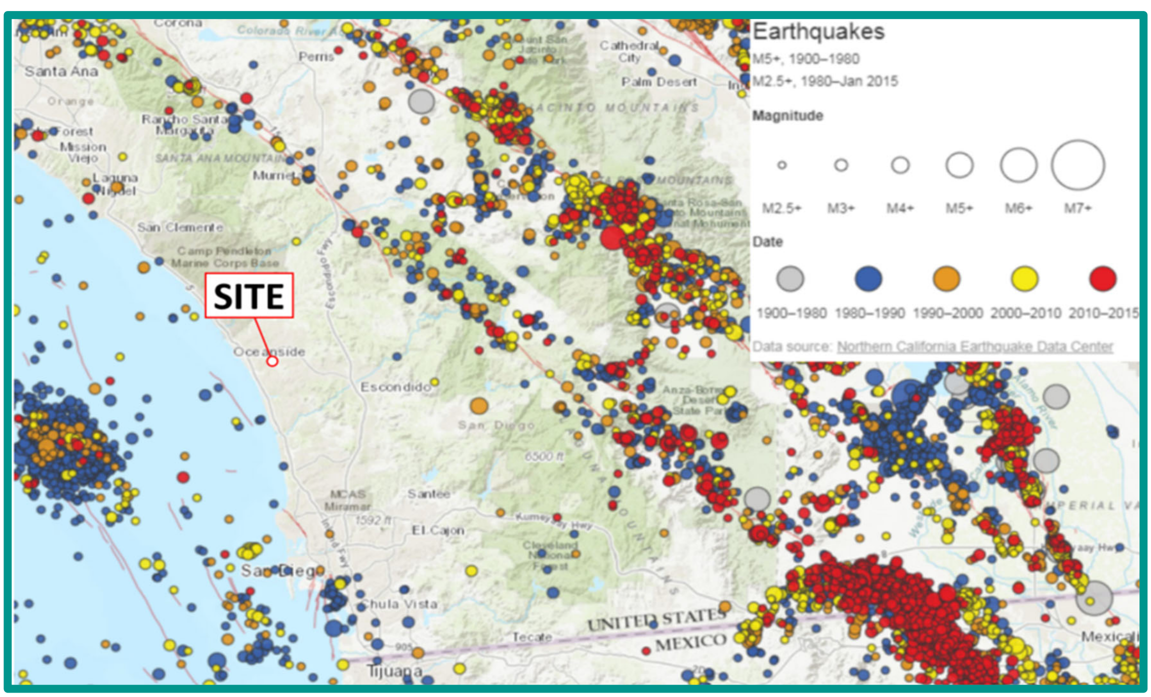
A review of the referenced geologic materials and our knowledge of the general area indicate that the site is not underlain by active, potentially active, or inactive faults. An active fault is defined by the California Geological Survey (CGS) as a fault showing evidence for activity within the last 11,700 years. The site is not located within a State of California Earthquake Fault Zone.

The USGS has developed a program to evaluate the approximate location of faulting in the area of properties. The following figure shows the location of the existing faulting in the San Diego County and Southern California region. The fault traces are shown as solid, dashed and dotted that represent well-constrained, moderately constrained and inferred, respectively. The fault line colors represent faults with ages less than 150 years (red), 15,000 years (orange), 130,000 years (green), 750,000 years (blue) and 1.6 million years (black).



Faults in Southern California

The San Diego County and Southern California region is seismically active. The following figure presents the occurrence of earthquakes with a magnitude greater than 2.5 from the period of 1900 through 2015 according to the Bay Area Earthquake Alliance website.



Earthquakes in Southern California

Considerations important in seismic design include the frequency and duration of motion and the soil conditions underlying the site. Seismic design of structures should be evaluated in accordance with the California Building Code (CBC) guidelines currently adopted by the local agency.

7.2 Liquefaction

Liquefaction typically occurs when a site is located in a zone with seismic activity, onsite soils are cohesionless, groundwater is encountered within 50 feet of the surface, and soil relative densities are less than about 70 percent. If all four previous criteria are met, a seismic event could result in a rapid pore water pressure increase from the earthquake-generated ground accelerations. The groundwater table was not encountered underlying the portions of the property where development is planned; therefore, the potential for liquefaction occurring at the site within the proposed improvement areas is considered to be very low.

7.3 Storm Surge, Tsunamis, and Seiches

Storm surges are large ocean waves that sweep across coastal areas when storms make landfall. Storm surges can cause inundation, severe erosion and backwater flooding along the water front. The site is located over 5 miles from the Pacific Ocean and is at an elevation of about 185 feet or greater above Mean Sea Level (MSL). Therefore, the potential of storm surges affecting the site is considered low.

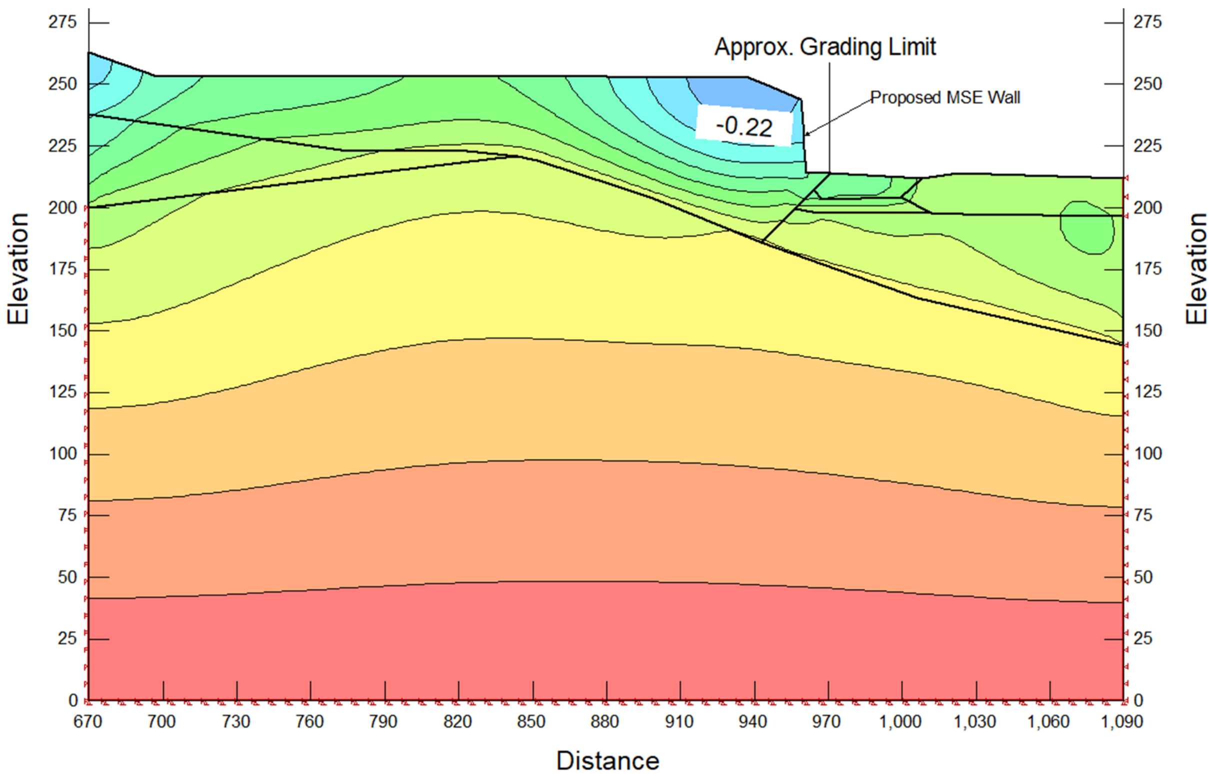
A tsunami is a series of long period waves generated in the ocean by a sudden displacement of large volumes of water. Causes of tsunamis include underwater earthquakes, volcanic eruptions, or offshore slope failures. The potential for the site to be affected by a tsunami is negligible due to the distance from the Pacific Ocean and the site elevation.

A seiche is a run-up of water within a lake or embayment triggered by fault- or landslide-induced ground displacement. The site is not located in the vicinity of or downstream from such bodies of water. Therefore, the risk of seiches affecting the site is negligible.

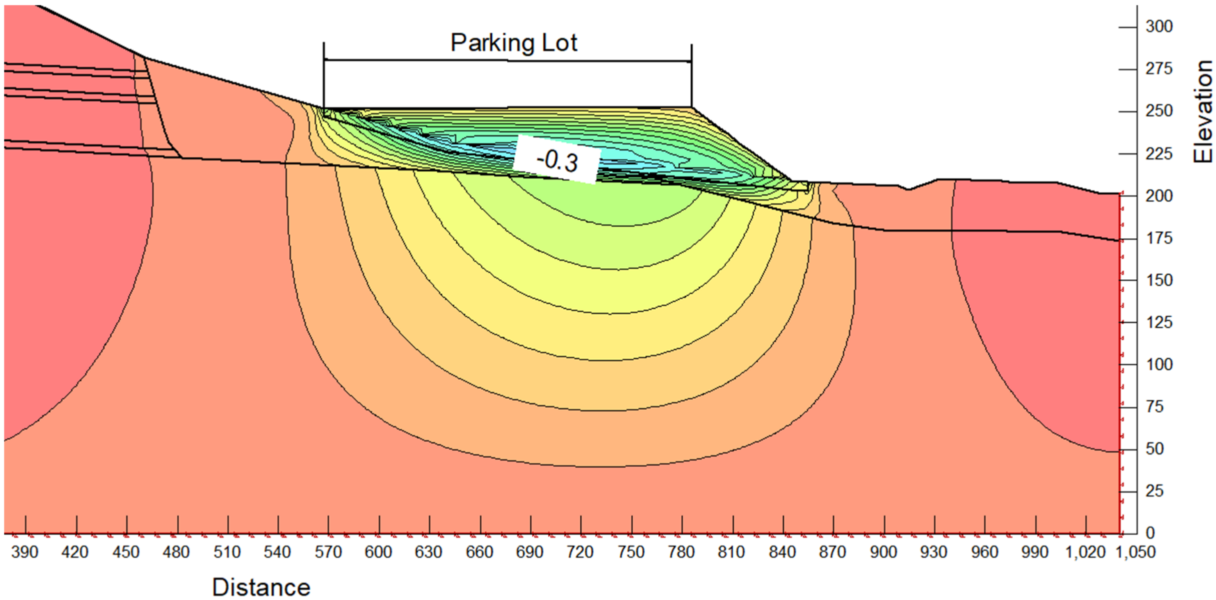
7.4 Settlement Due to Fill Loads

We understand new fill will be placed to achieve proposed grades with depths ranging from 10 to 60 feet. The increased weight due to the anticipated fill load is expected to cause settlement due to the underlying compressible landslide debris and alluvial soils, where left in place. We expect the compressible materials underneath the proposed building’s footprint will be removed and replaced with properly compacted fill, as discussed herein. However, we expect approximately 20 feet of compressible material will be left in place underneath the proposed western parking lot and in the western portion of the north retaining wall due to grading and/or temporary slope limitations.

The amount of settlement that could occur is a function of how thick the fill layer is, how compressible the existing layer is, and the magnitude of the new vertical load (weight of new fill or future building loads). We performed a settlement evaluation using Geostudio2018 (SigmaW). Based on laboratory test results and engineering analyses, we estimate theoretical maximum settlements of up to 3 inches (0.22 feet) and 3.6 (0.3 feet) inches for the retaining wall and western parking lot, respectively. The following figures present the computer output of our static condition settlement analyses for the retaining wall and parking lot (with settlements indicated in feet).



Vertical Settlement Analysis – Western Portion of Retaining Wall



Vertical Settlement Analysis – Western Parking Lot

Deep foundations are the most effective means of reducing the ultimate settlement potential of proposed structures to a negligible amount. Recommendations for deep foundations can be provided upon request. The settlement due to the weight of the fill should be considered in the design of improvements and adjacent flatwork. Additionally, the total and differential settlement should be incorporated into the design for pavement areas and retaining walls (where applicable). Placing the fill during construction and waiting for the settlement to occur would also help reduce the potential for distress. Settlement monitors can be installed to determine when the consolidation has stabilized and should be installed as discussed herein. We can provide additional mitigation options (including wick drains, surcharging, etc.) if being considered by the design team and once design plans are available.

7.5 Mitigation of Compressible Soils

Based on our analysis discussed herein, we estimate a potential for up to approximately 5.5 inches of settlement due to fill loads in the western parking lot subsequent to remedial grading. We expect mitigation of soil will be necessary for settlement-sensitive structures. The effects of differential settlement of utilities and improvements, including pavement and flatwork, can be mitigated by designing to accommodate for the differential movement using the settlement values presented herein. Several alternatives are generally available for mitigation including deep foundations, ground improvements and structural mitigation.

Based on the grading plans, we expect fills ranging from 0 to 40 feet will be placed in the area of the western parking lot. Therefore, we expect the total and differential settlements due to fill loads will be about 5.5 inches. The utilities should be designed with flexible connections to incorporate these settlements.

Ground improvement techniques mitigate compressible soils by densifying existing soil using aggregate piers, deep dynamic compaction, compaction grouting, soil mixing or other densification method. We do not recommend that deep dynamic compaction be used for densification due to the proximity of adjacent residential homes and the limited influence depth of the method in fine grained materials. In addition, compaction grouting may not be economical due to the expected depth and the area of the required improvements.

Soil-cement mixing is a soil improvement technique of mechanically blending a cementitious binder into existing unsuitable soils to create load bearing columns. As the soil mixing tool is advanced into the ground, cement-based slurry is pumped through the hollow stem of the shaft and injected into the soil through jets located on the backside of the leading rotating mixing blades. The mixing blades on the tool mix the soil with the slurry. Injection and mixing will continue to design depth. When design depth is reached, the mixing tool is withdrawn, leaving behind stabilized soil mix columns. Soil mix piles are typically designed and installed by a specialty geotechnical contractor. Soil mix piles should derive support in the competent Santiago Formation or Granitic Rock.

Rammed aggregate pier systems are a ground improvement technique that provides a densified column of aggregate surrounded by a stiffened soil matrix. The aggregate piers are constructed by applying direct vertical ramming energy to densely compact aggregate to form a high stiffness engineered soil column within the foundation zone and increased lateral strength to the surrounding soil. Aggregate pier systems are typically designed and installed by a specialty geotechnical contractor.

The remedial grading can be reduced to the upper 3 to 4 feet of the existing soil if ground improvements (cement-mixing or rammed aggregate piers) are selected. Additional grading may be required after the ground improvements process to reestablish the building pad.

The mitigation could be limited to the foundation areas of the storm drain vault as determined by the specialty contractor. We can provide additional recommendations for the ground improvement techniques when the improvement has been selected.

7.6 Slope Stability

Slope stability analyses for deep seated failure are discussed in the Recommendations section of this report and the computer output analyses is presented in Appendix D. The southern slope consists of a backscarp of a landslide and landslide debris is located on the site. The Santiago Formation possesses weak claystone/siltstone beds that generally create slope instability. We performed a slope stability evaluation for the existing and proposed slope configurations as discussed in this report. Shear pins and buttresses will be required to stabilize the southern slope in the areas of the proposed building as discussed herein.

Slope stability analyses for the proposed buttress fill slopes with inclinations as steep as 2:1 (horizontal: vertical) indicate a calculated factor of safety of at least 1.5 under static conditions for surficial failure. The following table presents the surficial slope stability analysis for the existing siltstone in the Santiago Formation and proposed fill slope sloping conditions.

SURFICIAL SLOPE STABILITY EVALUATION

Parameter	Value	
	Existing	Proposed
Slope Height, H	∞	∞
Vertical Depth of Saturation, Z	5 Feet	5 Feet
Slope Inclination, I (Horizontal to Vertical)	2.3:1 (23.5 Degrees)	2:1 (26.6 Degrees)
Total Soil Unit Weight, γ	125 pcf	125 pcf
Water Unit Weight, γ_W	62.4 pcf	62.4 pcf
Friction Angle, f	28 Degrees	28 Degrees
Cohesion, C	200 psf	300 psf
Factor of Safety = $(C+(\gamma+\gamma_W)Z\cos^2 I \tan f)/(\gamma Z \sin I \cos I)$	1.50	1.73

Slopes should be landscaped with drought-tolerant vegetation having variable root depths and requiring minimal landscape irrigation. In addition, slopes should be drained and properly maintained to reduce erosion.

7.7 Landslides

Referenced information and the results of our subsurface investigation indicate that the majority of the northern half of the site is underlain by landslides. Landslide deposits are described herein and the approximate extent of landslide deposits is presented on the Geologic Map and in the Geologic Cross Sections, Figures 1 and 2. We encountered landslides deposits to a depth of approximately 56 feet during our field investigation and generally thin toward the northern portion of the site.

Topographically, the site shows lobate features, topographic benches, deflected and depressed drainages, and local low areas, which are features indicative of landsliding. These topographic features indicate most of the intermediate slopes are affected by landslides. Topographic expression and our geologic mapping suggests the upper portions of the steep slopes along the south margin of the property are composed of Santiago Formation and likely represent a "backscarp" to deeper landslides that underlie the intermediate slopes. The backscarp areas are clearly evident on the 1953 aerial photographs as steep slopes with a prominent break in slope denoting the "heads" of the landslide debris. To aid in our interpretation of landslide morphology, we reviewed a color anaglyph created from AXN-8M-66 and -67, which are part of the 1953 aerial photograph flight series covering San Diego County. Given that the site has never been developed, historical topographic maps with wider contour intervals are less useful for interpretation of landslide morphology when compared to the site topography provided by the project civil engineer.

The backscarp areas have been subject to subsequent erosion which has likely removed the previously existing landslide debris along the lower portions of these steep slopes. The "toes" of the larger landslides extend into the active creek drainage and are typically overlain by alluvium. Smaller and more recent landslides have developed within the larger-scale landslide debris. The on-site landslides have occurred within the weak claystone and/or siltstone beds of the Santiago Formation. The lower portions of the landslide debris in the western portion of the site were observed to be saturated and prone to significant caving and seepage. The landslide debris should be removed and recompacted or stabilized by remedial grading measures, as described herein.

Based on our review of predevelopment aerial photographs and site topographic maps, we estimated the southern limit of landslide debris and is therefore queried on the Geologic Cross-Sections, Figure 2. Additionally, the presence of thick colluvial deposits in Borings B-12 (Geocon, 1985), B-3 (Geocon, 2005), and B-5 (Geocon, 1985) above landslide deposits is interpreted as graben infill which would indicate the southerly limit of the landslide headscarp area.

Figure 3 depicts an overlay of landslide limits taken from the following reports: Geocon (1985), Geocon (2005), Geotek (2007), and Geocon (03/2024 and 08/2024). The published landslide boundary interpretations shown in Figure 3 are congruent with the accepted geomorphic principal that the headscarp of an ancient landslide is generally coincident with a break-in-slope separating hummocky or convrex-rounded terrain from steeper slopes behind the headscarp. Three of the four southern landslide limit interpretations shown on Figure 3 partially overlap. The fourth interpretation (Geocon; 2005 and 03/2024) is between 30 and 50 feet of the next closest limit line. The southern landslide limit matches our mapped field conditions and closely matches previous interpretations.

7.8 Debris Flows

Debris flows are rapid downslope movements of surficial soil resulting from the failure of unconsolidated sediments along steep slopes. Debris flows generally occur within colluvial deposits and may be triggered by over-saturation during periods of heavy rainfall or due to seismic shaking. Slopes that are at particular risk include those with relatively thick colluvial deposits and relatively thin or denuded vegetative cover on slopes composed of low permeability formational material (Turner and Schuster, 1996). The steep slope portions of the site were observed during our geologic reconnaissance to contain relatively thin deposits of colluvium and relatively thick, native vegetation overlying slopes composed of relatively permeable sandstone formational material. We encountered colluvium within the landslide debris along the shallower intermediate slopes in the central portion of the site. Due to lack of high-risk factors, the relatively large distance from the steep slopes to the proposed areas of development, and the results of our analysis of shallow slope stability, we opine the slopes along the southern portion of the site do not pose a significant debris flow hazard to the proposed development.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 General

8.1.1 We did not encounter soil or geologic conditions during our exploration that would preclude the proposed development, provided the recommendations presented herein are followed and implemented during design and construction. We will provide supplemental recommendations if we observe variable or undesirable conditions during construction, or if the proposed construction will differ from that anticipated herein. The following table summarizes our conclusions and recommendations for the proposed project.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Attribute	Conclusion/Recommendations
Existing Geologic Hazards	Strong Seismic Shaking
	Settlement
	Slope Stability
Existing Geologic Units	Undocumented Fill (Requiring Remedial Grading)
	Landslide Debris (Requiring Remedial Grading)
	Alluvium/Topsoil/Colluvium (Requiring Remedial Grading)
	Santiago Formation (Suitable for Support)
	Granitic Rock (Suitable for Support)
Groundwater	Not Encountered Within the Proposed Development
	May Be Encountered During Deep Utility Excavations
Seepage	May Be Encountered During Landslide Removals
Excavations	Surficial Soil – Moderate to Difficult
	Rock – Difficult to Non-Rippable
Expansion Index	130 or Less
Water-Soluble Sulfate Content	"S0"
Drainage	Maintain Drainage As Discussed Herein

8.1.2 Potential geologic hazards exist at the site including unstable slopes and seismic shaking. Existing landslides have been mapped at the site by the State of California and were observed during our subsurface investigation. Proposed cut slopes and building pads are susceptible to hazards associated with future landslides, slope instability and settlement, if not properly stabilized, as discussed herein.

8.1.3 The undocumented fill, landslide debris, and alluvium are potentially compressible and unsuitable in their present condition for the support of compacted fill or settlement-sensitive improvements. Remedial grading of these materials should be performed as discussed herein. Weak claystone/siltstone beds, bedding plane shears and unfavorable bedding orientations are common within the Santiago Formation. Slopes with calculated factors of safety less than 1.5 should be stabilized as recommended herein. Formational materials of the Santiago Formation and granitic rock are considered suitable for the support of proposed fill and structural loads.

8.1.4 We encountered groundwater at a depth of approximately 7 to 13 feet below the existing ground surface (approximate elevation of 1 to 5 feet above MSL) on the western portion of the property (not in the proposed development area). Groundwater will likely have a significant influence on construction of deep utilities and subterranean structures (if proposed in the alluvium areas). Dewatering will likely be required for excavations below the fluctuating groundwater elevation and preliminary recommendations are provided herein. However, we do not expect we will encounter groundwater during the construction of the proposed building. We may encounter groundwater during the installation of improvements that extend to the west of the proposed development area where alluvium is present.

8.1.5 We expect the surficial soils to be rippable with moderate effort to proposed finish grades using conventional grading equipment. The rippability of the granitic rock is variable and ranges between moderate to difficult. We do not expect a rock blasting program will be required for the proposed grading operations due to the limited cut areas within the rock areas. However, the grading contractor should be prepared to handle localized strong rock areas and rock corestones, if encountered.

8.1.6 The majority of the existing slopes and proposed cut slopes will be subject to potential slope instability and will require extensive remedial grading measures. Appendix D presents the results of our slope stability analyses.

8.1.7 Proper drainage should be maintained in order to preserve the engineering properties of the fill in both the building pads and slope areas. Recommendations for site drainage are provided herein.

8.1.8 We will prepare a storm water management investigation under a separate report to help evaluate the potential for infiltration on the property. The project civil engineer should use that report to help design the storm water management devices.

8.1.9 Based on our review of the project plans, we opine the planned development can be constructed in accordance with our recommendations provided herein. We do not expect the planned development will destabilize or result in settlement of adjacent properties if properly constructed.

8.1.10 Canyon subdrains will not be required on this project. However, surface settlement monuments may be used to utilized to determine when the fill and consolidation settlement has stabilized as discussed herein.

8.2 Excavation and Soil Characteristics

8.2.1 Excavation of the in-situ soil should be possible with moderate to heavy effort using conventional heavy-duty equipment. Excavation of the formational materials will require heavy to very heavy effort and may generate oversized material using conventional heavy-duty equipment during the grading operations. Oversized rock (rocks greater than 12 inches in dimension) may be generated with the granitic rock materials that can be incorporated into landscape use or deep compacted fill areas, if available. The grading and improvement contractors should review this report and evaluate the proper equipment to use for the planned excavations. Based on the proposed grading plans, deep excavations into the granitic material are not expected; therefore, a seismic study for excavation characteristics are not necessary.

8.2.2 The soil encountered in the field investigation is “expansive” (expansion index [EI] greater than 20) as defined by 2022 California Building Code (CBC) Section 1803.5.3. We expect most of the soil encountered possess a “very low” to “high” expansion potential (EI of 130 or less) in accordance with ASTM D 4829. The following presents soil classifications based on the expansion index.

EXPANSION CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	ASTM D 4829 Expansion Classification	2022 CBC Expansion Classification
0 – 20	Very Low	Non-Expansive
21 – 50	Low	Expansive
51 – 90	Medium	
91 – 130	High	
Greater Than 130	Very High	

8.2.3 We performed laboratory tests on samples of the site materials to evaluate the percentage of water-soluble sulfate content. Appendix B presents results of the laboratory water-soluble sulfate content tests. The test results indicate the on-site materials at the locations tested possess "S0" sulfate exposure to concrete structures as defined by 2022 CBC Section 1904 and ACI 318-19 Chapter 19.

8.2.4 Geocon Incorporated does not practice in the field of corrosion engineering. Therefore, further evaluation by a corrosion engineer may be performed if improvements susceptible to corrosion are planned.

8.3 Slope Stability Analyses

8.3.1 We performed slope stability analyses using the two-dimensional computer program *GeoStudio* created by Geo-Slope International Ltd. We calculated the factor of safety for the planned slopes for rotational-mode and block-mode analyses using the Spencer's method. Output of the computer program including the calculated factor of safety and the failure surface is presented in Appendix C.

8.3.2 We used average drained direct shear, fully softened, residual strength parameters and Stark Correlations (2023) based on laboratory tests and our experience with similar soil types in nearby areas for the slope stability analyses. Our calculations indicate the proposed slopes, constructed of on-site materials, should have calculated factors of safety (FOS) of at least 1.5 and 1.1 under static and seismic conditions, respectively for deep-seated failure and a FOS of at least 1.5 for shallow sloughing conditions when the recommendations of this report are followed.

8.3.3 We selected Cross-Sections 1-1′, 2-2′, and 3-3′ to perform the slope stability analyses. Appendix D presents the results of the slope stability analyses. Based on our analyses, the existing southern slopes possess a factor of safety of less than 1.5 and stabilization techniques will be required. A factor of safety of at least 1.5 is currently required by the City of Oceanside for all slopes that could affect proposed and existing structures.

8.3.4 Shear pins for the proposed southern slope will be required to provide an adequate factor of safety due to the presence of weak claystone/siltstone layers and landslide debris. The approximate location of the shear pins are shown on the Geologic Map, Figure 1, and Geologic Cross Sections, Figures 2 and 3. The shear pins should be designed by a structural engineer familiar with the design process. A more detailed discussion of the shear pins in provided in the following section.

8.3.5 In addition, slope buttresses will be required north of the planned shear pins to increase the local stability of the proposed slopes. Buttress widths ranging from 20 to 50 feet should be constructed along the southern edge of the plan development as shown on the Geologic Map, Figure 1. Based on our analyses, the slope will possess a factor of safety of at least 1.5 and 1.1 subsequent to the construction of the shear pins and buttresses for static and seismic conditions, respectively.

8.3.6 Planned buttress keyways and proposed subdrains should be surveyed during construction with their approximate locations depicted on the Geologic Map. We based the buttress widths and depths on the results of the slope stability analyses. The buttresses will require drains located at the heel of the buttress and will be as-built and surveyed by the project civil engineer.

8.3.7 Excavations including buttresses, shear keys, and stability fills should be observed during grading by an engineering geologist with Geocon to evaluate whether soil and geologic conditions do not differ significantly from those expected or identified in this report.

8.3.8 We performed the slope stability analyses based on the interpretation of geologic conditions encountered during our field investigation. We should evaluate the geologic conditions during the grading operations to check if the conditions observed during grading are consistent with our interpretations. Additional slope stability analyses and modifications to the proposed buttresses may be required during the grading operations.

8.3.9 The buttress excavations are not planned adjacent to existing improvements or residences. If excavation failures were to occur, we expect the failures would be limited to within the property limits and outside improvements/structures would not be affected. In addition, the grading contractor would be required to remove the volume of soil that failed and evaluate the additional excavation procedures.

8.3.10 We selected Cross Sections 1-1′ and 2-2′ to perform the slope stability analyses for temporary conditions as described in the following table. A minimum factor of safety of 1.25 is currently required by the City of Oceanside for temporary slope stability conditions. A temporary backcut ranging from of 1.3:1 to 1.5:1 (horizontal to vertical) with slot cutting would be required in the area of Geologic Cross Sections 1-1′ and 2-2′ to achieve an adequate factor of safety.

SUMMARY OF SLOPE STABILITY ANALYSES FOR TEMPORARY EXCAVATIONS

Cross-Section	File Name	Condition of Slope Stability Analyses	Slot Cut Elevation Feet (MSL)	Calculated Factor of Safety
1-1′	Case 10 1-1'-Temp Slot Cut	Temporary backcut for 50-foot-buttress, below shear pin (100 kips/foot), 1.5:1 slope, block-mode analysis along BPS, static condition	280	1.26
2-2′	Case 10_2-2'-Temp Slot Cut	Temporary backcut for 20-foot-buttress, 1.3:1 slope, below shear pin (115 kips/foot), block-mode analysis along BPS, static condition	261	1.25

8.3.11 Slopes should be landscaped with drought-tolerant vegetation having variable root depths and requiring minimal landscape irrigation. In addition, slopes should be drained and properly maintained to reduce erosion.

8.4 Slope Stabilization – Shear Pins

8.4.1 Based on our slope stability analyses for Cross-Sections 1-1′ and 2-2′ shear pins will be required to increase the factor of safety to at least 1.5 for the southern slope. A buttress will also be required north and below the shear pins to help stabilize the landslide debris and weak clay/siltstone layers.

8.4.2 We expect the shear pins will need to be installed on the southern slope prior to the grading operations for the building pads due to the potential slope instability.

8.4.3 We applied a shear load at the location of the bedding plane shear (BPS) within the cross-sections to calculate the load required to possess a factor of safety of at least 1.5. Based on our analyses, the resistive shear load ranges from at least 100 kips per linear foot (kpf) to 115 kpf and will be required for calculated Geologic Cross-Sections 1-1’ and 2-2’ (see Appendix D).

8.4.4 After we calculated the load required, we adjusted the pin location including the length above and below the shear plane, to calculate a factor of safety of at least 1.5 above and below the pin. The following table presents the calculated shear pin characteristics.

SHEAR PIN CHARACTERISTICS

Cross-Section	Calculated Minimum Shear Resistance (Kips/Foot)	Top of Pin Elevation (Feet, MSL)	Base of Pin Elevation (Feet)	Total Length of Pin (Feet)	Estimated Elevation of BPS (Feet)
1-1’	100	320	254	66	264
2-2’	115	307	250	57	265

*Based on the planned layout of the property (see Geologic Map, Figure 1).

8.4.5 The portion of the drilled excavation above the pin (elevations higher than the top of pin listed in the previous table) may be backfilled with lean concrete slurry.

8.4.6 A licensed structural engineer should be retained to design the required structural elements of the pins as discussed herein.

8.4.7 Geocon Incorporated should observe the drilling operations and perform down-hole observations to confirm that the pins are placed in the proper location and the geologic conditions are similar to those expected. Adjustments in the depth of the pins may be necessary based on the conditions encountered. The client should consider performing large diameter drilling in the locations of the proposed shear pins to confirm design assumption prior to contractor arriving on site.

8.5 Grading

8.5.1 Grading should be performed in accordance with the recommendations provided in this report, the Recommended Grading Specifications contained in Appendix E and the local grading ordinance. Geocon Incorporated should observe the grading operations on a full-time basis and provide testing during the fill placement.

8.5.2 Prior to commencing grading, a preconstruction conference should be held at the site with the agency inspector, owner or developer, grading contractor, civil engineer, and geotechnical engineer in attendance. Special soil handling and/or the grading plans can be discussed at that time.

8.5.3 The sequencing of the grading and slope stabilization operations should be evaluated by the grading contractor and design team due to the potential instability of the temporary slopes. We expect the shear pins will need to be installed on the southern slope prior to the grading operations for the building pads.

8.5.4 Site preparation should begin with the removal of deleterious material, debris, and vegetation. The depth of vegetation removal should be such that material exposed in cut areas or soil to be used as fill is relatively free of organic matter. Material generated during stripping and/or site demolition should be exported from the site. Asphalt and concrete should not be mixed with the fill soil unless approved by the Geotechnical Engineer.

8.5.5 Abandoned foundations, buried utilities (if encountered) and our previous exploratory excavations should be removed and the resultant depressions and/or trenches should be backfilled with properly compacted material as part of the remedial grading.

8.5.6 **Proposed Buildings:** Undocumented fill, landslide debris, colluvium and alluvium within the proposed building pads should be excavated to expose firm/competent formational materials. We expect the surficial soil can be removed in the areas of the proposed buildings and the structures can be supported on a shallow foundation system. In addition, the buildings pads should be undercut where formational materials are located near the surface at least 3 feet below proposed grade and 2 feet below proposed foundations and replaced with properly compacted fill, whichever results in a deeper excavation. Prior to fill soil being placed, the existing ground surface should be scarified, moisture conditioned as necessary, and compacted to a depth of at least 12 inches. Deeper excavations may be required if saturated or loose fill soil is encountered. The base of the excavations should extend laterally equal to the depth of the excavation below proposed grade such that the surficial materials are removed below a 1:1 plane that extends down from the proposed building envelopes. A representative of Geocon should be on-site during excavations to evaluate the limits of the remedial grading.

8.5.7 **North Retaining Wall:** We anticipate up to 30 feet of alluvium and landslide debris below the western portion of the proposed northern retaining wall. We understand the proposed grading is limited to 10 feet outside (north) of the proposed wall. Therefore, full removal of the existing surficial soil may be infeasible due to the property line constraints or possible groundwater within the western portion of the retaining wall area. The excavations can be limited to the underlying formational materials. The Geologic Cross-Sections, Figure 2, show the expected grading limits with the excavations beginning 10 feet outside of the proposed retaining walls. We expect some of the surficial soil will remain in place due to the limited excavations and the walls will be designed as discussed herein. The resulting excavations should be backfilled with properly compacted fill to proposed grades.

8.5.8 **Western Parking and Improvement Areas:** The existing soil in the upper 5 feet of the proposed improvement areas should be excavated and properly compacted fill should be placed. The excavations can be limited to competent formational materials, where encountered.

8.5.9 **Storm Drain Vault Option 1 – Remedial Grading:** Undocumented fill, landslide debris. Colluvium and alluvium within the storm drain vault area should be excavated to expose firm/competent formational materials. The base of the excavations should extend laterally equal to the depth of the excavation below proposed grade such that the surficial materials are removed below a 1:1 plane that extends down from the proposed vault envelope. The limits of the removal are presented on the Geologic Map, Figure 1. A representative of Geocon should be on-site during excavations to evaluate the limits of the remedial grading. This option increases the potential for backcut failures due to the existing landslide debris.

8.5.10 **Storm Drain Vault Option 2 – Ground Improvements:** To help reduce the potential for backcut failures, the storm drain vault can be supported on ground improvements. If the storm drain vault will be supported on shallow or mat foundation system over improved ground (i.e. deep soil mixing, rammed aggregate piers), the upper 5 feet of existing materials and 3 feet below the proposed grade (whichever results in a deeper excavation) should be excavated and properly compacted fill should be placed. The excavations should extend at least 10 feet laterally outside of the proposed foundation zones. Deeper excavations may be required in areas where loose or saturated materials are encountered. The remedial grading should be performed after completion of ground improvement operations for aggregate piers and prior to construction of soil mix columns.

SUMMARY OF REMEDIAL GRADING RECOMMENDATIONS

Area	Remedial Grading Excavation Recommendations
Building Pads	Excavate Landslide Debris to Formational Materials
	Undercut at Least 3 Feet Below Proposed Pad Grade or 2 Feet Below Footings, Whichever is Greater
Retaining Wall	Begin Excavation 10 Feet Outside of Wall and Excavate to Formational Materials Where Feasible
Storm Drain Vault	Option 1: Excavate Landslide Debris to Formational Materials
	Option 2: Excavate Upper 5 Feet or 3 Feet Below Proposed Grade Prior to Installing Ground Improvements
Site Development	Process Upper 5 Feet of Existing Materials
Lateral Grading Limits	Excavate Laterally Equal to the Depth of the Excavation Below Proposed Grade Such that the Surficial Materials Are Removed Below a 1:1 Plane that Extends Down from the Proposed Building Envelopes
	Storm Drain Vault: Excavate Outside A 1:1 Plane Outside The Area Or At Least 5 Feet Outside Area If Ground Improvements Are Used
	Minimum 10 Feet Outside of Buildings
	Minimum 2 Feet Outside of Improvement Areas
Exposed Excavation Bottoms	Scarify Upper 12 Inches and Recompact
	Slope 1% to Adjacent Street or Deeper Fill

8.5.11 The site should then be brought to final subgrade elevations with fill compacted in layers as recommended in the following table. In general, the existing soil is suitable for use from a geotechnical engineering standpoint as fill if relatively free from vegetation, debris and other deleterious material. Layers of fill should be about 6 to 8 inches in loose thickness and no thicker than will allow for adequate bonding and compaction. Fill materials placed below optimum moisture content may require additional moisture conditioning prior to placing additional fill.

SUMMARY OF COMPACTED FILL RECOMMENDATIONS

Fill Location	Relative Compaction*	Relative Moisture Content*
Upper 40 Feet of Grading	90% of Laboratory Maximum Dry Density	Near to Slightly Above Optimum
Utility/Retaining Wall Backfill		
Sidewalk and Curb/Gutter Subgrade		
Deeper Than 40 Feet of Grading	92% of Laboratory Maximum Dry Density	Near to Slightly Above Optimum
Pavement and Cross-Gutter Subgrade	95% of Laboratory Maximum Dry Density	Near to Slightly Above Optimum
Base Materials		

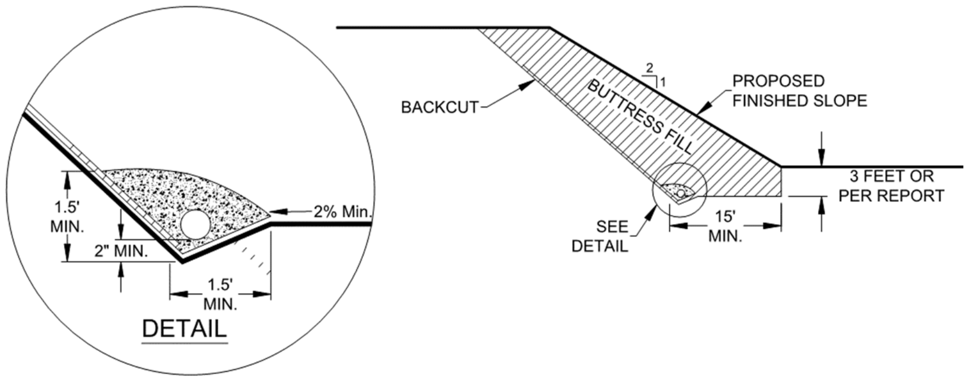
*In accordance with ASTM D 1557.

8.5.12 The upper 3 feet of all building pads should be composed of properly compacted fill with a "very low" to "medium" expansion potential (EI of 90 or less), where possible. Fill with an expansion index greater than 90 should be placed at least 3 feet below finish grade at the maximum extent practical. In addition, formational materials with an expansion index greater than 90 should be undercut at least 3 feet below finish-pad grade and replaced with soil with soil possessing a "very low" to "medium" expansion potential. Cobbles or concretions greater than 1 foot in maximum dimension should not be placed within 10 feet of finish grade or 3 feet of the deepest utility. Cobbles and concretions greater than 6 inches in maximum dimension should not be placed within 3 feet of finish grade.

8.5.13 Slope stability analyses utilizing drained direct shear strength parameters based on our experience with similar soil types in nearby areas and laboratory test results indicates the proposed southern slope will require shear pins and buttressing to obtain a factor of safety of at least 1.5. The slope is shown on the Geologic Map, Figure 1, should be graded with a buttress varying from approximately 20 to 50 feet wide at the base. The minimum design buttress widths are shown on the Geologic Cross-Sections, Figure 2.

8.5.14 The Typical Buttress/Stability Fill Detail should be used for design and construction of slopes. The backcut for the buttress should commence at least 10 feet from the top of the proposed finish-graded slope and should extend at least 5 feet below adjacent pad grade or below the bedding plane shear/claystone layer, to a maximum depth of 15 feet below finish-pad grade. The base of the key should be slopes at least 5 percent to the drain, into slope. Elevations of the base of the buttress are shown on the Geologic Map and Cross-Sections, Figures 1 and 2.

Buttress and stability fill excavations must be approved by our certified engineering geologist, and surveyed by the project civil engineer prior to fill placement.



Typical Buttress/Stability Fill Detail

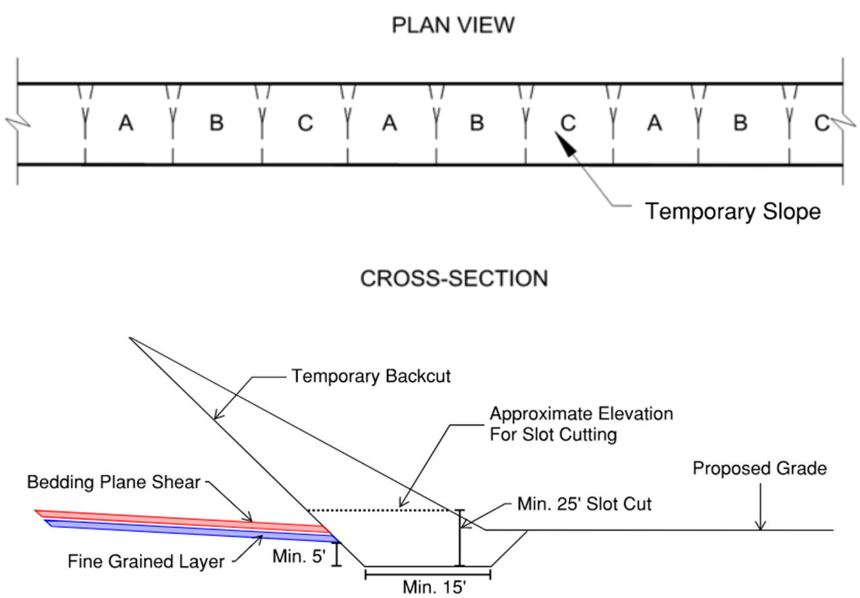
8.5.15 The slope backcut should be in accordance with OSHA requirements. Based on our analyses, we expect a slope of 2:1 or flatter will be required for stability purposes. Chimney drains should be installed along the backcut that are 4 feet wide, 20-foot on center and provide dual-sided drainage. Closer spacing may be required where seepage is encountered. The collector pipe at the base of the backcut should consists of a minimum 6-inch diameter, perforated, Schedule 40 PVC pipe drained at a minimum of 1%. The pipe should be surrounded by ¾-inch gravel wrapped in an approved filter fabric (Mirafi 140N or equivalent).

8.5.16 Cut slope excavations including buttresses and shear keys should be observed during grading operations to check that soil and geologic conditions do not differ significantly from those expected. During the construction of buttresses, there is a risk that the temporary backcut slopes will become unstable. This risk can be reduced by grading the buttress fill in short segments and/or flattening the inclination of the temporary slope. Temporary backcut slopes should be excavated and fill placed as soon as possible to help prevent slope backcut failures.

8.5.17 Slot cutting of the buttress excavations will likely be necessary to provide an adequate temporary factor of safety during grading. The top of the slot cut should be at an elevation of 25 feet above the design base of the buttress as shown on Cross-sections 1-1’ and 2-2’, Figure 2. The slot cut should then extend a minimum of 5 feet into the sandy portion of the formational materials. Each slot should be no wider than 50 feet (or as determined by the grading contractor) and the excavation should extend to the base of the keyway which should be graded as shown in the typical buttress/stability fill detail herein. This may require reduced slot cut lengths if loose or otherwise unstable soil is encountered. The contractor should be aware that there is an inherent risk to slot-cutting as movement of near vertical excavations can cause stress relief features and vertical ground settlement outside of the excavation. The grading contractor should be prepared to take necessary steps to provide lateral stability/temporary buttressing if slot cut sidewalls experience instability. The slot-cutting should be perform using the A-B-C Method (excavate the soil and place compacted fill in the A Areas, then the B areas, then the C areas). The following table presents the summary of the slot cutting elevations.

SUMMARY OF SLOT CUTTING ELEVATIONS

Cross-Section	Approximate Top Elevation of Slot Cut (Feet , MSL)	Approximate Bottom Elevation of Slot Cut (Feet , MSL)
1-1′	280	255
2-2′	261	240



Slot-Cutting Overexcavation Detail

8.5.18 The outer 15 feet (or a distance equal to the height of the slope, whichever is less) of slopes should be composed of properly compacted granular “soil” fill to reduce the potential for surficial sloughing. In general, soil with an expansion index of 90 or less or at least 35 percent sand-size particles should be acceptable as "soil" fill. Soil of questionable strength to satisfy surficial stability should be tested in the laboratory for acceptable drained shear strength. The use of cohesionless soil in the outer portion of fill slopes should be avoided. Fill slopes should be overbuilt 2 feet and cut back or be compacted by backrolling with a loaded sheepsfoot roller at vertical intervals not to exceed 4 feet and should be track-walked at the completion of each slope such that the fill is compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to slightly above optimum moisture content to the face of the finished sloped.

8.5.19 Import fill (if necessary) should consist of the characteristics presented in the following table. Geocon Incorporated should be notified of the import soil source and should perform laboratory testing of import soil prior to its arrival at the site to determine its suitability as fill material.

SUMMARY OF IMPORT FILL RECOMMENDATIONS

Soil Characteristic	Values
Expansion Potential	"Very Low" to "Medium" (Expansion Index of 90 or Less)
Particle Size	Maximum Dimension Less Than 3 Inches
	Generally Free of Debris

8.6 Earthwork Grading Factors

8.6.1 Estimates of shrink-swell factors are based on comparing laboratory compaction tests with the density of the material in its natural state and experience with similar soil types. Variations in natural soil density and compacted fill render shrinkage value estimates very approximate. As an example, the contractor can compact fill to a density of 90 percent or higher of the laboratory maximum dry density. Thus, the contractor has at least a 10 percent range of control over the fill volume. Based on the work performed to date and considering the discussion herein, the earthwork factors in the following table may be used as a basis for estimating how much the on-site soils may shrink or swell when removed from their natural state and placed as compacted fill.

SHRINKAGE AND BULK FACTORS

Soil Unit	Shrink/Bulk Factor
Surficial Soil (Fill/Topsoil/Colluvium/Qal/Qls)	10-15% Shrink
Santiago Formation (Tsa)	3-5% Bulk

8.7 Temporary Excavations

8.7.1 The recommendations included herein are provided for stable excavations. It is the responsibility of the contractor and their competent person to ensure all excavations, temporary slopes and trenches are properly constructed and maintained in accordance with applicable OSHA guidelines in order to maintain safety and the stability of the excavations and adjacent improvements. These excavations should not be allowed to become saturated or to dry out. Surcharge loads should not be permitted to a distance equal to the height of the excavation from the top of the excavation. The top of the excavation should be a minimum of 15 feet from the edge of existing improvements. Excavations steeper than those recommended or closer than 15 feet from an existing surface improvement should be shored in accordance with applicable OSHA codes and regulations.

8.7.2 The stability of the excavations is dependent on the design and construction of the shoring system and site conditions. Therefore, Geocon Incorporated cannot be responsible for site safety and the stability of the proposed excavations.

8.7.3 The property possesses landslide debris that typically has a tendency to possess stability issues. The underground contractors should be ready to provide shoring or flatten temporary excavation inclinations if localized instability is encountered.

8.8 Seismic Design Criteria – 2022 California Building Code

8.8.1 The following table summarizes site-specific design criteria obtained from the 2022 California Building Code (CBC; Based on the 2021 International Building Code [IBC] and ASCE 7-16), Chapter 16 Structural Design, Section 1613 Earthquake Loads. We used the computer program *U.S. Seismic Design Maps*, provided by the Structural Engineers Association (SEA) to calculate the seismic design parameters. The short spectral response uses a period of 0.2 second. We evaluated the Site Class based on the discussion in Section 1613.2.2 of the 2022 CBC and Table 20.3-1 of ASCE 7-16. The values presented herein are for the risk-targeted maximum considered earthquake (MCE_R). Sites designated as Site Class D, E and F may require additional analyses if requested by the project structural engineer and client.

2022 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2022 CBC Reference
Site Class	D	Section 1613.2.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	0.928g	Figure 1613.2.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.343g	Figure 1613.2.1(3)
Site Coefficient, F_A	1.129	Table 1613.2.3(1)
Site Coefficient, F_V	1.957*	Table 1613.2.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	1.047g	Section 1613.2.3 (Eqn 16-20)
Site Class Modified MCE_R Spectral Response Acceleration – (1 sec), S_{M1}	0..671g*	Section 1613.2.3 (Eqn 16-21)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.698g	Section 1613.2.4 (Eqn 16-22)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.447g*	Section 1613.2.4 (Eqn 16-23)

*See following paragraph.

8.8.2 Using the code-based values presented in the previous table, in lieu of a performing a ground motion hazard analysis, requires the exceptions outlined in ASCE 7-16 Section 11.4.8 be followed by the project structural engineer. Per Section 11.4.8 of ASCE/SEI 7-16, a ground motion hazard analysis should be performed for projects for Site Class "D" sites with S1 greater than 0.2g. Section 11.4.8 also provides exceptions which indicates that the ground motion hazard analysis may be waived provided the exceptions are followed. Supplement 3 of ASCE 7-16 provides an exception stating that that the GMHA may be waived provided that the parameter S_{M1} is increased by 50% for all applications of S_{M1}. The values for parameters S_{M1} and S_{D1} presented herein above have **not** been increased in accordance with Supplement 3 of ASCE 7-16.

8.8.3 The following table presents the mapped maximum considered geometric mean (MCE_G) seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-16.

ASCE 7-16 PEAK GROUND ACCELERATION

Parameter	Value	ASCE 7-16 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.402g	Figure 22-9
Site Coefficient, F_{PGA}	1.198	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.482g	Section 11.8.3 (Eqn 11.8-1)

8.8.4 Conformance to the criteria in this section for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur in the event of a large earthquake. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

8.8.5 The project structural engineer and architect should evaluate the appropriate Risk Category and Seismic Design Category for the planned structures. The values presented herein assume a Risk Category of II and resulting in a Seismic Design Category D. The following table summarizes of the risk categories in accordance with ASCE 7-16.

ASCE 7-16 RISK CATEGORIES

Risk Category	Building Use	Examples
I	Low risk to Human Life at Failure	Barn, Storage Shelter
II	Nominal Risk to Human Life at Failure (Buildings Not Designated as I, III or IV)	Residential, Commercial and Industrial Buildings
III	Substantial Risk to Human Life at Failure	Theaters, Lecture Halls, Dining Halls, Schools, Prisons, Small Healthcare Facilities, Infrastructure Plants, Storage for Explosives/Toxins
IV	Essential Facilities	Hazardous Material Facilities, Hospitals, Fire and Rescue, Emergency Shelters, Police Stations, Power Stations, Aviation Control Facilities, National Defense, Water Storage

8.9 Fill Settlement

8.9.1 Fill soil, even if properly compacted, will experience settlement over the lifetime of the improvements that it supports. The ultimate settlement potential of the fill is a function of the soil classification, placement relative compaction, and subsequent increases in the soil moisture content.

8.9.2 Building 1 and 2 will be underlain by a maximum fill thickness of about 50 and 25 feet, respectively. The settlement of compacted fill is expected to continue over a relatively extended time period resulting from both gravity loading and hydrocompression upon wetting from rainfall and/or landscape irrigation.

8.9.3 Due to the variable fill thickness, a potential for differential settlement across the proposed buildings exist and special foundation design may be consideration. Based on measured settlement of similar fill depths on other sites and the time period since the fill was placed, we estimate that maximum settlement of the compacted fill will be approximately 0.4 percent for the proposed compacted fills.

8.9.4 The following table presents the estimated total and differential fill thickness and settlements of the building pads for the proposed pad grades provided on the referenced plans. These settlement magnitudes should be considered in design of the foundation system and adjacent flatwork that connects to the proposed buildings.

EXPECTED DIFFERENTIAL SETTLEMENT OF FILL SOIL

Building	Maximum Depth of Fill Beneath Structure (Feet)	Maximum Fill Differential (Feet)	Estimated Maximum Settlement (Inches)	Estimated Differential Settlement (Inches)	Length of Differential Settlement (Feet)	Estimated Maximum Angular Distortion
Building 1	50	45	2.4	2.2	380	1/700
Building 2	25	20	1.2	1.0	180	1/950

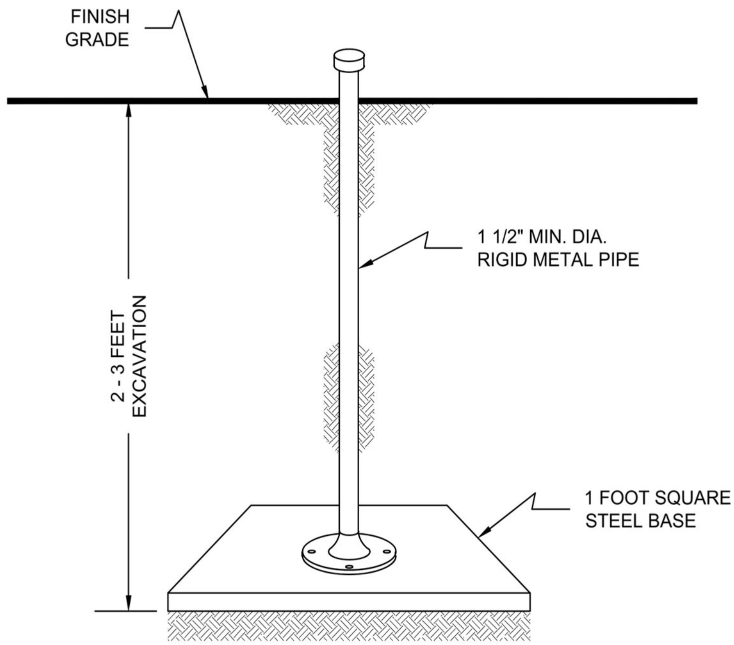
8.9.5 Deep foundations such as driven piles or drilled piers are the most effective means of reducing the ultimate settlement potential of the proposed structures to a negligible amount. Alternatively, ground improvements and/or highly reinforced shallow foundation systems and slabs-on-grade may be used for support of the buildings; however, the shallow foundation systems would not eliminate the potential for cosmetic distress related to differential settlement of the underlying fill. Some cosmetic distress cannot be avoided and should be expected over the life of the structure as a result of long-term differential settlement. The owner, tenants, and future owners should be made aware that cosmetic distress, including separation of caulking at wall joints, small non-structural wall panel cracks, and separation of concrete flatwork is likely to occur. This discussion in no way describes latent defects to the building's structure nor foundation, nor allows them to be common place. We understand the settlements and angular rotation values are within normal design ranges and are within "standard practice" values. We can provide additional recommendations when a structural engineer begins their design and if they require additional design parameters or recommendations to support the planned structure.

8.10 Settlement Monuments

8.10.1 We expect fill settlement and settlement due to fill loads over compressible materials will occur after remedial grading operations for the proposed development. Based on our recommendations, surficial soil will be left in place on the western portion of the site below the proposed parking area. We recommended a settlement program for this area for the proposed improvements and can occur for 6 months.

8.10.2 Therefore, settlement monitoring using plate and surface settlement monuments will be required as discussed herein to evaluate when the settlement has stabilized, and further improvements may proceed. The Geologic Map, Figure 1, presents the approximate locations of the proposed settlement monuments. However, we will evaluate the number, locations, and type of settlement monuments during grading operations based on the final limits or removals performed.

8.10.3 Surface settlement monuments should be installed at finished grade after the placement of fill in areas where compressible surficial materials will be left in place to monitor settlement movement of the underlying fill and surficial materials thereafter. A typical surface settlement monument detail is presented herein.



Surface Settlement Monument Detail

8.10.4 The project surveyor should record the movements of the surface settlement monuments every two weeks until data indicates that the rate of primary fill and left in place surficial material soil compression is essentially non-detrimental (settlement monument data with a relatively level plateau) to proposed improvements. When we receive two to three data points of settlement values that show a relatively level settlement slope on the graphs, the construction of the building and surrounding improvements can begin.

8.10.5 The City of Oceanside requires at least 6 months of monitoring unless documented evidence of the completion of primary settlement is provided. The settlement timeframe can be reduced, as necessary, during the settlement evaluation process. The settlement due to primary consolidation will be considered to have ceased when survey readings show a relatively level plateau of settlement data over 4 consecutive weekly readings. At that time, Geocon can prepare a report recommending for submittal for city approval. Improvements that are sensitive to the estimated settlements may be installed after the monitoring program shows the primary consolidation is relatively complete. Based on our experience, we expect the monuments will require monitoring for roughly 150 days. At that time, we expect development can begin for settlement-sensitive underground utilities with less than one percent gradient along with construction of the building and improvements. Underground utilities with a gradient of one percent or greater will not have a waiting period and can start construction after finish grade is achieved. Underground wet utilities should not be installed until finish grade is achieved, as excessive settlements will occur with the placement of compacted fills. We will evaluate the location of the settlement monuments subsequent to the grading operations. There will be no monitoring or waiting time for improvements that are not underlain by compressible materials or have less that 20 feet within the eastern end of the site.

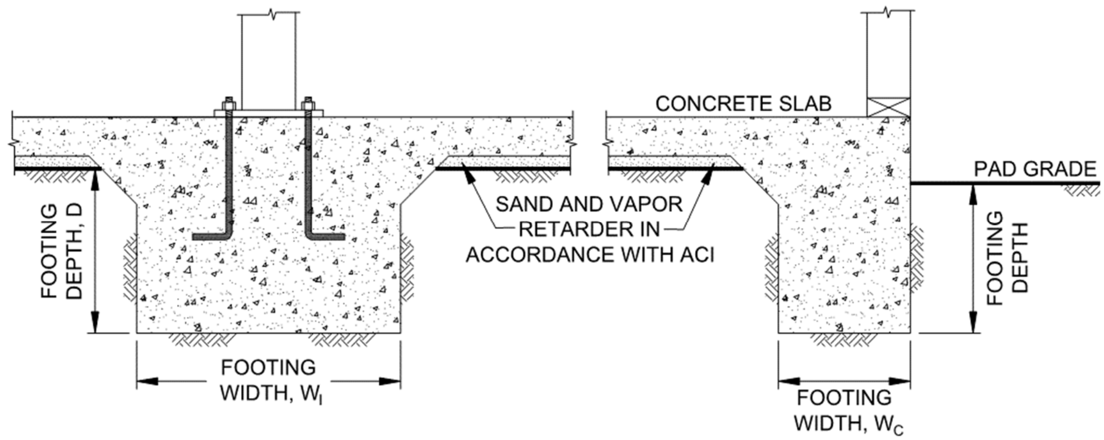
8.11 Shallow Foundations

8.11.1 The proposed structure can be supported on a shallow foundation system founded in the compacted fill. Foundations for the structure should consist of continuous strip footings and/or isolated spread footings and should be designed using the parameters in the following table.

SUMMARY OF FOUNDATION RECOMMENDATIONS

Parameter	Value
Minimum Continuous Foundation Width, W_C	12 Inches
Minimum Isolated Foundation Width, W_I	24 Inches
Minimum Foundation Depth, D	24 Inches Below Lowest Adjacent Grade
Minimum Steel Reinforcement	4 No. 5 Bars, 2 Top and 2 Bottom
Allowable Bearing Capacity	2,500 psf
Bearing Capacity Increase	500 psf per Foot of Depth
	300 psf per Foot of Width
Maximum Allowable Bearing Capacity	4,000 psf
Estimated Total Settlement	1 Inch
Estimated Differential Settlement	½ Inch in 40 Feet
Footing Size Used for Settlement	8-Foot Square
Design Expansion Index	50 or Less

8.11.2 The foundations should be embedded in accordance with the recommendations herein and the Wall/Column Footing Dimension Detail. The embedment depths should be measured from the lowest adjacent pad grade for both interior and exterior footings. Footings should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope (unless designed with a post-tensioned foundation system as discussed herein).



Wall/Column Footing Dimension Detail

8.11.3 The bearing capacity values presented herein are for dead plus live loads and may be increased by one-third when considering transient loads due to wind or seismic forces.

8.11.4 Where buildings or other improvements are planned near the top of a slope steeper than 3:1 (horizontal: vertical), special foundations and/or design considerations are recommended due to the tendency for lateral soil movement to occur.

- For fill slopes less than 20 feet high, building footings should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.
- When located next to a descending 3:1 (horizontal: vertical) fill slope or steeper, the foundations should be extended to a depth where the minimum horizontal distance is equal to H/3 (where H equals the vertical distance from the top of the fill slope to the base of the fill soil) with a minimum of 7 feet but need not exceed 40 feet. The horizontal distance is measured from the outer, deepest edge of the footing to the face of the slope. An acceptable alternative to deepening the footings would be the use of a post-tensioned slab and foundation system or increased footing and slab reinforcement. Specific design parameters or recommendations for either of these alternatives can be provided once the building location and fill slope geometry have been determined.
- If swimming pools are planned, Geocon Incorporated should be contacted for a review of specific site conditions.
- Although other improvements, which are relatively rigid or brittle, such as concrete flatwork or masonry walls, may experience some distress if located near the top of a slope, it is generally not economical to mitigate this potential. It may be possible,

however, to incorporate design measures that would permit some lateral soil movement without causing extensive distress. Geocon Incorporated should be consulted for specific recommendations.

8.11.5 We should observe the foundation excavations prior to the placement of reinforcing steel and concrete to check that the exposed soil conditions are similar to those expected and that they have been extended to the appropriate bearing strata. Foundation modifications may be required if unexpected soil conditions are encountered.

8.11.6 Geocon Incorporated should be consulted to provide additional design parameters as required by the structural engineer.

8.12 Concrete Slabs-On-Grade

8.12.1 Concrete slabs-on-grade for the structures should be constructed using the parameters presented in the following table.

MINIMUM CONCRETE SLAB-ON-GRADE RECOMMENDATIONS

Parameter	Value
Minimum Concrete Slab Thickness	5 Inches
Minimum Steel Reinforcement	No. 3 Bars 24 Inches on Center, Both Directions
Typical Slab Underlayment	3 to 4 Inches of Sand/Gravel/Base
Design Expansion Index	90 or Less

8.12.2 Slabs that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder. The vapor retarder design should be consistent with the guidelines presented in the American Concrete Institute's (ACI) *Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials* (ACI 302.2R-06). In addition, the membrane should be installed in accordance with manufacturer's recommendations and ASTM requirements and installed in a manner that prevents puncture. The vapor retarder used should be specified by the project architect or developer based on the type of floor covering that will be installed and if the structure will possess a humidity controlled environment.

8.12.3 The bedding sand thickness should be determined by the project foundation engineer, architect, and/or developer. It is common to have 3 to 4 inches of sand for 5-inch and 4-inch thick slabs, respectively, in the southern California region. However, we should be contacted to provide recommendations if the bedding sand is thicker than 6 inches. The foundation design engineer should provide appropriate concrete mix design criteria and curing measures to assure proper curing of the slab by reducing the potential for rapid moisture loss and subsequent cracking and/or slab curl. We suggest that the foundation design engineer present the concrete mix design and proper curing methods on the foundation plans. It is critical that the foundation contractor understands and follows the recommendations presented on the foundation plans.

8.12.4 Some projects remove the sand layer below the slab in parking structure areas. This is acceptable from a geotechnical engineering standpoint; however, relatively minor cracks could form due to differential curing. Therefore, the structural engineer and/or the concrete contractor should provide recommendations for proper curing techniques to help prevent cracking.

8.12.5 Concrete slabs should be provided with adequate crack-control joints, construction joints and/or expansion joints to reduce unsightly shrinkage cracking. The design of joints should consider criteria of the American Concrete Institute (ACI) when establishing crack-control spacing. Crack-control joints should be spaced at intervals no greater than 12 feet. Additional steel reinforcing, concrete admixtures and/or closer crack control joint spacing should be considered where concrete-exposed finished floors are planned.

8.12.6 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisturized to maintain a moist condition as would be expected in any such concrete placement.

8.12.7 The concrete slab-on-grade recommendations are based on soil support characteristics only. The project structural engineer should evaluate the structural requirements of the concrete slabs for supporting expected loads.

8.12.8 The recommendations of this report are intended to reduce the potential for cracking of slabs due to expansive soil (if present), differential settlement of existing soil or soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

8.13 Exterior Concrete Flatwork

8.13.1 Exterior concrete flatwork not subject to vehicular traffic should be constructed in accordance with the recommendations presented in the following table. The recommended steel reinforcement would help reduce the potential for cracking.

MINIMUM CONCRETE FLATWORK RECOMMENDATIONS

Expansion Index, EI	Minimum Steel Reinforcement* Options	Minimum Thickness
EI $\leq$ 90	No. 3 Bars 18 inches on center, Both Directions	4 Inches
EI $\leq$ 130	No. 4 Bars 12 inches on center, Both Directions	4 Inches

*In excess of 8 feet square.

8.13.2 The subgrade soil should be properly moisturized and compacted prior to the placement of steel and concrete. The subgrade soil should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to slightly above optimum moisture content in accordance with ASTM D 1557.

8.13.3 Even with the incorporation of the recommendations of this report, the exterior concrete flatwork has a potential to experience some uplift due to expansive soil beneath grade. The steel reinforcement should overlap continuously in flatwork to reduce the potential for vertical offsets within flatwork. Additionally, flatwork should be structurally connected to the curbs, where possible, to reduce the potential for offsets between the curbs and the flatwork.

8.13.4 Concrete flatwork should be provided with crack control joints to reduce and/or control shrinkage cracking. Crack control spacing should be determined by the project structural engineer based upon the slab thickness and intended usage. Criteria of the American Concrete Institute (ACI) should be taken into consideration when establishing crack control spacing. Subgrade soil for exterior slabs not subjected to vehicle loads should be compacted in accordance with criteria presented in the grading section prior to concrete placement. Subgrade soil should be properly compacted and the moisture content of subgrade soil should be verified prior to placing concrete. Base materials will not be required below concrete improvements.

8.13.5 Where exterior flatwork abuts the structure at entrant or exit points, the exterior slab should be dowelled into the structure's foundation stemwall. This recommendation is intended to reduce the potential for differential elevations that could result from differential settlement or minor heave of the flatwork. Dowelling details should be designed by the project structural engineer.

8.13.6 The recommendations presented herein are intended to reduce the potential for cracking of exterior slabs as a result of differential movement. However, even with the incorporation of the recommendations presented herein, slabs-on-grade will still crack. The occurrence of concrete shrinkage cracks is independent of the soil supporting characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, the use of crack control joints and proper concrete placement and curing. Crack control joints should be spaced at intervals no greater than 12 feet. Literature provided by the Portland Concrete Association (PCA) and American Concrete Institute (ACI) present recommendations for proper concrete mix, construction, and curing practices, and should be incorporated into project construction.

8.14 Conventional Retaining Walls

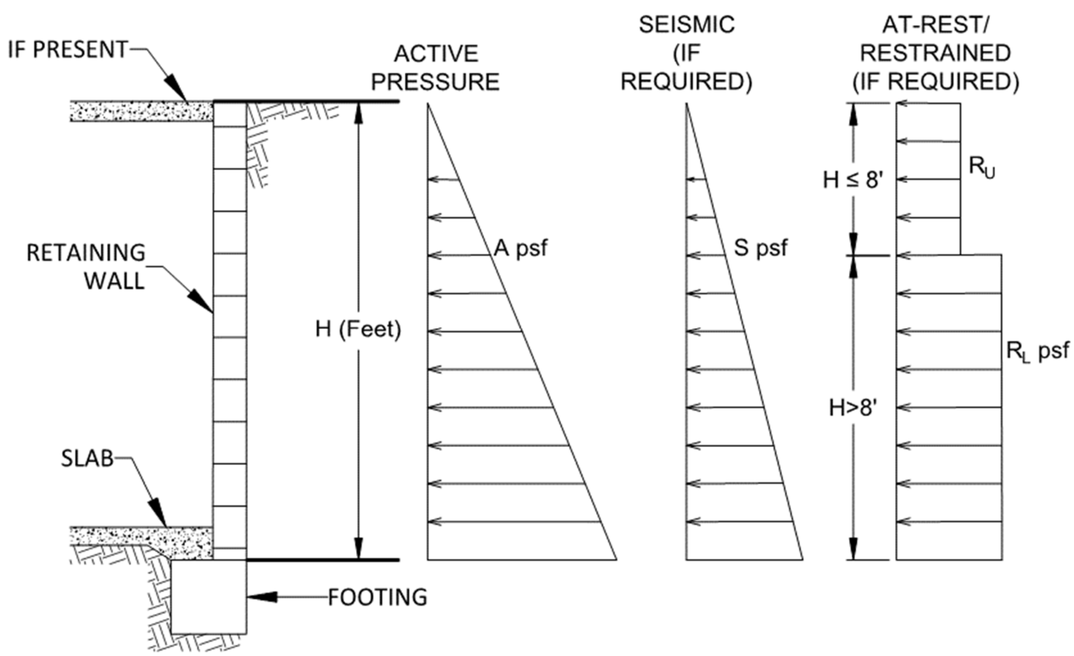
8.14.1 We understand that conventional and a subterranean garage walls may be planned for the site with a maximum height of about 10 feet. Retaining walls should be designed using the values presented in the following table. Soil with an expansion index (EI) of greater than 50 should not be used as backfill material behind retaining walls.

RETAINING WALL DESIGN RECOMMENDATIONS

Parameter	Value
Active Soil Pressure, A (Fluid Density, Level Backfill)	40 pcf
Active Soil Pressure, A (Fluid Density, 2:1 Sloping Backfill)	55 pcf
Seismic Pressure, S	15H psf
At-Rest/Restrained Walls Additional Uniform Pressure, R_U (0 to 8 Feet High)	7H psf
At-Rest/Restrained Walls Additional Uniform Pressure, R_L (8+ Feet High)	13H psf
Expected Expansion Index for the Subject Property	EI≤ 90

H equals the height of the retaining portion of the wall

8.14.2 The project retaining walls should be designed as shown in the Retaining Wall Loading Diagram.



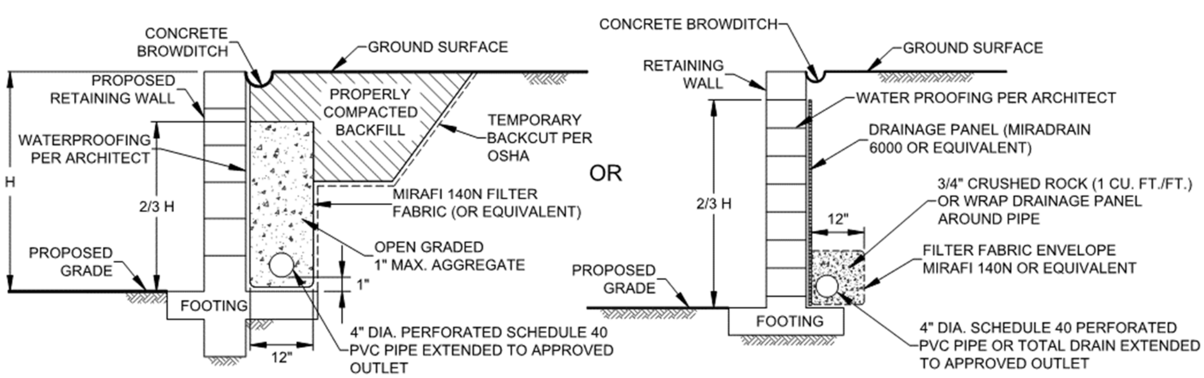
Retaining Wall Loading Diagram

8.14.3 Unrestrained walls are those that are allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall) at the top of the wall. Where walls are restrained from movement at the top (at-rest condition), an additional uniform pressure should be applied to the wall. For retaining walls subject to vehicular loads within a horizontal distance equal to two-thirds the wall height, a surcharge equivalent to 2 feet of fill soil should be added to the upper 10 feet of the retaining wall.

8.14.4 The structural engineer should determine the Seismic Design Category for the project in accordance with Section 1613 of the 2022 CBC or Section 11.6 of ASCE 7-16. For structures assigned to Seismic Design Category of D, E, or F, retaining walls that support more than 6 feet of backfill should be designed with seismic lateral pressure in accordance with Section 1803.5.12 of the 2022 CBC. The seismic load is dependent on the retained height where H is the height of the wall, in feet, and the calculated loads result in pounds per square foot (psf) exerted at the base of the wall and zero at the top of the wall.

8.14.5 Retaining walls should be designed to ensure stability against overturning sliding, and excessive foundation pressure. Where a keyway is extended below the wall base with the intent to engage passive pressure and enhance sliding stability, it is not necessary to consider active pressure on the keyway.

8.14.6 Drainage openings through the base of the wall (weep holes) should not be used where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The recommendations herein assume a properly compacted granular (EI of 90 or less) free-draining backfill material with no hydrostatic forces or imposed surcharge load. The retaining wall should be properly drained as shown in the Typical Retaining Wall Drainage Detail. If conditions different than those described are expected, or if specific drainage details are desired, Geocon Incorporated should be contacted for additional recommendations.



Typical Retaining Wall Drainage Detail

8.14.7 The retaining walls may be designed using either the active and restrained (at-rest) loading condition or the active and seismic loading condition as suggested by the structural engineer. Typically, it appears the design of the restrained condition for retaining wall loading may be adequate for the seismic design of the retaining walls. However, the active earth pressure combined with the seismic design load should be reviewed and also considered in the design of the retaining walls.

8.14.8 In general, wall foundations should be designed using the parameters presented in the following table. The proximity of the foundation to the top of a slope steeper than 3:1 could impact the allowable soil bearing pressure. Therefore, retaining wall foundations should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.

SUMMARY OF RETAINING WALL FOUNDATION RECOMMENDATIONS

Parameter	Value
Minimum Retaining Wall Foundation Width	12 Inches
Minimum Retaining Wall Foundation Depth	12 Inches
Minimum Steel Reinforcement	Per Structural Engineer
Allowable Bearing Capacity	2,000 psf
Estimated Total Settlement	1 Inch
Estimated Differential Settlement	½ Inch in 40 Feet

8.14.9 The recommendations presented herein are generally applicable to the design of rigid concrete or masonry retaining walls. In the event that other types of walls (such as mechanically stabilized earth [MSE] walls, soil nail walls, or soldier pile walls) are planned, Geocon Incorporated should be consulted for additional recommendations.

8.14.10 It is common to see retaining walls constructed in the areas of the elevator pits. The retaining walls should be properly drained and designed in accordance with the recommendations presented herein. If the elevator pit walls are not drained, the walls should be designed with an increased active pressure with an equivalent fluid density of 90 pcf. It is also common to see seepage and water collection within the elevator pit. The pit should be designed and properly waterproofed to prevent seepage and water migration into the elevator pit.

8.14.11 Unrestrained walls will move laterally when backfilled and loading is applied. The amount of lateral deflection is dependent on the wall height, the type of soil used for backfill, and loads acting on the wall. The retaining walls and improvements above the retaining walls should be designed to incorporate an appropriate amount of lateral deflection as determined by the structural engineer.

8.14.12 Soil contemplated for use as retaining wall backfill, including import materials, should be identified in the field prior to backfill. At that time, Geocon Incorporated should obtain samples for laboratory testing to evaluate its suitability. Modified lateral earth pressures may be necessary if the backfill soil does not meet the required expansion index or shear strength. City or regional standard wall designs, if used, are based on a specific active lateral earth pressure and/or soil friction angle. In this regard, on-site soil to be used as backfill may or may not meet the values for standard wall designs. Geocon Incorporated should be consulted to assess the suitability of the on-site soil for use as wall backfill if standard wall designs will be used.

8.15 Mechanically Stabilized Earth (MSE) Retaining Walls

8.15.1 We understand a Mechanized stabilized earth (MSE) retaining wall will be used on the northern edge of the property. MSE retaining walls are alternative walls that consist of modular block facing units with geogrid reinforced earth behind the block. The reinforcement grid attaches to the block units and is typically placed at specified vertical intervals and embedment lengths. The grid length and spacing will be determined by the wall designer. The designer should also check that sufficient horizontal distance exists to install the grids without having to excavate into the slope as the slope face consists of very strong rock material or rock fill.

8.15.2 We expect the MSE wall footing will be embedded in properly compacted fill over formational materials from Sta 3+85-9+48. From Sta 0+00-3+85 the wall footing will be embedded into properly compacted fill with a potential of 15 to 20 feet of landslide debris being left in place at Sta 0+00 and thinning out to a full removal at Sta 3+85. The settlement and stability analyses are presented herein.

8.15.3 The geotechnical parameters listed in the following table can be used for preliminary design of the MSE walls. We understand that a combination of onsite soil and import soil will be used as backfill material behind the walls. Once the import source has been determined, laboratory testing should be performed to check that the shear strength parameters used in the design of the MSE walls meet the required strength within the reinforced zone.

GEOTECHNICAL PARAMETERS FOR MSE WALLS

Parameter	Soil Source	Reinforced Zone	Retained Zone	Foundation Zone
Angle of Internal Friction	On-Site	26 Degrees	26 Degrees	26 Degrees
	Select Sand Grading	30 Degrees	30 Degrees	30 Degrees
Cohesion	On-Site and Select Grading	200 psf	200 psf	200 psf
Wet Unit Density	On-Site and Select Grading	125 pcf	125 pcf	125 pcf

8.15.4 The soil parameters presented in the previous table are based on our experience and direct shear-strength tests performed during the geotechnical investigation and represent some of the on-site materials. The wet unit density values can be used for design but actual in-place densities may range from approximately 90 to 135 pounds per cubic foot. Geocon has no way of knowing which materials will actually be used as backfill behind the wall during construction. It is up to the wall designers to use their judgment in selection of the design parameters. As such, once backfill materials have been selected and/or stockpiled, sufficient shear tests should be conducted on samples of the proposed backfill materials to check that they conform to actual design values. Results should be provided to the designer to re-evaluate stability of the walls. Dependent upon test results, the designer may require modifications to the original wall design (e.g., longer reinforcement embedment lengths and/or steel reinforcement).

8.15.5 The foundation zone is the area where the footing is embedded, the reinforced zone is the area of the backfill that possesses the reinforcing fabric, and the retained zone is the area behind the reinforced zone.

8.15.6 The MSE wall foundations should be designed using the values in the following table. The walls should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.

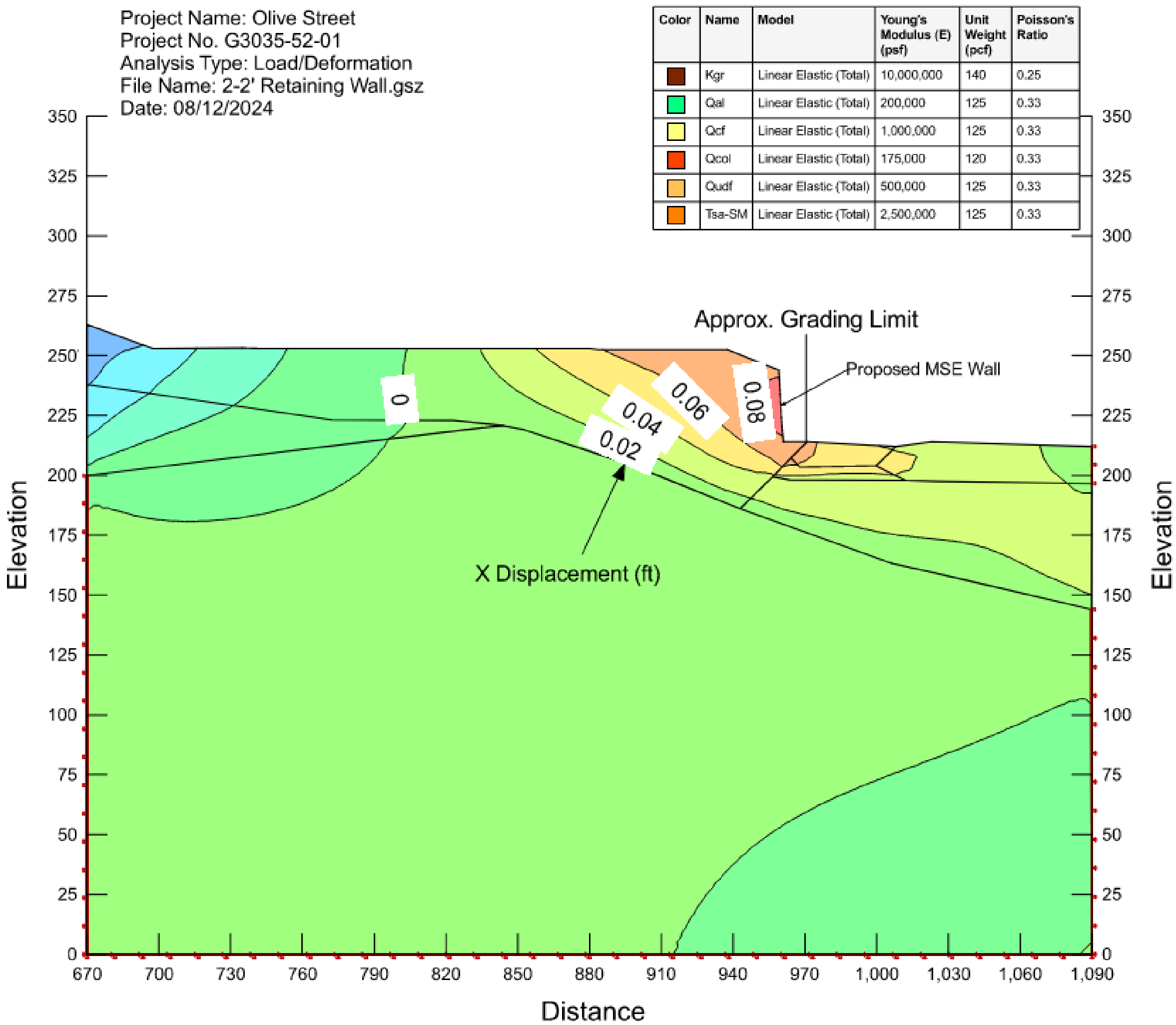
SUMMARY OF MSE RETAINING WALL FOUNDATION RECOMMENDATIONS

Parameter	Value
Minimum Retaining Wall Foundation Width	12 Inches
Minimum Retaining Wall Foundation Depth	12 Inches
Bearing Capacity	2,000 psf
Bearing Capacity Increase	500 psf per Foot of Depth
	300 psf per Foot of Width
Maximum Bearing Capacity	3,500 psf
Estimated Total and Differential Settlement	1 Inch (Stations 3+80 to 9+40)
	3 Inches (Stations 0+00 to 3+80)

*Settlement associated with 35-foot fill height

8.15.7 MSE retaining walls can be designed for a differential settlement of up to 1 percent in accordance with Section 12.3.4 of the *Design Manual for Segmental Retaining Walls, 3rd Edition*. The settlement values presented herein show the proposed MSE retaining walls should be designed using a differential settlement of 1 inches in 40 feet (about 0.2 percent) for the wall from Stations 3+80 to 9+40 and 3 inches in 40 feet (about 0.6 percent) for the wall from Stations 0+00 to 3+80. Therefore, we opine the MSE walls will be able to tolerate the proposed settlements based on the calculated estimates from SigmaW. We can provide additional recommendations if the MSE retaining wall designer requests additional support for the proposed walls.

8.15.8 We performed a lateral deflection analysis using SigmaW that resulted in a calculated maximum lateral movement of about 1 inch (0.08 feet) for the wall as shown in the following lateral Deflection Analysis.



Lateral Deflection Analysis

8.15.9 We will perform testing and observation services during grading operations and retaining wall backfill operations. Backfill materials within the reinforced zone should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to slightly above optimum moisture content in accordance with ASTM D 1557. This is applicable to the entire embedment width of the reinforcement. Typically, wall designers specify no heavy compaction equipment within 3 feet of the face of the wall. However, smaller equipment (e.g., walk-behind, self-driven compactors or hand whackers) can be used to compact the materials without causing deformation of the wall. If the designer specifies no compactive effort for this zone, the materials are essentially not properly compacted and the reinforcement grid within the uncompacted zone should not be relied upon for reinforcement, and overall embedment lengths will have to be increased to account for the difference.

8.15.10 Select backfill materials may be required to be in accordance with the MSE retaining wall system. Materials as outlined in the specifications of the retaining wall plans may be generated and stockpiled during grading, if encountered, or may require import. Geocon should perform laboratory tests during the backfill materials to check that soil properties are in accordance with the retaining wall plans and specifications.

8.15.11 The wall should be provided with a drainage system sufficient to prevent excessive seepage through the wall and the base of the wall, thus preventing hydrostatic pressures behind the wall.

8.15.12 Geosynthetic reinforcement must elongate to develop full tensile resistance. This elongation generally results in movement at the top of the wall. The amount of movement is dependent on the height of the wall (e.g., higher walls rotate more) and the type of reinforcing grid used. In addition, over time the reinforcement grid has been known to exhibit creep (sometimes as much as 5 percent) and can undergo additional movement. Given this condition, the owner should be aware that structures and pavement placed within the reinforced and retained zones of the wall may undergo movement.

8.15.13 The MSE wall contractor should provide the estimated deformation of wall and adjacent ground in associated with wall construction. The calculated horizontal and vertical deformations should be determined by the wall designer. The estimated movements should be provided to the project structural engineer to determine if the planned improvements can tolerate the expected movements.

8.15.14 The MSE wall designer/contractor should review this report, including the slope stability requirements, and incorporate our recommendations as presented herein. We should be provided the plans for the MSE walls to check if they are in conformance with our recommendations prior to issuance of a permit and construction.

8.16 Lateral Loading

8.16.1 The values in the following table should be used to help design the proposed structures and improvements to resist lateral loads for the design of footings or shear keys. The allowable passive pressure assumes a horizontal surface extending at least 5 feet, or three times the surface generating the passive pressure, whichever is greater. The upper 12 inches of material in areas not protected by floor slabs or pavement should not be included in design for passive resistance.

SUMMARY OF LATERAL LOAD DESIGN RECOMMENDATIONS

Parameter	Value
Passive Pressure Fluid Density	300 pcf
Coefficient of Friction (Concrete and Soil)	0.35
Coefficient of Friction (Along Vapor Barrier)	0.2 to 0.25*

*Per manufacturer's recommendations.

8.16.2 The passive and frictional resistant loads can be combined for design purposes. The lateral passive pressures may be increased by one-third when considering transient loads due to wind or seismic forces.

8.17 Preliminary Pavement Recommendations

8.17.1 We calculated the flexible pavement sections in general conformance with the *Caltrans Method of Flexible Pavement Design* (Highway Design Manual, Section 608.4) using an estimated Traffic Index (TI) of 5.0, 5.5, 6.0, and 7.0 for parking stalls, driveways, medium truck traffic areas, and heavy truck traffic areas, respectively. The project civil engineer and owner should review the pavement designations to determine appropriate locations for pavement thickness. The final pavement sections for the parking lot should be based on the R-Value of the subgrade soil encountered at final subgrade elevation. We have assumed an R-Value of 15 (based on previous testing) and 78 for the subgrade soil and base materials, respectively, for the purposes of this preliminary analysis. The following table presents the preliminary flexible pavement sections.

PRELIMINARY FLEXIBLE PAVEMENT SECTION

Location	Assumed Traffic Index	Assumed Subgrade R-Value	Asphalt Concrete Thickness (Inches)		
			3	3 ½	4
			Class 2 Aggregate Base (Inches)		
Parking Stalls for Automobiles and Light-Duty Vehicles	5.0	15	8	7	6
Driveways for Automobiles and Light-Duty Vehicles	5.5	15	10	9	8
Medium Truck Traffic Areas	6.0	15	---	11	10
Driveways for Heavy Truck Traffic	7.0	15	---	---	13

8.17.2 Prior to placing base materials, the upper 12 inches of the subgrade soil should be scarified, moisture conditioned as necessary, and recompacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content as determined by ASTM D 1557. Similarly, the base material should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content. Asphalt concrete should be compacted to a density of at least 95 percent of the laboratory Hveem density in accordance with ASTM D 2726.

8.17.3 Base materials should conform to Section 26-1.02B of the *Standard Specifications for The State of California Department of Transportation (Caltrans)* with a ¾-inch maximum size aggregate. Asphalt concrete should conform to Section 203-6 of the *Standard Specifications for Public Works Construction (Greenbook)*.

8.17.4 The base thickness can be reduced if the subgrade can be compacted to 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content and a reinforcement geogrid is used during the installation of the pavement. In areas where reinforcement geogrid is placed due to pumping subgrade or not being able to achieve 95 percent of the laboratory maximum dry density then the base cannot be reduced and the full section should be installed. Geocon should be contact for additional recommendations if alternate design parameters are requested. In are

8.17.5 A rigid Portland cement concrete (PCC) pavement section should be placed in roadway aprons and cross gutters. We calculated the rigid pavement section in general conformance with the procedure recommended by the American Concrete Institute report ACI 330-21 *Commercial Concrete Parking Lots and Site Paving Design and Construction – Guide.* We used the following traffic categories and design parameters used for the calculations for 20-year design life.

TRAFFIC CATEGORIES

Traffic Category	Description	Reliability (%)	Slabs Cracked at End of Design Life (%)
A	Car Parking Areas and Access Lanes	60	15
B	Entrance and Truck Service Lanes	60	15
E	Garbage or Fire Truck Lane	75	15

8.17.6 We used the parameters presented in the following table to calculate the pavement design sections. We should be contacted to provide updated design sections, if necessary.

RIGID PAVEMENT DESIGN PARAMETERS

Design Parameter	Design Value
Modulus of Subgrade Reaction, k	100 pci
Modulus of Rupture for Concrete, M_R	500 psi
Concrete Compressive Strength	3,000 psi
Concrete Modulus of Elasticity, E	3,150,000 psi

8.17.7 Based on the criteria presented herein, the PCC pavement sections should have the following minimum thicknesses for the applicable traffic category.

RIGID VEHICULAR PAVEMENT RECOMMENDATIONS

Traffic Category	Trucks Per Day	Portland Cement Concrete, T (Inches)
A = Car Parking Areas and Access Lanes	10	6
B = Entrance and Truck Service Lanes	10	6
E = Garbage or Fire Truck Lanes	5	6½

8.17.8 The PCC vehicular pavement should be placed over a minimum of 6 inches of aggregate base, per City of Oceanside, over subgrade soil both compacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content. The garbage truck pad should be large enough such that all wheels are on the concrete pad during the loading operations.

8.17.9 Adequate joint spacing should be incorporated into the design and construction of the rigid pavement in accordance with the following table.

MAXIMUM JOINT SPACING

Pavement Thickness, T (Inches)	Maximum Joint Spacing (Feet)
4<T<5	10
5≤T<6	12.5
6≤T	15

8.17.10 The rigid pavement should also be designed and constructed incorporating the following parameters.

ADDITIONAL RIGID PAVEMENT RECOMMENDATIONS

Subject	Value
Thickened Edge	1.2 Times Slab Thickness Adjacent to Structures
	1.5 Times Slab Thickness Adjacent to Soil
	Minimum Increase of 2 Inches
	4 Feet Wide
Crack Control Joint Depth	Early Entry Sawn = T/6 to T/5, 1.25 Inch Minimum
	Conventional (Tooled or Conventional Sawing) = T/4 to T/3
Crack Control Joint Width	¼-Inch for Sealed Joints and Per Sealer Manufacturer's Recommendations
	$^{1}/_{16}$- to $^{1}/_{4}$-Inch is Common for Unsealed Joints

8.17.11 Reinforcing steel will not be necessary within the concrete for geotechnical purposes with the possible exception of dowels at construction joints as discussed herein.

8.17.12 To control the location and spread of concrete shrinkage cracks, crack-control joints (weakened plane joints) should be included in the design of the concrete pavement slab. Crack-control joints should be sealed with an appropriate sealant to prevent the migration of water through the control joint to the subgrade materials. The depth of the crack-control joints should be in accordance with the referenced ACI guide.

8.17.13 To provide load transfer between adjacent pavement slab sections, a butt-type construction joint should be constructed. The butt-type joint should be thickened by at least 20 percent at the edge and taper back at least 4 feet from the face of the slab.

8.17.14 Concrete curb/gutter should be placed on soil subgrade compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to slightly above optimum moisture content. Cross-gutters that receive vehicular traffic should be placed on a minimum of 6 inches of Class II Base, unless the subgrade soils have an expansion index of 20 or less, per City of Oceanside, over subgrade soil both compacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content. Where flatwork is located directly adjacent to the curb/gutter, the concrete flatwork should be structurally connected to the curbs to help reduce the potential for offsets between the curbs and the flatwork.

8.18 Site Drainage and Moisture Protection

8.18.1 Adequate site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2022 CBC 1804.4 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed structure.

8.18.2 We understand a storm drain vault will be constructed underneath the western parking lot. We expect that up to 20 feet of compressible material may be left in place underneath the storm drain vault if remedial grading measures or ground improvements are not performed. The amount of settlement that could occur is a function of how thick the layer is, how compressible the layer is and the magnitude of the new vertical load (weight of new fill or vault loads). Based on laboratory test results and engineering analyses, we estimate theoretical maximum settlements of up to 1½ inches and 3½ inches and the following table presents the settlement values of the vault. As previously discussed, these settlements can be mitigated with remedial grading (excavating the landslide debris to expose the underlying formational materials and placing compacted fill) or ground improvements (soil mixing or rammed aggregate piers).

STORM VAULT SETTLEMENTS

Vault Location	Settlement (Inches)
Northeast & Northwest Corners	3½
Southeast Corner	2
Southwest Corner	1½

8.18.3 In the case of basement walls or building walls retaining landscaping areas, a water-proofing system should be used on the wall and joints, and a Miradrain drainage panel (or similar) should be placed over the waterproofing. The project architect or civil engineer should provide detailed specifications on the plans for all waterproofing and drainage.

8.18.4 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

8.18.5 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. Area drains to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes can be used. In addition, where landscaping is planned adjacent to the pavement, construction of a cutoff wall along the edge of the pavement that extends at least 6 inches below the bottom of the base material should be considered.

8.18.6 We should prepare a storm water infiltration feasibility report of storm water management devices are planned.

8.19 Grading and Foundation Plan Review

8.19.1 Geocon Incorporated should review the grading and building foundation plans for the project prior to final design submittal to evaluate if additional analyses and/or recommendations are required.

8.20 Testing and Observation Services During Construction

8.20.1 Geocon Incorporated should provide geotechnical testing and observation services during the grading operations, foundation construction, utility installation, retaining wall backfill and pavement installation. The following table presents the typical geotechnical observations we would expect for the proposed improvements.

EXPECTED GEOTECHNICAL TESTING AND OBSERVATION SERVICES

Construction Phase	Observations	Expected Time Frame
Ground Modification	Installation	Full Time (Including Confirmation Logging of Select Drilled Shafts)
Grading	Base of Removal	Part Time During Removals
	Geologic Logging	Part Time to Full Time
	Fill Placement and Soil Compaction	Full Time
Foundations	Foundation Excavation Observations	Full Time
Shear Pins	Drilling Operations for Pins	Full Time
Utility Backfill	Fill Placement and Soil Compaction	Part Time to Full Time
Retaining Wall Backfill	Fill Placement and Soil Compaction	Part Time to Full Time
Subgrade for Sidewalks, Curb/Gutter and Pavement	Soil Compaction	Part Time
Pavement Construction	Base Placement and Compaction	Part Time
	Asphalt Concrete Placement and Compaction	Full Time

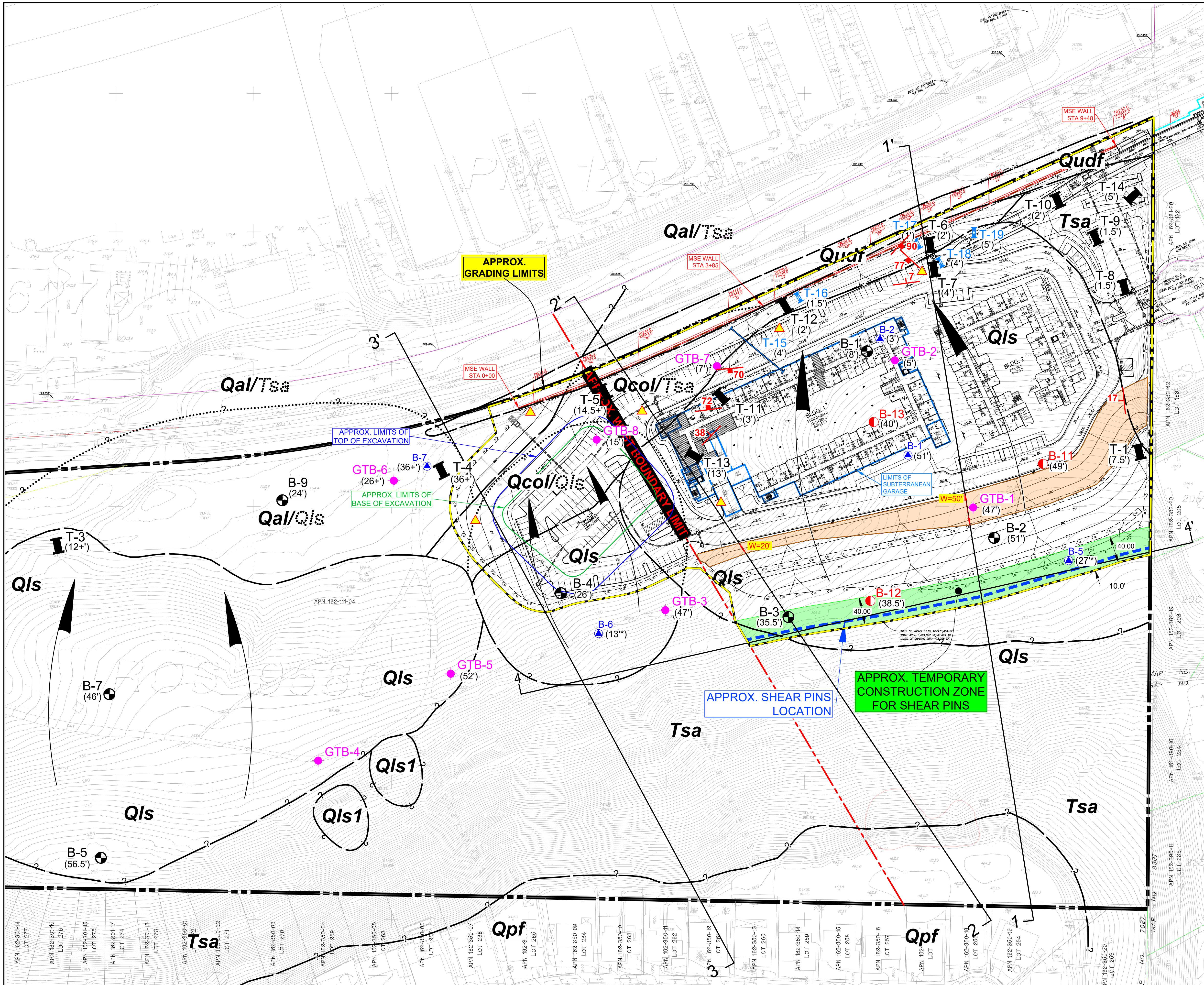
LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

2. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon Incorporated should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon Incorporated.

3. This report is issued with the understanding that it is the responsibility of the owner or his representative to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

4. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.



B-1	
@5'	S:N59W/14NE
@13'	C:N38W/8SW
@22'	B:N16E/5SE

B-2	
@19'	S:N29E/6NW
@21'	B:N42W/5NE
@32'	B:N16W/6NE
@48'	S:N56W/12SW
@63'	C:N22E/7SE
@69.5'	S:N41W/11SW
@70.5'	S:N13W/15SW

B-3	
@19'	C:N64W/3NE
@20'	B:N7E/4NW
@32'	C:N75E/6NW
@34'	F:N54W/32SW
@35.5'	C:N29W/5NE
@35.5'	S:N68W/3NE
@56'	B:N10E/8SE
@70.5'	C:N18W/8SW

B-4	
@7'	B:N70E/22NW
@13'	S:N51E/36NW
@15.5'	C:N29E/16NW
@24'	S:N59W/14NE
@41.5'	C:N44W/6SW

B-5	
@47.5'	B:N81W/44SW
@55'	B:N81W/17SW
@56'	S:N11W/4NE
@65'	B:N17E/4NW

B-6	
@9.5'	C:N14W/46NE
@19'	B:N28E/38SE

B-7	
@ 7'	B:N56W/40SW
@17.5'	B:N85E/27NW
@21.5'	C:N83E/21SE
@45'	S:N46W/4NE

B-8	
@35'	B:N4E/53NW

GEOCON LEGEND

- **Qudf** ........UNDOCUMENTED FILL
- **Qpf** ....PREVIOUSLY PLACED FILL
- **Qal** ....ALLUVIUM
- **Qls** ....LANDSLIDE DEBRIS (Dotted Where Buried; Queried Where Uncertain)
- **Tsa** ....SANTIAGO FORMATION (Dotted Where Buried)
- **Kgr** ....GRANITIC ROCK (Dotted Where Buried)
- B-7 ....APPROX. LOCATION OF BORING (Geocon, 1985)
- GTB-8 ....APPROX. LOCATION OF BORING (GeoTek, 2007)
- B-10 ....APPROX. LOCATION OF EXPLORATORY BORINGS (Geocon, 2005)
- B-13 ....APPROX. LOCATION OF BORINGS (Geocon, 2024)
- T-15 ....APPROX. LOCATION OF TRENCHES (Geocon, 2024)
- T-14 ....APPROX. LOCATION OF EXPLORATORY TRENCHES (Geocon, 2005)
- (56.5) ....APPROX. DEPTH TO FORMATIONAL MATERIAL (In Feet)
- (28.5*) ....APPROX. DEPTH TO FORMATION MAY BE INACCURATE (In Feet)
- 77 ....APPROX. ORIENTATION OF GEOLOGIC STRUCTURE
- 38 ....APPROX. ORIENTATION OF CONTACT BETWEEN GEOLOGIC UNITS
- ....APPROX. LOCATION OF PROPOSED SETTLEMENT MONUMENTS
- ....APPROX. LOCATION OF PROPOSED SHEAR PINS
- 4 4' ....APPROX. LOCATION OF GEOLOGIC CROSS SECTION
- W=35' ....APPROX. WIDTH OF BUTTRESS KEY (In Feet)
- ....APPROX. LOCATION OF GEOLOGIC CONTACT (Dotted Where Buried; Queried Where Uncertain)
- ....APPROX. LOCATION OF BUTTRESS KEY WIDTH

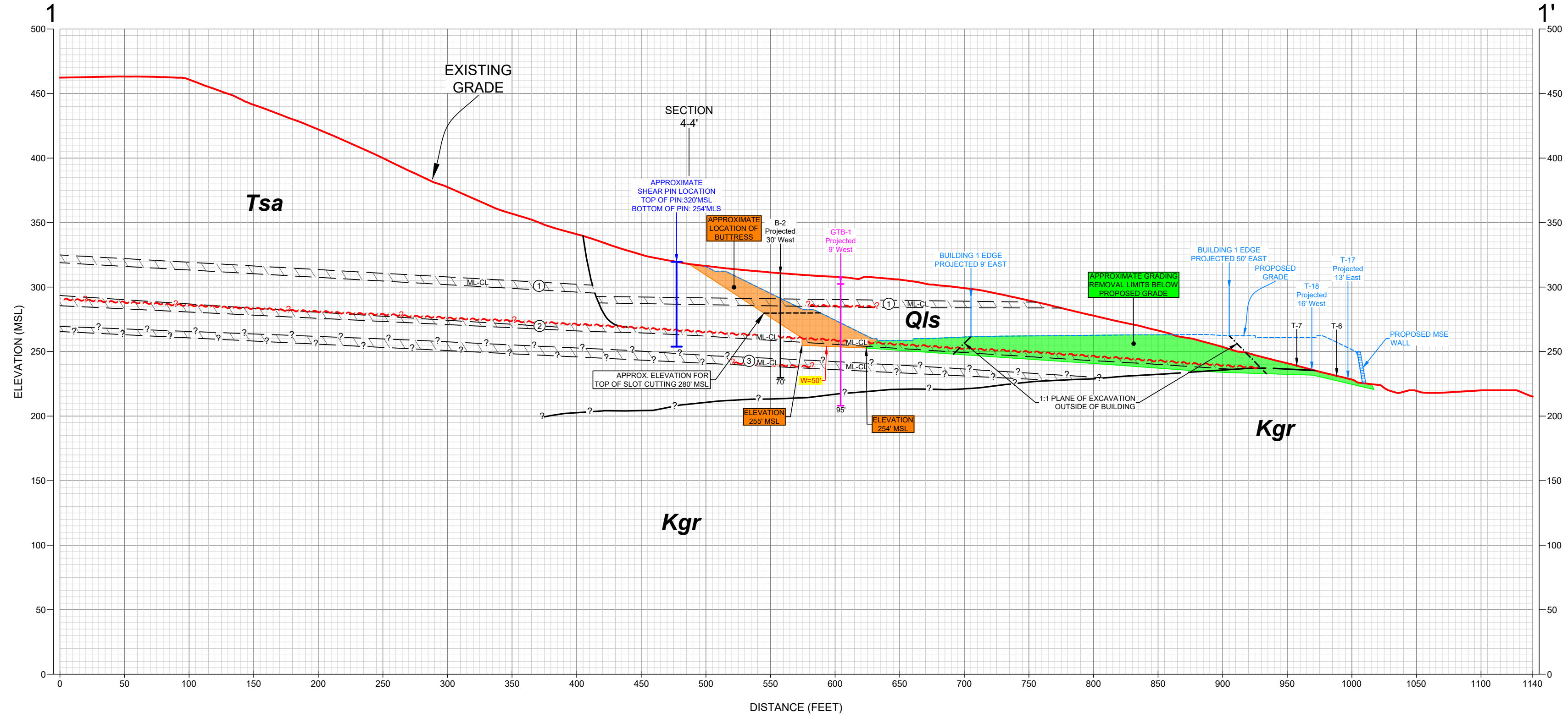
GEOLOGIC MAP

OLIVE PARK APARTMENTS
OCEANSIDE, CALIFORNIA

GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

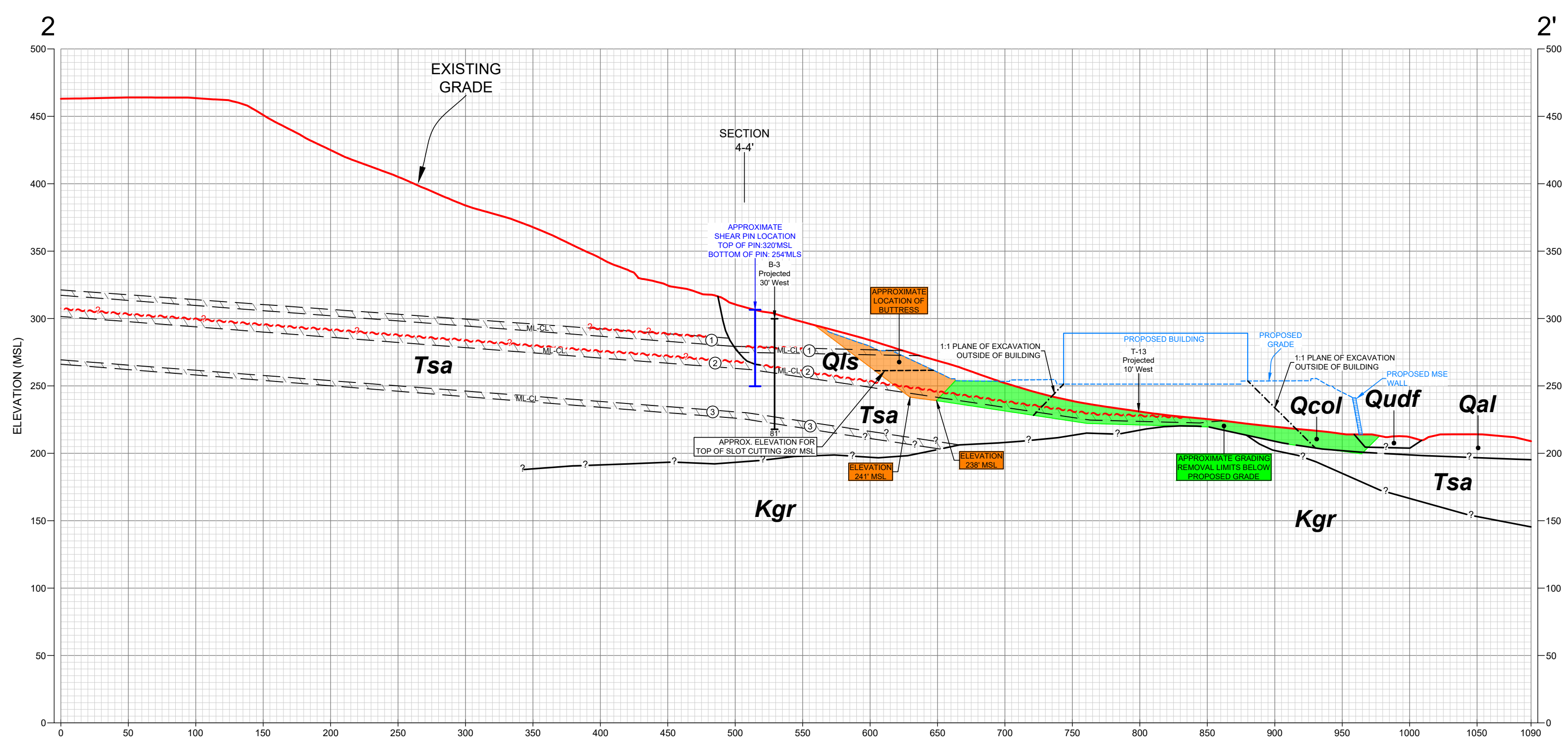
SCALE 1" = 50'	DATE 08 - 13 - 2024	
PROJECT NO. G3035 - 52 - 01		FIGURE 1
SHEET 1 OF 1		

Plotted:08/13/2024 3:35PM | By:JONATHAN WILKINS | File Location:Y:\PROJECTS\G3035-52-01 Oceanside Trolley Place\SHEETS\G3035-52-01 GeoMap-ProposedBorings.dwg



GEOLOGIC CROSS-SECTION 1-1'

SCALE: 1" = 50' (Vert. = Horiz.)



GEOLOGIC CROSS-SECTION 2-2'

SCALE: 1" = 50' (Vert. = Horiz.)

GEOCON LEGEND

- **Qudf** ........UNDOCUMENTED FILL
- **Qal** ....ALLUVIUM
- **Qls** ....LANDSLIDE DEBRIS
- **Qcol** ....COLLUVIUM
- **Tsa** ....SANTIAGO FORMATION
- **Kgr** ....GRANITIC ROCK
- ....APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)
- ....APPROX. LOCATION OF SILTSTONE/CLAYSTONE (Queried Where Uncertain)
- ....APPROX. LOCATION OF BEDDING PLANE SHEAR (BPS) (Queried Where Uncertain)
- B-5 ....APPROX. LOCATION OF BORING (Geocon, 1985)
- GTB-8 ....APPROX. LOCATION OF BORING (GeoTek, 2007)
- B-4 ....APPROX. LOCATION OF EXPLORATORY BORINGS (Geocon, 2005)
- B-12 ....APPROX. LOCATION OF BORINGS (Geocon, 2024)

GEOLOGIC CROSS - SECTIONS

OLIVE PARK APARTMENTS
OCEANSIDE, CALIFORNIA

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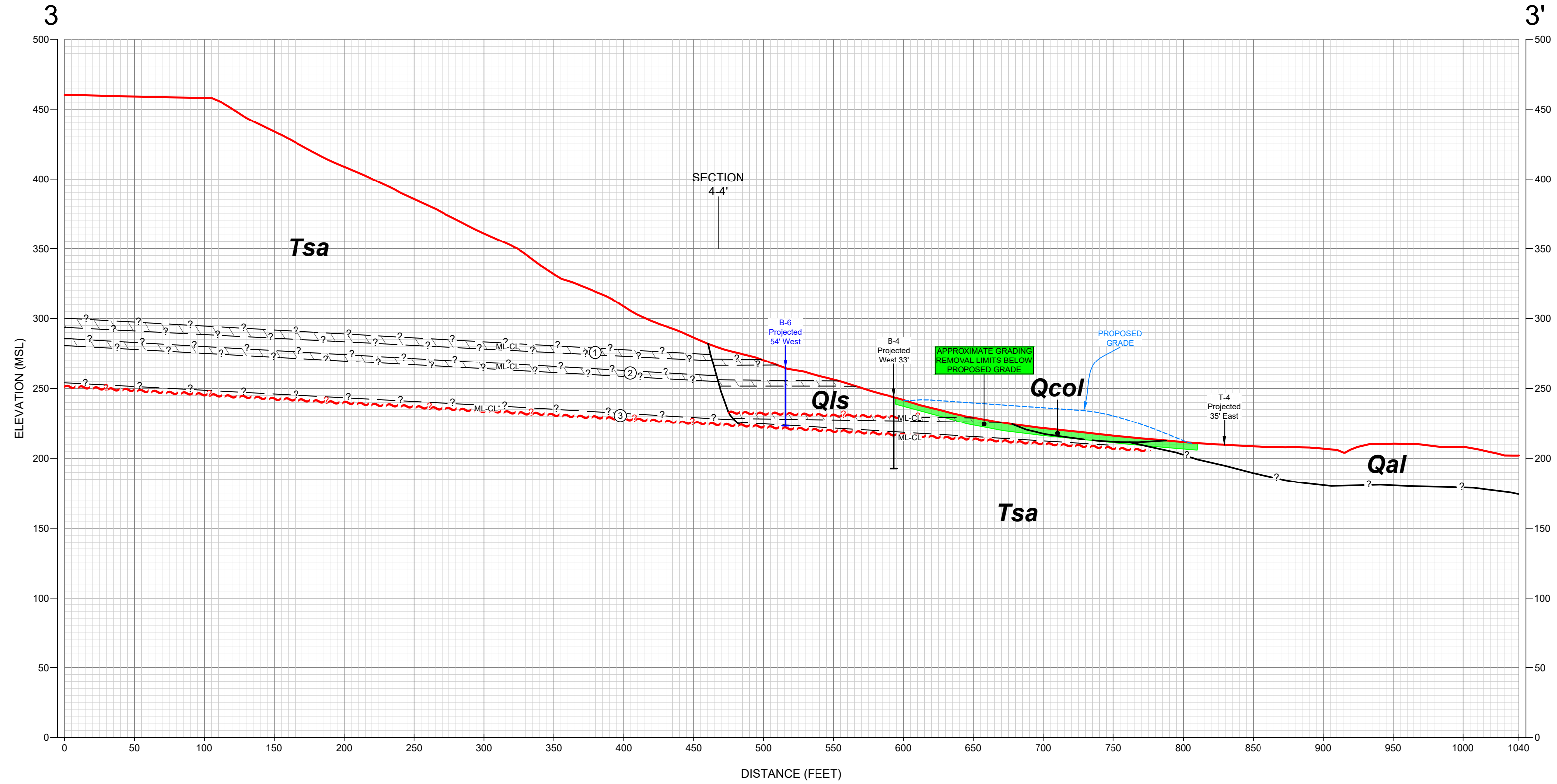
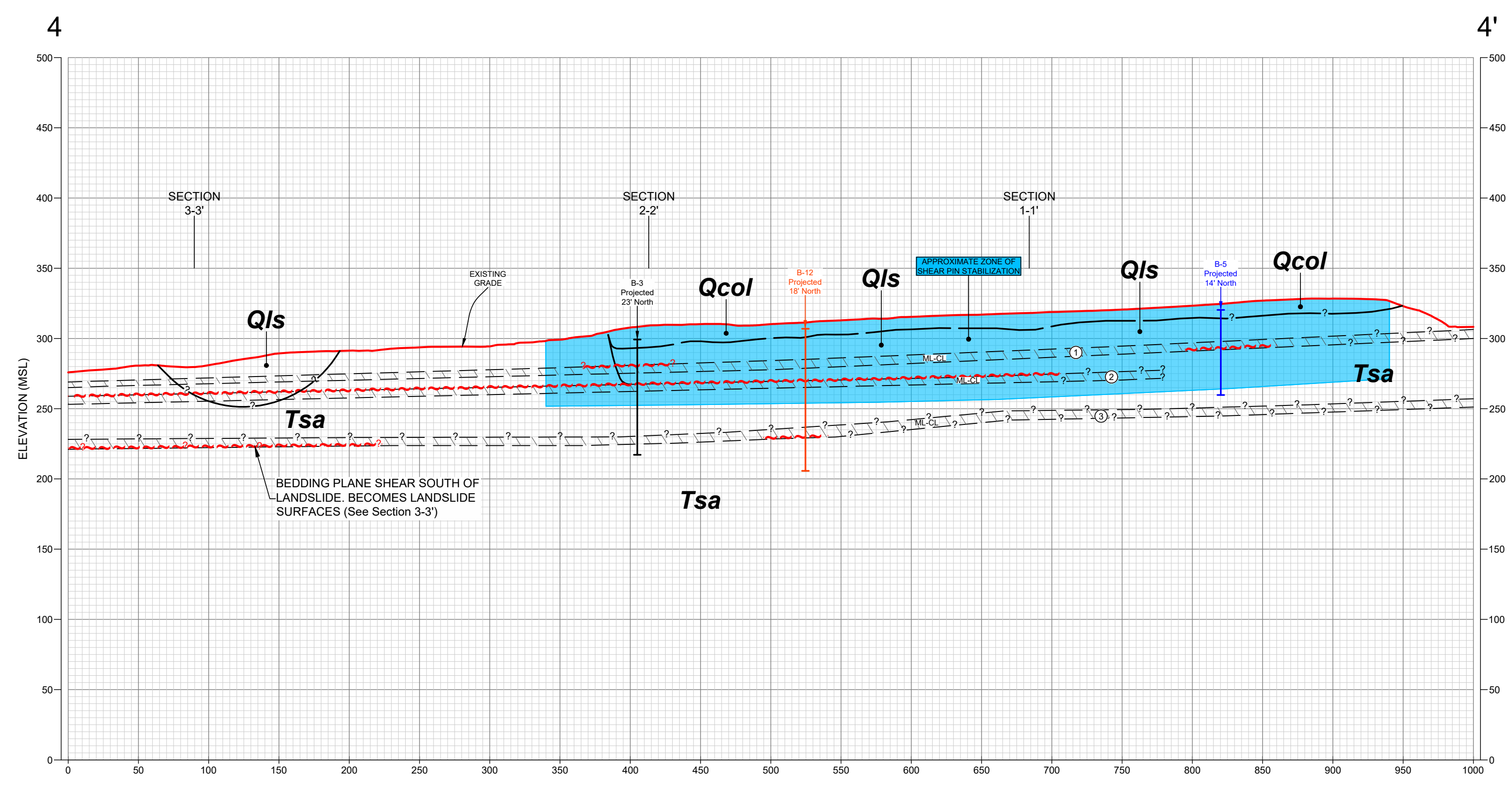
SCALE 1" = 50'	DATE 08 - 13 - 2024		FIGURE 2
PROJECT NO. G3035 - 52 - 01			
SHEET 1 OF 2			



GEOLOGIC CROSS-SECTION 3-3'

SCALE: 1" = 50' (Vert. = Horiz.)



GEOLOGIC CROSS-SECTION 4-4'

SCALE: 1" = 50' (Vert. = Horiz.)

GEOCON LEGEND

- ***Qudf*** ........UNDOCUMENTED FILL
- ***Qal*** ....ALLUVIUM
- ***Qls*** ....LANDSLIDE DEBRIS
- ***Qcol*** ....COLLUVIUM
- ***Tsa*** ....SANTIAGO FORMATION
- ***Kgr*** ....GRANITIC ROCK
- ....APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)
- ....APPROX. LOCATION OF SILTSTONE/CLAYSTONE (Queried Where Uncertain)
- ....APPROX. LOCATION OF BEDDING PLANE SHEAR (BPS) (Queried Where Uncertain)
- B-5 ....APPROX. LOCATION OF BORING (Geocon, 1985)
- GTB-8 ....APPROX. LOCATION OF BORING (GeoTek, 2007)
- B-4 ....APPROX. LOCATION OF EXPLORATORY BORINGS (Geocon, 2005)
- B-12 ....APPROX. LOCATION OF BORINGS (Geocon, 2024)

GEOLOGIC CROSS - SECTION

OLIVE PARK APARTMENTS\
OCEANSIDE, CALIFORNIA

GEOCON
INCORPORATED
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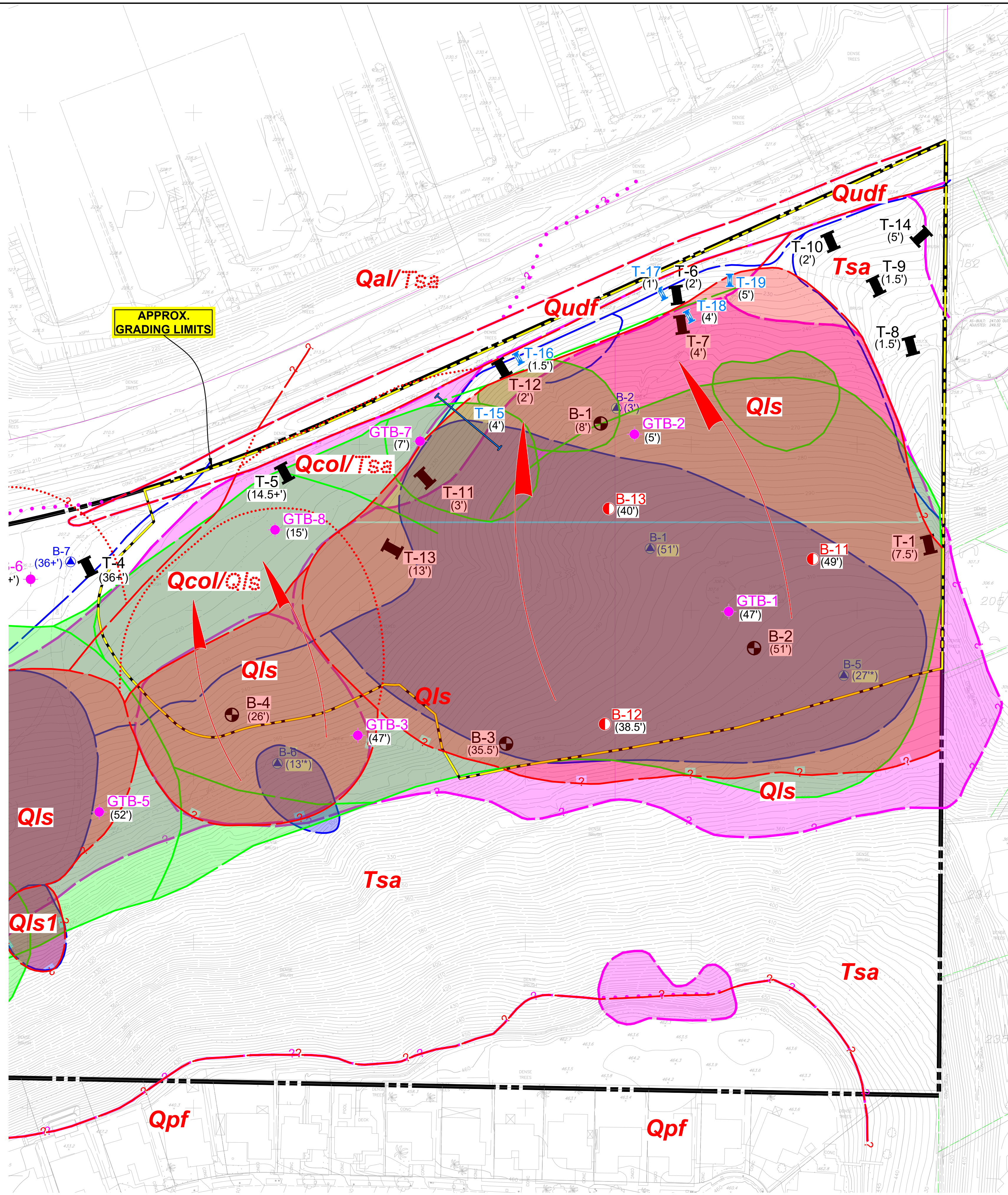
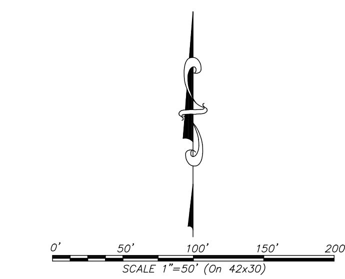
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SCALE 1" = 50'	DATE 08 - 13 - 2024	
PROJECT NO. G3035 - 52 - 01		FIGURE 3
SHEET 2 OF 2		





GEOCON LEGEND

- Qudf ........UNDOCUMENTED FILL
- Qpf ....PREVIOUSLY PLACED FILL
- Qal ....ALLUVIUM
- Qls ....LANDSLIDE DEBRIS (Dotted Where Buried; Queried Where Uncertain)
- Tsa ....SANTIAGO FORMATION (Dotted Where Buried)
- Kgr ....GRANITIC ROCK (Dotted Where Buried)
- B-7 ....APPROX. LOCATION OF BORING (Geocon, 1985)
- GTB-8 ....APPROX. LOCATION OF BORING (GeoTek, 2007)
- B-10 ....APPROX. LOCATION OF EXPLORATORY BORINGS (Geocon, 2005)
- B-13 ....APPROX. LOCATION OF BORINGS (Geocon, 2024)
- T-15 ....APPROX. LOCATION OF TRENCHES (Geocon, 2024)
- T-14 ....APPROX. LOCATION OF EXPLORATORY TRENCHES (Geocon, 2005)
- (56.5) ....APPROX. DEPTH TO FORMATIONAL MATERIAL (In Feet)
- (28.5*)........APPROX. DEPTH TO FORMATION MAY BE INACCURATE (In Feet)
- 77 ....APPROX. ORIENTATION OF GEOLOGIC STRUCTURE
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- ....APPROX. LOCATION OF PROPOSED SETTLEMENT MONUMENTS
- ....APPROX. LOCATION OF PROPOSED SHEAR PINS
- 4 4' ....APPROX. LOCATION OF GEOLOGIC CROSS SECTION
- W=35' ....APPROX. WIDTH OF BUTTRESS KEY (In Feet)
- ?........APPROX. LOCATION OF GEOLOGIC CONTACT (Dotted Where Buried; Queried Where Uncertain)
- ....APPROX. LOCATION OF BUTTRESS KEY WIDTH
- ....LANDSLIDE INFO FROM 1985 - Geocon
- ....LANDSLIDE INFO FROM 2005/03-2024 - Geocon
- ....LANDSLIDE INFO FROM 2007 - Geotek
- ....LANDSLIDE INFO FROM 08-2024 - Geocon

GEOLOGIC MAP

OLIVE PARK APARTMENTS
OCEANSIDE, CALIFORNIA

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SCALE 1" = 50'	DATE 08 - 13 - 2024	
PROJECT NO. G3035 - 52 - 01		FIGURE 4
SHEET 1 OF 1		

Plotted:10/21/2024 12:46PM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\G3035-52-01 Oceanside Trolley Place\SHEETS\G3035-52-01 GeoMap-LandslideLimitsExhibit.dwg

APPENDIX A

APPENDIX A
FIELD INVESTIGATION

Geocon has performed several historical field investigations at the site. Our investigations were performed in June, 1985, and included excavation of 6 large diameter borings and 2 small diameter borings, Between May 9 and May 25, 2005, and included 10 exploratory borings and 14 exploratory trenches and July 11 through July 13, 2024 that consisted of the excavation of 3 exploratory borings and 5 exploratory trenches. Borings B-1 through B-8 and B-11 through B-13 were excavated to a maximum depth of approximately 100 feet with an EZ-Bore drill rig with a 30-inch-diameter bucket auger. Borings B-9 and B-10 were excavated to a maximum depth of approximately 58 feet below existing grade using a CME-75 drill rig equipped with 8-inch diameter hollow stem augers. The exploratory trenches were excavated to a maximum depth of approximately 18 feet using a JD 555 track-mounted backhoe equipped with a 24-inch wide bucket. The Geologic Map, figure 1, shows the approximate locations of the current exploratory excavations for this study. We located the borings and trenches in the field using a measuring tape and existing reference points; therefore, actual boring locations may deviate slightly. The exploratory logs are presented herein.

We obtained soil samples during our subsurface exploration in the borings using either a California sampler or a Standard Penetration Test (SPT) sampler. Both samplers are composed of steel and are driven to obtain ring samples. The California sampler has an inside diameter of 2.5 inches and an outside diameter of 3 inches. Up to 18 rings are placed inside the sampler that is 2.4 inches in diameter and 1 inch in height. The SPT sampler has an inside diameter of 1.5 inches and an outside diameter of 2 inches. We obtained ring samples at appropriate intervals, placed them in moisture-tight containers, and transported them to the laboratory for testing. We also obtained bulk samples for laboratory testing. The type of sample is noted on the exploratory boring logs.

For the small diameter borings, the sampler was driven 18 inches into the bottom of the excavations with the use of an automatic hammer and the use of A rods. The sampler is connected to the A rods and driven into the bottom of the excavation using a 140-pound hammer with a 30-inch drop. Blow counts are recorded for every 6 inches the sampler is driven. The penetration resistances shown on the boring logs are shown in terms of blows per foot. The values indicated on the boring logs are the sum of the last 12 inches of the sampler if driven 18 inches. If the sampler was not driven for 18 inches, an approximate value is calculated in term of blows per foot or the final 6-inch interval is reported. These values are not to be taken as N-values, adjustments have not been applied.

For the large diameter borings, the samplers were driven 12 inches into the bottom of the excavations with the use of a telescoping Kelly bar. The weight of the Kelly bar (3,500 lbs. maximum) drives the sampler and varies with depth. The height of drop is usually 12 inches. Blow counts are recorded for every 12 inches the sampler is driven. The penetration resistance values shown on the boring logs are shown in terms of blows per foot. These values are not to be taken as N-values; adjustments have not been applied. Elevations shown on the boring logs were determined either from a topographic map or by using a benchmark. Each excavation was backfilled unless otherwise noted.

We visually examined, classified, and logged the soil encountered in the borings in general accordance with American Society for Testing and Materials (ASTM) practice for Description and Identification of Soils (Visual-Manual Procedure D 2488). The logs depict the soil and geologic conditions observed and the depth at which samples were obtained.

PROJECT NO. 07227-52-02

BORING B 1

ELEV. (MSL.)	259'
DATE COMPLETED	05-10-2005
EQUIPMENT	30-INCH DIAMETER BUCKET AUGER

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 5				SC+CL	**LANDSLIDE DEBRIS** Loose and stiff, moist, grayish brown to brownish gray, Clayey and Silty SAND and Sandy CLAY; jumbled texture; thin roots and rock fragments; pockets of clay material in sandy matrix; layer of fat sheared clay at 5 feet approximately 1/2" to 1" thick (S: N59W/14NE)			
5 – 8	B1-1 B1-6			CL	Stiff, moist, olive gray, Silty to fine Sandy CLAY; highly fractured and sheared with internal polished surfaces and iron oxide mineralization	1/12"	99.9	24.7
8 – 13	B1-2			ML	**SANTIAGO FORMATION** Hard, damp, light olive gray, Sandy to Clayey SILTSTONE; moderately to strongly indurated; few joints; overall intact and undisturbed -B: N38W/8SW	6/12"	116.4	11.6
13 – 25.5	B1-3			SM	Dense, damp, light gray, Silty, fine- to medium-grained SANDSTONE; moderately cemented; micaceous; massive bedding; intact	8/9"	129.4	7.5
					-Very dense; drilling using down-crowds			
	B1-4					8/6"	122.2	5.7
					-Strongly cemented; some cross bedding; B:N16E/5SE			
					-Very dense and very strongly cemented along basal contact -Contact irregular to dipping approximately 18º NW			
25.5 – 30					**GRANITIC ROCK** Moderately hard, damp, grayish brown to light gray, GRANITIC ROCK; fine- to coarse-grained crystalline texture; moderately weathered; high-angle jointing			

Figure A-1,
Log of Boring B 1, Page 1 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 1 ELEV. (MSL.) 259' DATE COMPLETED 05-10-2005 EQUIPMENT 30-INCH DIAMETER BUCKET AUGER	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
30	B1-5					15/6"	124.0	6.4
32								
					BORING TERMINATED AT 33 FEET No groundwater encountered Backfilled with 45 cu. ft. of bentonite and soil cuttings in alternating layers			

Figure A-1,
Log of Boring B 1, Page 2 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

BORING B 2

ELEV. (MSL.) **311'** DATE COMPLETED **05-10-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**LANDSLIDE DEBRIS** Stiff, moist, dark brown, fine, Sandy CLAY; porous; moderate topsoil development; thin roots			
4	B2-1			SC	Medium dense, moist, mottled olive, reddish and grayish brown, Clayey, fine SAND; jumbled texture; thin roots; no distinguishable bedding; scattered carbonate pods; abundant fractures, generally healed with manganese and iron oxide mineralization	2/12"	115.9	14.5
9.5	B2-2			SM	Medium dense, moist, gray with mottled yellowish brown, Silty, fine to medium SAND; structureless; few coarse grains and pieces of charcoal	3/12"	115.9	11.2
	B2-3				-Loose; mixed with pods of olive clay; decomposed pods of organic material; sand becomes fine to coarse grained; jumbled mixture of disturbed sand and silt beds displaying offset along randomly oriented fractures	2/12"	112.9	14.5
19	B2-4 B2-15 B2-5				-Encountered layers of (weathered) sheared fat, gray-green clay; undulates with scour approximately 1/2 inch thick; undulating with general orientation of S: N29E/6NW; common slickensides; probably main slip surface (potential shear surface if undercut)	3/12"	111.5	14.3
				CL	**SANTIAGO FORMATION** Very stiff, most, olive to greenish gray, fat CLAYSTONE; highly fractured with abundant polished and slickensided shear surfaces; manganese oxide mineralization and sheared clay between claystone fragments B: N42W/5NE			
25.5	B2-6			ML	Hard, moist, olive gray, Clayey, SILTSTONE; moderately indurated; some fractures; overall intact and undisturbed	7/12"	109.8	19.3
					-Marked increase in degree of induration; few fractures			

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28

Figure A-2,
Log of Boring B 2, Page 1 of 3

07227-52-02.GPJ

SAMPLE SYMBOLS ... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED) ... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING B 2

ELEV. (MSL.) **311'** DATE COMPLETED **05-10-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B2-7			14/12"	105.5	13.9
32		SM	Grades to dense, damp, gray to olive gray, Silty, fine-grained SANDSTONE; moderately cemented. B:N16W/6NE			
34			-Becomes white; massive at 34 feet			
36	B2-8			15/9"	126.0	7.2
38						
40	B2-9			15/9"		
42			-Few pods of olive green, subrounded claystone with sandstone matrix			
44						
46			-Becomes strongly cemented; common claystone pods; probably rip-up clasts			
48		CL	Abrupt contact between SANDSTONE and CLAYSTONE, C: N56W/12SW slightly undulating; sandstone is reddish brown in a layer approximately 1/2 inch thick; polished, slickensided shear surface along base of sandstone unit continuous around hole (bedding plane shear); sandstone very moist and weakly cemented within 1 foot of contact. Hard, damp, olive gray, fine-grained Sandy CLAYSTONE at 50 feet			
50	B2-10			11/12"	120.5	13.9
52		ML	Grades to hard, damp, olive gray, fine-grained Sandy SILTSTONE; moderately to strongly indurated			
54		SM	Very dense, damp, light gray to white, Silty, fine- to coarse-grained SANDSTONE; moderately to strongly cemented; massive			
56	B2-11			15/7"	123.9	8.7
58						

Figure A-2,
Log of Boring B 2, Page 2 of 3

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**BORING B 2** ELEV. (MSL.) **311'** DATE COMPLETED **05-10-2005** EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
60–63				SM	-Abrupt contact between SANDSTONE and Clayey SILTSTONE at 63 feet; sandstone yellowish to reddish within 3 inches of contact C: N22E/7SE.			
63–66	B2-12			ML	Hard, damp, olive gray, Clayey SILTSTONE; strongly indurated	30/11"	122.7	11.2
66–68				CH	Hard, damp, dark reddish gray, fat CLAYSTONE; strongly indurated; polished internal surfaces			
68–72	B2-13 B2-14			CL	Hard, damp, reddish gray, CLAYSTONE; highly fragmented and fractured; yellow clay film along polished surfaces; shearing generally high-angle and discontinuous. -CLAYSTONE shattered to crushed within a 9-inch thick zone; becomes soft and sheared with remolded clays and polished slickensided surfaces; layer continuous around hole; S: N14W/11SW; (bedding plane shear) abundant yellowish to reddish brown iron oxide mineralization	30/10"	132.9	8.4
72–80				ML	Basal contact with very hard, damp, mottled gray and yellowish to reddish brown, Clayey SILTSTONE; strongly indurated, laminated locally; no evidence of shearing or displacement			
80					BORING TERMINATED AT 80 FEET No groundwater encountered Backfilled with 69 cu. ft. of bentonite and soil cuttings in alternating layers			

Figure A-2,
Log of Boring B 2, Page 3 of 3

07227-52-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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PROJECT NO. 07227-52-02

BORING B 3

ELEV. (MSL.) **300'** DATE COMPLETED **05-11-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 8				CL	**LANDSLIDE DEBRIS** Soft to stiff, most, dark brown, fine Sandy CLAY; porous with thin roots; moderately well developed topsoil in upper foot; probably within graben zone of upper slide			
					-Grades to clayey sand; common carbonate pods and stringers			
5	B3-1					1	116.8	13.4
8 – 15				SM	Loose, moist, light grayish brown, Clayey and Silty, fine to medium SAND with pods of olive clay; jumbled texture; chaotic and discontinuous bedding; displaced beds of silt and clay			
10	B3-2					1/12"	115.1	9.9
11	B3-3							
					-Scattered pieces of organic material and carbon			
					-Discontinuous beds of fat claystone and siltstone displaced and dipping 28º NW			
					-Approximately 2- to 4-inch thick, partially remolded sandy clay B: N60E/50NW; scattered fragments of charcoal			
15 – 19	B3-4			SM	Loose to medium dense, light gray, Silty, fine to coarse SAND with pods of olive clay	2/12"	116.5	13.1
					-Becomes very moist and fractured; undulating contact C: N63W/3NE			
					-Basal contact of upper slide; some sheared clays and yellow-green mineralization 2 inch thick band around hole			
19 – 22				ML	Medium dense, moist, olive gray, fine Sandy SILTSTONE; some fracturing			
20	B3-5					3/12"	117.1	14.7
22 – 25				CL	Moderately hard, moist, olive gray, Silty CLAYSTONE; internal fracturing and shearing with polished surfaces and slickensides			
25 – 29	B3-6			ML	Very stiff, moist, olive gray, Clayey SILTSTONE; fractured	3/12"	113.9	15.4
					-Discordant, undulating basal contact			
29				SM	Medium dense, light gray, fine SAND; red and yellow banding; some			

Figure A-3,
Log of Boring B 3, Page 1 of 3

07227-52-02.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING B 3

ELEV. (MSL.) **300'** DATE COMPLETED **05-11-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B3-7			SM	manganese oxide and carbonate mineralization -Medium dense to dense, moist, light gray, Silty, fine to coarse SAND; through going thin clay-filled fractures; pods of greenish clay -At 32 feet: continuous 2 to 4 inch bed of sandy siltstone B: N79E/6NW -At 33 feet: discontinuous bed of fractured gray CLAYSTONE within sandstone beds -Along contact: yellow to red mineralization; beds displaced approximately 4 inches on fracture F: N54W/32S; C: N29W/5NE; 3 inch thick layer of crushed, remolded clay with shears and slickensides S: N68W/3NE	11/12"	119.6	10.5
36	B3-8			CL	**SANTIAGO FORMATION** Hard, moist, olive green, fat CLAYSTONE, internally sheared with polished surfaces and manganese oxide mineralization	7/12"	106.3	20.3
40				ML	Dense, damp, olive gray, Clayey SILTSTONE; strongly indurated; intact			
41	B3-9			SM	Dense, damp, light olive gray, Silty, fine-grained SANDSTONE; massive and undisturbed; moderately cemented -Becomes fine- to coarse-grained	15/10"	119.0	13.0
46	B3-10				-Fine- to medium-grained, very light gray	15/16"	131.0	6.4
50	B3-11			SM	-Light gray, silty sandstone	15/9"	129.6	6.5
52					-Becomes hard and strongly cemented; difficult drilling using down-crowds			
56					-Beds with common claystone fragments B: N10E/8SE			
58								

Figure A-3,
Log of Boring B 3, Page 2 of 3

07227-52-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

BORING B 3

ELEV. (MSL.) **300'** DATE COMPLETED **05-11-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
60	B3-12			SM	Very dense, damp, light gray, Silty, fine- to coarse-grained SANDSTONE; pods of olive claystone; overall massive and intact; moderately cemented	30/8"	112.7	6.8
62								
64								
66					-Cross bedded; fine- to medium-grained			
68					-Pods of iron oxide mineralization			
70					-Abrupt basal contact between silty sandstone and siltstone C: N18W/8SW			
	B3-13			ML	Hard, damp, olive gray, Clayey SILTSTONE; strongly indurated	28/12"	113.9	16.2
72								
74				CL	Hard, damp, dark gray with mottled dark reddish brown, Silty CLAYSTONE; moderately to strongly indurated; local, randomly oriented, polished internal surfaces with some manganese oxide mineralization; no evidence of remolding or displacement			
76								
78				ML	Hard, damp, greenish gray, Clayey SILTSTONE; strongly indurated			
80	B3-14					28/12"	114.6	15.4

BORING TERMINATED AT 80 FEET
No groundwater encountered
Backfilled with 69 cu. ft. of bentonite and soil cuttings in alternating layers

Figure A-3,
Log of Boring B 3, Page 3 of 3

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

PROJECT NO. 07227-52-02

BORING B 4

ELEV. (MSL.) **243'** DATE COMPLETED **05-20-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 7	B4-1			CL	**LANDSLIDE DEBRIS** Stiff, damp to moist, dark grayish brown, fine to medium Sandy CLAY; pods of carbonate; porous with thin roots; graben zone backfilled with colluvial material; krotovina; some small pieces of charcoal	1/12"	115.9	9.5
7 – 13	B4-2			SM	-B: N70E/22NW -Becomes jumbled mixture of sand, silt, and clay; common krotovina Loose, moist, light yellowish to olive brown, Silty, fine to medium SAND with pockets of clay and shattered claystone, fragments of sandstone; generally structureless -Common small charcoal fragments; iron oxide mineralization at 12 feet	2/12"	114.0	10.2
13 – 15	B4-3			SP	-Thick layer of remolded and sheared clay; some slickensides; S: N51E/36NW; basal slip surface of upper recent slide Displaced bed of fine- to medium-grained SANDSTONE approximately 2 feet thick on south side of hole and completely sheared away on north side; microfaulting and crossbedding common within sandstone bed; undulating basal contact C: N29E/16NW	3/12"	112.0	17.1
15 – 19				CL-ML	Fractured to shattered beds of very stiff, olive gray, Clayey SILTSTONE and Silty CLAYSTONE			
19 – 20				CH	Very stiff, moist, olive gray, fat CLAYSTONE, internally sheared with polished surfaces and slickensides			
20 – 24	B4-4			CL-ML	Stiff, moist, olive gray, Clayey SILTSTONE and CLAYSTONE beds; internally sheared with evidence of displacement	3/12"	110.0	18.3
24 – 26	B4-9 B4-5			SC CH	Approximately 6 to 12 inch thick bed of white SANDSTONE displaced approximately 6 inches along approximately 2 inch thick sheared and remolded clay seam S: N59W/14NE; undulating contact with iron oxide staining at base of sandstone -Base of slide debris at 26 feet within sheared and remolded fat CLAY	2/12"	108.9	17.0
26 – 30				ML	**SANTIAGO FORMATION** Hard, moist, olive gray, Clayey SILTSTONE; strongly indurated; weakly jointed to relatively intact; no displacement			

Figure A-4,
Log of Boring B 4, Page 1 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

BORING B 4

ELEV. (MSL.) **243'** DATE COMPLETED **05-20-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B4-6			CL+ML	Hard, damp, olive gray, Silty CLAYSTONE and Clayey SILTSTONE, mottled with reddish brown; strongly indurated; few joints; gradational contact	8/12"	119.6	14.0
32								
34				SM	Dense, moist, light olive gray, Silty, fine-grained SANDSTONE; moderately cemented; massive			
36					-Grades to fine- to coarse-grained, very light gray sandstone at 36 feet			
38								
40	B4-7					10/10"	123.3	10.2
42					-Slightly undulating contact; iron oxide mineralization along contact C: N44W/6SW			
				CL+ML	Hard, moist, olive gray, Clayey SILTSTONE and Silty CLAYSTONE interbeds; strongly indurated; weakly jointed with some polishing and manganese oxide along joint surfaces			
44								
46				SM	Very dense, damp, light gray to gray, Silty, fine-grained SANDSTONE; massive and moderately to strongly cemented			
48								
50	B4-8					10/10"	121.7	12.2

BORING TERMINATED AT 51 FEET
No groundwater encountered
Backfilled with soil cuttings and 55 cu. ft. of bentonite in alternating layers

Figure A-4,
Log of Boring B 4, Page 2 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR SEEPAGE

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BORING B 5

ELEV. (MSL.) **287'** DATE COMPLETED **05-24-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**LANDSLIDE DEBRIS**			
					Loose, moist, dark brown, Clayey, fine to medium SAND; thin roots; carbonate pods and stringers			
2				SC				
					Loose, moist, light brown to light olive brown, Silty, fine to medium SAND; porous; common krotovina; generally structureless; few gravel and charcoal			
4								
	B5-1					2/12"	108.5	6.4
6								
8								
					-Common thin, clay-filled fractures			
10	B5-2					1/12"		
12								
14								
	B5-3					1/12"	93.4	9.1
16				SM				
18					-Relict structure in disturbed sand beds B: N86E/23SE; some sandstone and claystone fragments in matrix of silty fine sand			
20	B5-4					1/12"	97.8	8.0
22								
24								
	B5-5					1/12"	99.1	9.0
26								
					-Minor caving; hole belled to 48-inch diameter; increase in sandstone and claystone fragments			
28								

Figure A-5,
Log of Boring B 5, Page 1 of 3

07227-52-02.GPJ

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING B 5

ELEV. (MSL.) 287' DATE COMPLETED 05-24-2005

EQUIPMENT 30-INCH DIAMETER BUCKET AUGER

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B5-6					3/12"	101.4	7.7
32					-Mottled yellowish brown to light gray; abundant thin fractures backfilled with carbonate and clay; highly disturbed bedding with random and discontinuous orientations; some relatively intact blocks of sandstone and claystone generally less than 6-inch diameter			
34								
36	B5-7					3/12"	99.0	9.1
38								
40	B5-8					4/12"	108.8	10.8
42								
44				SM	-Displaced sheared and elongated beds of siltstone and claystone off set along abundant thin fractures; dip approximately 65º S; overall chaotic structure			
46	B5-9					6/12"	116.1	13.6
48					-Displaced bed of sandstone B: N81W/44SW			
					-Becomes increasingly moist; medium dense; and light gray to grayish brown			
50	B5-10				-Twisted and rotated block of light gray sandstone in matrix of yellowish brown sand; block approximately 2 foot diameter and containing stratification oriented nearly vertical	6/12"	108.9	14.0
52								
54								
	B5-11				-Sheared and elongated bed of yellowish brown sandy silt; very moist; B: N81W/17SW; bed thinned from 6 inches to 1 inch from north to south at 55 feet	12/12"	112.1	17.7
56	B5-16			CH				
				CL	BASAL SLIP SURFACE; approximately 3 inch thick layer of remolded and sheared fat gray CLAY with abundant polished slickensided surfaces; very well defined; S: N11W/4NE			
58				ML	**SANTIAGO FORMATION** Hard, moist, dark olive gray, Silty CLAYSTONE; strongly indurated; some sheared and polished internal surfaces; randomly oriented			

Figure A-5,
Log of Boring B 5, Page 2 of 3

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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BORING B 5

ELEV. (MSL.) **287'** DATE COMPLETED **05-24-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
60	B5-12			ML	Hard, damp, olive gray, Clayey to Sandy SILTSTONE; strongly indurated; intact and well-bedded; no indications of shearing or offset	12/10"	113.1	16.8
62				SM	Dense, moist, light olive gray, Silty, fine-grained SANDSTONE; moderately cemented			
64	B5-13			ML	Hard, moist, olive gray, Clayey SILTSTONE; strongly indurated B: N17E/4NW	7/12"	113.9	15.7
66 – 78	B5-14			SM+ML	Becomes interbedded Sandy SILTSTONE and Silty SANDSTONE; moderately cemented; generally well-bedded and intact; beds 1 to 2 feet thick; few interbeds of strongly indurated claystone	15/10"	125.3	11.5
80	B5-15			CL	Hard, moist, dark olive gray, Silty CLAYSTONE; strongly indurated; no evidence of shearing	25/10"	112.7	15.5

BORING TERMINATED AT 81 FEET
No groundwater encountered
Backfilled with alternating layers of soil cuttings and 69 cu. ft. of bentonite

Figure A-5,
Log of Boring B 5, Page 3 of 3

07227-52-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

BORING B 6

ELEV. (MSL.) 223' DATE COMPLETED 05-23-2005

EQUIPMENT 30-INCH DIAMETER BUCKET AUGER

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0–4				SC	**LANDSLIDE DEBRIS** Loose, moist, dark brown, Clayey, fine to medium SAND; thin roots and pods to stringers of carbonate; porous; moderate topsoil development			
4–6.5	B6-1			SM-ML	Loose, moist, grayish brown, Silty, fine SAND to Sandy SILT; abundant carbonate-filled fractures; porous; few pieces of charcoal	2/12"	115.9	9.8
6.5–9.5				SM	Loose, moist, light gray, Silty, fine to coarse SAND and SANDSTONE fragments; some elongated and sheared beds of claystone; high-angle dip			
9.5–22	B6-2			CL-ML	Displaced contact between SAND unit and SILT/CLAY units; displaced along series of stepped fractures; approximately 4 feet of vertical displacement; C: N14W/46NE; fractures high-angle to near vertical; thin bed of sheared, elongated claystone underlying contact	3/12"	106.4	5.4
					-Becomes displaced beds of olive gray sandy to clayey siltstone with abundant fractures			
	B6-3				-Siltstone fragments in a matrix of sheared and crushed clay and silt	4/12"	119.7	13.2
					-Chaotic mixture of crushed siltstone, sandstone, and claystone fragments; generally structureless at 18 feet			
	B6-4				-Beds of claystone and sandstone displaced along high-angle fractures; vertical offset approximately 2 1/2 feet B: N28E/38SE; material crushed and rubbly on downthrown blocks	2/12"	112.1	14.7
22–30			▼ (24)	SM	Becomes loose, moist, light gray to white, Silty, fine to coarse SAND; some claystone fragments; disturbed sandstone beds offset by significant fractures; groundwater at 24 feet; hole belled and caving			
	B6-5				Loose, moist to wet, olive gray, Silty, fine to medium SAND	2/12"	114.9	13.4
					-Unable to proceed down-hole logging deeper than 24 feet due to groundwater table and caving			

Figure A-6,
Log of Boring B 6, Page 1 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 6 ELEV. (MSL.) 223' DATE COMPLETED 05-23-2005 EQUIPMENT 30-INCH DIAMETER BUCKET AUGER	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
30	B6-6			SM		7/12"	117.9	14.8
32					BORING TERMINATED AT 32 FEET Groundwater encountered at 24 feet Backfilled with alternating layers of soil cuttings and 45 cu. ft. of bentonite			

Figure A-6,
Log of Boring B 6, Page 2 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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BORING B 7

ELEV. (MSL.) **241'** DATE COMPLETED **05-20-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**LANDSLIDE DEBRIS** Loose, damp, dark brown, Clayey, fine to medium SAND; weakly developed topsoil in upper 9 inches; porous with thin roots -Loose, damp, light gray, silty, fine to medium SAND to Sandy SILT; common carbonate stringers and krotovina; some fragments of sandstone and claystone			
4				SM-ML				
6	B7-1					2/12"	109.6	13.4
6					-Common blocks of shattered claystone and sandstone in a matrix of sand and silt; few void spaces at 6 feet -Highly displaced and tilted bed of shattered claystone B: N56W/40SW; internal stratification			
8					Loose, damp, light gray, Silty, fine SAND; generally structureless; common thin, high-angle fractures; scattered fragments of claystone			
10	B7-2					2/12"	102.8	9.4
12					-Tilted and displaced block of silty sandstone with beds generally dipping toward the north at relatively high angles; common fractures			
16	B7-3			SM	-Broken block of cemented sandstone; fragments displaced approximately 2 feet -No sample recovery in layer of strongly cemented sandstone fragments at 15 feet	5/12"		
18					-Elongated and highly disturbed bed of sheared claystone B: N85E/27NW at 17.5 feet -Loose, moist, light gray, fine to coarse SAND with fragments of claystone and sandstone; generally disturbed and structureless			
20	B7-4				-Block of white sandstone displaced approximately 1.5 feet to the south along fractures at 20 feet	3/12"	103.3	3.7
22					-Undulating contact C: N83E/21SE at 21.5 feet Fractured and sheared beds of Silty CLAYSTONE in a matrix of sand and clay			
24				SC+CL	-Chaotic mixture of sheared and displaced sandstone and claystone beds; common iron oxide mineralization infilling fractures and between blocks			
26	B7-5					2/12"	111.5	16.8
28					Becomes more intact; disturbed beds of Clayey SILTSTONE and Silty CLAYSTONE			

Figure A-7,
Log of Boring B 7, Page 1 of 3

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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BORING B 7

ELEV. (MSL.) **241'** DATE COMPLETED **05-20-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B7-6			ML+CL	-Approximately 6 inch thick bed of loose sand and sandstone fragments; undulating and irregular contact	3/12"	107.5	19.8
32				CL	Disturbed and sheared beds of Silty CLAYSTONE; polished surfaces and slickensides; manganese and iron oxide mineralization			
34								
36	B7-7					3/12"	109.4	17.2
38								
40	B7-8				-Stiff, moist, olive gray, silty claystone beds; disturbed and sheared -Becomes wet and shattered to crushed; pods of carbonate; abundant remolded and polished surfaces; dark gray and fat	3/12"	100.9	22.9
42								
44			▼		-Water seeping from abundant fractures			
	B7-9					6/12"	109.3	19.6
46	B7-12			CH	Abrupt and very well defined slip surface S: N46W/4NE; slightly undulating approximately 3 inch thick seam in highly remolded, polished and slickensided fat CLAY; base of slide debris at approximately 46 feet; slip surface within beds of fat claystone			
48				SM-ML	**SANTIAGO FORMATION** Dense, damp, light olive gray, Silty, fine-grained SANDSTONE to fine-grained Sandy SILTSTONE; moderately cemented; some minor water seeping from thin fractures			
50	B7-10					10/10"	121.3	12.4
52				SM	Dense, moist to wet, light gray, Silty, fine- to medium-grained SANDSTONE; massive; moderately cemented; relatively intact and undisturbed			
54								
56					-Grades fine- to coarse-grained			
58								

Figure A-7,
Log of Boring B 7, Page 2 of 3

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 7 ELEV. (MSL.) 241' DATE COMPLETED 05-20-2005 EQUIPMENT 30-INCH DIAMETER BUCKET AUGER	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
60	B7-11					20/6"	119.0	9.1
					BORING TERMINATED AT 60.5 FEET Seepage encountered at 44 feet Backfilled with alternating layers of soil cuttings and 60 cu. ft. of bentonite			

Figure A-7,
Log of Boring B 7, Page 3 of 3

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 8 ELEV. (MSL.) 234' DATE COMPLETED 05-24-2005 EQUIPMENT 30-INCH DIAMETER BUCKET AUGER	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0	B8-1				**LANDSLIDE DEBRIS** Loose, moist, dark brown, Clayey, fine to medium SAND; porous with thin roots			
2								
4								
6				SC	-Abundant carbonate pods and stringers; medium dense; probably colluvium-infilled graben zone of slide			
8								
10					-Common roots; loose and porous			
12					Loose, moist, light grayish brown, Silty, fine to medium SAND; mottled with dark gray; common krotovina; porous			
14								
16					-Scattered fragments of sandstone and claystone; few pieces of charcoal			
18								
20				SM+CL				
22								
24					-Jumbled texture; thin clay-filled fractured; scattered blocks of sandstone and claystone generally less than 6-inch diameter, continued pieces of charcoal; yellowish brown to light olive gray			
26								
28								

Figure A-8,
Log of Boring B 8, Page 1 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	◣ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

BORING B 8

ELEV. (MSL.) **234'** DATE COMPLETED **05-24-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30–39				SM	-Displaced sandstone beds; highly fractured to shattered; elongated layer of carbon-rich material along bedding surface B: N4E/53NW -Becomes light gray			
39–49			▼ (45)	SM+SC	Becomes jumbled mixture of Sandstone and Claystone fragments in a matrix of Silty SAND; carbonate pods; pieces of charcoal; few shattered sandstone blocks; structureless; wet -Hole completely caved to 44 feet; abundant seepage; unable to continue down-hole logging			
49–54				CL+SM	Mixture of olive gray clay and Claystone fragments in a matrix of SAND and SANDSTONE fragments; sheared and remolded clay seams			

BORING TERMINATED AT 54 FEET
Seepage encountered at 45 feet
Caving 44 to 54 feet
Backfilled with 54 cu. ft. of bentonite and soil cuttings in alternating layers

Figure A-8,
Log of Boring B 8, Page 2 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

BORING B 9

ELEV. (MSL.) **202'** DATE COMPLETED **05-25-2005**

EQUIPMENT **CME 75 WITH 8" HOLLOW STEM AUGER** BY: **N. ASH**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**ALLUVIUM** Very stiff, moist, dark brown, fine, Sandy CLAY; porous with thin roots and scattered pieces of organic material; interlayers of medium dense, moist, gray, clayey, fine sand			
4	B9-2							
6	B9-1			CL+SC		19	102.5	22.3
10	B9-3			SC	Medium dense, moist, brownish gray, Clayey, fine to medium SAND; porous, scattered pockets of clay	10		
13			▼		-Encountered groundwater table at 13 feet			
14					**LANDSLIDE DEBRIS** Loose, saturated, olive gray, Silty, fine to coarse SAND; jumbled texture			
16	B9-4			SM		11	106.5	19.6
20	B9-5					7		
24					**SANTIAGO FORMATION** Dense, wet, light gray, Silty, fine- to coarse-grained SANDSTONE; weakly cemented			
26	B9-6			SM		30		

Figure A-9,
Log of Boring B 9, Page 1 of 3

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

BORING B 9

ELEV. (MSL.) **202'** DATE COMPLETED **05-25-2005**

EQUIPMENT **CME 75 WITH 8" HOLLOW STEM AUGER** BY: **N. ASH**

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B9-7	ML	Hard, moist, light gray to olive gray, fine-grained Sandy to Clayey SILTSTONE; scattered iron oxide staining	59	98.9	23.4
34		SM+SC	Medium dense to dense, wet, light olive gray, Clayey and Silty, fine to coarse SAND			
	B9-8			43	107.6	20.6
38		ML	Hard, moist, olive to olive gray, fine-grained Sandy SILTSTONE; weakly indurated			
40	B9-9			31		
44		CL-SC	Dense to hard, moist, olive to greenish gray, fine-grained Sandy CLAYSTONE to Clayey SANDSTONE; weakly indurated and cemented			
	B9-10			42	100.5	23.9
50	B9-11			28		
52		ML	Hard, moist, olive gray, Clayey SILTSTONE; strongly indurated			
	B9-12			50/5"	111.3	16.6
56.5			**GRANITIC ROCK** Hard, moist, gray, GRANITIC ROCK; moderately weathered; fine- to coarse-grained crystalline texture			
58	B9-13			50/1"		
			-No recovery at 58 feet -Refusal at 58.5 feet			

Figure A-9,
Log of Boring B 9, Page 2 of 3

07227-52-02.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

GEOCON

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 9 ELEV. (MSL.) 202' DATE COMPLETED 05-25-2005 EQUIPMENT CME 75 WITH 8" HOLLOW STEM AUGER BY: N. ASH	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
					BORING TERMINATED AT 58.5 FEET Groundwater encountered at 13 feet Backfilled with 20.5 cu. ft. of bentonite slurry			

Figure A-9,
Log of Boring B 9, Page 3 of 3

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR ... SEEPAGE

BORING B 10

ELEV. (MSL.) **198'** DATE COMPLETED **05-25-2005**

EQUIPMENT **CME 75 WITH 8" HOLLOW STEM AUGER** BY: **N. ASH**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B10-1			SM+SC	**ALLUVIUM** Loose, moist, dark brown, Clayey and Silty, fine to medium SAND; porous with thin roots			
2								
4								
	B10-2					10	100.6	21.9
6					-Wet			
8				SC	Medium dense, moist, dark brown to mottled grayish brown, Clayey, fine to medium SAND; some carbonate pods; porous			
10	B10-3					18	104.0	20.3
12								
14			▼		-Encountered groundwater at 15 feet			
	B10-4			SM	**LANDSLIDE DEBRIS** Loose to medium dense, wet, olive gray, Silty, fine to medium SAND; pods of carbonate	15	104.5	21.9
16								
18								
					-Loose to medium dense, saturated, fine- to coarse-grained			
20	B10-5					32		
22				SM	Dense, moist, light gray, Silty, fine- to medium-grained SANDSTONE; carbonate-filled fractures			
24				SM-ML	**SANTIAGO FORMATION** Dense, moist, light olive gray, Silty, fine-grained SANDSTONE to fine-grained Sandy SILTSTONE; moderately cemented			
	B10-6					74/11"	114.2	15.3
26								
28								

Figure A-10,
Log of Boring B 10, Page 1 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR ▽ ... SEEPAGE

GEOCON

BORING B 10

ELEV. (MSL.) **198'** DATE COMPLETED **05-25-2005**

EQUIPMENT **CME 75 WITH 8" HOLLOW STEM AUGER** BY: **N. ASH**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B10-7				Dense, moist, light gray, Silty, fine- to coarse-grained SANDSTONE; weakly cemented; slightly micaceous	74		
32								
34								
	B10-8			SM	-Moderately cemented	50/6"	117.4	13.4
36								
38								
40	B10-9					50/5"	111.5	15.4
					Hard, moist, olive gray, Clayey to fine-grained Sandy SILTSTONE; strongly indurated; some iron oxide mineralization			
42				ML				
	B10-10					80/10"		
44					-Refusal to penetration at 43.5 feet			

BORING TERMINATED AT 44 FEET
Groundwater encountered at 15 feet
Backfilled with 15 cu. ft. of bentonite slurry

Figure A-10,
Log of Boring B 10, Page 2 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

SOIL BORING NUMBER: B - 1 1

GEOCON

PROJECT	Olive Park Apartments	**CLIENT**	Capstone Equities
PROJECT NUMBER	G3035-52-01	**PROJECT LOCATION**	Olive Drive, Oceanside, CA
DATE STARTED	07/12/2024	**COMPLETED**	07/12/2024
GROUND ELEVATION	~307'	**NORTHING**	-
CONTRACTOR	Dave's Drilling	**GROUND WATER LEVELS:**	
EASTING	-		
METHOD	HSA	**INITIALLY ENCOUNTERED**	N/A
LOGGED BY	R. Adams	**AFTER 15 MIN**	N/A
NOTES	-	**HAMMER WEIGHT / DROP**	- / -

Depth (ft)	Elevation (ft)	USCS	Water Levels	Material Description	Sample Interval	Sample Number
	307					
0–1.5	305	SC		**LANDSLIDE DEBRIS** (Qls) Hard, dry, brown to reddish brown, **Clayey SAND** (SC); few rock fragments		
1.5–7		SM		Dense, damp, pale yellowish brown, **Silty SANDSTONE** (SM), fine to coarse grained; abundant chunks of claystone up to 8" in width, some clay-infilled fractures (near vertical)		
5	300					
7–11		SC		Dense, damp, yellowish brown, **Clayey SANDSTONE** (SC), fine to coarse grained; few roots on fracture surfaces		
10	295					
11–12.5		CL		Firm, moist, grayish brown, **Sandy CLAYSTONE** (CL); no remolding		
12.5–17		CL-ML		Soft to Firm, damp, greenish gray to greenish brown, **CLAYSTONE** (CL-ML); highly fractured and brecciated, weakly fissured with few polished, striated parting surfaces; no remolded clay seams observed -Claystone becomes less brecciated		
15	290					
17–19.5		ML		Hard, damp, olive brown, **Sandy SILTSTONE** (ML), fine grained; massive, contact with overlying claystone is undulatory (subhorizontal)		
20	285					
19.5–24		SC		Very dense, damp to moist, pale yellowish brown to whitish brown, **Clayey SANDSTONE** (SC), fine to coarse grained; massive, few infilled fractures		
25	280					
24–30		SP		Very dense, damp to moist, whitish brown, **SANDSTONE** (SP), medium to coarse grained; moderately cross-bedded, trace silt and clay		

Graphics Legend

SC
SM
CL
ML

Water Levels

▽ -
▼ -

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON **SOIL BORING:** B-11

Depth (ft)	Elevation (ft)	Graphic Log	USCS	Water Levels	Material Description	Sample Interval	Sample Number
	275		SP				
35					-Becomes very coarse grained. Several 4-6" diameter claystone rip up clasts. Imbricated with cross-bedding direction		
	270		SC		Very dense, damp to moist, grayish white, **Clayey SANDSTONE** (SC), fine to coarse grained; massive		
40	265		ML		Hard, damp, olive brown, **Clayey SILTSTONE** (ML); massive, contact of overlying sandstone is erosional (uncomformable) with an approximate orientation of N20°E/25°W, few gypsum filled fractures throughout		
					-High angle fracture N6°E/58°W		
45	260		CL-ML		Firm to hard, damp, dark greenish brown, **CLAYSTONE** (CL-ML); contact with overlying siltstone is transitional		
					-BASAL RUPTURE SURFACE; 1/4 to 3/4" thick, gray, plastic, poorly to moderately remolded clay gouge. Polished and striated on bounding surfaces. Gouge zone is poorly developed but can be traced around the hole. Clay gouge surface is undulatory with a dip of less than 2°		
50	255		SC		-At 47.8'; Claystone becomes moderately fissured and fractured with heavy orangish brown oxidation staining		
55	250				**SANTIAGO FORMATION** (Tsa) Very dense, damp to moist, whitish brown, **Clayey SANDSTONE** (SC), medium to coarse grained; massive, contact with overlying claystone is undulatory sub-horizontal		
					REFUSAL AT 57' No groundwater encountered Backfilled 07/12/2024		

Graphics Legend

SP

ML

CL-ML

Water Levels

- -
- -

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

SOIL BORING NUMBER: B - 1 2

PROJECT Olive Park Apartments

PROJECT NUMBER G3035-52-01

DATE STARTED 07/11/2024 **COMPLETED** 07/11/2024

CONTRACTOR Dave's Drilling

METHOD HSA

RIG TYPE EZ Bore **BORING DIAMETER** 30 in

HAMMER TYPE -

LOGGED BY R. Adams

LATITUDE / LONGITUDE 33.20242, -117.28951

DEPTH 100' **SURFACE ELEVATION** ~307'

GROUND WATER LEVELS: **WATER ENCOUNTER** N/A

WATER ENCOUNTER N/A

Depth (ft)	Elevation (ft)	Graphic Log	USCS	Water Levels	Material Description
	307				
0–9 (5)	305, 300		SC		**COLLUVIUM** (Qcol) Dense, moist, brown, **Clayey SAND** (SC), fine grained; few claystone fragments, few krotovina, minor carbonate development. Probable graben infill.
9–15 (10)	295		SM		**LANDSLIDE DEBRIS** (Qls) Dense to very dense, damp to moist, gray to pale yellowish brown, **Silty SANDSTONE** (SM), fine to coarse grained; some claystone fragments up to 5" in width, few thin, sub-vertical clay filled fractures Dense, damp, olive gray, **Silty SANDSTONE** (SM), fine grained; minor offset along sub-vertical, clay filled fractures
15–22 (15, 20)	290, 285		SP		Very dense, damp to moist, pale yellowish brown, **SANDSTONE** (SP); few very coarse cross-beds
22–30 (25)	280		CL-ML		Stiff to hard, damp, olive gray, **CLAYSTONE** (CL-ML); moderately fissured and fractured with pockets of soft clay throughout, few rootlets along clay-filled fractures, fractures are closed contact with overlying sandstone is undulatory N80°E/8°S

Graphics Legend

SC

CL-ML

SM

Water Levels

-

-

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

SOIL BORING: B-12

Depth (ft)	Elevation (ft)	Graphic Log	USCS	Water Levels	Material Description
			SP		Dense, damp, whitish brown, **SANDSTONE** (SP), coarse grained; sub-horizontal approximate bedding N10°W/5°W
	275		SM		Dense to very dense, moist, light olive brown, **Silty SANDSTONE** (SM), fine to coarse grained
35	270		CL-ML		Hard, moist, olive gray, **CLAYSTONE** (CL-ML); moderately to highly fissured and fractured with some plastic clay films on fracture surfaces BASAL RUPTURE SURFACE; 1/8 to 1/4" thick, slightly to moderately developed, approximate angle of basal rupture surface N5°E/4-6°W
40 45 50 55	265 260 255 250		SM		**SANTIAGO FORMATION** (Tsa) Very dense, moist, olive gray, **Silty SANDSTONE** (SM), fine grained; interbedded with hard Sandy SILTSTONE, few gypsum filled fractures -Slow drilling (concretionary) -Some claystone rip-up clasts
			CL		Hard, damp to moist, olive gray, **Silty CLAYSTONE** (CL); very minor fissuring,

Graphics Legend

SP

CL-ML

Water Levels

-

-

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

SOIL BORING: B-12

Depth (ft)	Elevation (ft)	Graphic Log	USCS	Water Levels	Material Description
			CL		Hard, damp to moist, olive gray, **Silty CLAYSTONE** (CL); very minor fissuring, upper contact: N25°W/8°W, some oxidation staining
	245		SC-SM		Very dense, moist, olive gray, **Silty to Clayey SANDSTONE** (SC-SM), fine to medium grained, with gravel; few gypsum filled fractures, massive
65	240				
70			ML		Hard, moist, olive gray, **Sandy SILTSTONE** (ML); upper contact is horizontal, waxy texture
	235				
75					-Becomes moderately fissured with few pockets of soft clay
	230				
			CL-ML		Hard, moist, olive gray, **Silty CLAYSTONE** (CL-ML); highly fissured and brecciated -BEDDING PLANE SHEAR; 1/8" to 1/4" thick, moderately remolded plastic clay gouge, BPS is bifurcated/offset along fracture. Polished on bounding surfaces approximate attitude N45°E/4°N
80	225				
85					Hard, moist, olive gray, **Clayey SILTSTONE**; 1.4' thick siltstone bed; horizontal
	220				-High angle fracture with clay infill; fracture orientation N65°E/40°S

Graphics Legend

- CL
- ML
- SC-SM
- Clayey Siltstone

Water Levels

- ∇ -
- ▼ -

DRAFT

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

SOIL BORING: B-12

Depth (ft)	Elevation (ft)	Graphic Log	USCS	Water Levels	Material Description
	215				
95	210				
100	205				TOTAL DEPTH 100 FEET Logged to 97 feet No groundwater encountered Backfilled 07/11/2024
105	200				
110	195				
115	190				

Water Levels

⊻ -

▼ -

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

SOIL BORING NUMBER: B - 1 3

PROJECT Olive Park Apartments
LOGGED BY R. Adams
PROJECT NUMBER G3035-52-01
LATITUDE / LONGITUDE 33.20313, -117.28951
DATE STARTED 07/12/2024 **COMPLETED** 07/12/2024
DEPTH 48' **SURFACE ELEVATION** 286'
CONTRACTOR Dave's Drilling
GROUND WATER LEVELS: **WATER ENCOUNTER** N/A
METHOD HSA
RIG TYPE EZ Bore **BORING DIAMETER** 30 in
HAMMER TYPE -
WATER ENCOUNTER N/A

Depth (ft)	Elevation (ft)	Graphic Log	USCS	Water Levels	Material Description
	286				
	285		CL		**COLLUVIUM** (Qcol) Stiff, dry to damp, brown, **Sandy CLAY** (CL)
5	280		SM		**LANDSLIDE DEBRIS** (Qls) Loose to medium dense, damp to moist, grayish white, **Silty SANDSTONE** (SM), fine to coarse grained; multiple near vertical clay-filled fractures, some embedded fragments of colluvium -Few claystone fragments, some oxidation staining
10	275				-1/2 to 2" thick, offset, back-rotated clay bed bedding: N30°E/10°S, fracture offset: N70°E/74°S
15	270		CL		Firm, moist, grayish brown to olive brown, **Sandy CLAYSTONE** (CL); no remolding, weakly fissured with few polished and striated parting surfaces Stiff to hard, damp, greenish gray, **CLAYSTONE** (CL); weakly to moderately fissured, no remolding, slightly brecciated
20	265		SM		Very dense, damp to moist, grayish white, **Silty SANDSTONE** (SM), fine to coarse grained; trace clay, massive with some cross-bedding, contact with overlying claystone is horizontal
25	260				Dense, damp, dark brown to dark reddish-brown, **Silty SANDSTONE**, fine to coarse grained; convoluted cross-bedding

Graphics Legend

CL

CL

SM

Water Levels

-

-

GEOCON **SOIL BORING:** B-13

Depth (ft)	Elevation (ft)	Graphic Log	USCS	Water Levels	Material Description
	255				-Becomes coarse grained
35	250				-Few claystone rip-up clasts
			CL-ML		Hard, damp, greenish gray to greenish black, **CLAYSTONE** (CL-ML); moderately to highly fissured and fractured, numerous polished and striated parting surfaces throughout. Contact with overlying sandstone is horizontal -BASAL RUPTURE SURFACE; 1 to 3" thick zone of pulverized claystone containing a 1/4 to 3/4" thick, moderately remolded clay seam. Remolded clay seam is moderately developed/semi-continuous around the boring. Bounding surfaces are polished and striated. Heavy oxidation mottling below the remolded clay seam
40	245				**SANTIAGO FORMATION** (Tsa) Very dense, damp, grayish brown to whitish brown, **Silty SANDSTONE**, fine to coarse grained; massive, contact with overlying claystone is undulatory/sub-horizontal
45	240				
					REFUSAL AT 48 FEET No groundwater encountered Backfilled 07/12/2024
50	235				
55	230				

Graphics Legend

Silty Sandstone

CL-ML

Bulk - Bulk Sample

Water Levels

▽ -

▼ -

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

TRENCH T 1

ELEV. (MSL.) **300'** DATE COMPLETED **05-09-2005**

EQUIPMENT **JD 450 TRACK-MOUNTED BACKHOE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 2				CL	**LANDSLIDE DEBRIS** Soft, moist, dark brown to grayish brown, fine Sandy CLAY; moderate topsoil development; common thin roots			
4 – 6				CH	Stiff, moist, brownish to olive gray, fine Sandy fat CLAY; abundant slickensided sheared surfaces; carbonate mineralization; scattered roots; overall jumbled texture; fractured claystone blocks S: N5W/17SW			
8 – 10				SM+SC	**SANTIAGO FORMATION** Dense, moist, light olive gray, fine- to medium-grained Silty to locally Clayey SANDSTONE; moderately cemented; weakly jointed; generally massive and undisturbed			
					TRENCH TERMINATED AT 11 FEET No groundwater encountered			

Figure A-11,
Log of Trench T 1, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 2 ELEV. (MSL.) 195' DATE COMPLETED 05-09-2005 EQUIPMENT JD 450 TRACK-MOUNTED BACKHOE	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0 2				CL	**LANDSLIDE DEBRIS** Soft, moist, brown to grayish brown, fine Sandy CLAY; moderate topsoil development; abundant thin roots			
4 6 8				CH+SC	Medium dense and stiff, moist, light gray to olive gray, fat CLAY and Clayey to Silty SAND; jumbled texture; chaotic structure; some fragments of sandstone and claystone; clayey areas sheared and slickensided; back-rotated beds generally dipping at low to moderate angles into hillside			
					TRENCH TERMINATED AT 9 FEET No groundwater encountered			

Figure A-12,
Log of Trench T 2, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 3 ELEV. (MSL.) 204' DATE COMPLETED 05-09-2005 EQUIPMENT JD 450 TRACK-MOUNTED BACKHOE	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0 2				CL	**LANDSLIDE DEBRIS** Soft, moist, dark brown, fine Sandy CLAY; abundant roots and porosity			
4 6 8 10			▼	SM+SC	Loose, moist to wet, yellowish brown to light olive gray, Silty to Clayey SAND; highly disturbed, chaotic texture, some fragments of sandstone; few roots -Very loose and saturated; walls of trench highly prone to caving; abundant seepage			
12					TRENCH TERMINATED AT 12 FEET Seepage at 10 feet			

Figure A-13,
Log of Trench T 3, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	◣ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 4 ELEV. (MSL.) 207' DATE COMPLETED 05-09-2005 EQUIPMENT JD 450 TRACK-MOUNTED BACKHOE	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0 – 5				SC	**ALLUVIUM** Loose, moist, dark brown, Clayey, fine SAND; porous; common roots			
5 – 14			▼ (9 ft)	SM+SC	**LANDSLIDE DEBRIS** Loose, wet, olive gray to grayish brown, Clayey to Silty, fine SAND and Sandy CLAY; porous; jumbled texture and chaotic structure -Saturated; abundant seepage; caving of trench walls			
14					TRENCH TERMINATED AT 14 FEET Seepage at 9 feet			

Figure A-14,
Log of Trench T 4, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**TRENCH T 5** ELEV. (MSL.) **212'** DATE COMPLETED **05-09-2005** EQUIPMENT **JD 450 TRACK-MOUNTED BACKHOE**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0 – 5				SC	**LANDSLIDE DEBRIS** Loose, moist, dark gray, Clayey, fine SAND; porous; thin roots; weakly developed topsoil in upper 2 feet			
5 – 14.5				SM+SC	Loose, moist to wet, olive gray, Clayey to Silty, fine to coarse SAND; jumbled texture; chaotic structure; some clayey sandstone fragments in sandy matrix			
					TRENCH TERMINATED AT 14.5 FEET No groundwater encountered			

Figure A-15,
Log of Trench T 5, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

TRENCH T 6

ELEV. (MSL.) **226'** DATE COMPLETED **05-10-2005**

EQUIPMENT **JD 450 TRACK-MOUNTED BACKHOE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 2				SC	**TOPSOIL** Loose to medium dense, dry to damp, Clayey SAND			
2 – 9.5	T6-1 (4–5 ft)				**GRANITIC ROCK** Moderately hard, moist, tan to gray, GRANITIC ROCK; highly weathered; moderately fractured; damp to dry; light green clay on fracture surfaces -At 5 feet J: N37E/vertical -At 7 feet J:N53W/77SW			

TRENCH TERMINATED AT 9.5 FEET
No groundwater encountered
No caving

Figure A-16,
Log of Trench T 6, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

TRENCH T 7

ELEV. (MSL.) **240'** DATE COMPLETED **05-10-2005**

EQUIPMENT **JD 450 TRACK-MOUNTED BACKHOE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 4				SC	**LANDSLIDE DEBRIS** Loose to medium dense, dry to damp, dark gray, Clayey SAND; moderate topsoil development Medium dense, moist, light gray brown; scattered flecks of black organics; base subparallel to slope; grades to very light gray with medium gray brown laminations			
4 – 8				SM	**SANTIAGO FORMATION** Dense, damp, very light gray, fine- to medium-grained Silty SANDSTONE; massive to thickly slightly weathered -Becomes dark brown at 7.5 feet -C: 80E/5-10N (at top)			
8 – 9					**GRANITIC ROCK** Moderately hard, damp to moist, greenish gray with abundant orange staining, GRANITIC ROCK; highly weathered			

TRENCH TERMINATED AT 9 FEET
No groundwater encountered
No caving

Figure A-17,
Log of Trench T 7, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 8 ELEV. (MSL.) 254' DATE COMPLETED 05-10-2005 EQUIPMENT JD 450 TRACK-MOUNTED BACKHOE	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SC	**TOPSOIL** Medium dense, dry to damp, dark gray, Clayey SAND			
2 4	T8-1			SM	**SANTIAGO FORMATION** Dense, damp, very light gray, Silty SANDSTONE; fine- to medium-grained; moderately weathered; massive; moderately cemented -Slightly weathered at 4 feet			
					TRENCH TERMINATED AT 5 FEET No groundwater encountered			

Figure A-18,
Log of Trench T 8, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 9 ELEV. (MSL.) 241' DATE COMPLETED 05-10-2005 EQUIPMENT JD 450 TRACK-MOUNTED BACKHOE	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**TOPSOIL** Medium dense, dry to damp, dark gray-brown, Silty SAND			
2 4				SM	**SANTIAGO FORMATION** Dense, damp, very light gray with some orange staining, Silty SANDSTONE; fine- to medium-grained; moderately weathered, slightly fractured; moderately cemented; massive -Slightly weathered; fine roots; dark brown staining at 4 feet -At 3 feet; J: N70W/65NE			
					TRENCH TERMINATED AT 5 FEET No groundwater encountered			

Figure A-19,
Log of Trench T 9, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 10 ELEV. (MSL.) 228' DATE COMPLETED 05-10-2005 EQUIPMENT JD 450 TRACK-MOUNTED BACKHOE	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0 – 2				SM	**TOPSOIL** Medium dense, dry to damp, dark gray, Silty SAND			
2 – 11				SP	**SANTIAGO FORMATION** Medium dense, moist, very light pale brown, SANDSTONE; massive; moderately hard; weakly cemented; moderately weathered -Very light gray; slightly weathered; slightly moist at 4 feet			
11 – 13	T10-1		▼	SM	-Moderate seepage at 11 feet Dense, damp, greenish medium gray, Silty, fine to medium SANDSTONE; trace clay -Refusal at 13 feet			

TRENCH TERMINATED AT 13 FEET
Seepage at 11 feet

Figure A-20,
Log of Trench T 10, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 11 ELEV. (MSL.) 226' DATE COMPLETED 05-10-2005 EQUIPMENT JD 450 TRACK-MOUNTED BACKHOE	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0 2				SC	**TOPSOIL** Medium dense, damp, dark gray, Clayey SAND			
4 6					**GRANITIC ROCK** Moderately hard, slightly moist, light gray brown with orange staining, GRANITIC ROCK; highly weathered, highly fractured -At 6 feet J: N70E/72NW; J: N72E/70SE			
					TRENCH TERMINATED AT 7.5 FEET No groundwater encountered			

Figure A-21,
Log of Trench T 11, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

TRENCH T 12

ELEV. (MSL.) **220'** DATE COMPLETED **05-10-2005**

EQUIPMENT **JD 450 TRACK-MOUNTED BACKHOE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 2				SC	**TOPSOIL** Medium dense, slightly moist, dark gray, Clayey SAND			
2 – 7					**GRANITIC ROCK** Moderately hard, damp, light gray brown with orange staining, GRANITIC ROCK; highly weathered; scattered hard rounded nodules (some nodules, moderately weathered); fine- to coarse-grained crystalline texture			

TRENCH TERMINATED AT 7 FEET
No groundwater encountered

Figure A-22,
Log of Trench T 12, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

TRENCH T 13

ELEV. (MSL.) **228'** DATE COMPLETED **05-10-2005**

EQUIPMENT **JD 450 TRACK-MOUNTED BACKHOE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 3				CL	**LANDSLIDE DEBRIS** Stiff, moist, dark brown, Sandy CLAY; porous with roots and krotovina; moderate topsoil development			
3 – 5.5				SM	Loose, moist, light olive gray, Silty, fine to medium SAND; common clay-filled; high-angle fractures			
5.5 – 13	T13-1			CH	Stiff, moist, dark olive gray; Sandy, fat CLAY; pockets of silty sand and granitic rock fragments; highly fractured and sheared; chaotic bedding orientations B: N35E/38NW -Carbonate and iron oxide mineralization between sand and clay beds -At 13 feet, contact roughly horizontal, undulatory			
13 – 14					**GRANITIC ROCK** Moderately hard to hard, damp, light to medium brown, GRANITIC ROCK; moderately weathered			

TRENCH TERMINATED AT 14 FEET
No groundwater encountered
No caving

Figure A-23,
Log of Trench T 13, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

TRENCH T 14

ELEV. (MSL.) **238'** DATE COMPLETED **05-10-2005**

EQUIPMENT **JD 450 TRACK-MOUNTED BACKHOE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 2				SC	**PREVIOUSLY PLACED FILL** Loose, moist, grayish brown, Clayey, fine to medium SAND; few gravels			
2 – 5				CL	**TOPSOIL** Stiff, moist, dark brown, fine Sandy CLAY; few gravels; common roots; porous			
5 – 8				CH	**SANTIAGO FORMATION** Very stiff, moist, dark olive gray, fine Sandy, fat CLAY; highly weathered and some shearing			
8 – 18				SM-SC	Medium dense, moist, light olive gray, Clayey and Silty, SANDSTONE; fine- to medium-grained; very weakly cemented; massive bedding -Becomes dense; fine-grained and clayey			
18					TRENCH TERMINATED AT 18 FEET No groundwater encountered No caving			

Figure A-24,
Log of Trench T 14, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

TRENCH NUMBER: T - 15

GEOCON

PROJECT NAME	Olive Park Apartments	**CLIENT NAME**	Capstone Equities
PROJECT NUMBER	G3035-52-01	**LATITUDE / LONGITUDE**	33.20341, -117.29006
DATE STARTED	07/13/2024 **COMPLETED** 07/13/2024	**DEPTH**	8' **SURFACE ELEVATION** 227'
CONTRACTOR	Dave's Drilling	**GROUND WATER LEVELS:**	
RIG TYPE	CAT 430F	**SEEPAGE ENCOUNTERED**	N/A
LOGGED BY	R. Adams **METHOD** Backhoe	**GROUNDWATER ENCOUNTERED**	N/A

Depth (ft)	Elevation (ft)	Graphic Log	USCS	Water Levels	Material Description
0–3	227–224	CL	CL		**LANDSLIDE DEBRIS** (Qls) Firm to stiff, moist, grayish brown to light brown, **Sandy CLAY** (CL); roots, some carbonate development, few infilled fractures with oxidation staining on fracture surfaces
3–8	224–219	Granitic Rock			**GRANITIC ROCK** (Kgr) Moderately Weak, weathered, pale reddish brown to grayish brown, **Granitic Rock**; isolated weathered core stones <18" diameter; excavates as a coarse SAND
8	219				PRACTICAL REFUSAL AT 8 FEET No groundwater encountered Backfilled 07/13/2024

Depth scale: 5, 10. Elevation scale: 227, 225, 220.

Graphics Legend

CL

Granitic Rock

Water Levels

No free water encountered

-

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH NUMBER: T - 1 6

PROJECT NAME Olive Park Apartments

CLIENT NAME Capstone Equities

PROJECT NUMBER G3035-52-01

LATITUDE / LONGITUDE 33.20363, -117.28987

DATE STARTED 07/13/2024 **COMPLETED** 07/13/2024

DEPTH 7' **SURFACE ELEVATION** 223'

CONTRACTOR Dave's Drilling

GROUND WATER LEVELS:

RIG TYPE CAT 430F

SEEPAGE ENCOUNTERED N/A

LOGGED BY R. Adams **METHOD** Backhoe

GROUNDWATER ENCOUNTERED N/A

Depth (ft)	Elevation (ft)	Graphic Log	USCS	Water Levels	Material Description
	223				
0–1		CL	CL		**COLLUVIUM** (Qcol) Stiff to hard, dry to moist, dark brown to black, **Sandy CLAY** (CL)
1–7	220	Granitic Rock			**GRANITIC ROCK** (Kgr) Weak to moderately weak, completely to highly weathered, greenish gray to reddish brown, **Granitic Rock**; excavates as a Silty, coarse SAND
5					
7	215				TRENCH TERMINATED AT 7 FEET No groundwater encountered Backfilled 07/13/2024
10					

Graphics Legend

CL

Granitic Rock

Water Levels

-

-

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH NUMBER: T - 1 7

PROJECT NAME	Olive Park Apartments	**CLIENT NAME**	Capstone Equities
PROJECT NUMBER	G3035-52-01	**LATITUDE / LONGITUDE**	33.20385, -117.28931
DATE STARTED	07/13/2024 **COMPLETED** 07/13/2024	**DEPTH**	3' **SURFACE ELEVATION** 228'
CONTRACTOR	Dave's Drolling	**GROUND WATER LEVELS:**	
RIG TYPE	CAT 430F	**SEEPAGE ENCOUNTERED**	N/A
LOGGED BY	R. Adams **METHOD** Backhoe	**GROUNDWATER ENCOUNTERED**	N/A

Depth (ft)	Elevation (ft)	Graphic Log	USCS	Water Levels	Material Description
	228				
			CL		**COLLUVIUM** (Qcol) Hard, dry, dark grayish brown, **Sandy CLAY** (CL)
					GRANITIC ROCK Weak, highly weathered, orangish brown, **Granitic Rock**; excavates as a coarse SAND
	225				TRENCH TERMINATED AT 3 FEET No groundwater encountered Backfilled 07/13/2024
5					
	220				
10					

DRAFT

Graphics Legend

CL

Granitic Rock

Water Levels

-

-

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH NUMBER: T - 1 8

PROJECT NAME Olive Park Apartments
CLIENT NAME Capstone Equities
PROJECT NUMBER G3035-52-01
LATITUDE / LONGITUDE 33.20377, -117.2892
DATE STARTED 07/13/2024 **COMPLETED** 07/13/2024
DEPTH 6' **SURFACE ELEVATION** 238'
CONTRACTOR Dave's Drilling
GROUND WATER LEVELS:
RIG TYPE CAT 430F
▽ **SEEPAGE ENCOUNTERED** N/A
LOGGED BY R. Adams **METHOD** Backhoe
▼ **GROUNDWATER ENCOUNTERED** N/A

Depth (ft)	Elevation (ft)	Graphic Log	USCS	Water Levels	Material Description
	238				
0–1.5		CL	CL		**LANDSLIDE DEBRIS** (Qls) Stiff, dry to moist, dark brown, **Sandy CLAY** (CL)
1.5–4	235	SM	SM		Medium dense, damp, grayish white, **Silty SAND** (SM), fine to coarse grained; highly irregular contact with inclusions of colluvium along contact with granitic rock, fractures terminate at contact
4–6 (5)		Granitic Rock			**GRANITIC ROCK** (Kgr) Weak, completely to highly weathered, **Granitic Rock**; excavates to a Silty, medium to coarse SAND
6					TRENCH TERMINATED AT 6 FEET No groundwater encountered Backfilled 07/13/2024
10	230				

Graphics Legend

CL

SM

Granitic Rock

Water Levels

▽ -

▼ -

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH NUMBER: T - 19

PROJECT NAME Olive Park Apartments

CLIENT NAME Capstone Equities

PROJECT NUMBER G3035-52-01

LATITUDE / LONGITUDE 33.20389, -117.28904

DATE STARTED 07/13/2024 **COMPLETED** 07/13/2024

DEPTH 8' **SURFACE ELEVATION** 227'

CONTRACTOR Dave's Drilling

GROUND WATER LEVELS:

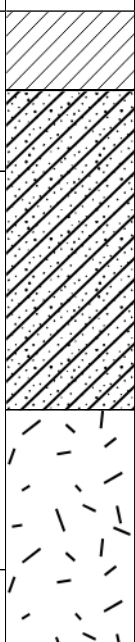
RIG TYPE CAT 430F

SEEPAGE ENCOUNTERED N/A

LOGGED BY R. Adams **METHOD** Backhoe

GROUNDWATER ENCOUNTERED N/A

Depth (ft)	Elevation (ft)	Graphic Log	USCS	Water Levels	Material Description
	227				
0–1			CL		**LANDSLIDE DEBRIS** (Qls) Stiff, dry to damp, brown, **Sandy CLAY** (CL)
1–5	225		SC		Medium dense, damp, white gray, **Clayey SAND** (SC), medium to coarse grained; numerous clay filled, subvertical fractures -Sand becomes mixed with overlying sandy clay
5–8	220				**GRANITIC ROCK** (Kgr) Weak, completely to highly weathered, greenish gray to grayish brown, **Granitic Rock**; excavates as a coarse sand
8					TRENCH TERMINATED AT 8 FEET No groundwater encountered Backfilled 07/13/2024
10					



Graphics Legend

CL

SC

Granitic Rock

Water Levels

-

-

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

APPENDIX B

APPENDIX B
LABORATORY TESTING

We performed laboratory tests in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. We tested selected soil samples for in-place dry density/moisture content, maximum density/optimum moisture content, expansion index, water-soluble sulfate, Atterberg limits, R-Value, unconfined compressive strength, consolidation, gradation and direct shear strength. The results of our current laboratory tests are presented herein. The in-place dry density and moisture content of the samples tested are presented on the boring logs in Appendix A.

SUMMARY OF LABORATORY MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST RESULTS ASTM D 1557

Sample No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% dry wt.)
B3-3	Olive brown, Silty, fine SAND	124.0	10.1
T13-1	Dark olive gray, Sandy, CLAY	117.8	14.9

SUMMARY OF LABORATORY DIRECT SHEAR TEST RESULTS ASTM D 3080

Sample No.	Dry Density (pcf)	Moisture Content (%)		Unit Cohesion (psf)	Angle of Shear Resistance (degrees)
		Initial	Final		
B1-1	99.9	24.7	30.8	275	20
B1-3	129.4	7.5	11.1	1300	29
B1-5	124.0	6.4	13.1	1000	51
B1-6*	--	--	--	250	13
B2-6	109.8	19.3	23.9	200	30
B3-8	106.3	20.3	26.9	475	22
B4-7	119.0	8.8	13.8	800	35
B5-2	102.7	8.8	20.7	0	35
B7-9**	109.3	19.6	27.7	250	13
B7-10	119.9	11.1	18.8	900	31
B7-12*	--	--	--	50	15

*Samples were remolded into a paste to obtain fully softened values.
**Residual Shear

SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS
ASTM D 4829

Sample No.	Moisture Content (%)		Dry Density (pcf)	Expansion Index	2022 CBC Expansion Classification	ASTM Soil Expansion Classification
	Before Test	After Test				
B3-3	11.4	20.3	105.8	28	Expansive	Low
T10-1	11.8	22.4	105.5	35	Expansive	Low
T13-1	14.3	26.9	95.1	25	Expansive	Low

SUMMARY OF LABORATORY WATER-SOLUBLE SULFATE TEST RESULTS
CALIFORNIA TEST NO. 417

Sample No.	Depth (feet)	Geologic Unit	Water-Soluble Sulfate (%)	ACI 318 Sulfate Exposure
T10-1	11-13	Tsa	0.011	S0
T13-1	10-12	Qls	0.005	S0

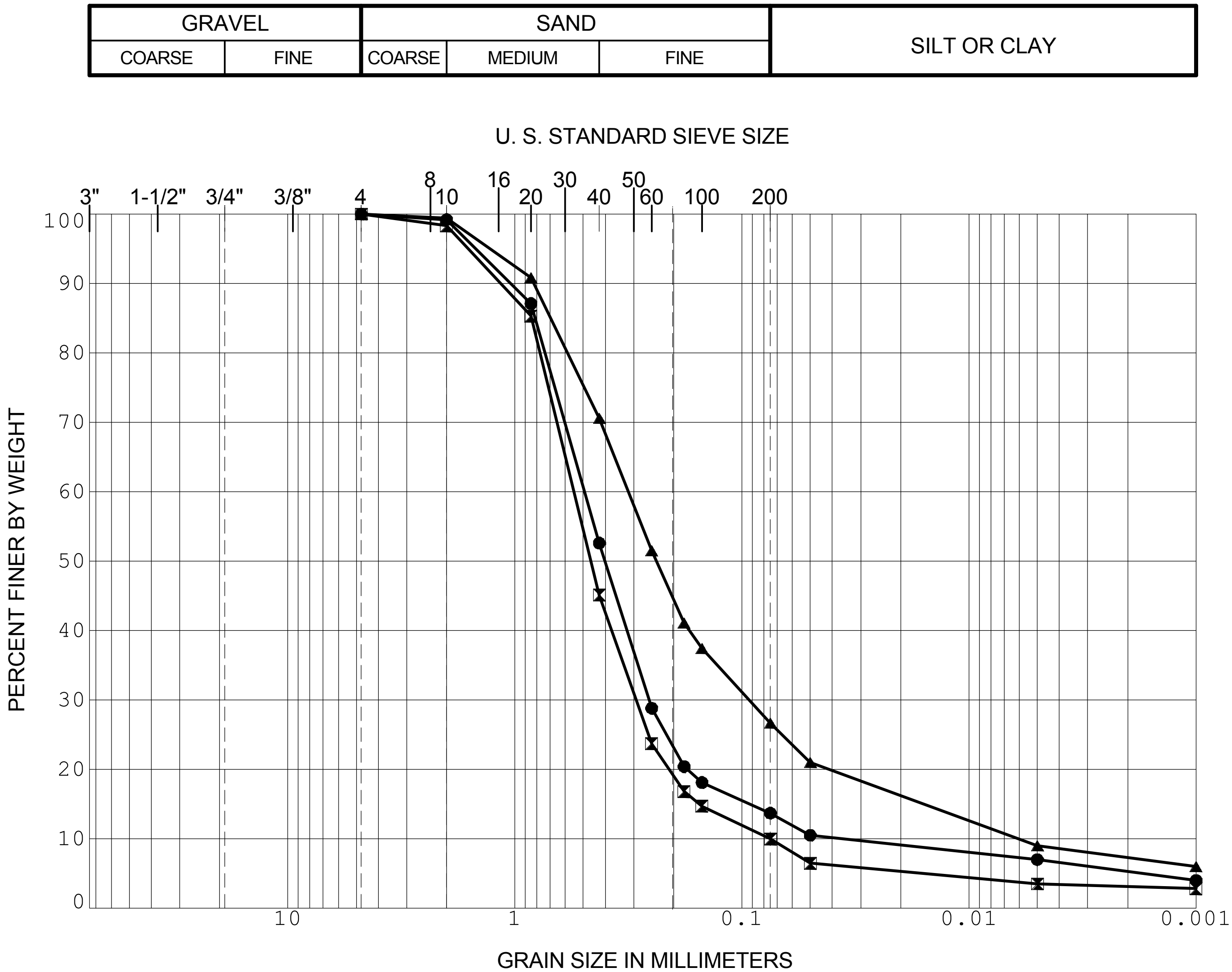
SUMMARY OF LABORATORY RESISTANCE VALUE (R-VALUE) TEST RESULTS
ASTM D 2844

Sample No.	Depth (Feet)	Description (Geologic Unit)	R-Value
B3-3	10-15	Olive brown, Silty, fine SAND (Qls)	18
T10-1	11-13	Olive gray, Silty, fine to medium SAND (Tsa)	15
T13-1	10-12	Dark olive gray, Sandy, CLAY (Qls)	23

SUMMARY OF LABORATORY PLASTICITY INDEX TEST RESULTS
ASTM D 4318

Sample No.	Depth (Feet)	Geologic Unit	Liquid Limit	Plastic Limit	Plasticity Index	Soil Classification
B1-6	6	Qls	63	22	41	CH
B7-12	45	Qls	55	32	23	MH

PROJECT NO. 07227-52-02

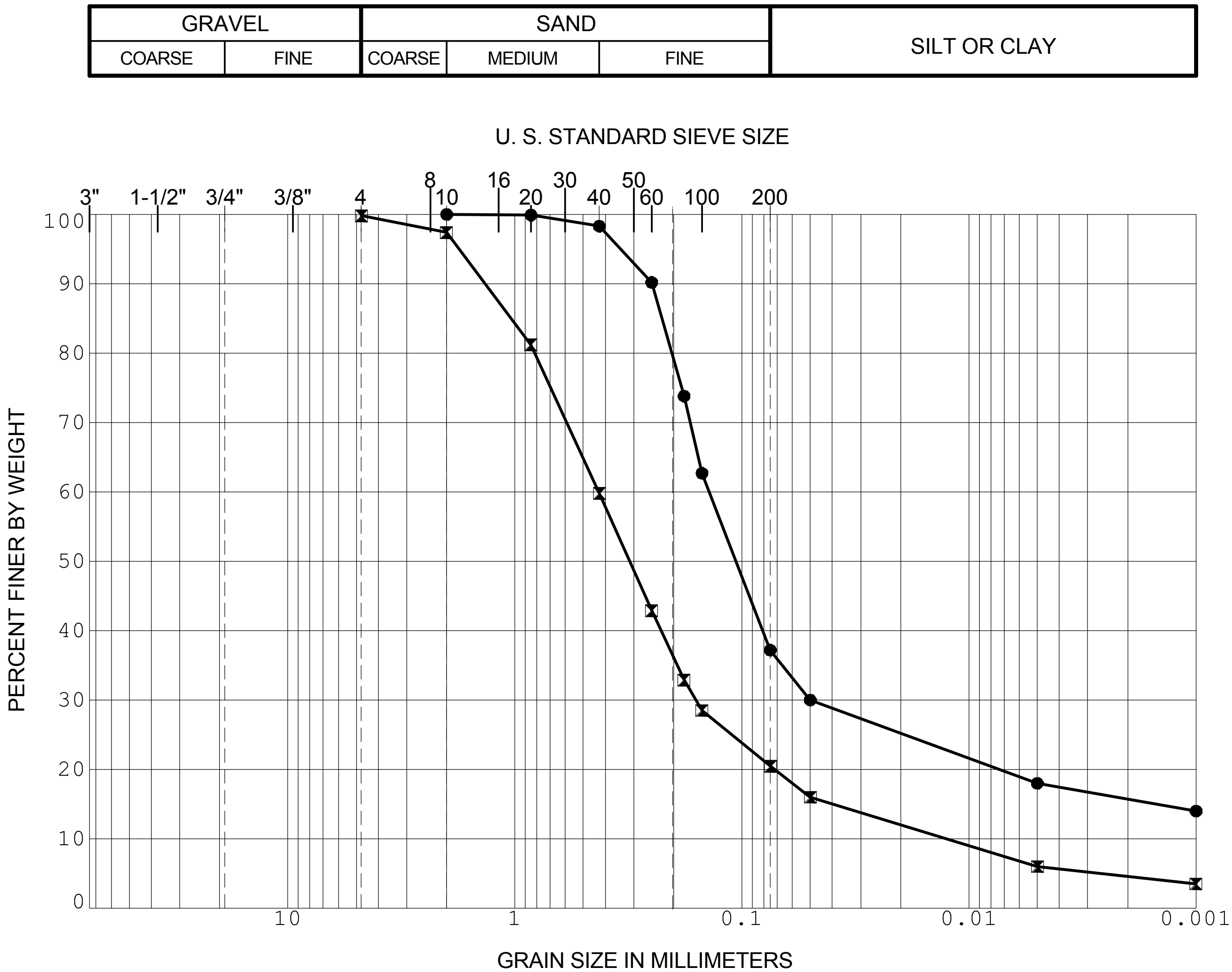


	SAMPLE	DEPTH (ft)	CLASSIFICATION	NAT WC	LL	PL	PI
●	B9-4	16.0	Silty SAND (SM)				
⧗	B9-5	21.0	SAND with Silt (SP-SM)				
▲	B9-6	26.0	Silty SAND (SM)				

GRADATION CURVE

OCEANSIDE VISTA

OCEANSIDE, CALIFORNIA



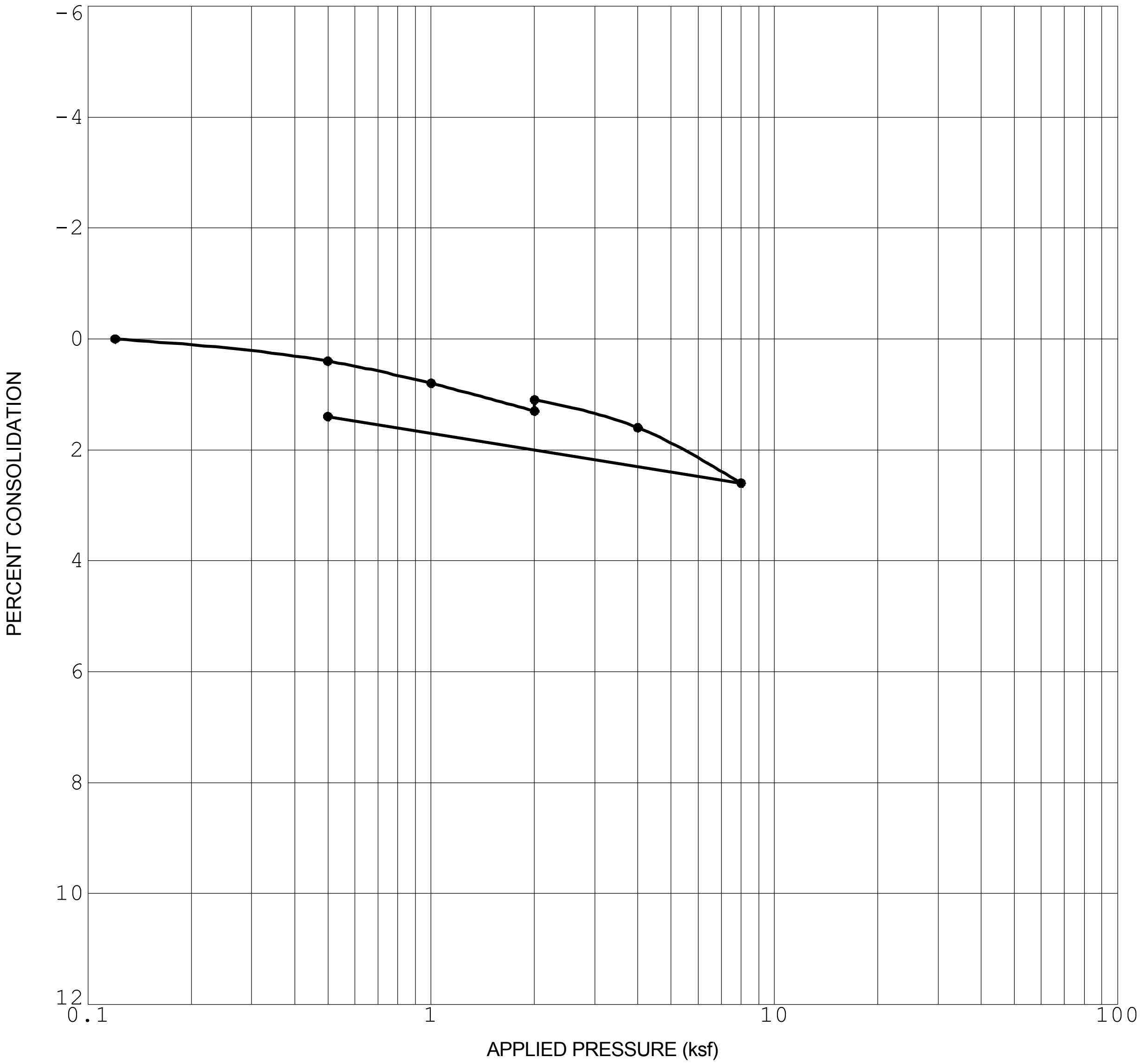
	SAMPLE	DEPTH (ft)	CLASSIFICATION	NAT WC	LL	PL	PI
●	B10-4	16.0	Silty Clayey SAND (SC-SM)				
⧗	B10-5	21.0	Silty SAND (SM)				

GRADATION CURVE

OCEANSIDE VISTA

OCEANSIDE, CALIFORNIA

SAMPLE NO. B2-3



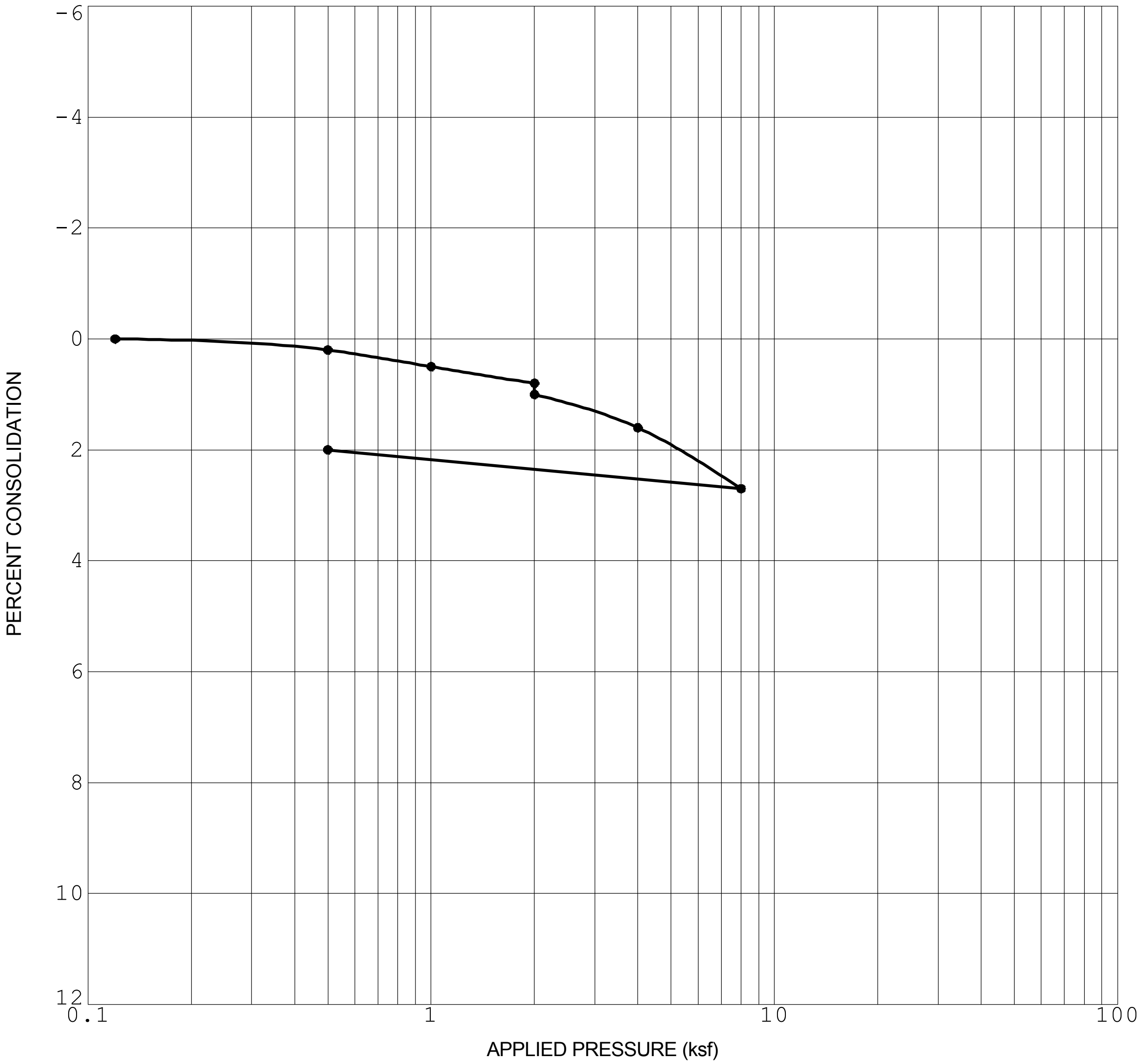
Initial Dry Density (pcf)	108.6		**Initial Saturation (%)**	80.7
Initial Water Content (%)	16.0		**Sample Saturated at (ksf)**	2.0

CONSOLIDATION CURVE

OCEANSIDE VISTA

OCEANSIDE, CALIFORNIA

SAMPLE NO. B3-7



Initial Dry Density (pcf)	115.9
Initial Water Content (%)	8.8

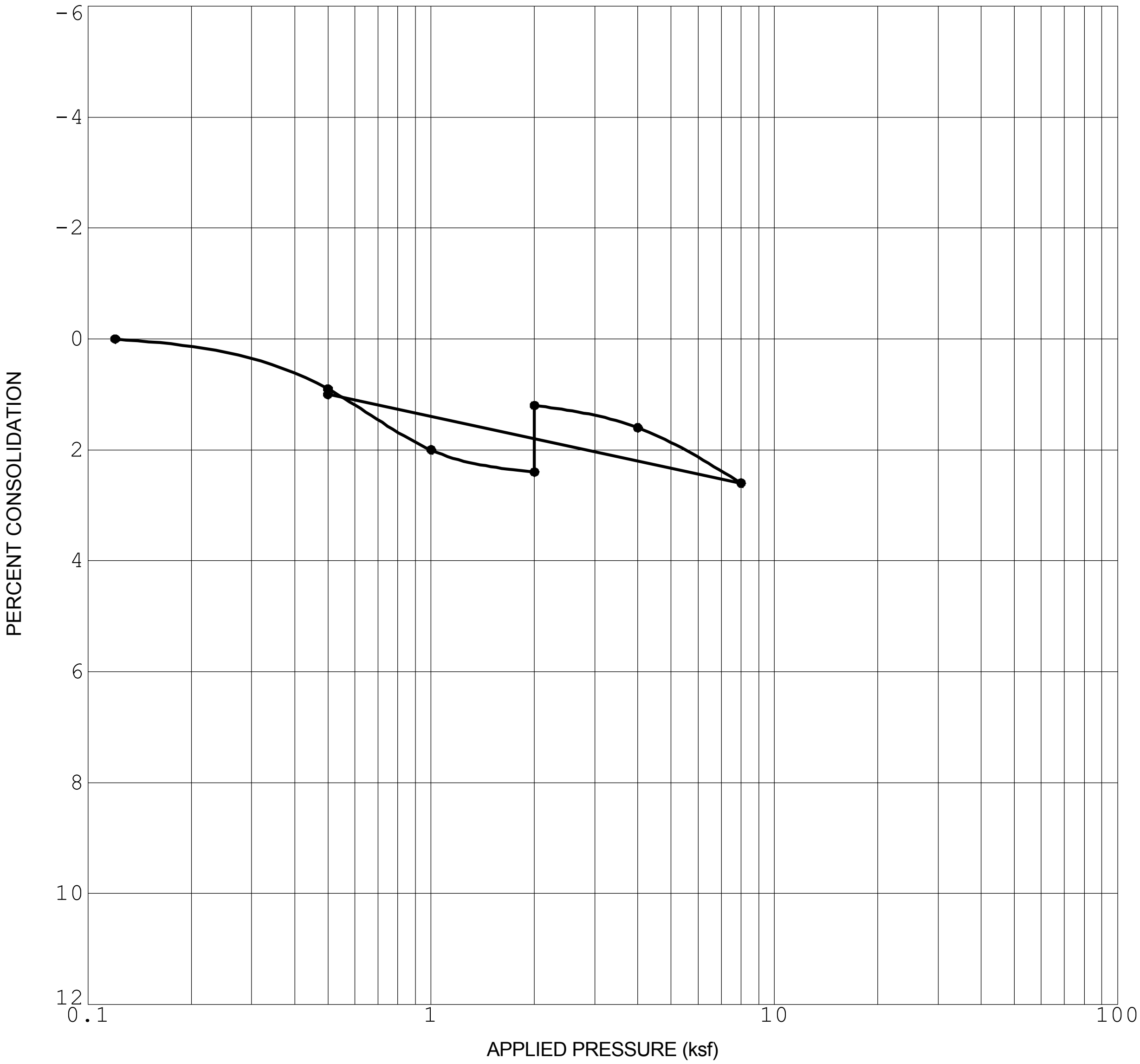
Initial Saturation (%)	54.0
Sample Saturated at (ksf)	2.0

CONSOLIDATION CURVE

OCEANSIDE VISTA

OCEANSIDE, CALIFORNIA

SAMPLE NO. B4-4



Initial Dry Density (pcf)	108.7	**Initial Saturation (%)**	100
Initial Water Content (%)	17.7	**Sample Saturated at (ksf)**	2.0

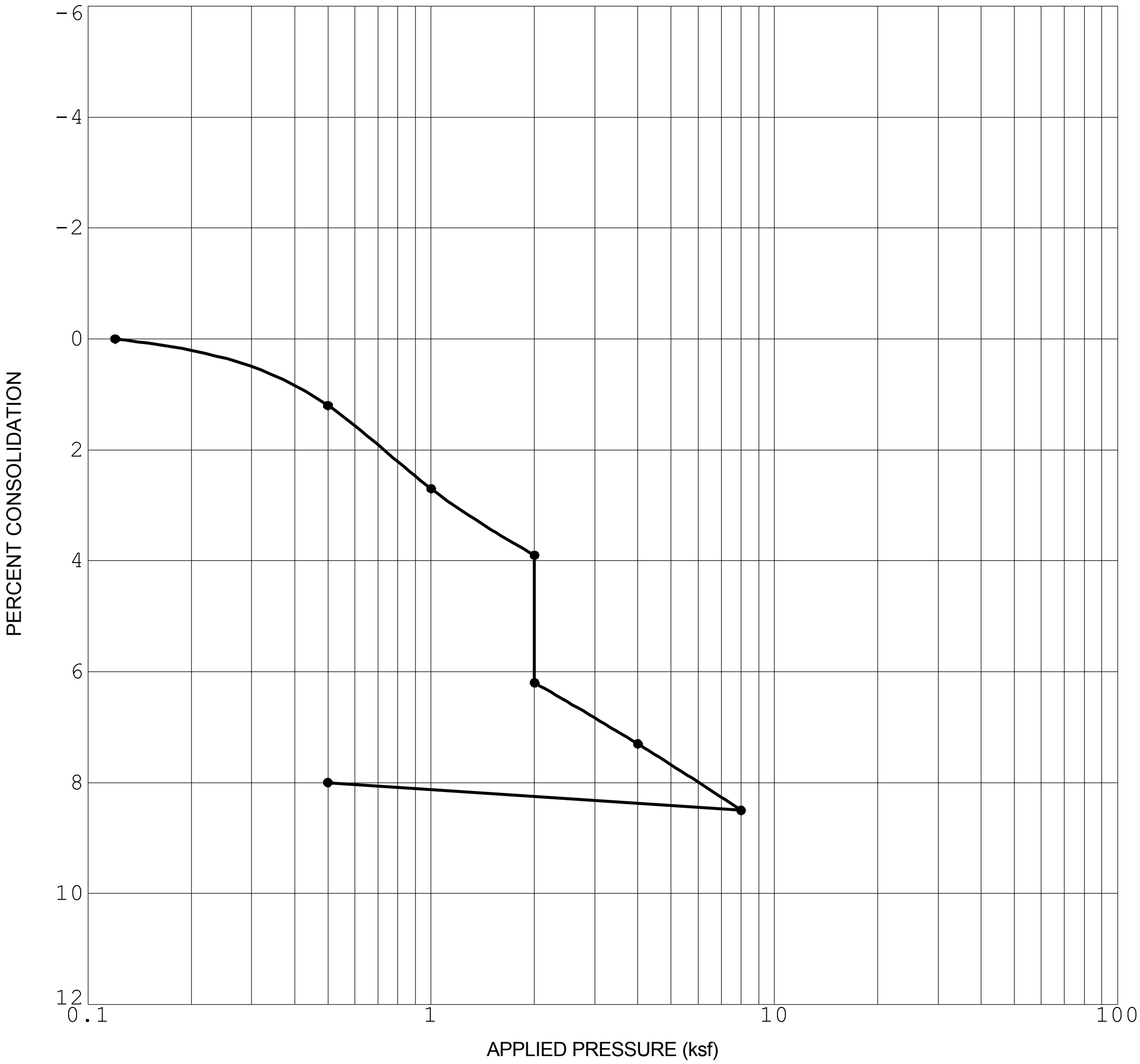
CONSOLIDATION CURVE

OCEANSIDE VISTA

OCEANSIDE, CALIFORNIA

PROJECT NO. 07227-52-02

SAMPLE NO. B7-4



Initial Dry Density (pcf)	96.9
Initial Water Content (%)	8.8

Initial Saturation (%)	32.8
Sample Saturated at (ksf)	2.0

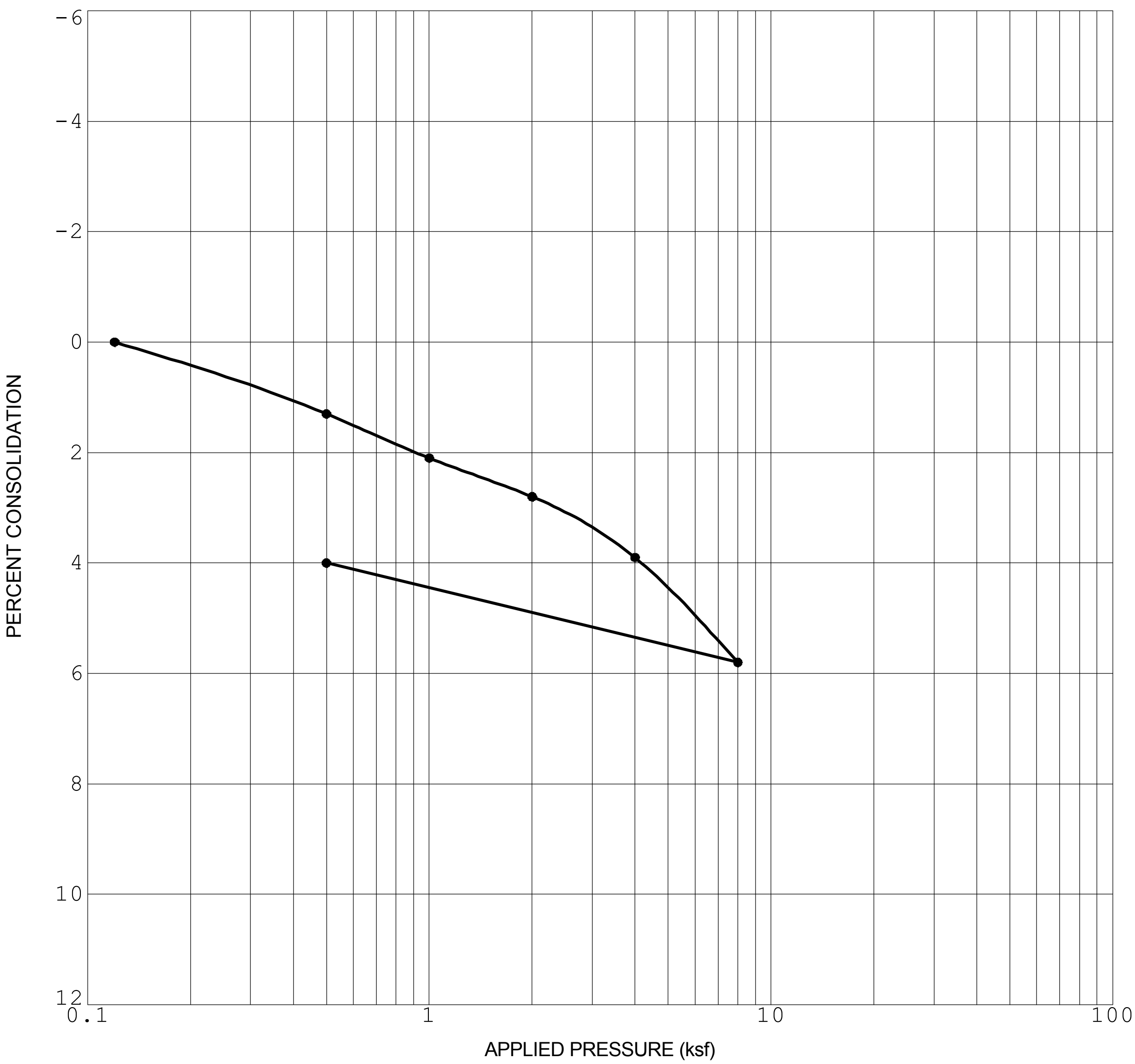
CONSOLIDATION CURVE

OCEANSIDE VISTA

OCEANSIDE, CALIFORNIA

PROJECT NO. 07227-52-02

SAMPLE NO. B7-6



Initial Dry Density (pcf)	104.9		**Initial Saturation (%)**	72.2
Initial Water Content (%)	14.3		**Sample Saturated at (ksf)**	2.0

CONSOLIDATION CURVE

OCEANSIDE VISTA

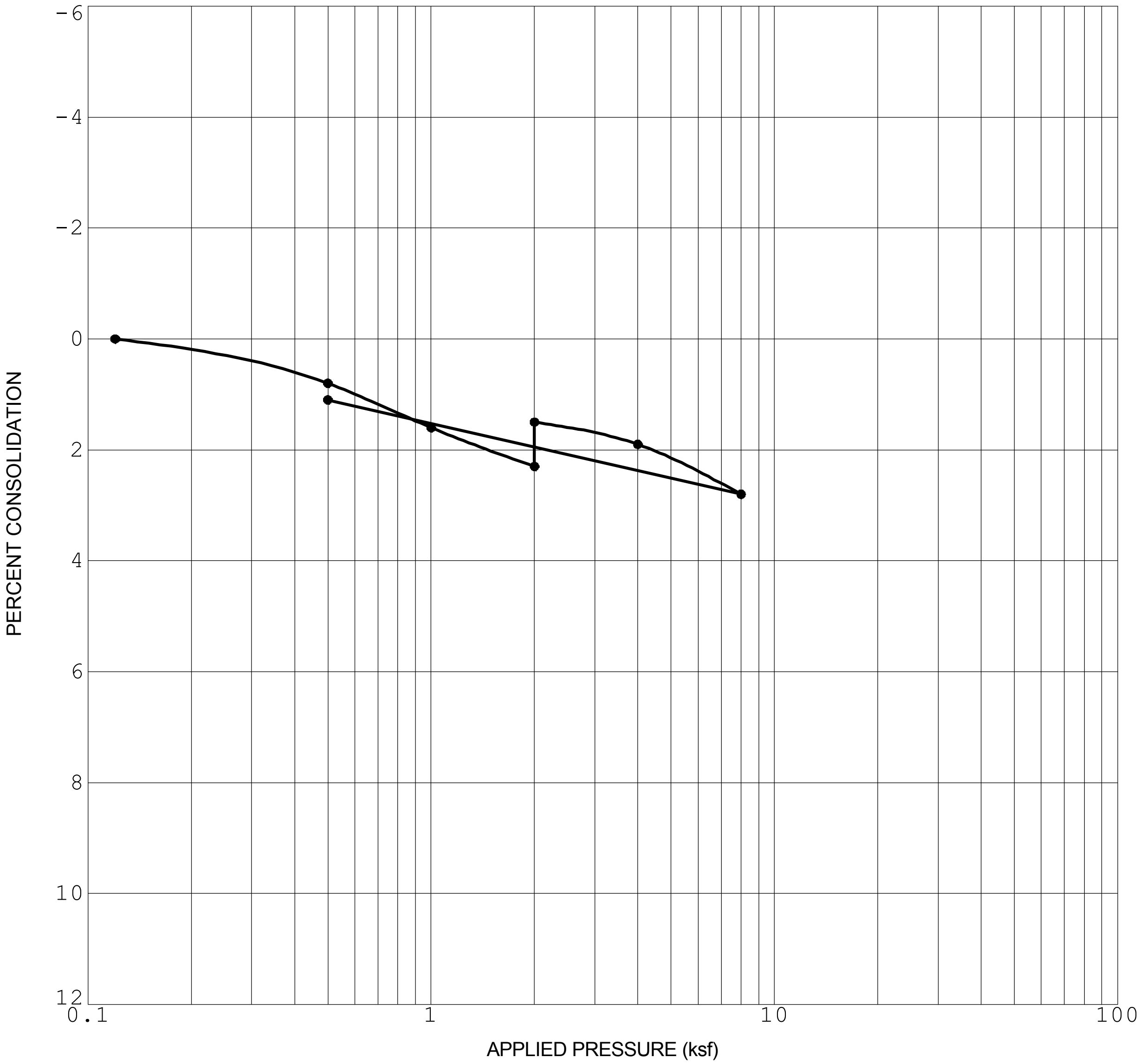
OCEANSIDE, CALIFORNIA

07227-52-02.GPJ

Figure B-7

PROJECT NO. 07227-52-02

SAMPLE NO. B7-8



Initial Dry Density (pcf)	103.6	**Initial Saturation (%)**	87.1
Initial Water Content (%)	19.7	**Sample Saturated at (ksf)**	2.0

CONSOLIDATION CURVE

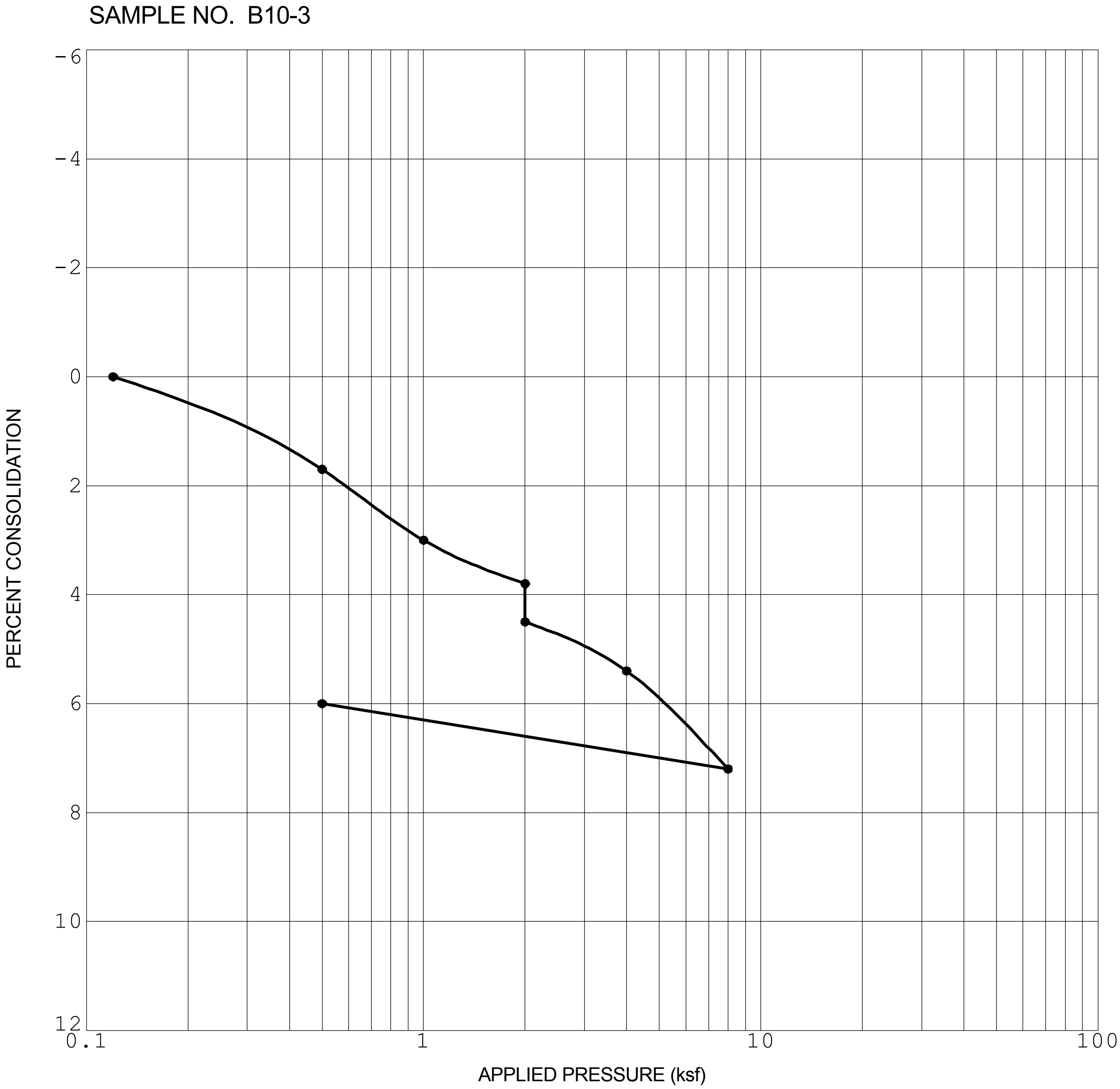
OCEANSIDE VISTA

OCEANSIDE, CALIFORNIA

07227-52-02.GPJ

Figure B-8

PROJECT NO. 07227-52-02



Initial Dry Density (pcf)	105.5
Initial Water Content (%)	19.2

Initial Saturation (%)	89.1
Sample Saturated at (ksf)	2.0

CONSOLIDATION CURVE

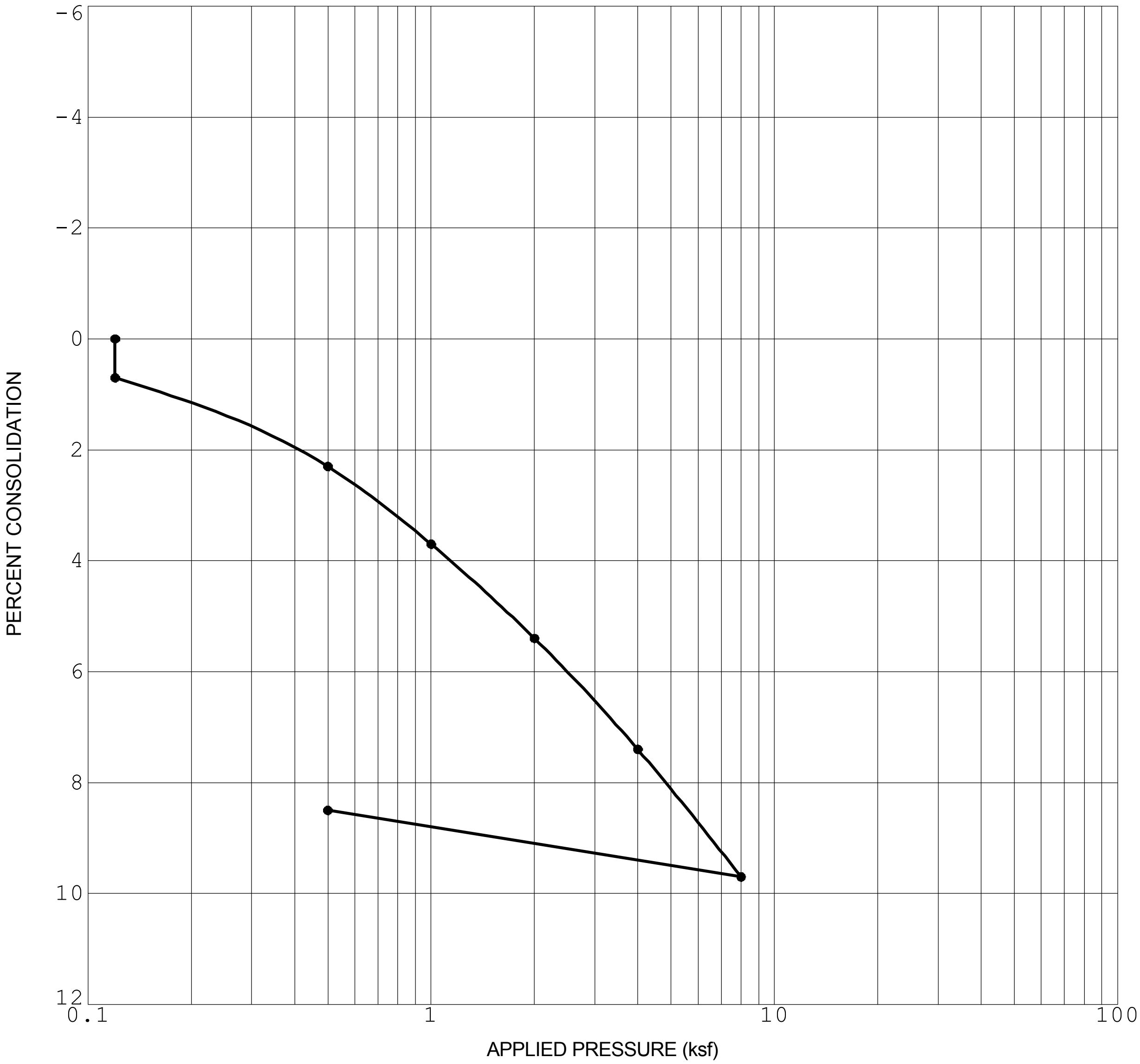
OCEANSIDE VISTA

OCEANSIDE, CALIFORNIA

07227-52-02.GPJ

Figure B-9

SAMPLE NO. B10-4



Initial Dry Density (pcf)	101.5	**Initial Saturation (%)**	92.1
Initial Water Content (%)	22.0	**Sample Saturated at (ksf)**	0.125

CONSOLIDATION CURVE

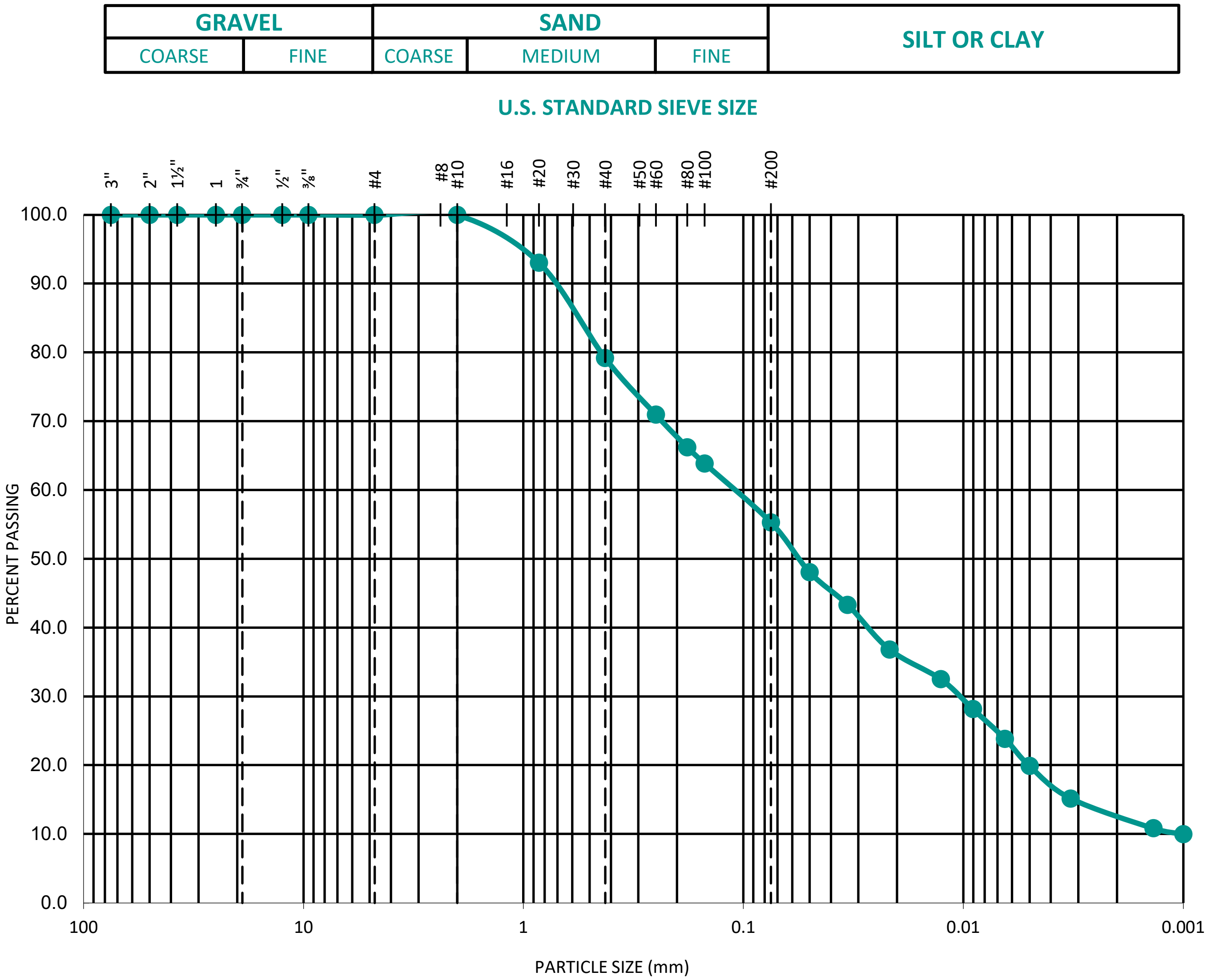
OCEANSIDE VISTA

OCEANSIDE, CALIFORNIA

SAMPLE NO.: **B11-1**

SAMPLE DEPTH (FT.): **39**

GEOLOGIC UNIT: **Qls**



TEST DATA					
D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_c	C_u	SOIL DESCRIPTION
0.00101	0.01058	0.11618	1.0	115.4	Sandy SILT

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SIEVE ANALYSES - ASTM D 135 & D 422

OLIVE PARK APARTMENTS

PROJECT NO.: G3035-52-01

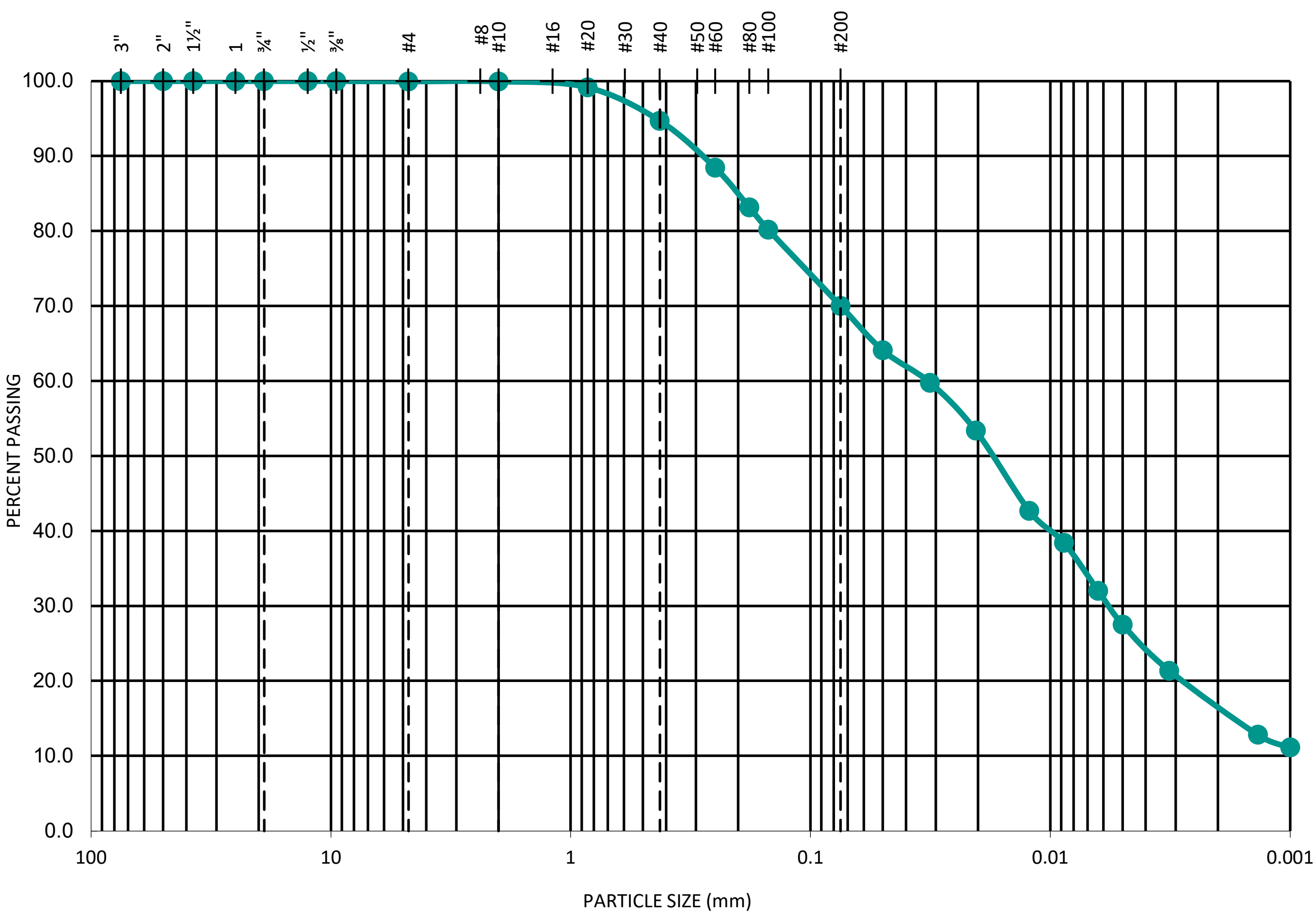
SAMPLE NO.: **B-12**

SAMPLE DEPTH (FT.): **78**

GEOLOGIC UNIT: **Qls**

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

U.S. STANDARD SIEVE SIZE



TEST DATA					
D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_c	C_u	SOIL DESCRIPTION
--	0.00573	0.03271	--	--	SILT with sand

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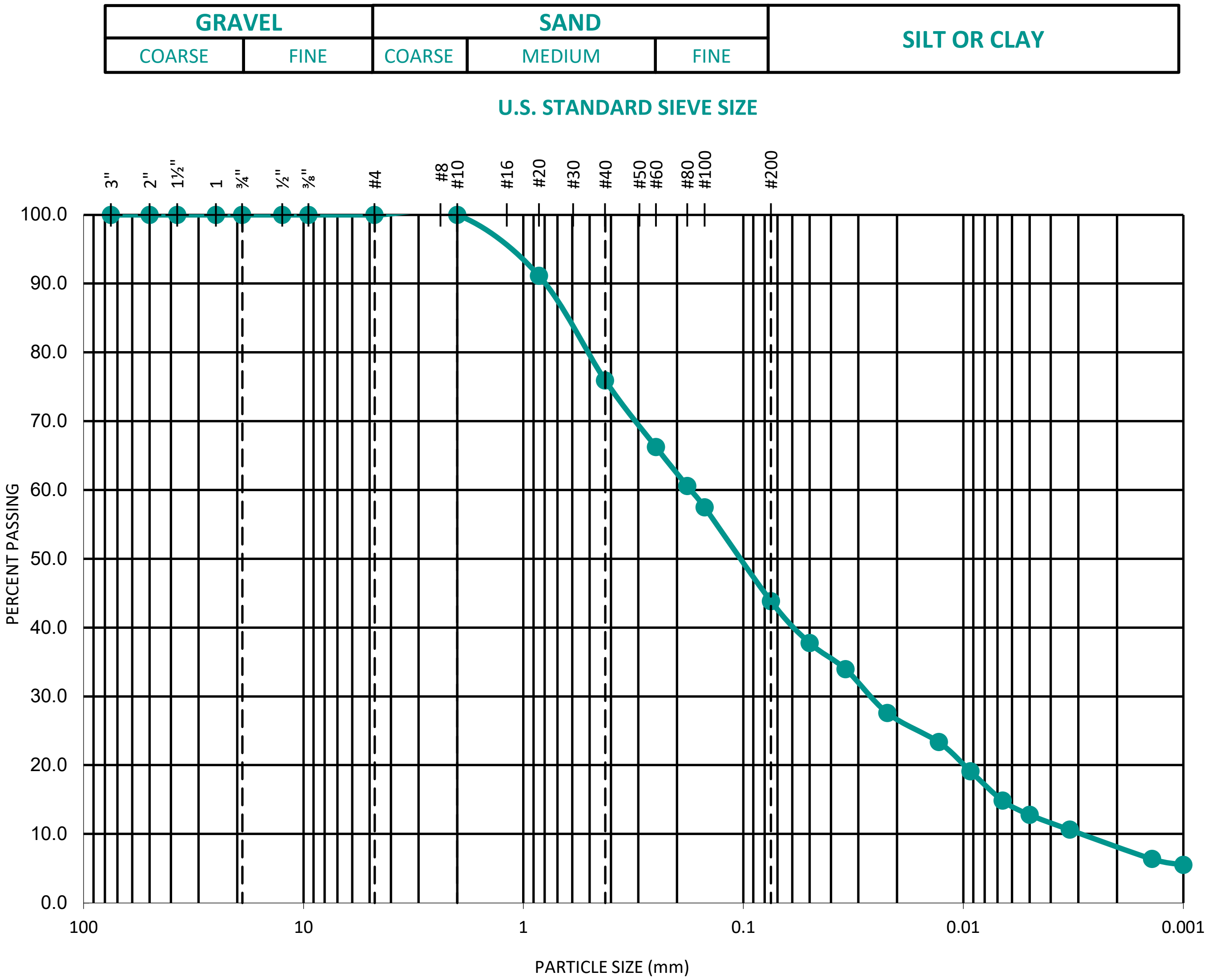
OLIVE PARK APARTMENTS

PROJECT NO.: G3035-52-01

SAMPLE NO.: B13-1

SAMPLE DEPTH (FT.): 39'

GEOLOGIC UNIT: Qls



TEST DATA					
D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_c	C_u	SOIL DESCRIPTION
0.00301	0.02675	0.17441	1.4	58.0	Silty SAND

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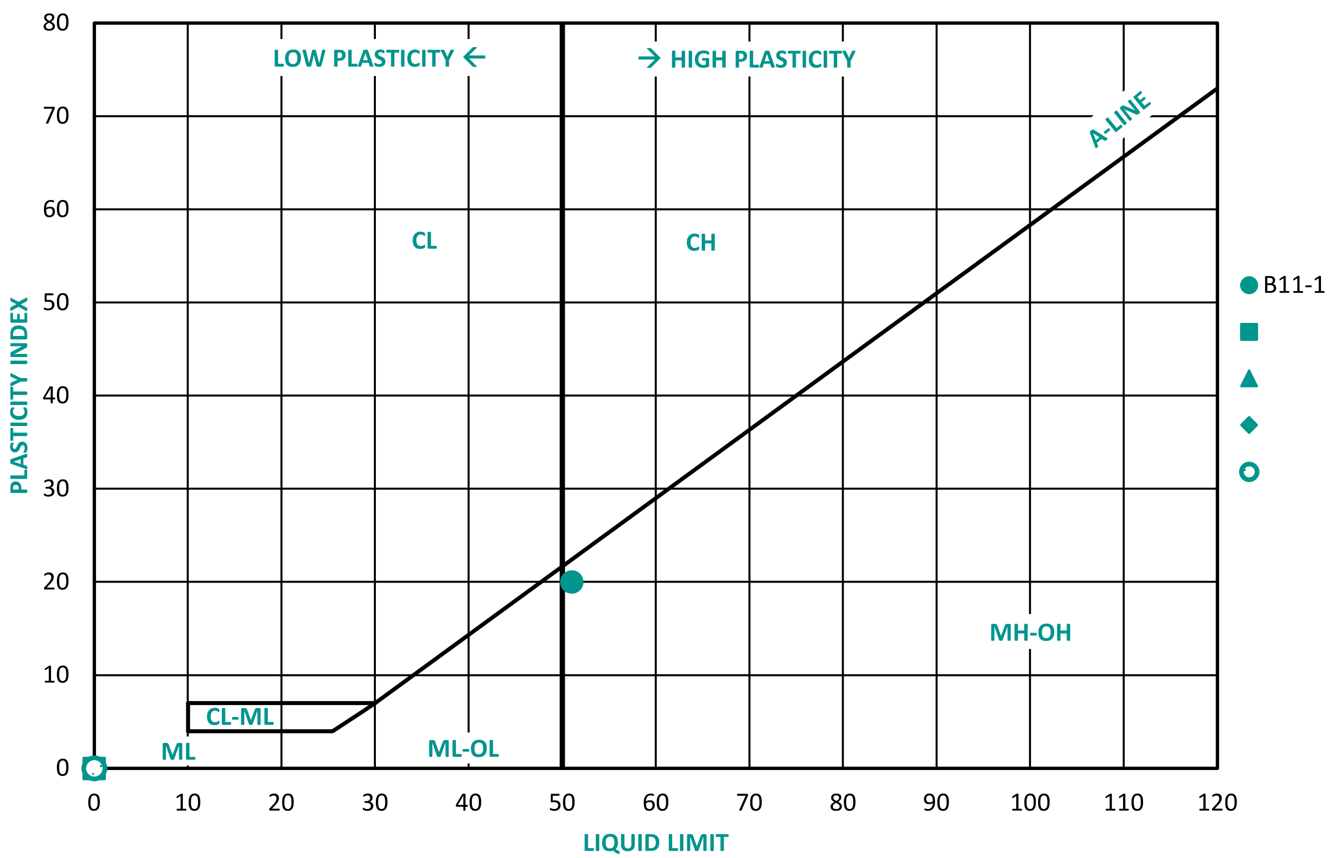
SIEVE ANALYSES - ASTM D 135 & D 422

OLIVE PARK APARTMENTS

PROJECT NO.: G3035-52-01

TEST RESULTS					
SAMPLE NO.	GEOLOGIC UNIT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SOIL TYPE
B11-1	Qls	51	31	20	MH-OH



SOIL TYPE DESCRIPTION	
CH	High-Plasticity Clay
CL	Low-Plasticity Clay
ML	Low-Plasticity Silt
CL-ML	Low-Plasticity Clay to Low-Plasticity Silt
MH-OH	High-Plasticity Silt to High-Plasticity, Organic Silt
ML-OL	Low-Plasticity Silt to Low-Plasticity, Organic Silt

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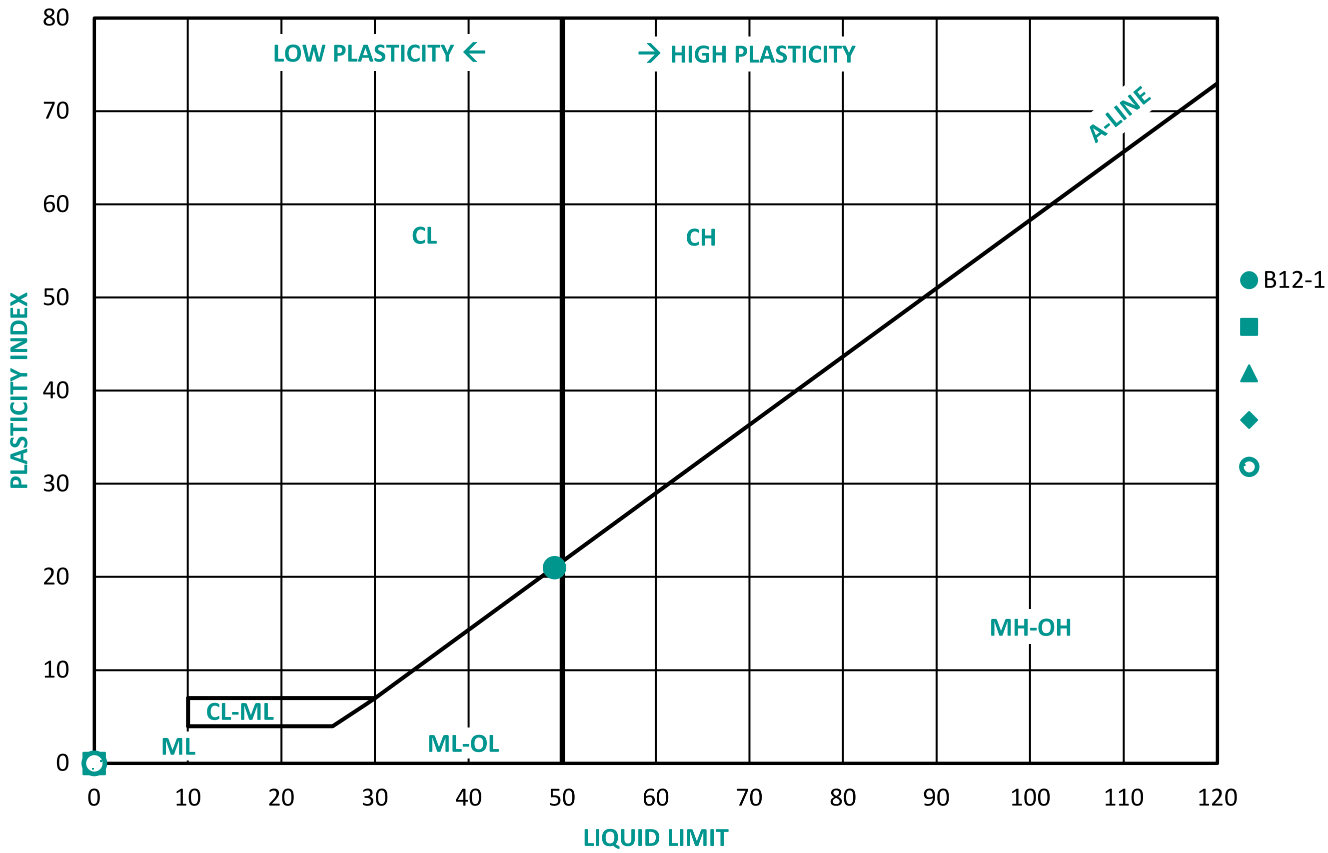
PLASTICITY INDEX - ASTM D 4318

OLIVE PARK APARTMENTS

PROJECT NO.: G3035-52-01

TEST RESULTS					
SAMPLE NO.	GEOLOGIC UNIT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SOIL TYPE
B12-1	Qls	49	28	21	ML-OL



SOIL TYPE DESCRIPTION	
CH	High-Plasticity Clay
CL	Low-Plasticity Clay
ML	Low-Plasticity Silt
CL-ML	Low-Plasticity Clay to Low-Plasticity Silt
MH-OH	High-Plasticity Silt to High-Plasticity, Organic Silt
ML-OL	Low-Plasticity Silt to Low-Plasticity, Organic Silt

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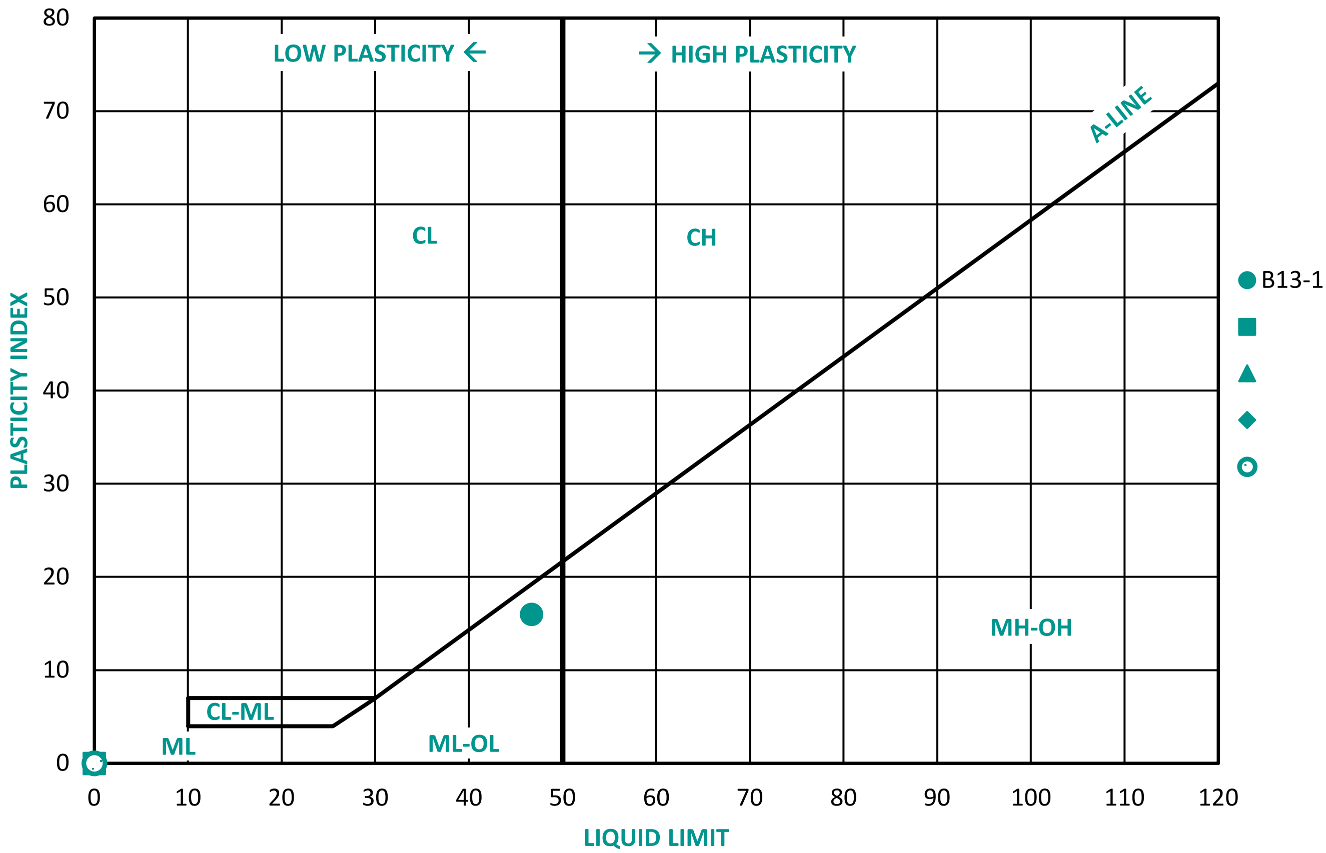
PLASTICITY INDEX - ASTM D 4318

OLIVE PARK APARTMENTS

PROJECT NO.: G3035-52-01

TEST RESULTS					
SAMPLE NO.	GEOLOGIC UNIT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SOIL TYPE
B13-1	Qls	47	31	16	ML-OL



SOIL TYPE DESCRIPTION	
CH	High-Plasticity Clay
CL	Low-Plasticity Clay
ML	Low-Plasticity Silt
CL-ML	Low-Plasticity Clay to Low-Plasticity Silt
MH-OH	High-Plasticity Silt to High-Plasticity, Organic Silt
ML-OL	Low-Plasticity Silt to Low-Plasticity, Organic Silt

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PLASTICITY INDEX - ASTM D 4318

OLIVE PARK APARTMENTS

PROJECT NO.: G3035-52-01

APPENDIX C

APPENDIX C

PREVIOUS BORING LOGS, TRENCHES AND RESULTS OF LABORATORY TESTING (GEOCON, 1985 AND GEOTEK, 2007)

FOR

OLIVE PARK APARTMENTS
OLIVE DRIVE
OCEANSIDE, CALIFORNIA

PROJECT NO. G3035-52-01

File No. D-3453-MO2
July 1, 1985

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	BORING 1 ELEVATION 292' DATE DRILLED 6/5/85 EQUIPMENT Bucket Rig	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
					MATERIAL DESCRIPTION			
0					COLLUVIUM Medium dense, humid, light brown, Clayey SAND			
2								
4					LANDSLIDE DEBRIS Dense, humid, olive Silty SAND			
6					grades into very dense, moist, olive gray, highly fractured SANDSTONE			
8								
10					Dense, humid, cohesionless, whitich gray, medium-grained SAND			
12					Medium stiff to soft, humid, olive-gray, highly fractured CLAYSTONE with numerous randomly oriented minor shear planes			
14								
16					grades into hard, fractured Sandy SILTSTONE			
18								
20								
22					Very dense, humid, whitish-gray, fractured SANDSTONE			
24								
26					becomes massive, light gray, weakly cemented, medium- to coarse-grained SANDSTONE			
28								
30								

Figure A-1, Log of Test Boring 1

Continued next page

SAMPLE SYMBOLS
- ☐ — SAMPLING UNSUCCESSFUL
- ☒ — DISTURBED OR BAG SAMPLE
- STANDARD PENETRATION TEST
- CHUNK SAMPLE
- DRIVE SAMPLE (UNDISTURBED)
- WATER TABLE OR SEEPAGE

File No. D-3453-M02
July 1, 1985

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	BORING 1 CONTINUED ELEVATION ____ DATE DRILLED ____ EQUIPMENT ____ MATERIAL DESCRIPTION	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
30								
31–35					Highly fractured, humid, olive-gray CLAYSTONE, contact sheared, dips steeply NW			
36					dense, humid, whitish-gray cohesionless SAND			
38					grades into highly fractured, dark gray, fine Silty SANDSTONE			
41					becomes light gray, medium to coarse SANDSTONE			
44					highly cemented zone			
47					grades into medium-grained to fine SANDSTONE			
51					becomes well cemented			
52					Shear zone, thickness 1", attitude N10°W/6°W			
55					PALEOSOL Hard, well cemented, humid, mottled rust btown-olive gray, Sandy SILTSTONE/SANDSTONE			
60								

Figure A-2, Log of Test Boring 1 Continued

Continued next page

SAMPLE SYMBOLS
- SAMPLING UNSUCCESSFUL
- DISTURBED OR BAG SAMPLE
- STANDARD PENETRATION TEST
- CHUNK SAMPLE
- DRIVE SAMPLE (UNDISTURBED)
- WATER TABLE OR SEEPAGE

File No. D-3453-M02
July 1, 1985

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	BORING 1 CONTINUED ELEVATION ______ DATE DRILLED ______ EQUIPMENT ______ MATERIAL DESCRIPTION	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
60								
62					Break in log			
74					DECOMPOSED GRANITICS			
76					Contact attitude N70°E/10°N, contact sheared, thickness of shear zone 1"-10", apparently discontinuous, very stiff, fractured, dark olive CLAYSTONE			
78					grades into very dense, moist, olive gray, Clayey, very coarse SANDSTONE			
80								
82					BORING TERMINATED AT 82.0 FEET			

Figure A-3, Log of Test Boring 1 Continued

SAMPLE SYMBOLS			
	☐ --- SAMPLING UNSUCCESSFUL	◧ --- STANDARD PENETRATION TEST	■ --- DRIVE SAMPLE (UNDISTURBED)
	☒ --- DISTURBED OR BAG SAMPLE	◩ --- CHUNK SAMPLE	▽ --- WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

File No. D-3453-M02
July 1, 1985

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	BORING 2 ELEVATION 259' DATE DRILLED 6/6/85 EQUIPMENT Bucket Rig	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
					MATERIAL DESCRIPTION			
0–3					TOPSOIL/COLLUVIUM Medium stiff, humid, blackish-gray, Sandy CLAY			
3–6					SANTIAGO FORMATION Very dense, humid, gray, fractured Sandy SILTSTONE grades into weakly cemented coarse SANDSTONE			
6–10					Stiff, humid, fractured, gray SILTSTONE, bedding attitude N50°W/6°SW			
10–18					grades into very dense, humid, light gray, slightly fractured, very fine SANDSTONE minor shear plane, thickness approximately 1/16", dips south 11°			
18–28					Very dense, humid, massive, whitish-gray, weakly cemented, medium-grained SANDSTONE			
28–30					Very hard, highly cemented, whitish-gray, coarse SANDSTONE			

Figure A-4, Log of Test Boring 2

Continued next page

SAMPLE SYMBOLS
- ☐ --- SAMPLING UNSUCCESSFUL
- ☒ --- DISTURBED OR BAG SAMPLE
- --- STANDARD PENETRATION TEST
- --- CHUNK SAMPLE
- --- DRIVE SAMPLE (UNDISTURBED)
- --- WATER TABLE OR SEEPAGE

File No. D-3453-M02
July 1, 1985

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	BORING 2 CONTINUED ELEVATION ________ DATE DRILLED 6/6/85 EQUIPMENT ________	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
					MATERIAL DESCRIPTION			
30					DECOMPOSED GRANITICS Very dense, humid, olive, weathered, coarse SAND in Clayey matrix, attitude of contact N60°E/30°SE, some highly cemented paleosol remnants along the contact			
32								
34								
					grades into very hard, very dense DECOMPOSED GRANITIC ROCKS			
36								
38								
40								
42								
44								
46								
					Shear zone, minor fault, attitude N-S/45°W			
48								
50								
52								
54								
56					BORING TERMINATED AT 55.0 FEET			

Figure A-5, Log of Test Boring 2 Continued

SAMPLE SYMBOLS

- ☐ --- SAMPLING UNSUCCESSFUL
- ☒ --- DISTURBED OR BAG SAMPLE
- STANDARD PENETRATION TEST
- CHUNK SAMPLE
- DRIVE SAMPLE (UNDISTURBED)
- WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

File No. D-3453-M02
July 1, 1985

BORING 3

ELEVATION 232'   DATE DRILLED 6/6/85

EQUIPMENT Bucket Rig

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
0					LANDSLIDE DEBRIS Loose to medium dense, humid, olive-light gray, highly fractured, very fine Silty SANDSTONE			
5					Dense, dry, whitish-gray, highly fractured, very weakly cemented to cohesionless, medium- to coarse-grained SANDSTONE			
10	3-1					1/ 4"	112.9	8.8
11					occasional rip-up clasts			
15					grades into dense, fractured, light gray, Silty, very fine SANDSTONE/SILTSTONE			
19.5					grades into highly fractured, humid, dark gray SILTSTONE			
20	3-2					3	104.6	18.0
26					highly fractured, very fine SANDSTONE			
30								

Figure A-6, Log of Test Boring 3

Continued next page

SAMPLE SYMBOLS
- SAMPLING UNSUCCESSFUL
- DISTURBED OR BAG SAMPLE
- STANDARD PENETRATION TEST
- CHUNK SAMPLE
- DRIVE SAMPLE (UNDISTURBED)
- WATER TABLE OR SEEPAGE

File No. D-3453-M02
July 1, 1985

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	BORING 3 CONTINUED ELEVATION ______ DATE DRILLED ______ EQUIPMENT ______	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
					MATERIAL DESCRIPTION			
30	3-3				minor shear zone, attitude approximately E-W/vertical	4	104.0	21.8
32					loose, moist, tan fine Silty SAND			
34					minor shear zone, attitude N45°W/60°NE			
36					Medium stiff to soft, moist, blackish-gray, Silty CLAY			
38					major shear zone, thickness 3"-4", attitude N60°W/4°SW			
40	3-4					20	115.1	16.1
42					SANTIAGO FORMATION Stiff, fractured, humid, light brown CLAYSTONE with shiny parting surfaces and randomly oriented minor shear planes			
44					grades into very dense, massive, humid, light gray Silty fine SANDSTONE			
46								
48					Very dense, massive, moist, whitish-gray, weakly cemented coarse SANDSTONE			
50					very hard, highly cemented SANDSTONE bed, attitude horizontal			
52					light general seepage			
54								
56					Unconformity, hard, wet, dark olive, fractured SILTSTONE, contact dips approximately 25°W			
58								
62					BORING TERMINATED AT 62.0 FEET			

Figure A-7, Log of Test Boring 3 Continued

SAMPLE SYMBOLS
- SAMPLING UNSUCCESSFUL
- DISTURBED OR BAG SAMPLE
- STANDARD PENETRATION TEST
- CHUNK SAMPLE
- DRIVE SAMPLE (UNDISTURBED)
- WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

File No. D-3453-M02
July 1, 1985

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	BORING 4 ELEVATION 282 DATE DRILLED 6/7/85 EQUIPMENT Bucket Rig	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
					MATERIAL DESCRIPTION			
0					TOPSOIL/COLLUVIUM Medium stiff to stiff, humid, blackish-brown, Silty CLAY			
6					LANDSLIDE DEBRIS Loose, humid to dry, light brown-tan, very fine Silty SAND			
10					grades into medium dense, humid, light brown-tan, cohesionless to very weakly cemented, very fine, poorly graded, Silty SAND with occasional angular sandstone fragments			
16	4-1					2	104.6	9.1
18	4-2						BULK SAMPLE	
					Break in log			
53					Basal Shear Zone, soft, sheared, dark olive, Silty CLAY, thickness 2"-4", attitude near horizontal			
57					SANTIAGO FORMATION Very stiff, fractured, dark olive CLAYSTONE with shiny parging surfaces			
60								

Figure A-8, Log of Test Boring 4

Continued next page

SAMPLE SYMBOLS
- SAMPLING UNSUCCESSFUL
- DISTURBED OR BAG SAMPLE
- STANDARD PENETRATION TEST
- CHUNK SAMPLE
- DRIVE SAMPLE (UNDISTURBED)
- WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

File No. D-3453-M02
July 1, 1985

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	BORING 4 CONTINUED ELEVATION ____ DATE DRILLED ____ EQUIPMENT ____	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
					MATERIAL DESCRIPTION			
60								
					---grades into hard, olive, Clayey massive SILTSTONE			
62								
64					--- grades into very dense, massive, humid, olive-gray, medium cemented, very fine SANDSTONE			
66								
					BORING TERMINATED AT 65.0 FEET			

Figure A-9, Log of Test Boring 4 Continued

SAMPLE SYMBOLS
- ☐ --- SAMPLING UNSUCCESSFUL
- ☒ --- DISTURBED OR BAG SAMPLE
- --- STANDARD PENETRATION TEST
- --- CHUNK SAMPLE
- --- DRIVE SAMPLE (UNDISTURBED)
- --- WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

File No. D-3453-M02
July 1, 1985

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	BORING 5 ELEVATION 320' DATE DRILLED 6/7/85 EQUIPMENT Bucket Rig	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
					MATERIAL DESCRIPTION			
0–6					TOPSOIL/COLLUVIUM Medium stiff, black, dry, Sandy CLAY grades into medium dense, moist, mottled Silty SAND			
6–26					LANDSLIDE DEBRIS Medium dense to dense, moist, mottled, light brown-tan, highly disturbed, fine Silty SAND with angular sandstone fragments soft, moist, gray, Silty CLAY/SILT Medium dense, humid, whitish-gray, cohesionless SAND with numerous soft SILTSTONE and CLAYSTONE fragments minor shear zone, thickness 1", attitude N50°W/35°SW Highly fractured, sheared, olive CLAYSTONE major shear zone, thickness 4"-6", attitude N20°W/16°W			
26–30					SANTIAGO FORMATION Highly fractured, humid, dark olive CLAYSTONE with shiny parting surfaces and randomly oriented minor shear planes			

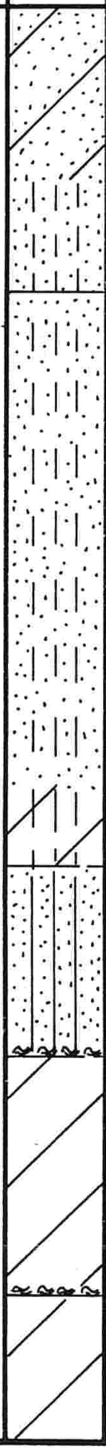


Figure A-10, Log of Test Boring 5

Continued next page

SAMPLE SYMBOLS
- SAMPLING UNSUCCESSFUL
- DISTURBED OR BAG SAMPLE
- STANDARD PENETRATION TEST
- CHUNK SAMPLE
- DRIVE SAMPLE (UNDISTURBED)
- WATER TABLE OR SEEPAGE

File No. D-3453-M02
July 1, 1985

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	BORING 5 CONTINUED ELEVATION ________ DATE DRILLED ________ EQUIPMENT ________	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
					MATERIAL DESCRIPTION			
30								
32					grades into very dense, moist, olive-gray, Sandy SILTSTONE/very fine SANDSTONE			
34								
36								
38					grades into very dense, massive, humid, whitish-gray, Silty fine SANDSTONE			
40					grades into very dense, humid, whitish-tan, weakly cemented, well graded SANDSTONE			
42								
44								
46					numerous pebbles and siltstone, rip-up clasts			
48								
50					approximately 3" thick SILTSTONE bed, attitude N10°W/2°W			
52								
54					Unconformity, attitude of contact N80°W/30°S contact highly irregular hard, humid, dark gray, Sandy SILTSTONE/ SANDSTONE			
56					Break in log			
60								
62					BORING TERMINATED AT 61.0 FEET			

Figute A-11, Log of Test Boring 5

SAMPLE SYMBOLS
- ☐ --- SAMPLING UNSUCCESSFUL
- ☒ --- DISTURBED OR BAG SAMPLE
- STANDARD PENETRATION TEST
- CHUNK SAMPLE
- DRIVE SAMPLE (UNDISTURBED)
- WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

File No. D-3453-M02
July 1, 1985

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	BORING 6	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
					ELEVATION 264' DATE DRILLED 6/7/85			
					EQUIPMENT Bucket Rig			
					MATERIAL DESCRIPTION			
0 – 5					TOPSOIL/COLLUVIUM Stiff, dry, grayish-brown, calichefied, Sandy CLAY			
5 – 11					LANDSLIDE DEBRIS Loose, dry, grayish-tan, cohesionless SAND			
11 – 13					Highly fractured, humid, dark olive, Silty CLAYSTONE, attitude N20°E/9°W			
14 – 19					SANTIAGO FORMATION Very dense, humid, massive, olive gray SANDSTONE grades into light olive gray SANDSTONE			
19 – 30					Very dense, humid, whitish gray-tan, weakly cemented, well graded SANDSTONE very coarse with numerous pebbles and rip-up clasts SILTSTONE bed			

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30

Figure A-12, Log of Test Boring 6

Continued next page

SAMPLE SYMBOLS
- ☐ --- SAMPLING UNSUCCESSFUL
- ☒ --- DISTURBED OR BAG SAMPLE
- STANDARD PENETRATION TEST
- CHUNK SAMPLE
- DRIVE SAMPLE (UNDISTURBED)
- WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

File No. D-3453-M02
July 1, 1985

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	BORING 6 CONTINUED ELEVATION ____ DATE DRILLED ____ EQUIPMENT ____	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
					MATERIAL DESCRIPTION			
30					very light seepage			
32					Unconformity, attitude of contact N65°E/6°NE, hard, highly fractured, moist, dark olive-gray CLAYSTONE with shiny paring surfaces and randomly oriented minor shear zones, contact with the overlying sandstone sheared			
34								
36								
38					grades into hard, massive, humid, gray SILTSTONE			
40								
42					BORING TERMINATED AT 42.0 FEET			

Figure A-13, Log of Test Boring 6 Continued

SAMPLE SYMBOLS

- SAMPLING UNSUCCESSFUL
- DISTURBED OR BAG SAMPLE
- STANDARD PENETRATION TEST
- CHUNK SAMPLE
- DRIVE SAMPLE (UNDISTURBED)
- WATER TABLE OR SEEPAGE

File No. D-3453-M02
July 1, 1985

BORING 7

ELEVATION 204 DATE DRILLED 6/12/85

EQUIPMENT Mobile B-50

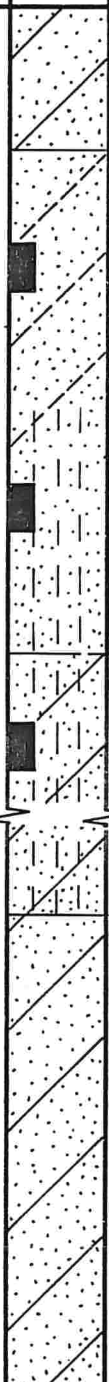
DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
0					TOPSOIL Soft, dry to humid, blackish-gray, Sandy CLAY			
4					ALLUVIUM Loose to medium dense, moist to wet, dark grayish-brown, Clayey SAND			
6	7-1					28	114.7	
8					grades into medium dense, wet, brownish-gray, Silty fine SAND			
10	7-2		▼			23	100.9	
14					Very dense, saturated, dark gray, Silty SAND with soft, blackish-gray CLAY interbeds			
16	7-3					40	112.3	
					Break in log			
26					LANDSLIDE DEBRIS? OR WEATHERED SANTIAGO FM. Medium stiff, saturated, mottled olive green-purple, Sandy CLAY/SAND			
36					BORING TERMINATED AT 35.0 FEET			

Figure A-14, Log of Test Boring 7

SAMPLE SYMBOLS
- ☐ — SAMPLING UNSUCCESSFUL
- ☒ — DISTURBED OR BAG SAMPLE
- STANDARD PENETRATION TEST
- CHUNK SAMPLE
- ■ — DRIVE SAMPLE (UNDISTURBED)
- ▼ — WATER TABLE OR SEEPAGE

File No. D-3453-M02
July 1, 1985

BORING 8

ELEVATION 185 DATE DRILLED 6/12/85

EQUIPMENT Mobile B-50

DEPTH IN FEET	SAMPLE NO.	GROUNDWATER	MATERIAL DESCRIPTION	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
0–3			ALLUVIUM Very loose, dry, whitish-gray, poorly graded fine SAND			
3–8			grades into loose, moist, mottled light gray-black SAND/CLAY			
6	8-1			19	102.0	
8–14			grades into moist to wet, olive gray, pooly graded fine Silty SAND			
10	8-2	▼		21	103.0	
14–17			grades into loose to medium dense, interbedded fine SAND and Sandy CLAY			
16	8-3			20	95.9	
			Break in log			
33–35			Soft, saturated, black Silty CLAY			
35–45			SANTIAGO FORMATION Very dense, saturated, light olive, massive, very fine Silty SANDSTONE			
46			BORING TERMINATED AT 45.0 FEET			

Figure A-15, Log of Test Boring 8

SAMPLE SYMBOLS

- ☐ --- SAMPLING UNSUCCESSFUL
- ☒ --- DISTURBED OR BAG SAMPLE
- ◧ --- STANDARD PENETRATION TEST
- ◪ --- CHUNK SAMPLE
- ■ --- DRIVE SAMPLE (UNDISTURBED)
- ▼ --- WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

File No. D-3453-M02
July 1, 1985

TABLE I

Summary of In-Place Moisture-Density and Direct Shear Test Results

Sample No.	Depth ft.	Dry Density pcf	Moisture Content %	Unit Cohesion psf	Angle of Shear Resistance Degrees
3-1	10	112.9	8.8		
3-2	20	104.6	18.0	1110	19
3-3	30	104.0	21.8		
3-4	40	115.1	16.1		
4-1	15	104.6	9.1		
*4-2	16-19	104.8	13.7	310	26

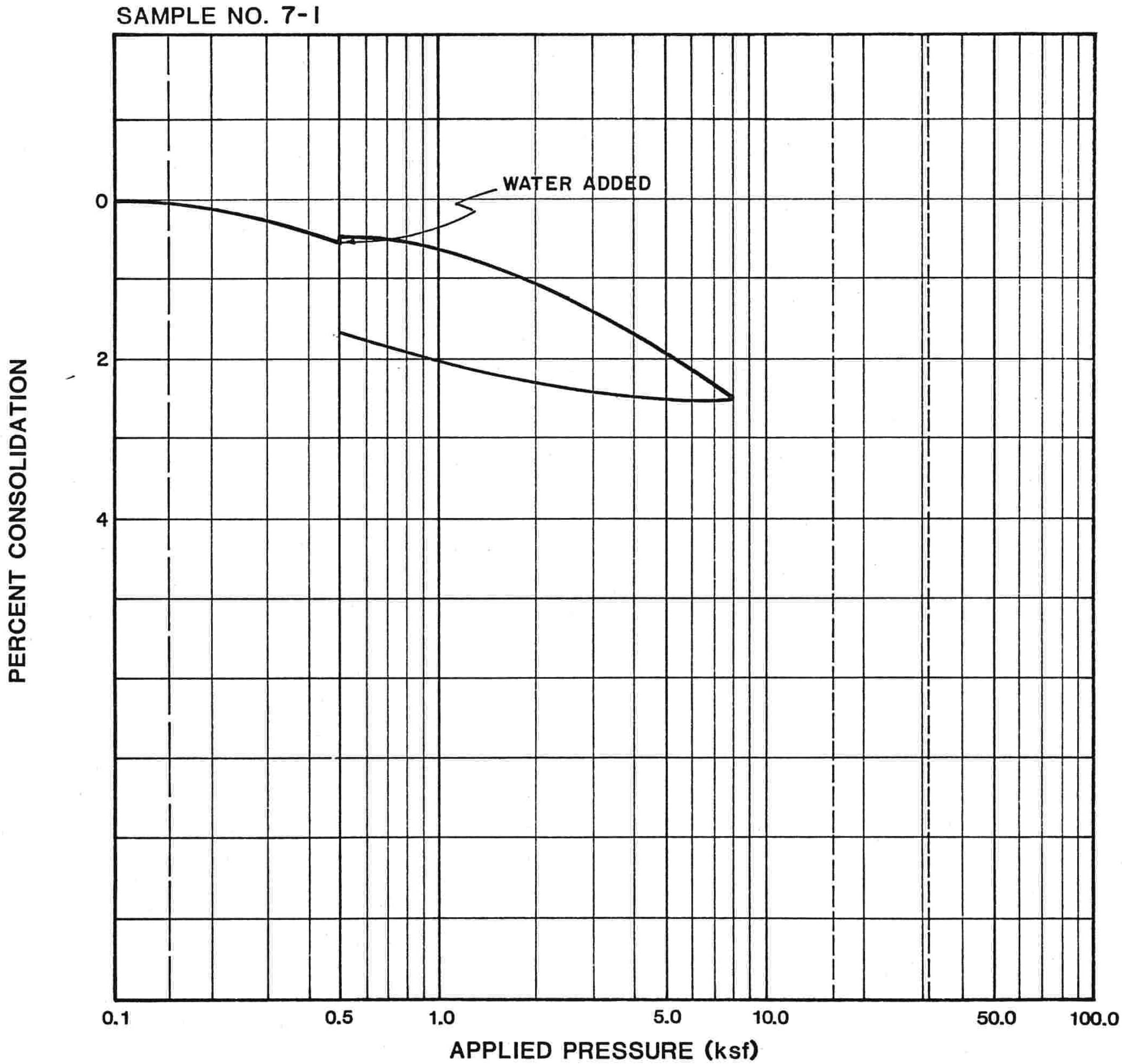
TABLE II

Summary of Laboratory Compaction Test Results

ASTM D1557-70

Sample No.	Description	Maximum Dry Density pcf	Optimum Moisture % Dry Wt.
4-2	Light brown, fine SAND	116.6	13.3

*Sample remolded to approximately 90 percent of maximum dry density at near optimum moisture content.



INITIAL DRY DENSITY	114.7 (pcf)	INITIAL SATURATION	15.9 (%)
INITIAL WATER CONTENT	13.7 (%)	SAMPLE SATURATED AT	500 (ksf)

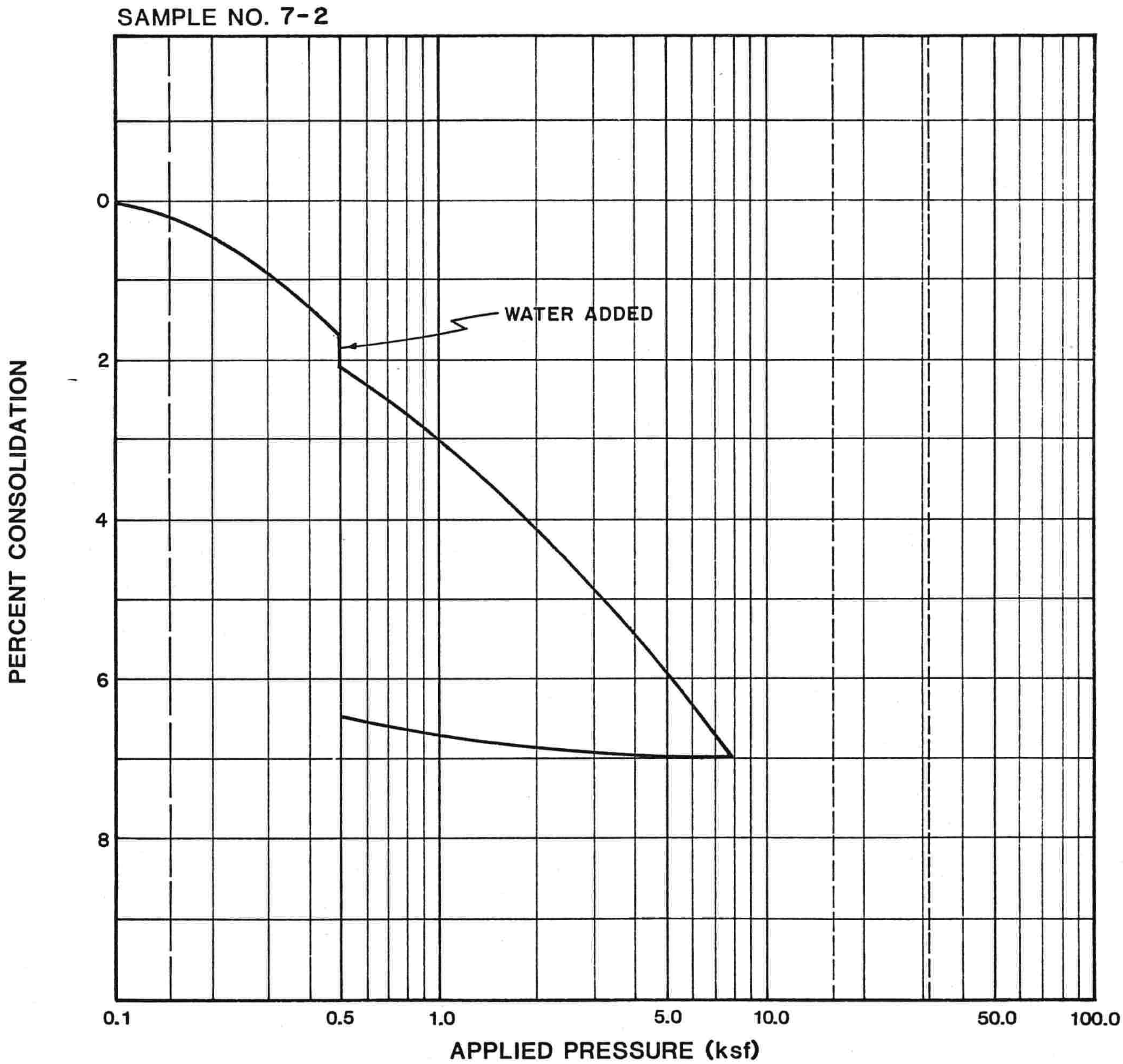
CONSOLIDATION CURVE

WESTWIND

OCEANSIDE, CALIFORNIA

Figure B-1

File No. D-3453-M02
July 1, 1985



INITIAL DRY DENSITY	100.9 (pcf)	INITIAL SATURATION	20.3 (%)
INITIAL WATER CONTENT	21.6 (%)	SAMPLE SATURATED AT	100.9 (ksf)

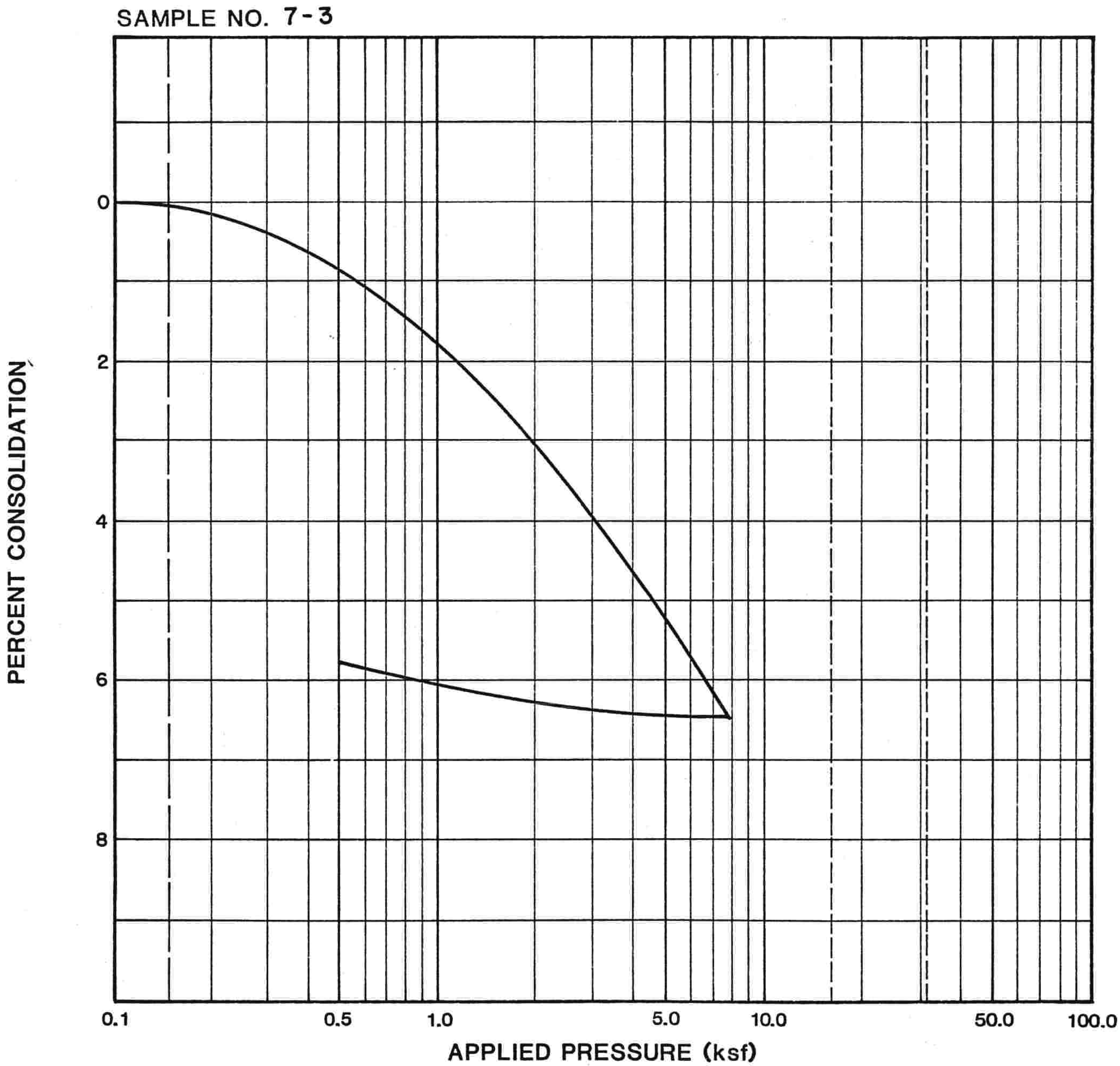
CONSOLIDATION CURVE

WESTWIND

OCEANSIDE, CALIFORNIA

Figure B-2

File No. D-3453-M02
July 1, 1985



INITIAL DRY DENSITY	112.3 (pcf)	INITIAL SATURATION	16.2 (%)
INITIAL WATER CONTENT	16.6 (%)	SAMPLE SATURATED AT	125 (ksf)

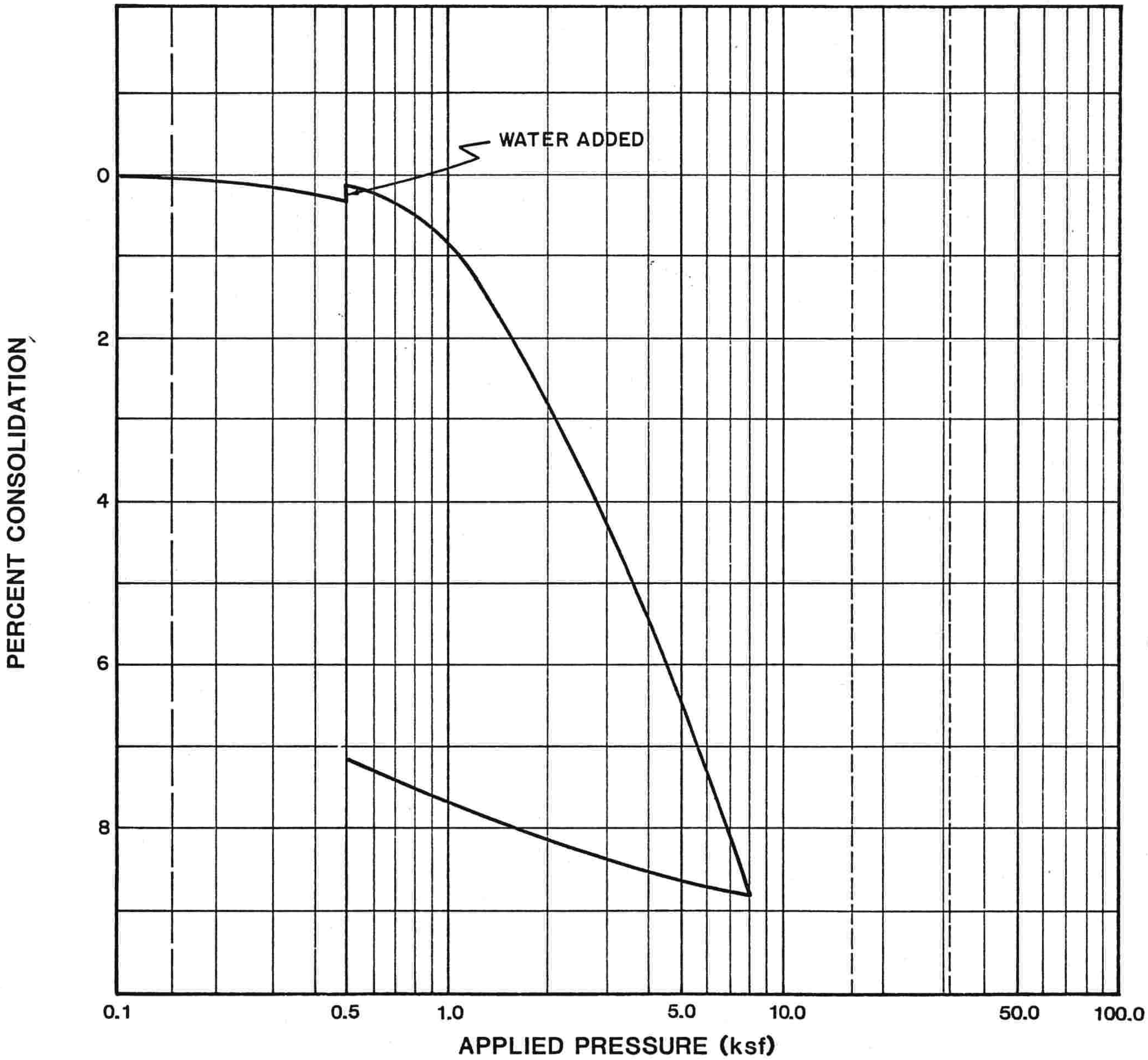
CONSOLIDATION CURVE

WESTWIND

OCEANSIDE, CALIFORNIA

Figure B-3

SAMPLE NO. 8-1



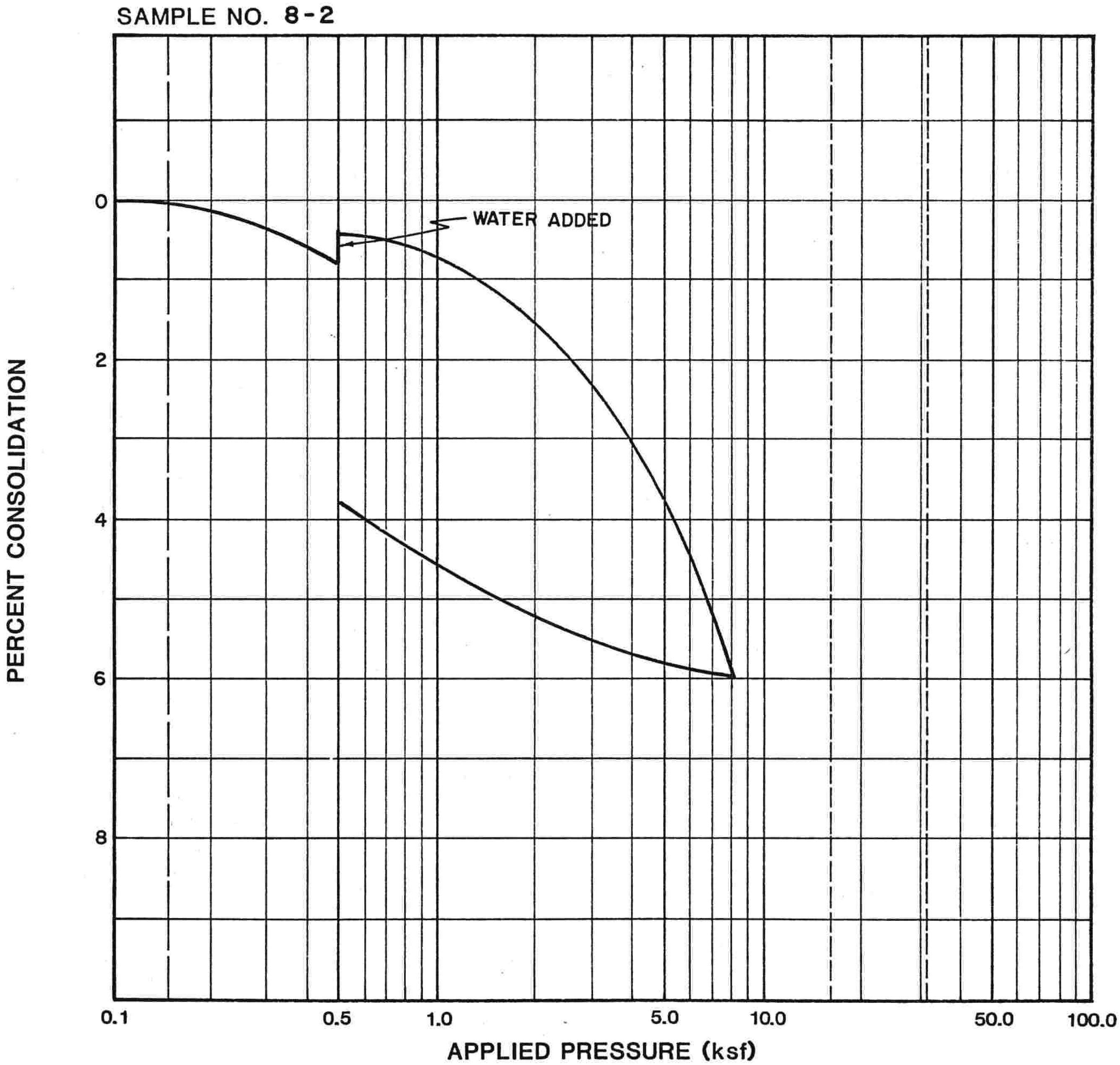
INITIAL DRY DENSITY	102 (pcf)	INITIAL SATURATION	19.4 (%)
INITIAL WATER CONTENT	8.7 (%)	SAMPLE SATURATED AT	500 (ksf)

CONSOLIDATION CURVE

WESTWIND

OCEANSIDE, CALIFORNIA

Figure B-4



INITIAL DRY DENSITY	103.0 (pcf)	INITIAL SATURATION	22.4 (%)
INITIAL WATER CONTENT	23.3 (%)	SAMPLE SATURATED AT	500 (ksf)

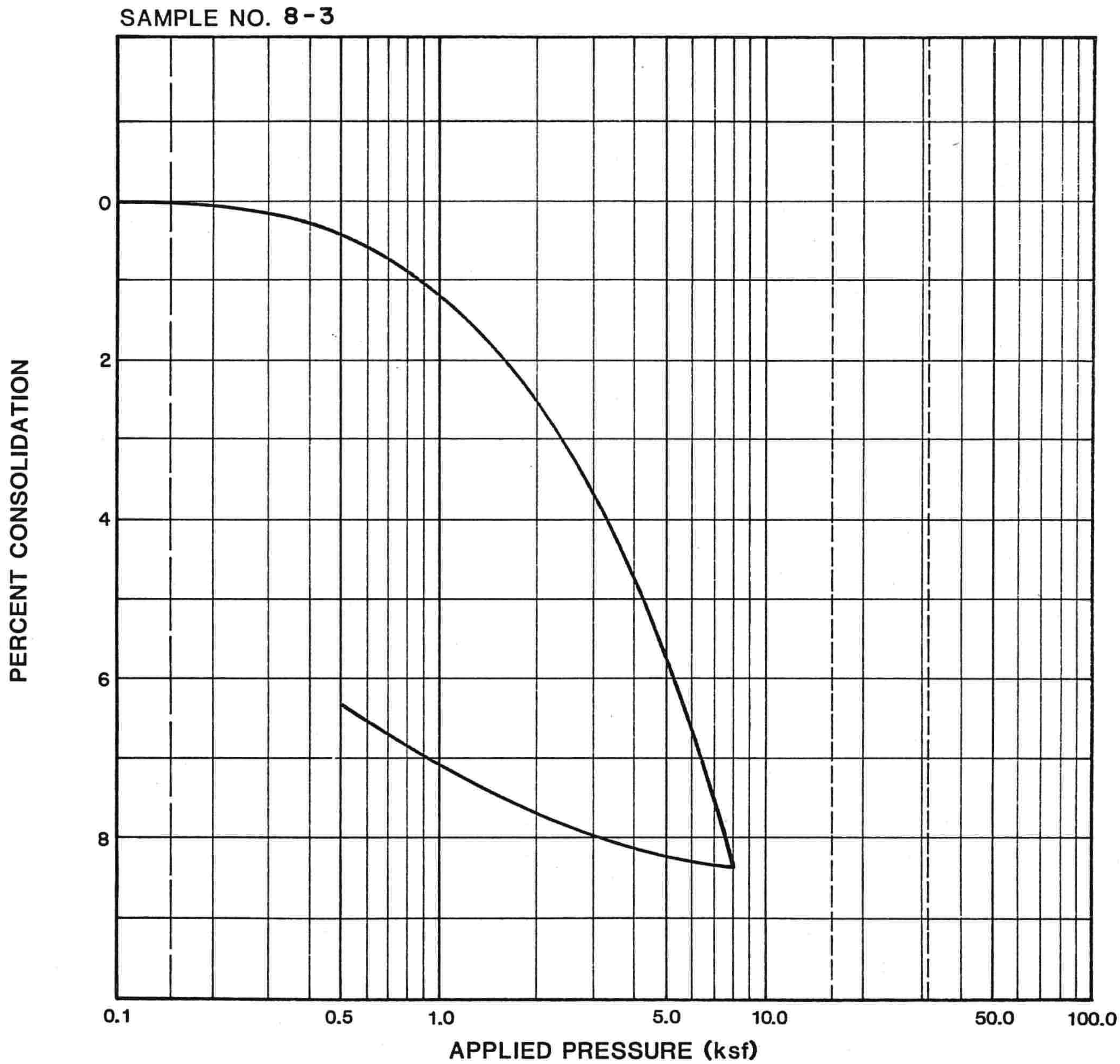
CONSOLIDATION CURVE

WESTWIND

OCEANSIDE, CALIFORNIA

Figure B-5

File No. D-3453-M02
July 1, 1985



INITIAL DRY DENSITY	95.9 (pcf)	INITIAL SATURATION	25.2 (%)
INITIAL WATER CONTENT	28.1 (%)	SAMPLE SATURATED AT	500 (ksf)

CONSOLIDATION CURVE

WESTWIND

OCEANSIDE, CALIFORNIA

Figure B-6

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Urban Structures LLC	**DRILLER:**	Larive	**LOGGED BY:**	BO/JB
PROJECT NAME:	Oceanside Vista Residential Dvlp	**DRILL METHOD:**	30" Bucket	**OPERATOR:**	Richard/Adam
PROJECT NO.:	3129SD3	**HAMMER:**	Kelly Bar	**RIG TYPE:**	Earthdrill 45L
LOCATION:	See Site Plan	**ELEVATION:**	304 feet above MSL	**DATE:**	11/28/2006

BORING NO.: *GTB-1*

Depth (ft)	SAMPLES: Sample Type	Blows/ 12 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
				SM	**Landslide Deposits** Tan to light gray, moist, loose, silty, fine to medium SAND, friable 1 inch fragments of silty claystone, iron oxide stain, rootlets.			Kelly Bar 3500 Lbs.
5	Ring	1	B1-1			10.7	96	SH
	Small Bulk		B1-2					SR, SA
10					@ 11': several sub-parallel clay lined fractures (1/2"), infilled, dipping steeply to the SE @ 40-60 degrees, continuous to contact @ 13.5 feet.			C: N50W 35NE
				CL	Light olive gray silty CLAYSTONE, moist, loose, steep undulating contact, fractured/jumbled appearance, interbeds with tan sandstone.			
15	Ring	Push	B1-3		@ 16.5': remolded olive gray clay seam (1/4"), soft, continuous around bore hole, slightly undulating, random orientated, polished surfaces and clay and Manganesse oxide staining, healed fractures	21.5	117	SH CS: N70E 11NE
					@ 19': becoming more massive, less fractured			
20					@ 21': random orientated slicks			
					@ 23': grades to well indurated massive silty claystone, some scattered orange-brown rip up casts.			
25								Kelly Bar 2400 Lbs. C: N40W 8NE
				SM	Tan to light gray, moist, very dense, silty fine to medium SAND massive			
30					**(continued)**			

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	CO = Consolidation test	MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Urban Structures LLC	**DRILLER:**	Larive	**LOGGED BY:**	BO/JB
PROJECT NAME:	Oceanside Vista Residential Dvlp	**DRILL METHOD:**	30" Bucket	**OPERATOR:**	Richard/Adam
PROJECT NO.:	3129SD3	**HAMMER:**	Kelly Bar	**RIG TYPE:**	Earthdrill 45L
LOCATION:	See Site Plan	**ELEVATION:**	304 feet above MSL	**DATE:**	11/28/2006

BORING NO.: *GTB-1*

Depth (ft)	SAMPLES: Sample Type	Blows/ 12 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
30	Ring	15/8"	B1-4	SM	**Landslide Deposits (continued)** Tan to light gray, moist, very dense, silty fine to medium SAND			
					@ 32': pockets of silty claystone within massive silty sandstone friable, massive.			
35					@ 36':increasing in grain size; becoming coarse grained sand			
40					@ 41': scattered 1" to 3" rip up casts of silty claystone			
					@ 44': sharply defined iron oxide stained 3" layer of coarse grained sandstone, undulating near horizontal attitude.			
45	Ring / Small Bulk	10	B1-5		@ 44.4 to 44.9': Basalrupture Surface: 5 inch thick zone of remolded clay, sheared and highly polished surfaces, iron oxide at base, rootlets in fractures			RS: N50W 2-4NE SH Driller utilized down crowds
				CL	**Santiago Formation** Olive gray, moist, hard silty CLAYSTONE very dense,silty fine SANDSTONE, well indurated, massive, no fractures.			
50								C: N30E 8 SE
				SM	@ 51': grades to light gray, damp, fine to medium silty SANDSTONE			
					@ 54': cemented zone in sandstone			
55					@ 55' becoming moist			Kelly 1300 Lbs.
	Small Bulk		B1-6					
60					**(contined)**			

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; CO = Consolidation test; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Urban Structures LLC	**DRILLER:**	Larive	**LOGGED BY:**	BO/JB
PROJECT NAME:	Oceanside Vista Residential Dvlp	**DRILL METHOD:**	30" Bucket	**OPERATOR:**	Richard/Adam
PROJECT NO.:	3129SD3	**HAMMER:**	Kelly Bar	**RIG TYPE:**	Earthdrill 45L
LOCATION:	See Site Plan	**ELEVATION:**	304 feet above MSL	**DATE:**	11/28/2006

BORING NO.: *GTB-1*

Depth (ft)	SAMPLES: Sample Type	Blows/ 12 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
60	Ring	25/9"	B1-7	SM	**Santiago Formation (continued)** @ 60': sharp flat contact 1" thick iron oxide layer: Tan silty SANDSTONE to pink to orange, mottled, damp, very dense, silty SANDSTONE, massive no bedding.	9.2	132	
65								
					@ 67'- 68': well cemented zone			
70								
	Ring	25/6"	B1-8					
75					@ 75'- 81': gray to orange mottled			
80	Ring	25/ 10"	B1-9					
	Ring		B1-10		@ 84': dark grayish green rip up casts w/ the appearance of weathered granitic rock.			
85				SC	Grayish green, moist, very dense, well indurated granitic detritus with 4" to 8" of cobbles of granitic rock, flat contact, very difficult drilling.			Kelly 1800 Lbs. 30" auger and down crowds
90								
					(continued)			

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits EI = Expansion Index SA = Sieve Analysis RV = R-Value Test SR = Sulfate/Resisitivity Test SH = Shear Test CO = Consolidation test MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Urban Structures LLC	DRILLER:	Larive	LOGGED BY:	BO/JB
PROJECT NAME:	Oceanside Vista Residential Dvlp	DRILL METHOD:	30" Bucket	OPERATOR:	Richard/Adam
PROJECT NO.:	3129SD3	HAMMER:	Kelly Bar	RIG TYPE:	Earthdrill 45L
LOCATION:	See Site Plan	ELEVATION:	304 feet above MSL	DATE:	11/28/2006

BORING NO.: *GTB-1*

Depth (ft)	SAMPLES: Sample Type	Blows/ 12 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
90				SC	**Santiago Formation (continued)** Greenish Gray, moist, very dense, well indurated granitic detritus with 4" to 8" granitic rock cobbles.			
95					-HOLE TERMINATED AT 95 FEET- Practical refusal at 95 feet No groundwater encountered Hole backfilled with 80 cft bentonite and cuttings			
100								
105								
110								
115								
120								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits
SR = Sulfate/Resisitivity Test
EI = Expansion Index
SH = Shear Test
SA = Sieve Analysis
CO = Consolidation test
RV = R-Value Test
MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Urban Structures LLC	**DRILLER:**	Larive	**LOGGED BY:**	BO/JB
PROJECT NAME:	Oceanside Vista Residential Dvlp	**DRILL METHOD:**	30" Bucket	**OPERATOR:**	Richard/Adam
PROJECT NO.:	3129SD3	**HAMMER:**	Kelly Bar	**RIG TYPE:**	Earthdrill 45L
LOCATION:	See Site Plan	**ELEVATION:**	259 feet above MSL	**DATE:**	

BORING NO.: *GTB-2*

Depth (ft)	SAMPLES: Sample Type	Blows/ 12 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
				SM	**Landslide Deposits** Dark Brown, damp, loose, silty fine SANDS			Kelly Bar 3500 Lbs.
	Ring	push/ 16"	B2-1					
	Small Bulk		B2-2	CL	Light greenish gray, v.moist, soft, silty CLAY mixed with tan fine to medium sands @ 3.5': clay seam 1/4 inch @ 4.7': Basalrupture surface, remolded clay seam greenish gray, highly plastic, saturated, undulatory surface			CS: N40E 16NW RS: N40E 15SE
5	Large Bulk		B2-3	CL	**Santiago Formation** Gray moist, medium dense, silty CLAYSTONE with some sand closed fractures, no apparent bedding.			SR, EI, MD, SH
10	Ring	5	B2-3			14.9	115	
				SM	@ 13.5' grades to light gray, damp,dense,silty fine to medium SANDSTONE massive			@14': down crowds
15								
20					@21': becomes red-brown, damp, v. dense, silty fine to coarse SANDSTONE: numerous redish-orange to greenish rock fragments			@21': down crowds and auger
	Large Bulk		B2-4					
25					@ 25': becomes tannish-brown well indurated granitic detritus with fragments of decomposed granitic rock.			Kelly Bar 2400 Lbs.
30					-HOLE TERMINATED AT 30 FEET- No groundwater encountered Practical refusal at 30 feet Hole backfilled with 45 cft bentonite and cuttings.			

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; CO = Consolidation test; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Urban Structures LLC	**DRILLER:**	Larive	**LOGGED BY:**	BO/JB
PROJECT NAME:	Oceanside Vista Residential Dvlp	**DRILL METHOD:**	30" Bucket	**OPERATOR:**	Richard/Adam
PROJECT NO.:	3129SD3	**HAMMER:**	Kelly Bar	**RIG TYPE:**	Earthdrill 45L
LOCATION:	See Site Plan	**ELEVATION:**	265 feet above MSL	**DATE:**	11/30/06 & 12/1/06

BORING NO.: *GTB-3*

Depth (ft)	SAMPLES: Sample Type	Blows/ 12 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
				SM	**Landslide Deposits** Tan moist, loose, silty fine SAND with small fragments of siltstone, CaCO3 stringers.			Kelly Bar 3500 Lbs.
5				CL	Olive gray silty CLAYSTONE @ 5.5': clay seam, broken and tumbled, FeOx stain on fractures some clay healing @ 6': fractures tighten @ 8': grades to fine sandy claystone			S: N20W 20 NW
10	Ring	8/10"	B3-1	SM	Light gray, moist, very dense silty fine SANDSTONE massive no discernable bedding. @ 12': becomes fine to coarse sandstone. From 12' to 14.7 feet closed near vertical fracture, FeOx staining on fracture face.	12.7	124	@ 9': down crowds
15	Ring	8/11"	B3-2			14.8	118	
20				SC	Olive gray, moist, dense, silty, clayey fine SANDSTONE massive @ 20.6': becomes silty fine to coarse sandstone			C: N40E 5SE
	Large Bulk		B3-3					
25								Kelly Bar 2400 Lbs.
	Ring	7	B3-4		@ 28.5: scattered rip up casts of claystone	14.6	118	MD, EI
30	Large Bulk		B3-5	CL	Olive green, moist, dense, silty CLAYSTONE fractured, polished surfaces, random oriented slicks. **(continued)**			C: N80E 4 NW

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; CO = Consolidation test; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Urban Structures LLC	**DRILLER:**	Larive	**LOGGED BY:**	BO/JB
PROJECT NAME:	Oceanside Vista Residential Dvlp	**DRILL METHOD:**	30" Bucket	**OPERATOR:**	Richard/Adam
PROJECT NO.:	3129SD3	**HAMMER:**	Kelly Bar	**RIG TYPE:**	Earthdrill 45L
LOCATION:	See Site Plan	**ELEVATION:**	265 feet above MSL	**DATE:**	11/30/06 & 12/1/06

BORING NO.: *GTB-3*

Depth (ft)	SAMPLES: Sample Type	Blows/ 12 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
30					**Landslide Deposits (continued)**			
				CL	@ 31'-32' polished surfaces, random oriented slicks, poorly developed shear plane, approximately 1/4" remolded clay discontinuous around bore hole.			S: N40E 13-20NW
35				SM	Light olive gray, moist, dense, fine to medium silty SANDSTONE			
40					@ 40': grades to damp, dense, coarse sandstone			
					@ 42': FeOx stain at base of coarse sandstone.			
				CL	Dark olive gray silty claystone @ 43': basalrupture surface, well developed shear zone, undulatory surface, polished @ 43.4 remolded clay layer 3/4" to 2" thick materials above and below do not appear disturbed.			RS: N5-10W 5-8 SW
45								
				ML-SC	**Santiago Formation** Dark gray, moist, very dense clayey SILTSTONE and fine silty SANDSTONE.			
50					@ 50'-51.5' sheared zone dicontinuous around hole, polished surfaces, tight discontinuous fractures; no basal plane/clay seams observed			
					@ 53': random polished surfaces; CaCO3 stringers in fractures dipping 25-30 south.			
55								@ 55': down crowds utilized Kelly 1300 Lbs.
60					-HOLE TERMINATED 60 FEET- No groundwater encountered Hole backfilled w/ 60 cft bentonite and cuttings.			

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	CO = Consolidation test	MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Urban Structures LLC	**DRILLER:**	Larive	**LOGGED BY:**	BO/JB
PROJECT NAME:	Oceanside Vista Residential Dvlp	**DRILL METHOD:**	30" Bucket	**OPERATOR:**	Richard/Adam
PROJECT NO.:	3129SD3	**HAMMER:**	Kelly Bar	**RIG TYPE:**	Earthdrill 45L
LOCATION:	See Site Plan	**ELEVATION:**	262 feet above MSL	**DATE:**	12/4/2006

BORING NO.: *GTB-4*

Depth (ft)	SAMPLES: Sample Type	Blows/ 12 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
				SM	**Landslide Deposits (graben material)** Dark brown, moist, loose, silty fine SAND; carbonate stringers and nodules.			Kelly Bar 3500 Lbs.
5	Large Bulk		B4-1		@ 5': becoming clayey silty fine sands			EI, MD, SH
	Ring	Push/ 10"	B4-2		@ 7': rootlets, porous, pockets of dark brown to black organic material	10.9	112	
10								
15								
				SM	**Landslide Deposit** Light tan, moist, loose, silty fine SAND, Steeply dipping iron oxide filled fractures			
20	Ring	1	B4-3			8.9	102	
					@ 22': fragments of heavely iron oxide stained decomposed granite.			
25					@ 25': steeply dipping (40 N) iron oxide stained fractures.			Kelly Bar 2400 Lbs.
					@ 28': fragments of greenish gray silty claystone.			
30					**(continued)**			

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits EI = Expansion Index SA = Sieve Analysis RV = R-Value Test
SR = Sulfate/Resisitivity Test SH = Shear Test CO = Consolidation test MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Urban Structures LLC	**DRILLER:**	Larive	**LOGGED BY:**	BO/JB
PROJECT NAME:	Oceanside Vista Residential Dvlp	**DRILL METHOD:**	30" Bucket	**OPERATOR:**	Richard/Adam
PROJECT NO.:	3129SD3	**HAMMER:**	Kelly Bar	**RIG TYPE:**	Earthdrill 45L
LOCATION:	See Site Plan	**ELEVATION:**	262 feet above MSL	**DATE:**	12/4/2006

BORING NO.: *GTB-4*

Depth (ft)	SAMPLES: Sample Type	Blows/ 12 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
30	Ring	2	B4-4	SM	**Landslide Deposits (continued)** Light tan, moist, loose, silty fine SAND	11.6	97	
					@ 34': claystone fragments			
35					@ 36': diagonal shears on SW wall.			
40	Ring	6	B4-5	CL	Steep undulating contact to olive gray silty claystone, iron oxide staining on fracture surfaces.	17.6	112	C: N65E 50NW
					@ 43' - 45': shear zone, polished surfaces, highly fractured, 1/4" remolded clay along near vertical fracture			F: N80E 70 NE/ N10W 5 NE
45								
50	Ring	7	B4-6		Possible basalrupture surface/slide plane at 51 feet	15.5	117	RS: N30E 20NW
				CL	**Santiago Formation (?)** Olive gray silty CLAYSTONE, very moist, dense.	▽		@ 51': Ground Water
55								Kelly 1300 Lbs.
60	Ring	12	B4-7		-same	19.3	109	
					-HOLE TERMINATED 61 FEET- Groundwater and caving encountered at 51 feet Hole backfilled w/ 93 cft of bentonite and cuttings			

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; CO = Consolidation test; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Urban Structures LLC	**DRILLER:**	Larive	**LOGGED BY:**	BO/JB
PROJECT NAME:	Oceanside Vista Residential Dvlp	**DRILL METHOD:**	30" Bucket	**OPERATOR:**	Richard/Adam
PROJECT NO.:	3129SD3	**HAMMER:**	Kelly Bar	**RIG TYPE:**	Earthdrill 45L
LOCATION:	See Site Plan	**ELEVATION:**	256 feet above MSL	**DATE:**	12/4/06 & 12/5/06

BORING NO.: *GTB-5*

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 12 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				SM	**Landslide Deposits (graben material)** Dark brown, damp to moist, loose, silty fine SAND, carbonate stringers.			Kelly Bar 3500 Lbs.
5	Large Bulk	1	B5-1	SM	**Landslide Deposits** Tan, moist, loose silty fine SAND, porous, rootlets, carbonate nodules.	8.4	106	MD
				CL	Well defined contact with olive gray silty CLAYSTONE, rip up casts of claystone in tan silty sand @ 9.5': highly fractured, open structure, carbonate stringers.			C: N5E 7NW
10								
				SM	Undulating contact, no apparent strike, iron oxide staining along contact. Light olive green, moist, medium dense, silty fine SANDSTONE with some clay.			
15								
					@ 17': jumbled claystone and sandstone, large (1 foot) rip up casts of claystone in sandstone matrix.			
20	Ring	8	B5-2		@ 21': root approx 1/2 " thick	12.2	124	
25								Kelly Bar 2400 Lbs.
				CL	Olive green, moist, medium dense, silty CLAYSTONE, fractured 4" to 6" spacing, rootlets in open fractures.			
30	Ring	7	B5-3		**(continued)**	19	114	

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits EI = Expansion Index SA = Sieve Analysis RV = R-Value Test SR = Sulfate/Resisitivity Test SH = Shear Test CO = Consolidation test MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Urban Structures LLC	**DRILLER:**	Larive	**LOGGED BY:**	BO/JB
PROJECT NAME:	Oceanside Vista Residential Dvlp	**DRILL METHOD:**	30" Bucket	**OPERATOR:**	Richard/Adam
PROJECT NO.:	3129SD3	**HAMMER:**	Kelly Bar	**RIG TYPE:**	Earthdrill 45L
LOCATION:	See Site Plan	**ELEVATION:**	256 feet above MSL	**DATE:**	12/4/06 & 12/5/06

BORING NO.: *GTB-5*

Depth (ft)	Sample Type	Blows/ 12 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Water Content (%)	Dry Density (pcf)	Others
30				CL	**Landslide Deposits (continued)** Olive green, moist, medium dense, silty claystone			
35					@ 35': shear zone polished surfaces, no apparent strike or dip.			
				SM	Light olive gray, moist, loose, silty fine SAND @ 35'-37' shear zone			
40	Ring	3	B5-4		@ 41': very coarse grained iron oxide stained zone	12	108	
				CL	Olive gray, moist, hard claystone			@ 42': down crowds
45						Water Table		12/4/2006 groundwater @ 46' overnight 12/5/2006
				SM	Light olive green silty sandstone jumbled with dark greenish gray silty claystone.			
					@ 49.5': basalrupture surface, 2 " thick remolded clay, undulatory surface,			RS: N20E 4-6 NW
50	Small Bulk	14	B5-5		free water seepage from slide plane, fracture zone above slide plane with 4" to 6" fracture fragments.			
				SM	**Santiago Formation** Massive, very dense, silty fine to coarse silty SANDSTONE, unbroken, unsheared	12.2	125	SH
55								Kelly 1300 Lbs. @ 55': down crowds
60	Ring	25/9"	B5-6		-same	10.5	128	SH
					-HOLE TERMINATED AT 61 FEET- Groundwater and caving encountered at 45 feet Hole Backfilled with 65 cft bentonite and cuttings.			

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	CO = Consolidation test	MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Urban Structures LLC	**DRILLER:**	Larive	**LOGGED BY:**	BO
PROJECT NAME:	Oceanside Vista Residential Dvlp	**DRILL METHOD:**	30" Bucket	**OPERATOR:**	Richard/Adam
PROJECT NO.:	3129SD3	**HAMMER:**	Kelly Bar	**RIG TYPE:**	Earthdrill 45L
LOCATION:	See Site Plan	**ELEVATION:**	206 feet above MSL	**DATE:**	12/5/2006

BORING NO.: *GTB-6*

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 12 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				SC	**Alluvium** Dark brown, moist, loose, clayey fine SAND			Kelly Bar 3500 Lbs.
5								
					@ 6': becoming very moist.			
10	Ring	Push	B6-1		-same	19.7	107	
						∇		@ 12': groundwater
				SM-SC	**Landslide Deposits** Dark grayish brown, very moist to wet, loose, clayey to silty fine SAND			
15								
					@ 17': light gray saturated clayey silty fine sands, iron oxide staining			
20	Ring	Push	B6-2		-same	19.1	112	
					@ 23': bore hole squeezing			
					@ 24': grayish green silty fine sands with fragments of olive green silty claystone fragments.			
25	Ring	Push	B6-3					Kelly Bar 2400 Lbs.
					-HOLE TERMINATED AT 26.5 FEET- Groundwater at 12 feet Hole backfilled with 45 cft bentonite and cuttings			
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ∇ ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	CO = Consolidation test	MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Urban Structures LLC	**DRILLER:**	Larive	**LOGGED BY:**	BO/JB
PROJECT NAME:	Oceanside Vista Residential Dvlp	**DRILL METHOD:**	30" Bucket	**OPERATOR:**	Richard/Adam
PROJECT NO.:	3129SD3	**HAMMER:**	Kelly Bar	**RIG TYPE:**	Earthdrill 45L
LOCATION:	See Site Plan	**ELEVATION:**	216 feet above MSL	**DATE:**	12/6/2006

BORING NO.: *GTB-7*

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 12 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				CL	**Landslide Deposits** Dark gray, damp, medium stiff, clayey coarse SAND, desiccated			Kelly Bar 3500 Lbs.
5	Ring	6	B7-1		@ 5': remolded clay seam (1/4"), associated with surficial landslide mapped above drill location.	5.4	128	S: N50E 22NW
				SC	**Santiago Formation** Light brown well indurated granitic detritus with 4" to 6" cobbles of rounded granite cobbles. Very difficult drilling.			@ 6': down crowds and auger
10								
15					@ 15': large rock in sidewall			
					-HOLE TERMINATED AT 18 FEET- No groundwater encountered Hole backfilled with cuttings Practical refusal at 18 feet Hole backfilled with 40 cft bentonite and cuttings			
20								
25								Kelly Bar 2400 Lbs.
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	CO = Consolidation test	MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Urban Structures LLC	**DRILLER:**	Larive	**LOGGED BY:**	BO/JB
PROJECT NAME:	Oceanside Vista Residential Dvlp	**DRILL METHOD:**	30" Bucket	**OPERATOR:**	Richard/Adam
PROJECT NO.:	3129SD3	**HAMMER:**	Kelly Bar	**RIG TYPE:**	Earthdrill 45L
LOCATION:	See Site Plan	**ELEVATION:**	216 feet above MSL	**DATE:**	12/6/2006

BORING NO.: *GTB-8*

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 12 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				CL	**Landslide Deposit** Dark gray, damp, soft, sandy CLAY, desiccated			Kelly Bar 3500 Lbs.
					@ 3': fragments of granitic rock			
5					@ 6': carbonate stringers and nodules.			
10	Ring	1	B8-1	SC	Light grayish green, moist, loose, silty fine to medium SAND with some clay; jumbled appearance with claystone fragments	9.8	117	SH
					Abrupt contact, 1.5" remolded clay shear zone,			
15	Small Bulk	Push/ 8" 1/5"	B8-2	CL	**Santiago formation** Grayish green, very moist, loose, silty CLAYSTONE	26.2	99	S: N10E 6-9NW
20					@ 20': bedding plane shear < 1/4" thick clay seam			S: N10W 25NW
					@ 21': becoming more hard			
								@ 22': down crowds utilized
					@ 24": fragments of heavily iron oxide stained granitic fragments			
25								Kelly Bar 2400 Lbs.
				SC	Light green, well indurated, granitic detritus, very dense.			
30					-HOLE TERMINATED AT 30 FEET- No groundwater encountered, Boring terminated due to practical refusal hole backfilled with 47 cft of bentonite and cuttings.			

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test
SR = Sulfate/Resisitivity Test; SH = Shear Test; CO = Consolidation test; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Urban Structures LLC	**DRILLER:**	Pacific Drilling	**LOGGED BY:**	LG
PROJECT NAME:	Oceanside Vista Residential Dvlp	**DRILL METHOD:**	6" Hollow Stem Auger	**OPERATOR:**	Toby
PROJECT NO.:	3129SD3	**HAMMER:**	140lbs/ 30in	**RIG TYPE:**	Mole Rig - Limited Access Rig
LOCATION:	See Site Plan	**ELEVATION:**	± 203.5 feet	**DATE:**	11/30/2006

BORING NO.: *GTB-9*

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
	Small Bulk		B9-1	SC	**Lanslide Deposits** Light gray-dry, loose, clayey fine SAND; rootlets			
	Ring	14 24 27	B9-2	SM	light gray, damp to moist, medium dense, silty fine SAND	9.5	122	
5	SPT	3 2 4	B9-3		@5': Light yellow, moist, loose, silty fine SAND with clay; iron oxide	11.8		
	Large Bulk		B9-4					
	Ring	16 14 20	B9-5		Yellow, moist, medium dense, silty fine to medium SAND	12.1	115	
10	SPT	5 4 5	B9-6		@10': becomes yellow, very moist, loose, silty fine to medium SAND; with clay	14		
15	SPT	7 8 9	B9-7	ML/CL	Green, wet, silty CLAY to clayey SILT	18.1		**Contact: QLS / Form** Water Table
					Santiago Formation White, moist, medium dense, silty fine SAND -difficulty drilling			
20	SPT	18 36 50/5"	B9-8		@20': becomes dense			
25	SPT	33 50/5"	B9-9		@24.5': becomes very dense			
30					-HOLE TERMINATED AT 24.5 FEET Groundwater at 17 feet Hole backfilled with bentonite Practical refusal at 25.5 feet on dense material			

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; CO = Consolidation test; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Urban Structures LLC	**DRILLER:**	Pacific Drilling	**LOGGED BY:**	LG
PROJECT NAME:	Oceanside Vista Residential Dvlp	**DRILL METHOD:**	6" Hollow Stem Auger	**OPERATOR:**	Toby
PROJECT NO.:	3129SD3	**HAMMER:**	140lbs/ 30in	**RIG TYPE:**	Mole Rig - Limited Access Rig
LOCATION:	See Site Plan	**ELEVATION:**	± 202 feet	**DATE:**	11/30/2006

BORING NO.: *GTB-10*

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
	Small Bulk		B10-1	SM	**Alluvium** Light gray, damp, loose, silty fine SAND; rootlets			
	Ring	18 16 21	B10-2		@2.5': Light brown, moist, medium dense, silty fine SAND; rootlests; chunks of white SS in rings	4.3	109	
5	SPT	10 8 6	B10-3	SM	Dark gray black, moist, medium dense, silty fine SAND ; calcium carbonate; roots	7.2		
	Ring	16 8 12	B10-4	SC	Dark gray-black, very moist, medium dense, clayey fine to medium SAND; calcium carbonate; roots; micaceous	19.6	109	
10	SPT	3 5 6	B10-5	SC	Gray-black, moist, medium dense, clayey fine SAND	19.5		Water Table
				SC/CL	Gray, wet to saturated clayey fine SAND to sandy CLAY; roots			
	Small Bulk		B10-6					
15	SPT	3 3 3	B10-7		@15': Gray, wet to saturated, loose, clayey fine SAND to sandy CLAY; roots	23.9		
20	SPT	2 2 3	B10-8		-same			
25	SPT	2 4 5	B10-9		-same			
				SM	**Santiago Formation** Light yellow, moist, medium dense, silty fine to medium SAND			
30	SPT	4 6 8	B10-10	ML/CL	Green, moist to wet, medium dense, clayey SILT to hard silty CLAY			
					-HOLE TERMINATED AT 31.5 FEET- Groundwater encountered at 10 feet Hole backfilled with bentonite			

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	CO = Consolidation test	MD = Maximum Density

APPENDIX A-2

LOGS OF EXPLORATORY BORINGS / TRENCHES

Borings B1 through B10 (Geocon Inc., previous studies)

Trenches T-1 through T-14 (Geocon Inc., previous studies)

BORING B 1

ELEV. (MSL.) 259' DATE COMPLETED 05-10-2005

EQUIPMENT 30-INCH DIAMETER BUCKET AUGER

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0–5				SC+CL	**LANDSLIDE DEBRIS** Loose and stiff, moist, grayish brown to brownish gray, Clayey and Silty SAND and Sandy CLAY; jumbled texture; thin roots and rock fragments; pockets of clay material in sandy matrix; layer of fat sheared clay at 5 feet approximately 1/2" to 1" thick (S: N59W/14NE)			
5–8	B1-1 B1-6			CL	Stiff, moist, olive gray, Silty to fine Sandy CLAY; highly fractured and sheared with internal polished surfaces and iron oxide mineralization	1/12"	99.9	24.7
8–13	B1-2			ML	**SANTIAGO FORMATION** Hard, damp, light olive gray, Sandy to Clayey SILTSTONE; moderately to strongly indurated; few joints; overall intact and undisturbed -B: N38W/8SW	6/12"	116.4	11.6
13–25.5	B1-3			SM	Dense, damp, light gray, Silty, fine- to medium-grained SANDSTONE; moderately cemented; micaceous; massive bedding; intact	8/9"	129.4	7.5
					-Very dense; drilling using down-crowds			
	B1-4					8/6"	122.2	5.7
					-Strongly cemented; some cross bedding; B:N16E/5SE			
					-Very dense and very strongly cemented along basal contact -Contact irregular to dipping approximately 18° NW			
25.5–30					**GRANITIC ROCK** Moderately hard, damp, grayish brown to light gray, GRANITIC ROCK; fine- to coarse-grained crystalline texture; moderately weathered; high-angle jointing			

Figure A-1,
Log of Boring B 1, Page 1 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 1 ELEV. (MSL.) 259' DATE COMPLETED 05-10-2005 EQUIPMENT 30-INCH DIAMETER BUCKET AUGER	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
30	B1-5	+ +				15/6"	124.0	6.4
32								
					BORING TERMINATED AT 33 FEET No groundwater encountered Backfilled with 45 cu. ft. of bentonite and soil cuttings in alternating layers			

Figure A-1,
Log of Boring B 1, Page 2 of 2

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SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING B 2

ELEV. (MSL.) 311' DATE COMPLETED 05-10-2005

EQUIPMENT 30-INCH DIAMETER BUCKET AUGER

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0–4				CL	**LANDSLIDE DEBRIS** Stiff, moist, dark brown, fine, Sandy CLAY; porous; moderate topsoil development; thin roots			
4–10	B2-1			SC	Medium dense, moist, mottled olive, reddish and grayish brown, Clayey, fine SAND; jumbled texture; thin roots; no distinguishable bedding; scattered carbonate pods; abundant fractures, generally healed with manganese and iron oxide mineralization	2/12"	115.9	14.5
10–19	B2-2			SM	Medium dense, moist, gray with mottled yellowish brown, Silty, fine to medium SAND; structureless; few coarse grains and pieces of charcoal	3/12"	115.9	11.2
	B2-3				-Loose; mixed with pods of olive clay; decomposed pods of organic material; sand becomes fine to coarse grained; jumbled mixture of disturbed sand and silt beds displaying offset along randomly oriented fractures	2/12"	112.9	14.5
19–21	B2-4 B2-15 B2-5				-Encountered layers of (weathered) sheared fat, gray-green clay; undulates with scour approximately 1/2 inch thick; undulating with general orientation of S: N29E/6NW; common slickensides; probably main slip surface (potential shear surface if undercut)	3/12"	111.5	14.3
21–25.5				CL	**SANTIAGO FORMATION** Very stiff, most, olive to greenish gray, fat CLAYSTONE; highly fractured with abundant polished and slickensided shear surfaces; manganese oxide mineralization and sheared clay between claystone fragments B: N42W/5NE			
25.5–30	B2-6			ML	Hard, moist, olive gray, Clayey, SILTSTONE; moderately indurated; some fractures; overall intact and undisturbed	7/12"	109.8	19.3
					-Marked increase in degree of induration; few fractures			

Figure A-2,
Log of Boring B 2, Page 1 of 3

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING B 2

ELEV. (MSL.) **311'** DATE COMPLETED **05-10-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B2-7					14/12"	105.5	13.9
32					Grades to dense, damp, gray to olive gray, Silty, fine-grained SANDSTONE; moderately cemented. B:N16W/6NE			
34					-Becomes white; massive at 34 feet			
	B2-8					15/9"	126.0	7.2
36								
38								
40	B2-9			SM		15/9"		
					-Few pods of olive green, subrounded claystone with sandstone matrix			
42								
44								
					-Becomes strongly cemented; common claystone pods; probably rip-up clasts			
46								
48					Abrupt contact between SANDSTONE and CLAYSTONE, C: N56W/12SW slightly undulating; sandstone is reddish brown in a layer approximately 1/2 inch thick; polished, slickensided shear surface along base of sandstone unit continuous around hole (bedding plane shear); sandstone very moist and weakly cemented within 1 foot of contact. Hard, damp, olive gray, fine-grained Sandy CLAYSTONE at 50 feet			
50	B2-10			CL		11/12"	120.5	13.9
52				ML	Grades to hard, damp, olive gray, fine-grained Sandy SILTSTONE; moderately to strongly indurated			
53					Very dense, damp, light gray to white, Silty, fine- to coarse-grained SANDSTONE; moderately to strongly cemented; massive			
54								
	B2-11					15/7"	123.9	8.7
56				SM				
58								

Figure A-2,
Log of Boring B 2, Page 2 of 3

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SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 2 ELEV. (MSL.) 311' DATE COMPLETED 05-10-2005 EQUIPMENT 30-INCH DIAMETER BUCKET AUGER MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
60–63				SM	-Abrupt contact between SANDSTONE and Clayey SILTSTONE at 63 feet; sandstone yellowish to reddish within 3 inches of contact C: N22E/7SE.			
63–66	B2-12			ML	Hard, damp, olive gray, Clayey SILTSTONE; strongly indurated	30/11"	122.7	11.2
66–68				CH	Hard, damp, dark reddish gray, fat CLAYSTONE; strongly indurated; polished internal surfaces			
68–70.5	B2-13			CL	Hard, damp, reddish gray, CLAYSTONE; highly fragmented and fractured; yellow clay film along polished surfaces; shearing generally high-angle and discontinuous. -CLAYSTONE shattered to crushed within a 9-inch thick zone; becomes soft and sheared with remolded clays and polished slickensided surfaces; layer continuous around hole; S: N14W/11SW; (bedding plane shear) abundant yellowish to reddish brown iron oxide mineralization	30/10"	132.9	8.4
70.5–80	B2-14			ML	Basal contact with very hard, damp, mottled gray and yellowish to reddish brown, Clayey SILTSTONE; strongly indurated, laminated locally; no evidence of shearing or displacement			
80					BORING TERMINATED AT 80 FEET No groundwater encountered Backfilled with 69 cu. ft. of bentonite and soil cuttings in alternating layers			

Figure A-2,
Log of Boring B 2, Page 3 of 3

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SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING B 3

ELEV. (MSL.) 300' DATE COMPLETED 05-11-2005

EQUIPMENT 30-INCH DIAMETER BUCKET AUGER

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0		CL	**LANDSLIDE DEBRIS** Soft to stiff, most, dark brown, fine Sandy CLAY; porous with thin roots; moderately well developed topsoil in upper foot; probably within graben zone of upper slide			
4			-Grades to clayey sand; common carbonate pods and stringers			
5	B3-1			1	116.8	13.4
8		SM	Loose, moist, light grayish brown, Clayey and Silty, fine to medium SAND with pods of olive clay; jumbled texture; chaotic and discontinuous bedding; displaced beds of silt and clay			
10	B3-2			1/12"	115.1	9.9
11	B3-3					
12			-Scattered pieces of organic material and carbon			
13			-Discontinuous beds of fat claystone and siltstone displaced and dipping 28° NW -Approximately 2- to 4-inch thick, partially remolded sandy clay B: N60E/50NW; scattered fragments of charcoal			
15	B3-4	SM	Loose to medium dense, light gray, Silty, fine to coarse SAND with pods of olive clay	2/12"	116.5	13.1
18			-Becomes very moist and fractured; undulating contact C: N63W/3NE -Basal contact of upper slide; some sheared clays and yellow-green mineralization 2 inch thick band around hole			
19		ML	Medium dense, moist, olive gray, fine Sandy SILTSTONE; some fracturing			
20	B3-5			3/12"	117.1	14.7
22		CL	Moderately hard, moist, olive gray, Silty CLAYSTONE; internal fracturing and shearing with polished surfaces and slickensides			
25	B3-6	ML	Very stiff, moist, olive gray, Clayey SILTSTONE; fractured	3/12"	113.9	15.4
29			-Discordant, undulating basal contact			
30		SM	Medium dense, light gray, fine SAND; red and yellow banding; some			

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Figure A-3,
Log of Boring B 3, Page 1 of 3

SAMPLE SYMBOLS ... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED) ... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR SEEPAGE

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PROJECT NO. 07227-52-02

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 3 ELEV. (MSL.) 300' DATE COMPLETED 05-11-2005 EQUIPMENT 30-INCH DIAMETER BUCKET AUGER	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
30	B3-7			SM	manganese oxide and carbonate mineralization -Medium dense to dense, moist, light gray, Silty, fine to coarse SAND; through going thin clay-filled fractures; pods of greenish clay -At 32 feet: continuous 2 to 4 inch bed of sandy siltstone B: N79E/6NW -At 33 feet: discontinuous bed of fractured gray CLAYSTONE within sandstone beds -Along contact: yellow to red mineralization; beds displaced approximately 4 inches on fracture F: N54W/32S; C: N29W/5NE; 3 inch thick layer of crushed, remolded clay with shears and slickensides S: N68W/3NE	11/12"	119.6	10.5
36	B3-8			CL	**SANTIAGO FORMATION** Hard, moist, olive green, fat CLAYSTONE, internally sheared with polished surfaces and manganese oxide mineralization	7/12"	106.3	20.3
39				ML	Dense, damp, olive gray, Clayey SILTSTONE; strongly indurated; intact			
40	B3-9			SM	Dense, damp, light olive gray, Silty, fine-grained SANDSTONE; massive and undisturbed; moderately cemented -Becomes fine- to coarse-grained	15/10"	119.0	13.0
45	B3-10				-Fine- to medium-grained, very light gray	15/16"	131.0	6.4
50	B3-11				-Light gray, silty sandstone	15/9"	129.6	6.5
52					-Becomes hard and strongly cemented; difficult drilling using down-crowds			
56					-Beds with common claystone fragments B: N10E/8SE			
58								

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Figure A-3,
Log of Boring B 3, Page 2 of 3

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING B 3

ELEV. (MSL.) 300' DATE COMPLETED 05-11-2005

EQUIPMENT 30-INCH DIAMETER BUCKET AUGER

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
60	B3-12			SM	Very dense, damp, light gray, Silty, fine- to coarse-grained SANDSTONE; pods of olive claystone; overall massive and intact; moderately cemented	30/8"	112.7	6.8
62								
64								
66					-Cross bedded; fine- to medium-grained			
68					-Pods of iron oxide mineralization			
70					-Abrupt basal contact between silty sandstone and siltstone C: N18W/8SW			
	B3-13			ML	Hard, damp, olive gray, Clayey SILTSTONE; strongly indurated	28/12"	113.9	16.2
72								
74				CL	Hard, damp, dark gray with mottled dark reddish brown, Silty CLAYSTONE; moderately to strongly indurated; local, randomly oriented, polished internal surfaces with some manganese oxide mineralization; no evidence of remolding or displacement			
76								
78				ML	Hard, damp, greenish gray, Clayey SILTSTONE; strongly indurated			
80	B3-14					28/12"	114.6	15.4

BORING TERMINATED AT 80 FEET
No groundwater encountered
Backfilled with 69 cu. ft. of bentonite and soil cuttings in alternating layers

07227-52-02.GPJ

Figure A-3,
Log of Boring B 3, Page 3 of 3

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... DISTURBED OR BAG SAMPLE
- ... STANDARD PENETRATION TEST
- ... CHUNK SAMPLE
- ... DRIVE SAMPLE (UNDISTURBED)
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING B 4

ELEV. (MSL.) 243' DATE COMPLETED 05-20-2005

EQUIPMENT 30-INCH DIAMETER BUCKET AUGER

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0–7	B4-1	CL	**LANDSLIDE DEBRIS** Stiff, damp to moist, dark grayish brown, fine to medium Sandy CLAY; pods of carbonate; porous with thin roots; graben zone backfilled with colluvial material; krotovina; some small pieces of charcoal	1/12"	115.9	9.5
			-B: N70E/22NW -Becomes jumbled mixture of sand, silt, and clay; common krotovina			
8–13	B4-2	SM	Loose, moist, light yellowish to olive brown, Silty, fine to medium SAND with pockets of clay and shattered claystone, fragments of sandstone; generally structureless -Common small charcoal fragments; iron oxide mineralization at 12 feet	2/12"	114.0	10.2
			-Thick layer of remolded and sheared clay; some slickensides; S: N51E/36NW; basal slip surface of upper recent slide			
14–15	B4-3	SP	Displaced bed of fine- to medium-grained SANDSTONE approximately 2 feet thick on south side of hole and completely sheared away on north side; microfaulting and crossbedding common within sandstone bed; undulating basal contact C: N29E/16NW	3/12"	112.0	17.1
16–19		CL-ML	Fractured to shattered beds of very stiff, olive gray, Clayey SILTSTONE and Silty CLAYSTONE			
19–20		CH	Very stiff, moist, olive gray, fat CLAYSTONE, internally sheared with polished surfaces and slickensides			
20–24	B4-4	CL-ML	Stiff, moist, olive gray, Clayey SILTSTONE and CLAYSTONE beds; internally sheared with evidence of displacement	3/12"	110.0	18.3
24–26	B4-9 B4-5	SC CH	Approximately 6 to 12 inch thick bed of white SANDSTONE displaced approximately 6 inches along approximately 2 inch thick sheared and remolded clay seam S: N59W/14NE; undulating contact with iron oxide staining at base of sandstone -Base of slide debris at 26 feet within sheared and remolded fat CLAY	2/12"	108.9	17.0
26–30		ML	**SANTIAGO FORMATION** Hard, moist, olive gray, Clayey SILTSTONE; strongly indurated; weakly jointed to relatively intact; no displacement			

Figure A-4,
Log of Boring B 4, Page 1 of 2

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SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING B 4

ELEV. (MSL.) **243'** DATE COMPLETED **05-20-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B4-6			CL+ML	Hard, damp, olive gray, Silty CLAYSTONE and Clayey SILTSTONE, mottled with reddish brown; strongly indurated; few joints; gradational contact	8/12"	119.6	14.0
34				SM	Dense, moist, light olive gray, Silty, fine-grained SANDSTONE; moderately cemented; massive -Grades to fine- to coarse-grained, very light gray sandstone at 36 feet			
40	B4-7					10/10"	123.3	10.2
41					-Slightly undulating contact; iron oxide mineralization along contact C: N44W/6SW			
42				CL+ML	Hard, moist, olive gray, Clayey SILTSTONE and Silty CLAYSTONE interbeds; strongly indurated; weakly jointed with some polishing and manganese oxide along joint surfaces			
45				SM	Very dense, damp, light gray to gray, Silty, fine-grained SANDSTONE; massive and moderately to strongly cemented			
50	B4-8					10/10"	121.7	12.2

BORING TERMINATED AT 51 FEET
No groundwater encountered
Backfilled with soil cuttings and 55 cu. ft. of bentonite in alternating layers

07227-52-02.GPJ

Figure A-4,
Log of Boring B 4, Page 2 of 2

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING B 5

ELEV. (MSL.) **287'** DATE COMPLETED **05-24-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**LANDSLIDE DEBRIS**			
				SC	Loose, moist, dark brown, Clayey, fine to medium SAND; thin roots; carbonate pods and stringers			
2								
4					Loose, moist, light brown to light olive brown, Silty, fine to medium SAND; porous; common krotovina; generally structureless; few gravel and charcoal			
	B5-1					2/12"	108.5	6.4
6								
8					-Common thin, clay-filled fractures			
10	B5-2					1/12"		
12								
14								
	B5-3					1/12"	93.4	9.1
16				SM				
18					-Relict structure in disturbed sand beds B: N86E/23SE; some sandstone and claystone fragments in matrix of silty fine sand			
20	B5-4					1/12"	97.8	8.0
22								
24								
	B5-5					1/12"	99.1	9.0
26					-Minor caving; hole belled to 48-inch diameter; increase in sandstone and claystone fragments			
28								

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Figure A-5,
Log of Boring B 5, Page 1 of 3

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING B 5

ELEV. (MSL.) 287' DATE COMPLETED 05-24-2005

EQUIPMENT 30-INCH DIAMETER BUCKET AUGER

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B5-6					3/12"	101.4	7.7
32					-Mottled yellowish brown to light gray; abundant thin fractures backfilled with carbonate and clay; highly disturbed bedding with random and discontinuous orientations; some relatively intact blocks of sandstone and claystone generally less than 6-inch diameter			
34								
36	B5-7					3/12"	99.0	9.1
38								
40	B5-8					4/12"	108.8	10.8
42				SM	-Displaced sheared and elongated beds of siltstone and claystone off set along abundant thin fractures; dip approximately 65° S; overall chaotic structure			
44								
46	B5-9					6/12"	116.1	13.6
48					-Displaced bed of sandstone B: N81W/44SW -Becomes increasingly moist; medium dense; and light gray to grayish brown			
50	B5-10				-Twisted and rotated block of light gray sandstone in matrix of yellowish brown sand; block approximately 2 foot diameter and containing stratification oriented nearly vertical	6/12"	108.9	14.0
52								
54								
56	B5-11				-Sheared and elongated bed of yellowish brown sandy silt; very moist; B: N81W/17SW; bed thinned from 6 inches to 1 inch from north to south at 55 feet	12/12"	112.1	17.7
	B5-16			CH	BASAL SLIP SURFACE; approximately 3 inch thick layer of remolded and sheared fat gray CLAY with abundant polished slickensided surfaces; very well defined; S: N11W/4NE			
58				CL				
				ML	**SANTIAGO FORMATION** Hard, moist, dark olive gray, Silty CLAYSTONE; strongly indurated; some sheared and polished internal surfaces; randomly oriented			

Figure A-5,
Log of Boring B 5, Page 2 of 3

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SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING B 5

ELEV. (MSL.) 287' DATE COMPLETED 05-24-2005

EQUIPMENT 30-INCH DIAMETER BUCKET AUGER

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
60	B5-12			ML	Hard, damp, olive gray, Clayey to Sandy SILTSTONE; strongly indurated; intact and well-bedded; no indications of shearing or offset	12/10"	113.1	16.8
62				SM	Dense, moist, light olive gray, Silty, fine-grained SANDSTONE; moderately cemented			
64	B5-13			ML	Hard, moist, olive gray, Clayey SILTSTONE; strongly indurated B: N17E/4NW	7/12"	113.9	15.7
66								
68				SM+ML	Becomes interbedded Sandy SILTSTONE and Silty SANDSTONE; moderately cemented; generally well-bedded and intact; beds 1 to 2 feet thick; few interbeds of strongly indurated claystone			
70	B5-14					15/10"	125.3	11.5
72								
74								
76								
78								
80	B5-15			CL	Hard, moist, dark olive gray, Silty CLAYSTONE; strongly indurated; no evidence of shearing	25/10"	112.7	15.5

BORING TERMINATED AT 81 FEET
No groundwater encountered
Backfilled with alternating layers of soil cuttings and 69 cu. ft. of bentonite

07227-52-02.GPJ

Figure A-5,
Log of Boring B 5, Page 3 of 3

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

BORING B 6

ELEV. (MSL.) **223'** DATE COMPLETED **05-23-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0–4				SC	**LANDSLIDE DEBRIS** Loose, moist, dark brown, Clayey, fine to medium SAND; thin roots and pods to stringers of carbonate; porous; moderate topsoil development			
4–6.5	B6-1			SM-ML	Loose, moist, grayish brown, Silty, fine SAND to Sandy SILT; abundant carbonate-filled fractures; porous; few pieces of charcoal	2/12"	115.9	9.8
6.5–9.5				SM	Loose, moist, light gray, Silty, fine to coarse SAND and SANDSTONE fragments; some elongated and sheared beds of claystone; high-angle dip			
9.5–22	B6-2			CL-ML	Displaced contact between SAND unit and SILT/CLAY units; displaced along series of stepped fractures; approximately 4 feet of vertical displacement; C: N14W/46NE; fractures high-angle to near vertical; thin bed of sheared, elongated claystone underlying contact	3/12"	106.4	5.4
					-Becomes displaced beds of olive gray sandy to clayey siltstone with abundant fractures			
	B6-3				-Siltstone fragments in a matrix of sheared and crushed clay and silt	4/12"	119.7	13.2
					-Chaotic mixture of crushed siltstone, sandstone, and claystone fragments; generally structureless at 18 feet			
	B6-4				-Beds of claystone and sandstone displaced along high-angle fractures; vertical offset approximately 2 1/2 feet B: N28E/38SE; material crushed and rubbly on downthrown blocks	2/12"	112.1	14.7
22–30			▼ (24)	SM	Becomes loose, moist, light gray to white, Silty, fine to coarse SAND; some claystone fragments; disturbed sandstone beds offset by significant fractures; groundwater at 24 feet; hole belled and caving Loose, moist to wet, olive gray, Silty, fine to medium SAND			
	B6-5					2/12"	114.9	13.4
					-Unable to proceed down-hole logging deeper than 24 feet due to groundwater table and caving			

Figure A-6,
Log of Boring B 6, Page 1 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

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BORING B 6

ELEV. (MSL.) **223'** DATE COMPLETED **05-23-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B6-6			SM		7/12"	117.9	14.8
32					BORING TERMINATED AT 32 FEET Groundwater encountered at 24 feet Backfilled with alternating layers of soil cuttings and 45 cu. ft. of bentonite			

Figure A-6,
Log of Boring B 6, Page 2 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... DISTURBED OR BAG SAMPLE
- ... STANDARD PENETRATION TEST
- ... CHUNK SAMPLE
- ... DRIVE SAMPLE (UNDISTURBED)
- ... WATER TABLE OR SEEPAGE

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PROJECT NO. 07227-52-02

BORING B 7

ELEV. (MSL.) 241' DATE COMPLETED 05-20-2005

EQUIPMENT 30-INCH DIAMETER BUCKET AUGER

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0–8				SM-ML	**LANDSLIDE DEBRIS** Loose, damp, dark brown, Clayey, fine to medium SAND; weakly developed topsoil in upper 9 inches; porous with thin roots -Loose, damp, light gray, silty, fine to medium SAND to Sandy SILT; common carbonate stringers and krotovina; some fragments of sandstone and claystone			
6	B7-1				-Common blocks of shattered claystone and sandstone in a matrix of sand and silt; few void spaces at 6 feet -Highly displaced and tilted bed of shattered claystone B: N56W/40SW; internal stratification	2/12"	109.6	13.4
8–21.5				SM	Loose, damp, light gray, Silty, fine SAND; generally structureless; common thin, high-angle fractures; scattered fragments of claystone			
10	B7-2					2/12"	102.8	9.4
12					-Tilted and displaced block of silty sandstone with beds generally dipping toward the north at relatively high angles; common fractures			
15	B7-3				-Broken block of cemented sandstone; fragments displaced approximately 2 feet -No sample recovery in layer of strongly cemented sandstone fragments at 15 feet -Elongated and highly disturbed bed of sheared claystone B: N85E/27NW at 17.5 feet -Loose, moist, light gray, fine to coarse SAND with fragments of claystone and sandstone; generally disturbed and structureless	5/12"		
20	B7-4				-Block of white sandstone displaced approximately 1.5 feet to the south along fractures at 20 feet -Undulating contact C: N83E/21SE at 21.5 feet	3/12"	103.3	3.7
21.5–27				SC+CL	Fractured and sheared beds of Silty CLAYSTONE in a matrix of sand and clay -Chaotic mixture of sheared and displaced sandstone and claystone beds; common iron oxide mineralization infilling fractures and between blocks			
25	B7-5					2/12"	111.5	16.8
27–32				ML+CL	Becomes more intact; disturbed beds of Clayey SILTSTONE and Silty CLAYSTONE			
30	B7-6				-Approximately 6 inch thick bed of loose sand and sandstone fragments; undulating and irregular contact	3/12"	107.5	19.8

Figure A-7,
Log of Boring B 7, Page 1 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR SEEPAGE

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BORING B 7

ELEV. (MSL.) **241'** DATE COMPLETED **05-20-2005**

EQUIPMENT **30-INCH DIAMETER BUCKET AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
32					Disturbed and sheared beds of Silty CLAYSTONE; polished surfaces and slickensides; manganese and iron oxide mineralization			
34								
	B7-7					3/12"	109.4	17.2
36								
38				CL				
40	B7-8				-Stiff, moist, olive gray, silty claystone beds; disturbed and sheared -Becomes wet and shattered to crushed; pods of carbonate; abundant remolded and polished surfaces; dark gray and fat	3/12"	100.9	22.9
42								
44			▼		-Water seeping from abundant fractures	6/12"	109.3	19.6
46	B7-9 B7-12			CH	Abrupt and very well defined slip surface S: N46W/4NE; slightly undulating approximately 3 inch thick seam in highly remolded, polished and slickensided fat CLAY; base of slide debris at approximately 46 feet; slip surface within beds of fat claystone			
48				SM-ML	**SANTIAGO FORMATION** Dense, damp, light olive gray, Silty, fine-grained SANDSTONE to fine-grained Sandy SILTSTONE; moderately cemented; some minor water seeping from thin fractures			
50	B7-10					10/10"	121.3	12.4
52					Dense, moist to wet, light gray, Silty, fine- to medium-grained SANDSTONE; massive; moderately cemented; relatively intact and undisturbed			
54								
56				SM	-Grades fine- to coarse-grained			
58								
60	B7-11					20/6"	119.0	9.1

BORING TERMINATED AT 60.5 FEET
Seepage encountered at 44 feet
Backfilled with alternating layers of soil cuttings and 60 cu. ft. of bentonite

07227-52-02.GPJ

Figure A-7,
Log of Boring B 7, Page 2 of 2

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... DISTURBED OR BAG SAMPLE
- ... STANDARD PENETRATION TEST
- ... CHUNK SAMPLE
- ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

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PROJECT NO. 07227-52-02

BORING B 8

ELEV. (MSL.) 234' DATE COMPLETED 05-24-2005

EQUIPMENT 30-INCH DIAMETER BUCKET AUGER

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B8-1				**LANDSLIDE DEBRIS** Loose, moist, dark brown, Clayey, fine to medium SAND; porous with thin roots			
6				SC	-Abundant carbonate pods and stringers; medium dense; probably colluvium-infilled graben zone of slide			
10					-Common roots; loose and porous			
12					Loose, moist, light grayish brown, Silty, fine to medium SAND; mottled with dark gray; common krotovina; porous			
16					-Scattered fragments of sandstone and claystone; few pieces of charcoal			
20				SM+CL				
24					-Jumbled texture; thin clay-filled fractured; scattered blocks of sandstone and claystone generally less than 6-inch diameter, continued pieces of charcoal; yellowish brown to light olive gray			

07227-52-02.GPJ

Figure A-8,
Log of Boring B 8, Page 1 of 2

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... DISTURBED OR BAG SAMPLE
- ... STANDARD PENETRATION TEST
- ... CHUNK SAMPLE
- ... DRIVE SAMPLE (UNDISTURBED)
- ... WATER TABLE OR SEEPAGE

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PROJECT NO. 07227-52-02

BORING B 8

ELEV. (MSL.) 234' DATE COMPLETED 05-24-2005

EQUIPMENT 30-INCH DIAMETER BUCKET AUGER

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30 – 39				SM	-Displaced sandstone beds; highly fractured to shattered; elongated layer of carbon-rich material along bedding surface B: N4E/53NW -Becomes light gray			
39 – 49			▼ (45)	SM+SC	Becomes jumbled mixture of Sandstone and Claystone fragments in a matrix of Silty SAND; carbonate pods; pieces of charcoal; few shattered sandstone blocks; structureless; wet -Hole completely caved to 44 feet; abundant seepage; unable to continue down-hole logging			
49 – 54				CL+SM	Mixture of olive gray clay and Claystone fragments in a matrix of SAND and SANDSTONE fragments; sheared and remolded clay seams			

BORING TERMINATED AT 54 FEET
Seepage encountered at 45 feet
Caving 44 to 54 feet
Backfilled with 54 cu. ft. of bentonite and soil cuttings in alternating layers

Figure A-8,
Log of Boring B 8, Page 2 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

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BORING B 9

ELEV. (MSL.) **202'** DATE COMPLETED **05-25-2205**

EQUIPMENT **CME 75 WITH 8" HOLLOW STEM AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**ALLUVIUM** Very stiff, moist, dark brown, fine, Sandy CLAY; porous with thin roots and scattered pieces of organic material; interlayers of medium dense, moist, gray, clayey, fine sand			
4	B9-2							
5	B9-1			CL+SC		19	102.5	22.3
9				SC	Medium dense, moist, brownish gray, Clayey, fine to medium SAND; porous, scattered pockets of clay			
10	B9-3					10		
13			▼		-Encountered groundwater table at 13 feet			
13				SM	**LANDSLIDE DEBRIS** Loose, saturated, olive gray, Silty, fine to coarse SAND; jumbled texture			
15	B9-4					11	106.5	19.6
20	B9-5					7		
24				SM	**SANTIAGO FORMATION** Dense, wet, light gray, Silty, fine- to coarse-grained SANDSTONE; weakly cemented			
25	B9-6					30		
30	B9-7			ML	Hard, moist, light gray to olive gray, fine-grained Sandy to Clayey SILTSTONE; scattered iron oxide staining	59	98.9	23.4

Figure A-9,
Log of Boring B 9, Page 1 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

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DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 9 ELEV. (MSL.) 202' DATE COMPLETED 05-25-2205 EQUIPMENT CME 75 WITH 8" HOLLOW STEM AUGER MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
32								
34 – 38	B9-8			SM+SC	Medium dense to dense, wet, light olive gray, Clayey and Silty, fine to coarse SAND	43	107.6	20.6
38 – 44	B9-9			ML	Hard, moist, olive to olive gray, fine-grained Sandy SILTSTONE; weakly indurated	31		
44 – 52	B9-10			CL-SC	Dense to hard, moist, olive to greenish gray, fine-grained Sandy CLAYSTONE to Clayey SANDSTONE; weakly indurated and cemented	42	100.5	23.9
	B9-11					28		
52 – 56	B9-12			ML	Hard, moist, olive gray, Clayey SILTSTONE; strongly indurated	50/5"	111.3	16.6
56 – 58.5	B9-13				**GRANITIC ROCK** Hard, moist, gray, GRANITIC ROCK; moderately weathered; fine- to coarse-grained crystalline texture -No recovery at 58 feet -Refusal at 58.5 feet	50/1"		

BORING TERMINATED AT 58.5 FEET
Groundwater encountered at 13 feet
Backfilled with 20.5 cu. ft. of bentonite slurry

Figure A-9,
Log of Boring B 9, Page 2 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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PROJECT NO. 07227-52-02

BORING B 10

ELEV. (MSL.) 198' DATE COMPLETED 05-25-2205

EQUIPMENT CME 75 WITH 8" HOLLOW STEM AUGER

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B10-1			SM+SC	**ALLUVIUM** Loose, moist, dark brown, Clayey and Silty, fine to medium SAND; porous with thin roots			
2								
4								
	B10-2					10	100.6	21.9
6					-Wet			
8				SC	Medium dense, moist, dark brown to mottled grayish brown, Clayey, fine to medium SAND; some carbonate pods; porous			
10	B10-3					18	104.0	20.3
12								
14			▼		-Encountered groundwater at 15 feet			
	B10-4			SM	**LANDSLIDE DEBRIS** Loose to medium dense, wet, olive gray, Silty, fine to medium SAND; pods of carbonate	15	104.5	21.9
16								
18					-Loose to medium dense, saturated, fine- to coarse-grained			
20	B10-5					32		
22				SM	Dense, moist, light gray, Silty, fine- to medium-grained SANDSTONE; carbonate-filled fractures			
24				SM-ML	**SANTIAGO FORMATION** Dense, moist, light olive gray, Silty, fine-grained SANDSTONE to fine-grained Sandy SILTSTONE; moderately cemented			
	B10-6					74/11"	114.2	15.3
26								
28								

Figure A-10,
Log of Boring B 10, Page 1 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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BORING B 10

ELEV. (MSL.) **198'** DATE COMPLETED **05-25-2205**

EQUIPMENT **CME 75 WITH 8" HOLLOW STEM AUGER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B10-7				Dense, moist, light gray, Silty, fine- to coarse-grained SANDSTONE; weakly cemented; slightly micaceous	74		
32								
34								
	B10-8			SM	-Moderately cemented	50/6"	117.4	13.4
36								
38								
40	B10-9					50/5"	111.5	15.4
42					Hard, moist, olive gray, Clayey to fine-grained Sandy SILTSTONE; strongly indurated; some iron oxide mineralization			
	B10-10			ML		80/10"		
44					-Refusal to penetration at 43.5 feet			

BORING TERMINATED AT 44 FEET
Groundwater encountered at 15 feet
Backfilled with 15 cu. ft. of bentonite slurry

Figure A-10,
Log of Boring B 10, Page 2 of 2

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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PROJECT NO. 07227-52-02

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 1 ELEV. (MSL.) 300' DATE COMPLETED 05-09-2005 EQUIPMENT JD 450 TRACK-MOUNTED BACKHOE MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 2				CL	**LANDSLIDE DEBRIS** Soft, moist, dark brown to grayish brown, fine Sandy CLAY; moderate topsoil development; common thin roots			
4 6				CH	Stiff, moist, brownish to olive gray, fine Sandy fat CLAY; abundant slickensided sheared surfaces; carbonate mineralization; scattered roots; overall jumbled texture; fractured claystone blocks S: N5W/17SW			
8 10				SM+SC	**SANTIAGO FORMATION** Dense, moist, light olive gray, fine- to medium-grained Silty to locally Clayey SANDSTONE; moderately cemented; weakly jointed; generally massive and undisturbed			
					TRENCH TERMINATED AT 11 FEET No groundwater encountered			

Figure A-11,
Log of Trench T 1, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... DISTURBED OR BAG SAMPLE
... STANDARD PENETRATION TEST
... CHUNK SAMPLE
... DRIVE SAMPLE (UNDISTURBED)
... WATER TABLE OR SEEPAGE

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DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**TRENCH T 2** ELEV. (MSL.) **195'** DATE COMPLETED **05-09-2005** EQUIPMENT **JD 450 TRACK-MOUNTED BACKHOE**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0 – 3				CL	**LANDSLIDE DEBRIS** Soft, moist, brown to grayish brown, fine Sandy CLAY; moderate topsoil development; abundant thin roots			
3 – 9				CH+SC	Medium dense and stiff, moist, light gray to olive gray, fat CLAY and Clayey to Silty SAND; jumbled texture; chaotic structure; some fragments of sandstone and claystone; clayey areas sheared and slickensided; back-rotated beds generally dipping at low to moderate angles into hillside			
					TRENCH TERMINATED AT 9 FEET No groundwater encountered			

Figure A-12,
Log of Trench T 2, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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PROJECT NO. 07227-52-02

TRENCH T 3

ELEV. (MSL.) **204'** DATE COMPLETED **05-09-2005**

EQUIPMENT **JD 450 TRACK-MOUNTED BACKHOE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 3				CL	**LANDSLIDE DEBRIS** Soft, moist, dark brown, fine Sandy CLAY; abundant roots and porosity			
3 – 12			▼ (10)	SM+SC	Loose, moist to wet, yellowish brown to light olive gray, Silty to Clayey SAND; highly disturbed, chaotic texture, some fragments of sandstone; few roots -Very loose and saturated; walls of trench highly prone to caving; abundant seepage			
12					TRENCH TERMINATED AT 12 FEET Seepage at 10 feet			

Figure A-13,
Log of Trench T 3, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL
◧ ... STANDARD PENETRATION TEST
■ ... DRIVE SAMPLE (UNDISTURBED)
⊠ ... DISTURBED OR BAG SAMPLE
◪ ... CHUNK SAMPLE
▼ ... WATER TABLE OR SEEPAGE

TRENCH T 4

ELEV. (MSL.) **207'** DATE COMPLETED **05-09-2005**

EQUIPMENT **JD 450 TRACK-MOUNTED BACKHOE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 5				SC	**ALLUVIUM** Loose, moist, dark brown, Clayey, fine SAND; porous; common roots			
5 – 14			▼ (9 ft)	SM+SC	**LANDSLIDE DEBRIS** Loose, wet, olive gray to grayish brown, Clayey to Silty, fine SAND and Sandy CLAY; porous; jumbled texture and chaotic structure -Saturated; abundant seepage; caving of trench walls			

TRENCH TERMINATED AT 14 FEET
Seepage at 9 feet

Figure A-14,
Log of Trench T 4, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS
☐ ... SAMPLING UNSUCCESSFUL
⊠ ... DISTURBED OR BAG SAMPLE
◧ ... STANDARD PENETRATION TEST
◩ ... CHUNK SAMPLE
■ ... DRIVE SAMPLE (UNDISTURBED)
▼ ... WATER TABLE OR SEEPAGE

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TRENCH T 5

ELEV. (MSL.) 212' DATE COMPLETED 05-09-2005

EQUIPMENT JD 450 TRACK-MOUNTED BACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 5				SC	**LANDSLIDE DEBRIS** Loose, moist, dark gray, Clayey, fine SAND; porous; thin roots; weakly developed topsoil in upper 2 feet			
5 – 14.5				SM+SC	Loose, moist to wet, olive gray, Clayey to Silty, fine to coarse SAND; jumbled texture; chaotic structure; some clayey sandstone fragments in sandy matrix			
					TRENCH TERMINATED AT 14.5 FEET No groundwater encountered			

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14

Figure A-15,
Log of Trench T 5, Page 1 of 1

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SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... DISTURBED OR BAG SAMPLE
- ... STANDARD PENETRATION TEST
- ... CHUNK SAMPLE
- ... DRIVE SAMPLE (UNDISTURBED)
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

TRENCH T 6

ELEV. (MSL.) **226'** DATE COMPLETED **05-10-2005**

EQUIPMENT **JD 450 TRACK-MOUNTED BACKHOE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**TOPSOIL** Loose to medium dense, dry to damp, Clayey SAND			
2					**GRANITIC ROCK** Moderately hard, moist, tan to gray, GRANITIC ROCK; highly weathered; moderately fractured; damp to dry; light green clay on fracture surfaces			
4	T6-1							
					-At 5 feet J: N37E/vertical			
6								
					-At 7 feet J:N53W/77SW			
8								
					TRENCH TERMINATED AT 9.5 FEET No groundwater encountered No caving			

Figure A-16,
Log of Trench T 6, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

TRENCH T 7

ELEV. (MSL.) **240'** DATE COMPLETED **05-10-2005**

EQUIPMENT **JD 450 TRACK-MOUNTED BACKHOE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 4				SC	**LANDSLIDE DEBRIS** Loose to medium dense, dry to damp, dark gray, Clayey SAND; moderate topsoil development. Medium dense, moist, light gray brown; scattered flecks of black organics; base subparallel to slope; grades to very light gray with medium gray brown laminations			
4 – 8				SM	**SANTIAGO FORMATION** Dense, damp, very light gray, fine- to medium-grained Silty SANDSTONE; massive to thickly slightly weathered. -Becomes dark brown at 7.5 feet. -C: 80E/5-10N (at top)			
8 – 9					**GRANITIC ROCK** Moderately hard, damp to moist, greenish gray with abundant orange staining, GRANITIC ROCK; highly weathered			

TRENCH TERMINATED AT 9 FEET
No groundwater encountered
No caving

07227-52-02.GPJ

Figure A-17,
Log of Trench T 7, Page 1 of 1

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... DISTURBED OR BAG SAMPLE
- ... STANDARD PENETRATION TEST
- ... CHUNK SAMPLE
- ... DRIVE SAMPLE (UNDISTURBED)
- ... WATER TABLE OR SEEPAGE

TRENCH T 8

ELEV. (MSL.) **254'** DATE COMPLETED **05-10-2005**

EQUIPMENT **JD 450 TRACK-MOUNTED BACKHOE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**TOPSOIL** Medium dense, dry to damp, dark gray, Clayey SAND			
2				SM	**SANTIAGO FORMATION** Dense, damp, very light gray, Silty SANDSTONE; fine- to medium-grained; moderately weathered; massive; moderately cemented			
4	T8-1				-Slightly weathered at 4 feet			
					TRENCH TERMINATED AT 5 FEET No groundwater encountered			

Figure A-18,
Log of Trench T 8, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

TRENCH T 9

ELEV. (MSL.) 241' DATE COMPLETED 05-10-2005

EQUIPMENT JD 450 TRACK-MOUNTED BACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**TOPSOIL** Medium dense, dry to damp, dark gray-brown, Silty SAND			
2 4				SM	**SANTIAGO FORMATION** Dense, damp, very light gray with some orange staining, Silty SANDSTONE; fine- to medium-grained; moderately weathered, slightly fractured; moderately cemented; massive -Slightly weathered; fine roots; dark brown staining at 4 feet -At 3 feet; J: N70W/65NE			
					TRENCH TERMINATED AT 5 FEET No groundwater encountered			

07227-52-02.GPJ

Figure A-19,
Log of Trench T 9, Page 1 of 1

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 10 ELEV. (MSL.) 228' DATE COMPLETED 05-10-2005 EQUIPMENT JD 450 TRACK-MOUNTED BACKHOE	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**TOPSOIL** Medium dense, dry to damp, dark gray, Silty SAND			
2 4 6 8 10				SP	**SANTIAGO FORMATION** Medium dense, moist, very light pale brown, SANDSTONE; massive; moderately hard; weakly cemented; moderately weathered -Very light gray; slightly weathered; slightly moist at 4 feet			
			▼		-Moderate seepage at 11 feet			
12	T10-1			SM	Dense, damp, greenish medium gray, Silty, fine to medium SANDSTONE; trace clay -Refusal at 13 feet			
					TRENCH TERMINATED AT 13 FEET Seepage at 11 feet			

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Figure A-20,
Log of Trench T 10, Page 1 of 1

SAMPLE SYMBOLS	☐ ... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 11 ELEV. (MSL.) 226' DATE COMPLETED 05-10-2005 EQUIPMENT JD 450 TRACK-MOUNTED BACKHOE	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0 2				SC	**TOPSOIL** Medium dense, damp, dark gray, Clayey SAND			
4 6					**GRANITIC ROCK** Moderately hard, slightly moist, light gray brown with orange staining, GRANITIC ROCK; highly weathered, highly fractured -At 6 feet J: N70E/72NW; J: N72E/70SE			
					TRENCH TERMINATED AT 7.5 FEET No groundwater encountered			

Figure A-21,
Log of Trench T 11, Page 1 of 1

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SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

TRENCH T 12

ELEV. (MSL.) **220'** DATE COMPLETED **05-10-2005**

EQUIPMENT **JD 450 TRACK-MOUNTED BACKHOE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**TOPSOIL** Medium dense, slightly moist, dark gray, Clayey SAND			
2 – 6					**GRANITIC ROCK** Moderately hard, damp, light gray brown with orange staining, GRANITIC ROCK; highly weathered; scattered hard rounded nodules (some nodules, moderately weathered); fine- to coarse-grained crystalline texture			
					TRENCH TERMINATED AT 7 FEET No groundwater encountered			

Figure A-22,
Log of Trench T 12, Page 1 of 1

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SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

TRENCH T 13

ELEV. (MSL.) **228'** DATE COMPLETED **05-10-2005**

EQUIPMENT **JD 450 TRACK-MOUNTED BACKHOE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 3				CL	**LANDSLIDE DEBRIS** Stiff, moist, dark brown, Sandy CLAY; porous with roots and krotovina; moderate topsoil development			
3 – 5.5				SM	Loose, moist, light olive gray, Silty, fine to medium SAND; common clay-filled; high-angle fractures			
5.5 – 13	T13-1 (10–12)			CH	Stiff, moist, dark olive gray; Sandy, fat CLAY; pockets of silty sand and granitic rock fragments; highly fractured and sheared; chaotic bedding orientations B: N35E/38NW -Carbonate and iron oxide mineralization between sand and clay beds -At 13 feet, contact roughly horizontal, undulatory			
13 – 14					**GRANITIC ROCK** Moderately hard to hard, damp, light to medium brown, GRANITIC ROCK; moderately weathered			

TRENCH TERMINATED AT 14 FEET
No groundwater encountered
No caving

07227-52-02.GPJ

Figure A-23,
Log of Trench T 13, Page 1 of 1

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... DISTURBED OR BAG SAMPLE
- ... STANDARD PENETRATION TEST
- ... CHUNK SAMPLE
- ... DRIVE SAMPLE (UNDISTURBED)
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07227-52-02

TRENCH T 14

ELEV. (MSL.) 238' DATE COMPLETED 05-10-2005

EQUIPMENT JD 450 TRACK-MOUNTED BACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 2				SC	**PREVIOUSLY PLACED FILL** Loose, moist, grayish brown, Clayey, fine to medium SAND; few gravels			
2 – 5				CL	**TOPSOIL** Stiff, moist, dark brown, fine Sandy CLAY; few gravels; common roots; porous			
5 – 8				CH	**SANTIAGO FORMATION** Very stiff, moist, dark olive gray, fine Sandy, fat CLAY; highly weathered and some shearing			
8 – 18				SM-SC	Medium dense, moist, light olive gray, Clayey and Silty, SANDSTONE; fine- to medium-grained; very weakly cemented; massive bedding -Becomes dense; fine-grained and clayey			
18					TRENCH TERMINATED AT 18 FEET No groundwater encountered No caving			

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18

Figure A-24,
Log of Trench T 14, Page 1 of 1

07227-52-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... DISTURBED OR BAG SAMPLE
- ... STANDARD PENETRATION TEST
- ... CHUNK SAMPLE
- ... DRIVE SAMPLE (UNDISTURBED)
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

SUMMARY OF LABORATORY TESTING

Classification

Soils were classified visually according to the Unified Soil Classification System (ASTM Test Method D2487). The soil classifications are shown on the logs of exploratory borings/trenches in Appendix A.

Liquid limit, plastic limit and plasticity index were determined in accordance with ASTM Test Method D4318. Results are shown below:

RESULTS OF LABORATORY ATTERBERG LIMITS

Boring No.	Sample Depth (Ft)	Liquid Limit (%)	Plasticity Index (%)	Unified Soil Classification Symbol
Geocon B1-6	6	63	41	CL
Geocon B7-12	46	55	23	CH

(Geocon, 2005)

Expansion Index

Expansion Index testing was performed on representative soil samples at locations listed. Testing was performed in general accordance with ASTM Test Method D4829. The Expansion Index (EI) test results are presented below:

RESULTS OF LABORATORY EXPANSION INDEX

Test Location	Expansion Index	Potential Expansion
GeoTek B-4 @ 5 feet	27	Low
GeoTek B-3 @ 29 feet	76	Medium
GeoTek B-2 @ 5 feet	164	High

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Project Name: Oceanside Residential Development

Project Number: 3129-SD3

Tested/ Checked By: TM Lab No 2507

Date Tested: 12/18/2006

Sample Source: GTB2 @ 5

Sample Description: Gray Silty Clay

Ring Id 12 Ring Dia. " 4" Ring 1"

Loading weight: 5516. grams

DENSITY DETERMINATION

A	Weight of compacted sample & ring	**760.4**
B	Weight of ring	370
C	Net weight of sample	390.4
D	Wet Density, lb / ft3 (C*0.3016)	117.7
E	Dry Density, lb / ft3 (D/1.F)	**105.1**

SATURATION DETERMINATION

F	Moisture Content, %	**12.0**
G	(E*F)	1261.5
H	(E/167.232)	0.63
I	(1.-H)	0.37
J	(62.4*I)	23.2
K	(G/J)= L % Saturation	**54.4**

READINGS

DATE	TIME	READING	
12/18/2006	11:20	0.024	Initial
12/18/2006	11:30	0.024	10 min/Dry
12/18/2006	11:31	0.032	1 min/Wet
12/18/2006	11:36	0.040	5 min/Wet
12/18/2006	1:10	0.052	Random
12/19/2006	8:00	0.182	Final

FINAL MOISTURE

Weight of wet sample & tare	Weight of dry sample & tare	Tare	% Moisture
138	110.3	12.5	**28.3%**

EXPANSION INDEX = 164

(@50% SATURATION)

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Project Name: Oceanside Residential Development

Project Number: 3129-SD3

Tested/ Checked By: TM Lab No 2507

Date Tested: 12/18/2006

Sample Source: GTB3 @ 29

Sample Description: Light Olive Gray Silty Clay

Ring Id 12 Ring Dia. " 4" Ring 1"

Loading weight: 5516. grams

DENSITY DETERMINATION

A	Weight of compacted sample & ring	**742.4**
B	Weight of ring	370
C	Net weight of sample	372.4
D	Wet Density, lb / ft3 (C*0.3016)	112.3
E	Dry Density, lb / ft3 (D/1.F)	**98.7**

SATURATION DETERMINATION

F	Moisture Content, %	**13.8**
G	(E*F)	1362.0
H	(E/167.232)	0.59
I	(1.-H)	0.41
J	(62.4*I)	25.6
K	(G/J)= L % Saturation	**53.3**

READINGS

DATE	TIME	READING	
12/18/2006	11:20	0.035	Initial
12/18/2006	11:30	0.035	10 min/Dry
12/18/2006	11:31	0.067	1 min/Wet
12/18/2006	11:36	0.089	5 min/Wet
12/18/2006	1:10	0.092	Random
12/19/2006	8:00	0.108	Final

FINAL MOISTURE

Weight of wet sample & tare	Weight of dry sample & tare	Tare	% Moisture
135	110.1	12.2	**25.4%**

EXPANSION INDEX = 76

(@50% SATURATION)

EXPANSION INDEX TEST

(ASTM D4829)

GEOTEK

Project Name: Oceanside Residential Development
Project Number: 3129-SD3

Tested/ Checked By: TM Lab No 2507
Date Tested: 12/18/2006
Sample Source: GTB4 @ 5
Sample Description: Gray Brown Clayey Silty Sand

Ring Id 12 Ring Dia. " 4" Ring 1"
Loading weight: 5516. grams

DENSITY DETERMINATION

A	Weight of compacted sample & ring	**764.1**
B	Weight of ring	370
C	Net weight of sample	394.1
D	Wet Density, lb / ft3 (C*0.3016)	118.9
E	Dry Density, lb / ft3 (D/1.F)	**105.6**

SATURATION DETERMINATION

F	Moisture Content, %	**12.6**
G	(E*F)	1330.1
H	(E/167.232)	0.63
I	(1.-H)	0.37
J	(62.4*I)	23.0
K	(G/J)= **L** % Saturation	**57.8**

READINGS

DATE	TIME	READING	
12/18/2006	11:20	0.013	Initial
12/18/2006	11:30	0.012	10 min/Dry
12/18/2006	11:31	0.015	1 min/Wet
12/18/2006	11:36	0.020	5 min/Wet
12/18/2006	1:10	0.024	Random
12/19/2006	8:00	0.036	Final

FINAL MOISTURE

Weight of wet sample & tare	Weight of dry sample & tare	Tare	% Moisture
111.5	92.8	12.5	**23.3%**

EXPANSION INDEX = **27**
(@50% SATURATION)

Moisture-Density Relations

Laboratory testing was performed on representative samples collected during the subsurface exploration. The laboratory maximum dry density and optimum moisture content for representative soil types were determined in general accordance with test method ASTM D1557.

RESULTS OF LABORATORY TEST OF MAXIMUM DRY DENSITY

Test Location	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
GeoTek B-5 @ 5 feet	117.5	13.5
GeoTek B-4 @ 5 feet	115.0	13.0
Geotek B-3 @ 29 feet	111.5	16.5
GeoTek B-2 @ 5 feet	115.5	14.0

Direct Shear

Shear testing was performed in a direct shear machine of the strain-control type in general accordance with ASTM Test Method D3080. The rate of deformation is 0.03 inches per minute. The sample was sheared under varying confining loads in order to determine the coulomb shear strength parameters, angle of internal friction and cohesion. The shear test results are included in the report.

RESULTS OF LABORATORY SHEAR TESTING

Soil Description/Source	Shear Strength		Dry Unit Weight (pcf)
	Friction (Degrees)	Cohesion (psf)	
GeoTek B-1 at 5’	41.0	116	112.2
GeoTek B-1 at 16’	38.0	114	114.3
GeoTek B-1 at 45’	43.8	260	118.7
GeoTek B-2 at 5’	35.4	560	103.9
GeoTek B-4 at 5’	33.0	360	103.9
GeoTek B-5 at 50’	42.9	940	123.5
GeoTek B-5 at 60’	41.7	150	117.9
GeoTek B-8 at 10’	36.5	280	116.4

MAXIMUM DENSITY CURVE

Curve No.: GTB2 @ 5'

Project No.: 3129-SD3 **Date:** 12/18/06

Project: Oceanside Residential Development

Location:

Elev./Depth:

Remarks:

MATERIAL DESCRIPTION

Description: Light Olive Gray Silty Clay

Classifications - **USCS:** **AASHTO:**

Nat. Moist. = **Sp.G. =**

Liquid Limit = **Plasticity Index =**

% > No.4 = % **% < No.200 =**

TEST RESULTS
Maximum dry density = 115.5 pcf
Optimum moisture = 14 %

Test specification:
ASTM D 1557-00 Method A Modified

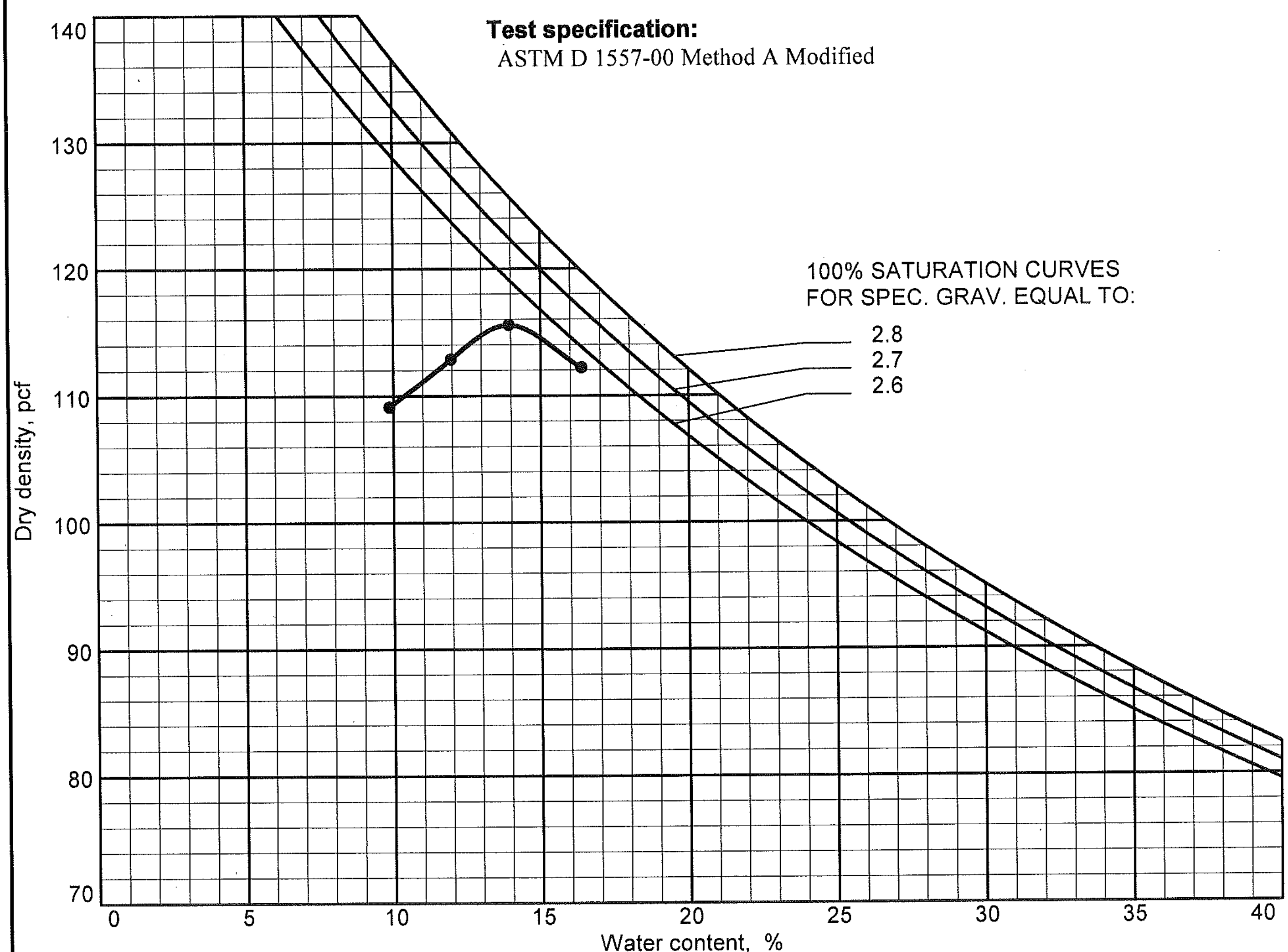


Plate 1

GeoTek, Inc.

MAXIMUM DENSITY CURVE

Curve No.: GTB3 @ 29'

Project No.: 3129-SD3 **Date:** 12/18/06

Project: Oceanside Residential Development

Location:

Elev./Depth:

Remarks:

MATERIAL DESCRIPTION

Description: Light Olive Gray Silty Clay

Classifications - **USCS:** **AASHTO:**

Nat. Moist. = **Sp.G. =**

Liquid Limit = **Plasticity Index =**

% > No.4 = % **% < No.200 =**

TEST RESULTS
Maximum dry density = 111.5 pcf
Optimum moisture = 16.5 %

Test specification:
ASTM D 1557-00 Method A Modified

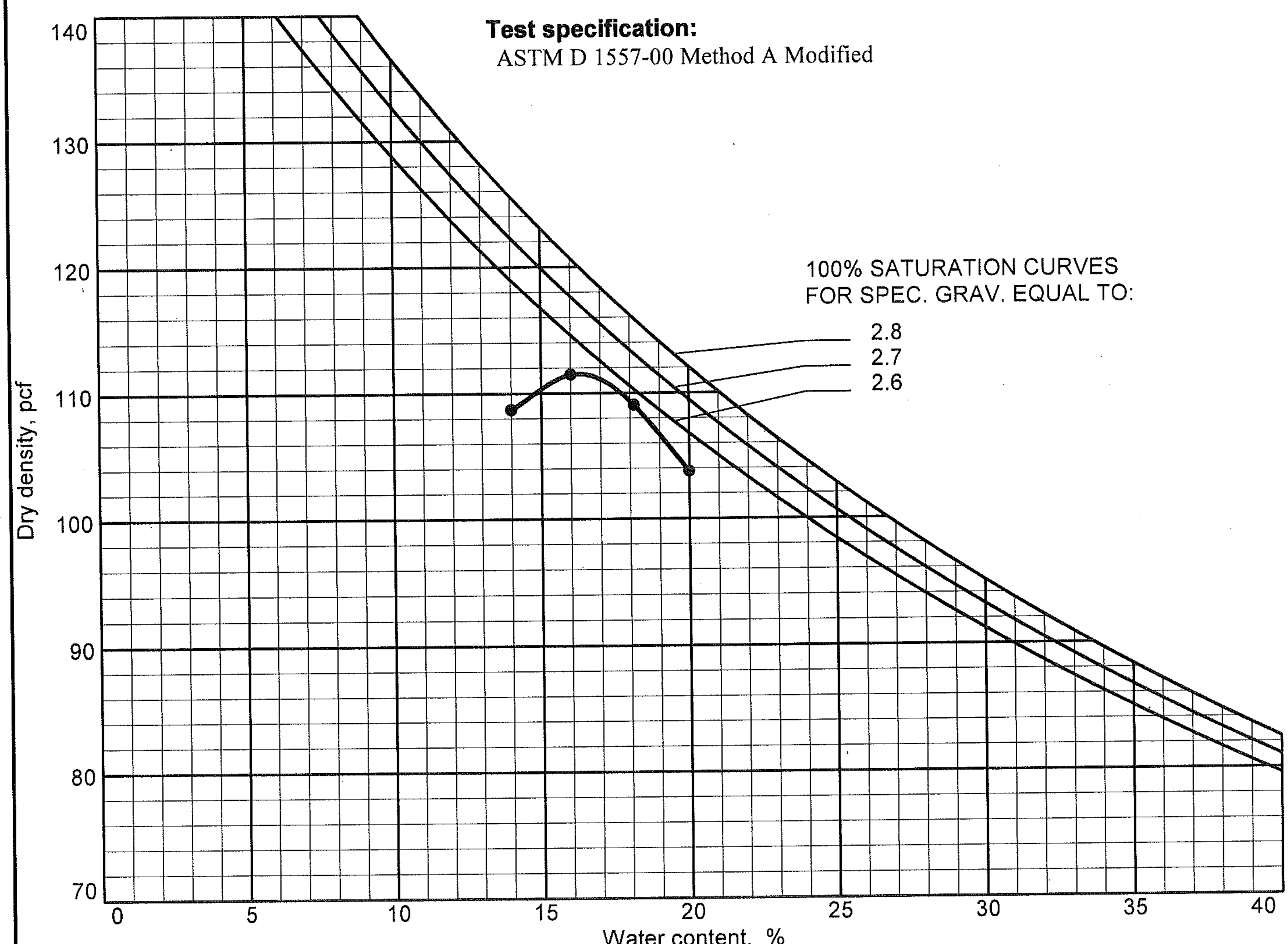


Plate 2

MAXIMUM DENSITY CURVE

Curve No.: GTB4 @ 5'

Project No.: 3129-SD3 **Date:** 12/19/06

Project: Oceanside Residential Development

Location:

Elev./Depth:

Remarks:

MATERIAL DESCRIPTION

Description: GRAY BROWN CLAYEY SILTY SAND

Classifications - **USCS:** **AASHTO:**

Nat. Moist. = **Sp.G. =**

Liquid Limit = **Plasticity Index =**

% > No.4 = % **% < No.200 =**

TEST RESULTS
Maximum dry density = 115 pcf
Optimum moisture = 13 %

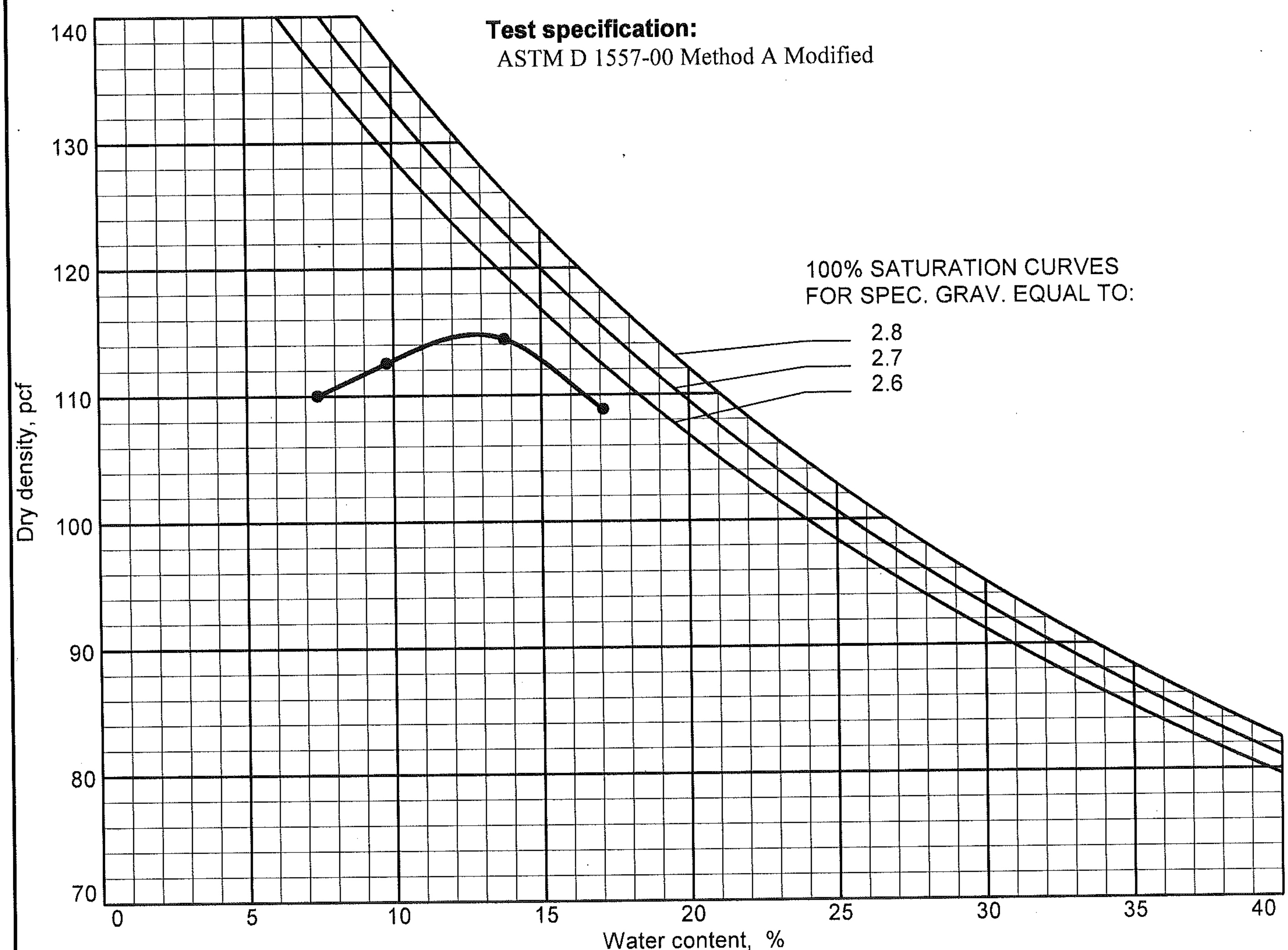


Plate 3

MAXIMUM DENSITY CURVE

Curve No.: GTB5 @ 5'

Project No.: 3129-SD3 **Date:** 12/19/06

Project: Oceanside Residential Development

Location:

Elev./Depth:

Remarks:

MATERIAL DESCRIPTION

Description: Olive Gray Silty Fine Sand

Classifications - **USCS:** **AASHTO:**

Nat. Moist. = **Sp.G. =**

Liquid Limit = **Plasticity Index =**

% > No.4 = % **% < No.200 =**

TEST RESULTS
Maximum dry density = 117.5 pcf
Optimum moisture = 13.5 %

Test specification:
ASTM D 1557-00 Method A Modified

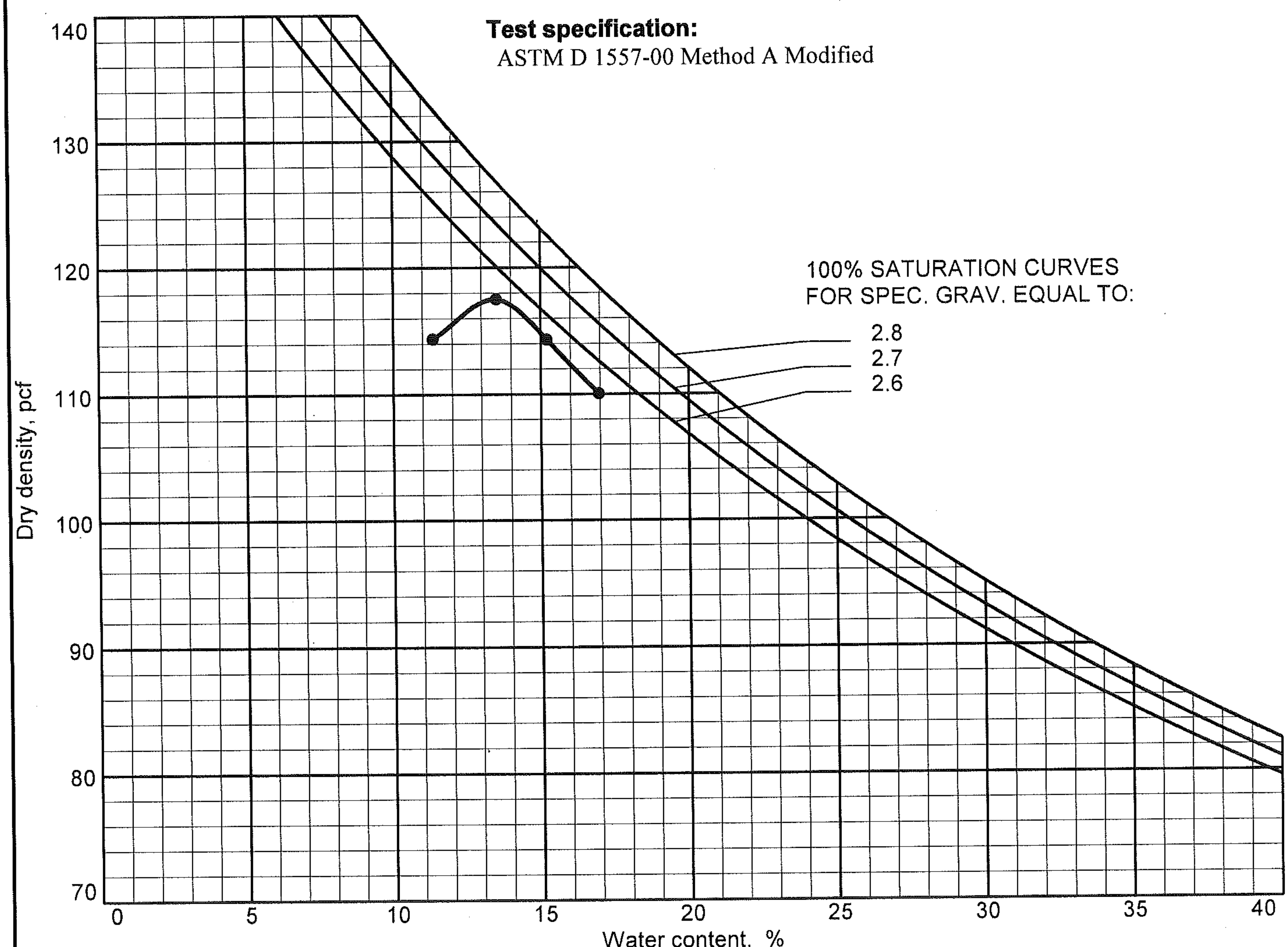


Plate 4

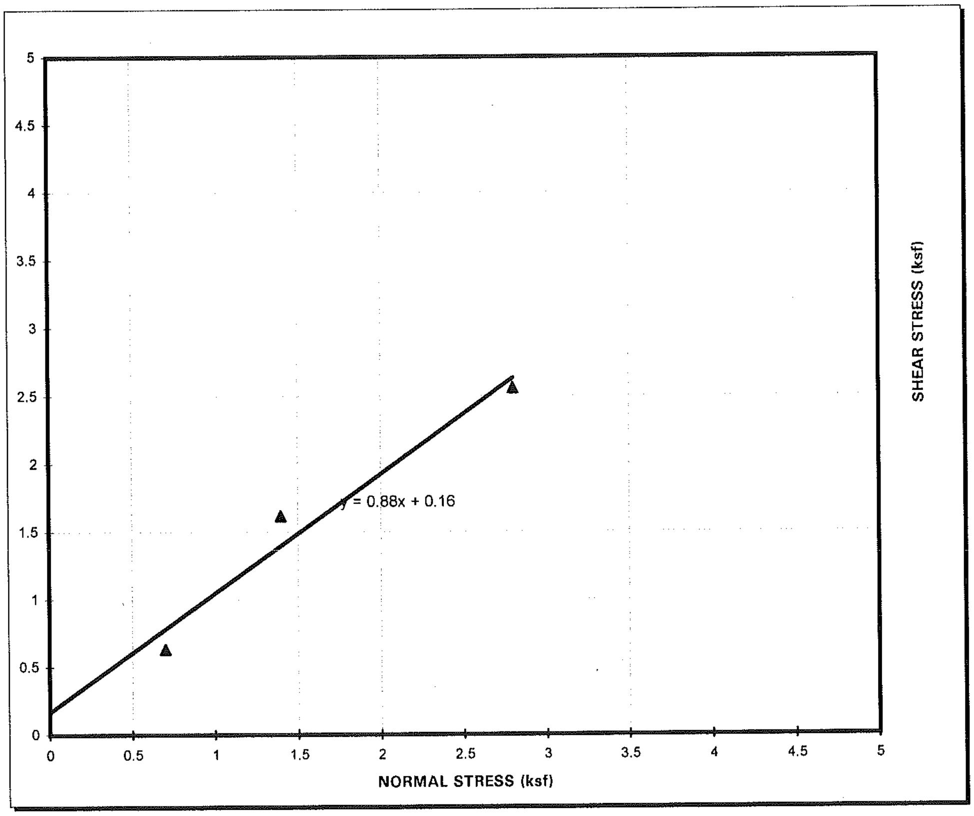
GEOTEK

DIRECT SHEAR TEST

Project Name: Lundstrom/Oceanside
Project Number: 3129 SD3

Sample Source: GTB1 @ 5'
Date Tested: 12/13/06

Soil Description: Brown Silty SAND



Shear Strength: $\Phi = 41.0^{o}$, **C =** 0.16 **ksf**

Test No.	Load (ksf)	Water Content (%)	Dry Density (pcf)
1	0.7	10.7	111.7
2	1.4	10.7	113.1
3	2.8	10.7	111.8

Note: Saturated in shear box

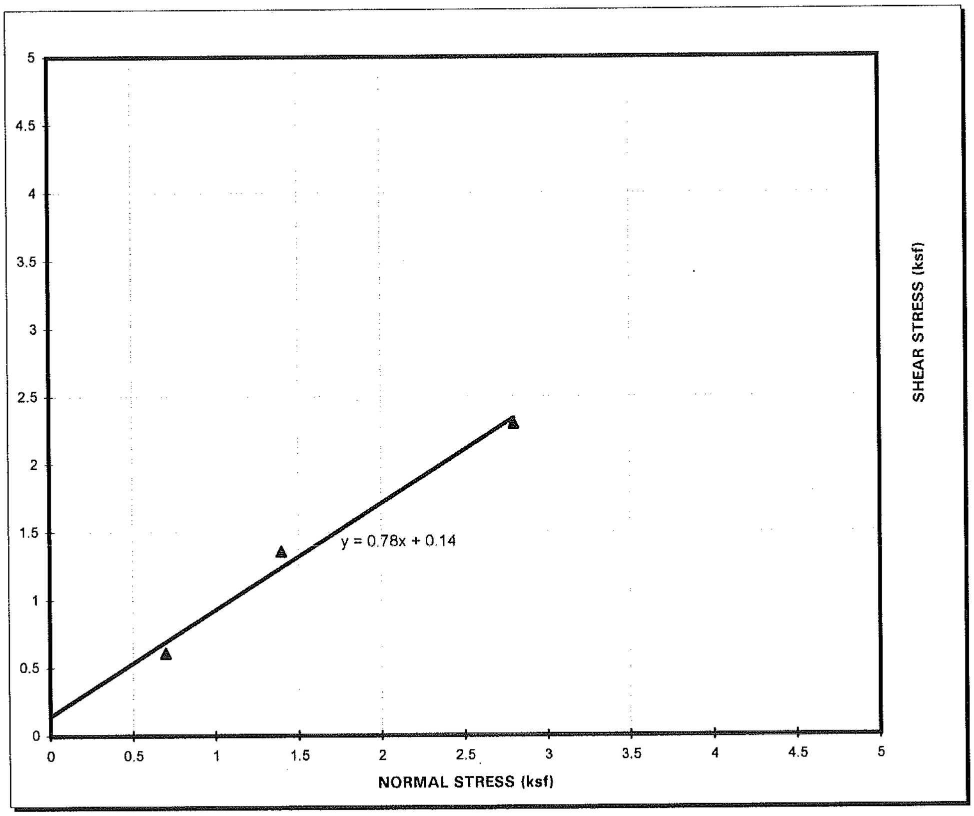
Notes:
1 - The soil specimen used in the shear box were "ring" samples collected during the field investigation.
2 - Shear strength calculated at peak load.
3 - The tests were ran at a shear rate of 0.03 in/min.

DIRECT SHEAR TEST

Project Name: Oceanside Residential Development
Project Number: 3129 SD3

Sample Source: GTB1 @ 16'
Date Tested: 12/14/06

Soil Description: Olive Gray Silty Clay



Shear Strength: $\Phi = 38.0^{O}$, **C =** 0.14 **ksf**

Test No.	Load (ksf)	Water Content (%)	Dry Density (pcf)
1	0.7	21.5	114.8
2	1.4	21.5	114.2
3	2.8	21.5	113.8

Note: Saturated in shear box

Notes:
1 - The soil specimen used in the shear box were "ring" samples collected during the field investigation.
2 - Shear strength calculated at peak load.
3 - The tests were ran at a shear rate of 0.03 in/min.

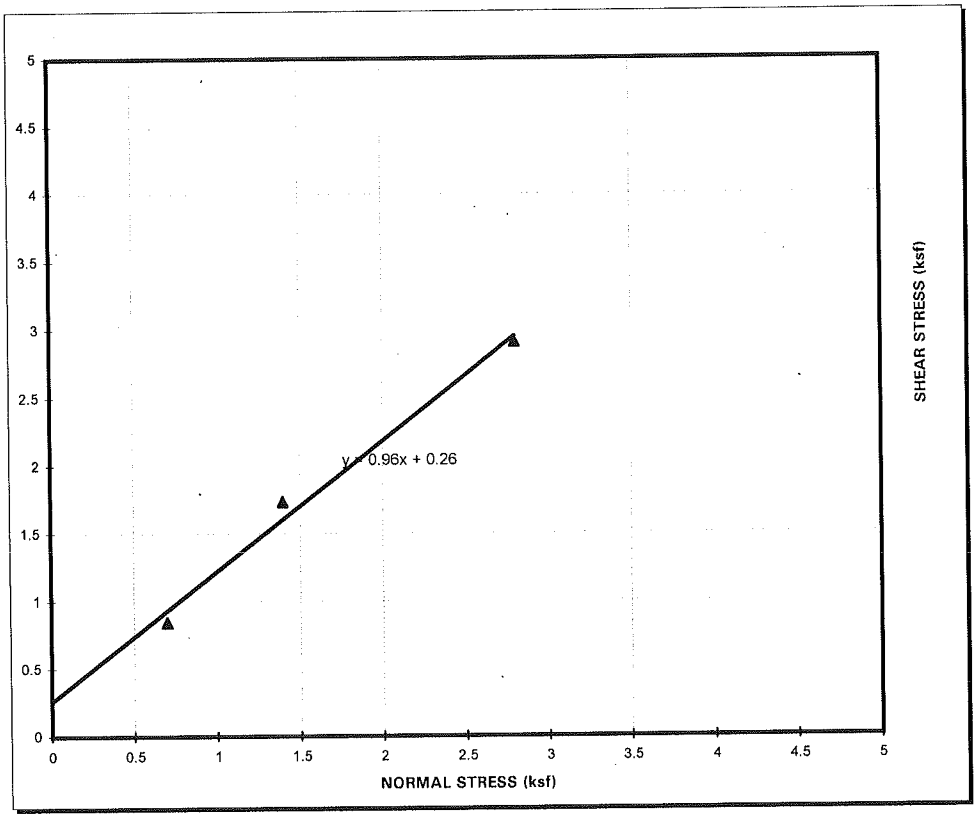
GEOTEK

DIRECT SHEAR TEST

Project Name: Oceanside Residential Development
Project Number: 3129 SD3

Sample Source: GTB1 @ 45'
Date Tested: 12/20/06

Soil Description: Olive Gray Brown Fine Sandy Silt



Shear Strength: $\Phi = 43.8^{O}$, **C =** 0.26 **ksf**

Test No.	Load (ksf)	Water Content (%)	Dry Density (pcf)
1	0.7	11.2	119.1
2	1.4	11.2	118.6
3	2.8	11.2	118.3

Note: Saturated in shear box

Notes:
1 - The soil specimen used in the shear box were "ring" samples collected during the field investigation.
2 - Shear strength calculated at peak load.
3 - The tests were ran at a shear rate of 0.03 in/min.

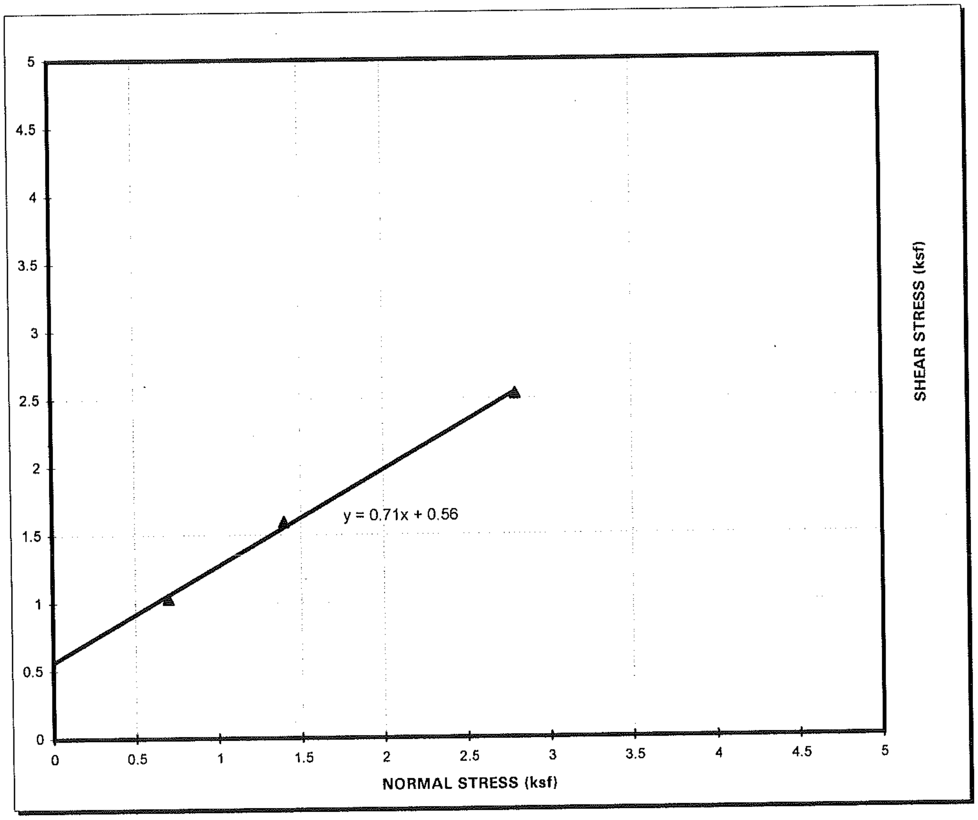
GEOTEK

DIRECT SHEAR TEST

Project Name: Oceanside Residential Development
Project Number: 3129 SD3

Sample Source: GTB2 @ 5'
Date Tested: 12/20/06

Soil Description: Light Olive Gray Silty Clay



Shear Strength: $\Phi =$ 35.4 ^{o} , **C =** 0.56 **ksf**

Test No.	Load (ksf)	Water Content (%)	Dry Density (pcf)
1	0.7	14	104.1
2	1.4	14	103.9
3	2.8	14	103.8

Note: Saturated in shear box

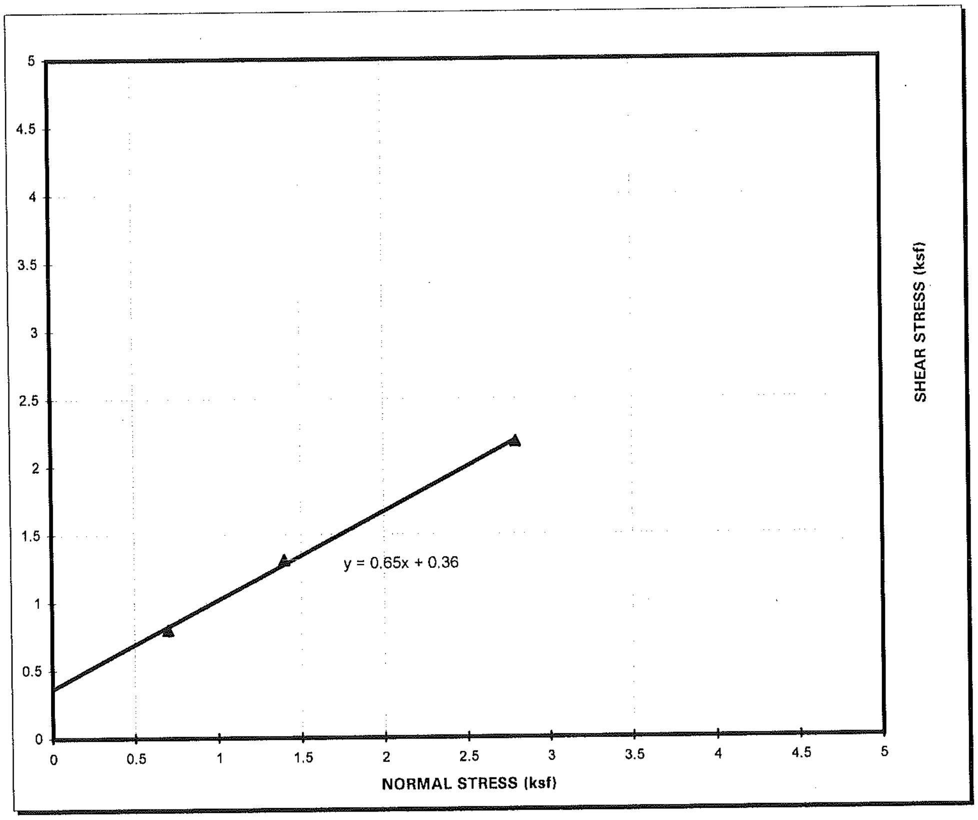
Notes:
1 - The soil specimen used in the shear box were remolded "ring" samples.
2 - Shear strength calculated at peak load.
3 - The tests were ran at a shear rate of 0.03 in/min.

DIRECT SHEAR TEST

Project Name: Oceanside Residential Development
Project Number: 3129 SD3

Sample Source: GTB4 @ 5'
Date Tested: 12/20/06

Soil Description: Dark Brown Silty Fine Sand



Shear Strength: $\Phi = 33.0^{o}$, **C =** 0.36 **ksf**

Test No.	Load (ksf)	Water Content (%)	Dry Density (pcf)
1	0.7	13	103.9
2	1.4	13	103.7
3	2.8	13	104.1

Note: Saturated in shear box

Notes:
1 - The soil specimen used in the shear box were remolded "ring" samples.
2 - Shear strength calculated at peak load.
3 - The tests were ran at a shear rate of 0.03 in/min.

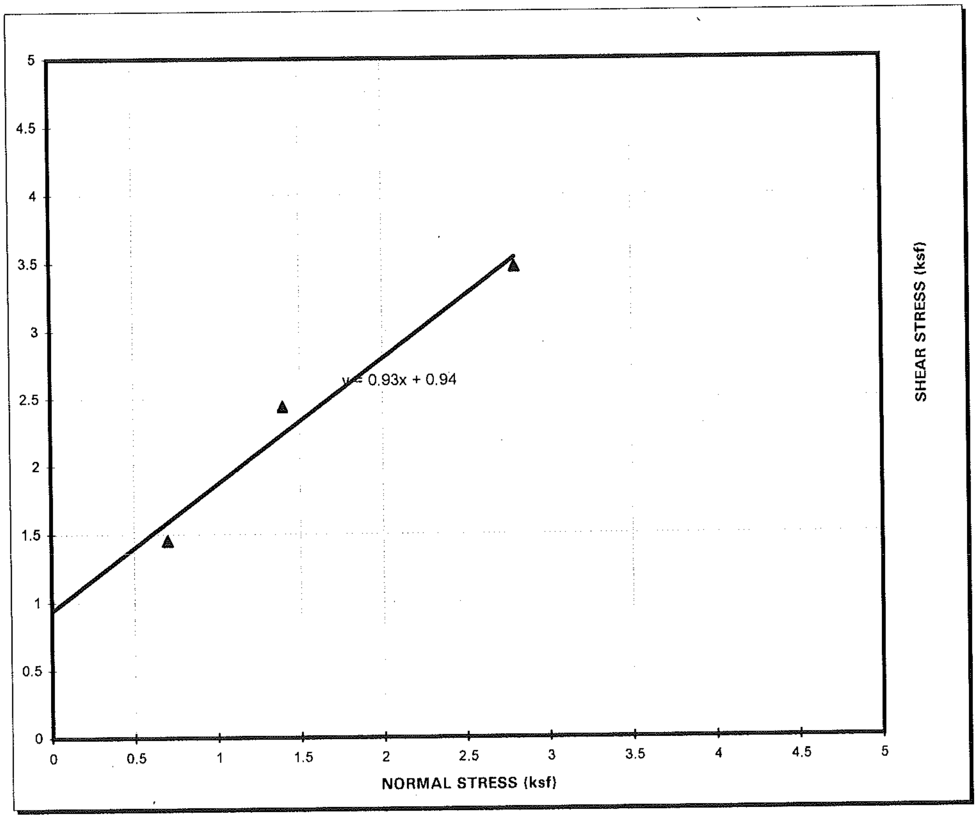
GEOTEK

DIRECT SHEAR TEST

Project Name: Oceanside Residential Development
Project Number: 3129 SD3

Sample Source: GTB5 @ 50'
Date Tested: 12/19/06

Soil Description: Olive Gray Silty Fine Sand



Shear Strength: $\Phi = 42.9^{o}$, **C =** 0.94 **ksf**

Test No.	Load (ksf)	Water Content (%)	Dry Density (pcf)
1	0.7	11.5	124.1
2	1.4	11.5	123.8
3	2.8	11.5	122.5

Note: Saturated in shear box

Notes: 1 - The soil specimen used in the shear box were "ring" samples collected during the field investigation.
2 - Shear strength calculated at residual load.
3 - The tests were ran at a shear rate of 0.03 in/min.

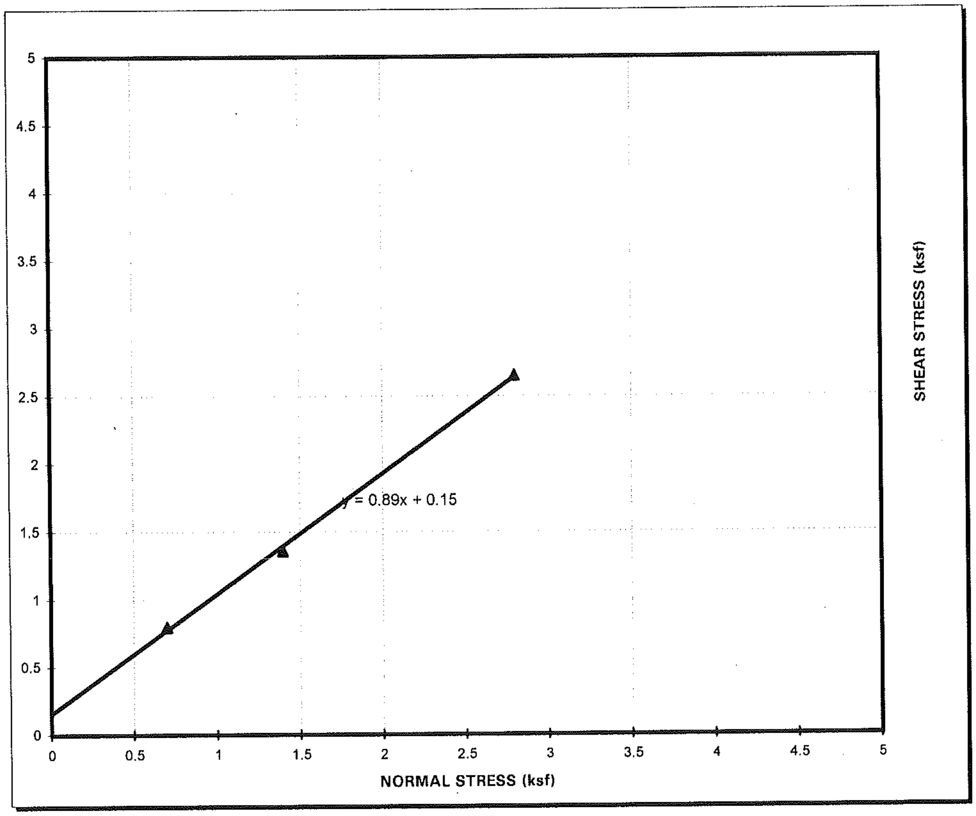
GEOTEK

DIRECT SHEAR TEST

Project Name: Oceanside Residential Development
Project Number: 3129 SD3

Sample Source: GTB5 @ 60'
Date Tested: 12/15/06

Soil Description: Brown Silty Sand



Shear Strength: $\Phi =$ 41.7 ^{o} , **C =** 0.15 **ksf**

Test No.	Load (ksf)	Water Content (%)	Dry Density (pcf)
1	0.7	10.4	118.4
2	1.4	10.4	117.5
3	2.8	10.4	117.8

Note: Saturated in shear box

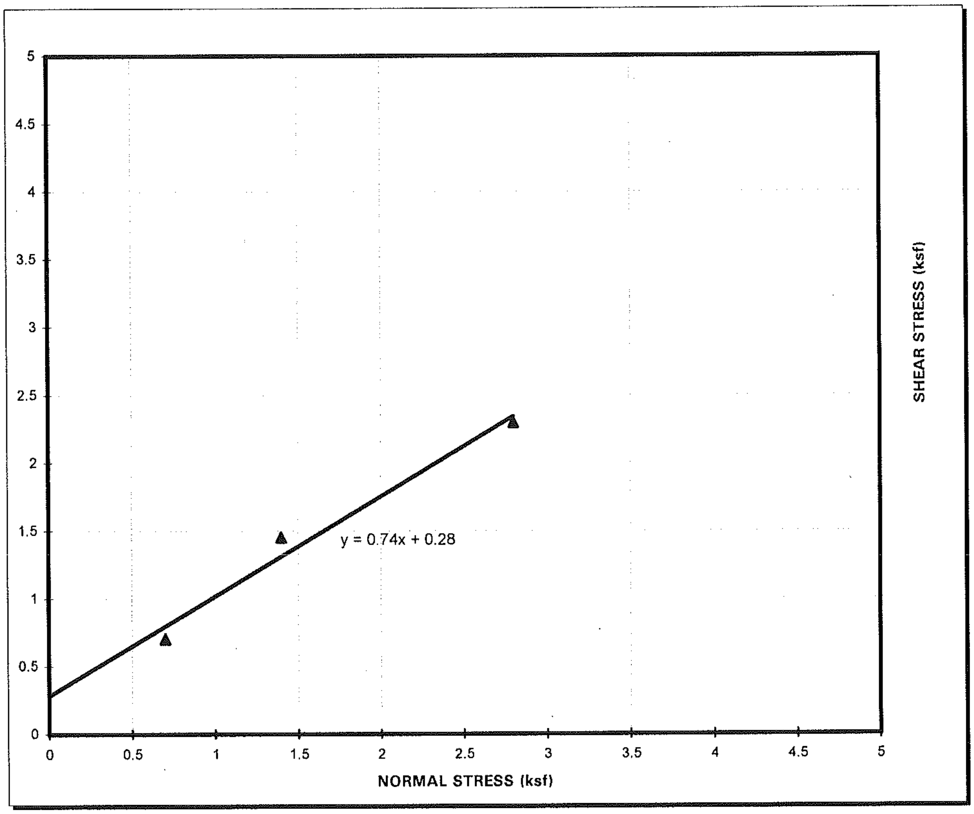
Notes:
1 - The soil specimen used in the shear box were "ring" samples collected during the field investigation.
2 - Shear strength calculated at residual load.
3 - The tests were ran at a shear rate of 0.03 in/min.

GEOTEK

DIRECT SHEAR TEST

Project Name: Oceanside Residential Development
Project Number: 3129 SD3
Sample Source: GTB8 @ 10'
Date Tested: 12/19/06

Soil Description: Grayish Brown Silty Fine Sand



Shear Strength: $\Phi = 36.5^{o}$, **C =** 0.28 **ksf**

Test No.	Load (ksf)	Water Content (%)	Dry Density (pcf)
1	0.7	9.7	117.1
2	1.4	9.7	116.4
3	2.8	9.7	115.8

Note: Saturated in shear box

Notes:
1 - The soil specimen used in the shear box were "ring" samples collected during the field investigation.
2 - Shear strength calculated at residual load.
3 - The tests were ran at a shear rate of 0.03 in/min.

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(760) 599-0509 FAX (760) 599-0593

SOIL RESISTIVITY
(California Test 643)

Project Name:	Oceanside Residential Development	***Tested/ Checked By:***	DC Lab No 2507
Project Number:	3129 SD3	***Date Tested:***	12/17/2006
		Sample Source:	GTB1 @ 6'
		Sample Description:	Brown Silty Sand

A Determing the soil's pH 8.6

	Water Added (mL)	Measured Res from Nil. 400 (ohms-cm)
B	100	1450
C	50	1150
D	20	1025
E	20	975
F	20	995
G		
H		
I		
J		

Minimum Resistivity = 975

24.7 years to perforation for a 18 gauge metal culvert.
32.1 years to perforation for a 16 gauge metal culvert.
39.5 years to perforation for a 14 gauge metal culvert.
54.4 years to perforation for a 12 gauge metal culvert.
69.2 years to perforation for a 10 gauge metal culvert.
84.0 years to perforation for a 8 gauge metal culvert.

GEOTEK

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(760) 599-0509 FAX (760) 599-0593

SOIL RESISTIVITY
(California Test 643)

Project Name:	Oceanside Residential Development	***Tested/ Checked By:***	DC Lab No 2507
Project Number:	3129 SD3	***Date Tested:***	12/17/2006
		Sample Source:	GTB2 @ 5'
		Sample Description:	Light Olive Gray Silty Clay

A Determing the soil's pH 8.3

	Water Added (mL)	Measured Res from Nil. 400 (ohms-cm)
B	100	750
C	50	425
D	20	300
E	20	260
F	20	275
G		
H		
I		
J		

Minimum Resistivity = 260

14.4 years to perforation for a 18 gauge metal culvert.
18.7 years to perforation for a 16 gauge metal culvert.
23.0 years to perforation for a 14 gauge metal culvert.
31.6 years to perforation for a 12 gauge metal culvert.
40.2 years to perforation for a 10 gauge metal culvert.
48.9 years to perforation for a 8 gauge metal culvert.

LABORATORY REPORT

Telephone (619) 425-1993 Fax 425-7917 Established 1928

CLARKSON LABORATORY AND SUPPLY INC.
350 Trousdale Dr. Chula Vista, Ca. 91910 www.clarksonlab.com
ANALYTICAL AND CONSULTING CHEMISTS

Date: December 21, 2006
Purchase Order Number: 640
Sales Order Number: 86732
Account Number: GEOT

To:

GeoTek, Inc.
1384 Poinsetta Avenue, Suite A
Vista, CA 92083
Attention: David Cliff

Laboratory Number: SO1979 Customers Phone: 760-599-0509
Fax: 760-599-0593

Sample Designation:

Two soil samples received on 12/20/06 taken from
Lundstrom 3129-SD3 Job# 2507 marked as follows:

ANALYSIS: Water Soluble Sulfate California Test 417

Sample	SO_4%
GTB1@6'	<0.001
GTB2@5'	0.017

Laura Torres

Laura Torres
LT/arr

APPENDIX D

APPENDIX D
SLOPE STABILITY ANALYSES

We performed the slope stability analyses using the two-dimensional computer software *GeoStudio2018* developed by Geo-Slope International Ltd. We analyzed the critical modes of potential slip surfaces using rotational-mode based on Spencer's method. The soil parameters used, case conditions, and the calculated factors of safety are presented herein. Plots of the calculation results, including the soil stratigraphy, potential failure surfaces, and calculated factors of safety, are attached within this appendix.

We used the average direct shear, fully softened, and residual strength parameters based on laboratory tests and our experience with similar soil types in nearby areas for the slope stability analyses. We performed direct shear tests on samples of the landslide debris, the sandstone and claystone portions of the Santiago Formation and the granitic rock. Fully softened and residual shear tests were performed on samples of the shear plane materials and the claystone encountered in the Santiago Formation. We performed the laboratory shear tests in accordance with AASHTO T-236 with strain rates of 0.001 in/min and strain distance of 0.25 to 0.3 inches. Additionally, we incorporated Stark Correlations to help evaluate the residual and fully softened strength parameters to perform our slope stability analyses.

We used the 2023 Stark correlation website to help evaluate the results of the laboratory data of the fully softened and residual shear strengths for the bedding plane shear. Based on the correlation spreadsheet (only using Plasticity Index, which is normally a more conservative evaluation, because we do not have the clay fraction information), we obtained a cohesion of 100 psf and a friction angle of 11 degrees. However, we did not include this result in our referenced report because the sample description did not match the other bedding plane shear descriptions and the sample is not taken from the same elevation of the basal slide plane that is controlling the slope stability analyses. A comparison of borings B-1 (Geocon, 2005), B-2 (Geocon, 1985), and GTB-2 (Geotek, 2007), which are located in the same general area and have the same approximate top-of-boring elevation, shows several discrepancies in landslide geometry interpretations. Given the discrepancy in basal shear plane elevations, and the fact that the aforementioned boring logs are inconsistent with our updated geologic model, we opine the shear strength values used herein are applicable for project design.

For the seismic analyses, we used a higher shear strength (as discussed in SP 117) and the lower-than-average value of the test results as shown in the figure titled *Landslide Debris – Fully Softened and Stark Correlations (Seismic Case)* presented herein. The Stark correlations used in this figure are based on the "fully-softened" equations/graphs.

We used average-to-lower bound shear values from our shear strength tests (see graphical representations herein). For the static analyses, we used the lower bound value of the test results for the bedding plane shear strengths (including residual shear tests and stark correlations) as shown in the figure titled *Landslide Debris – Residual and Stark Correlations*. The Stark correlations used in this figure are based on the "residual" equations/graphs. The following table presents the values used for the input into the Stark Correlation Spreadsheet.

SUMMARY OF SOIL PROPERTIES USED FOR STARK CORRELATION ANALYSES

Sample No. (Year)	Depth (Feet)	Plasticity Index	Liquid Limit	CF (% Clay <0.002mm)	Liquid Limit (Not Ball Milled Correction)	CF (Not Balled Milled Correction)
B7-12 (2005)	45	23	55	--	--	--
B1-6 (2006)	6	41	63	--	--	--
B11-1 (2024)	48	21	51	13	71	24
B12-1 (2024)	78	20	49	16	67	28
B13-1 (2024)	39	16	17	10	64	10

Peak shear values were assigned to the sandstone portion of the Santiago Formation and the granitic rock, an average of the ultimate-inflection point and the ultimate-end-of-test values were assigned to the alluvium, landslide debris, and the claystone portion of the Santiago Formation, and fully softened and residual values were assigned to the landslide shear plane and the along bedding (anisotropic) of the claystone/siltstone portion of the Santiago Formation. Our calculations indicate were the proposed buildings are planned the existing and proposed southern slopes have calculated factors of safety (FOS) of at least 1.5 and 1.1 under static and seismic permanent conditions, respectively for both deep-seated failure and shallow sloughing conditions with the construction of shear pins and buttresses. The following table presents a summary of the soil properties used for the slope stability analyses.

SUMMARY OF SOIL PROPERTIES USED FOR SLOPE STABILITY ANALYSES

Geologic Unit/Material	Density (pcf)	Cohesion (psf)	Friction Angle (degrees)
Compacted Fill (Qcf)	130	300	28
Alluvium (Qal)	130	150	26
Landslide Debris (Qls)	130	150	26
Landslide Shear Plane (Qlsp)	130	50	14
Santiago Formation – Sandstone (Tsa)	130	800	34
Santiago Formation – Siltstone/Claystone (Tsa)	130	200	28
Santiago Formation – Siltstone/Claystone Along Bedding (Tsa)	130	50	14
Granitic Rock (Kgr)	130	1000	51

We selected Cross-Sections 1-1’, 2-2’, and 3-3’ to perform the slope stability analyses for the existing conditions. Appendix D presents the results of the slope stability analyses.

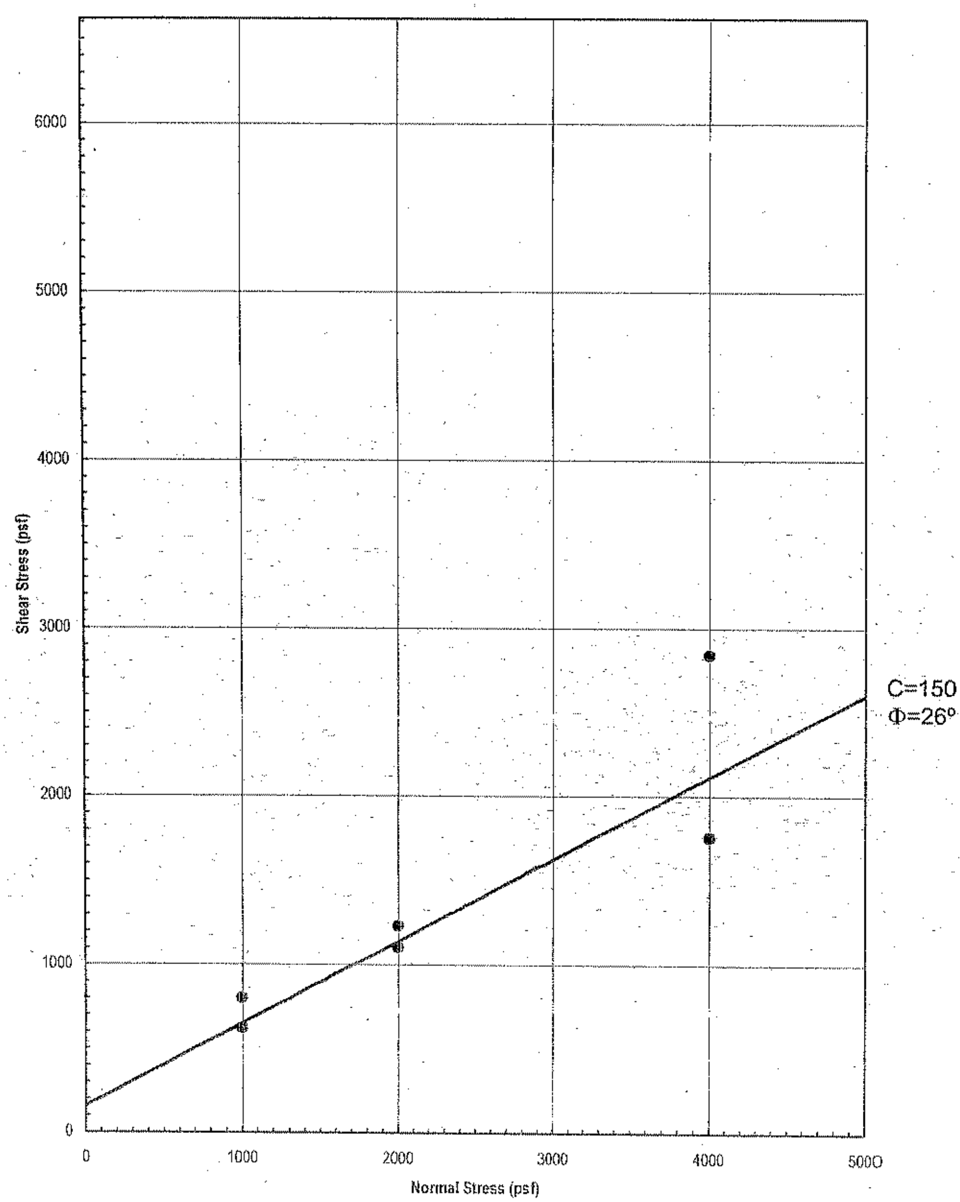
The presence of weak claystone/siltstone layers and landslide debris will require the installation of shear pins and the use of slope buttresses or stabilization fills on the southern slope. Surficial slope stability calculations were performed for a 2:1 (horizontal: vertical) fill slope. The calculated factor of safety is greater than the required minimum factor of safety of 1.5.

Excavations should be observed during grading by an engineering geologist with Geocon to evaluate whether soil and geologic conditions do not differ significantly from those expected or identified in this report.

We performed the slope stability analyses based on the interpretation of geologic conditions encountered during our field investigation. We should evaluate the geologic conditions during the grading operations to check if the conditions observed during grading are consistent with our interpretations. Additional slope stability analyses may be required during the grading operations.

OCEANSIDE VISTA
OCEANSIDE, CALIFORNIA

Landslide Debris - Average of Ultimate-Inflection and Ultimate End-of-Test



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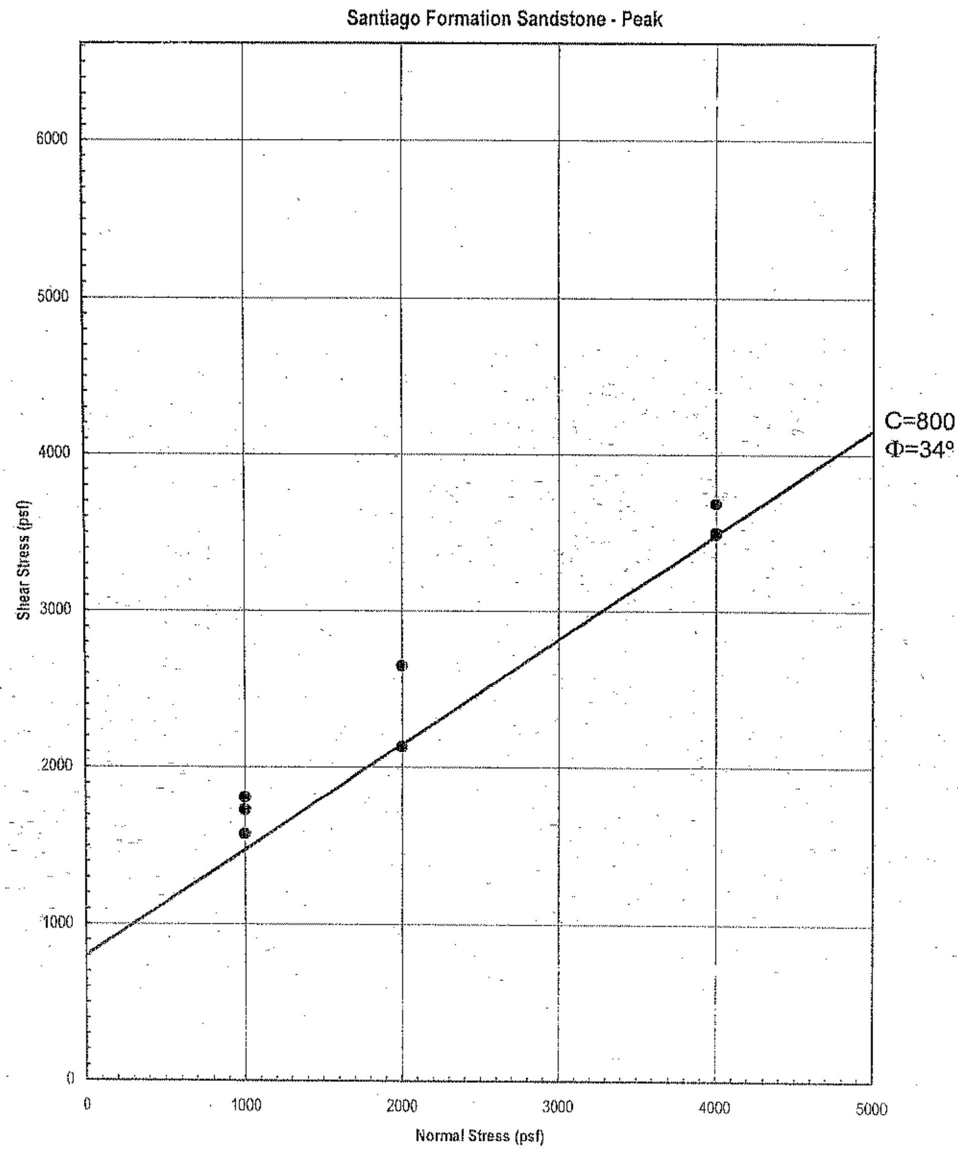
PROJECT NO. 07227 - 52 - 02

FIGURE C-1

OCEANSIDE VISTA
OCEANSIDE, CALIFORNIA



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PROJECT NO. 07227 - 52 - 02

FIGURE C-2

OCEANSIDE VISTA
OCEANSIDE, CALIFORNIA

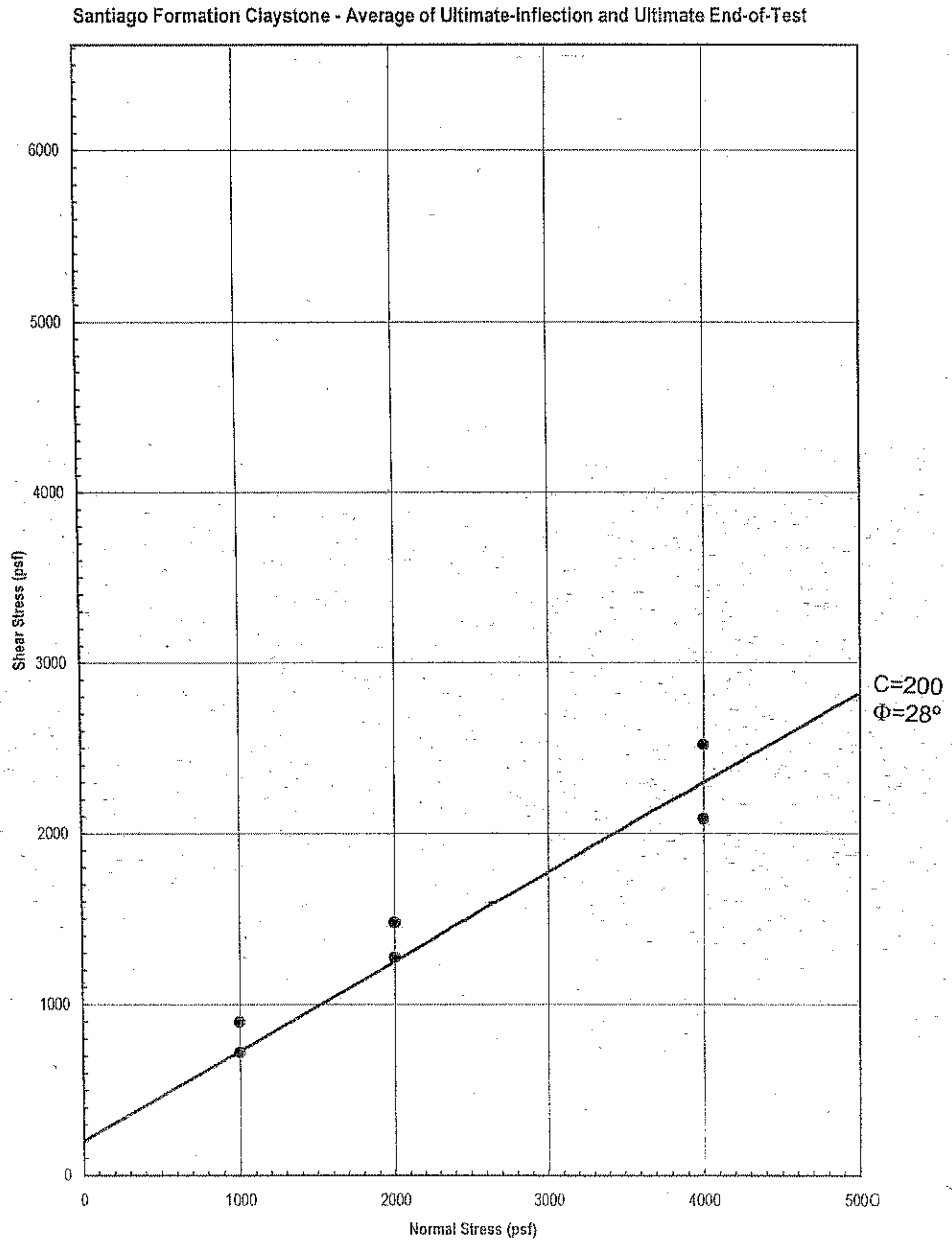

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FIGURE C-3

X:/R14TEMP/1_GEOTECH/1_GEOTECH_TEMPLATES

OCEANSIDE VISTA
OCEANSIDE, CALIFORNIA

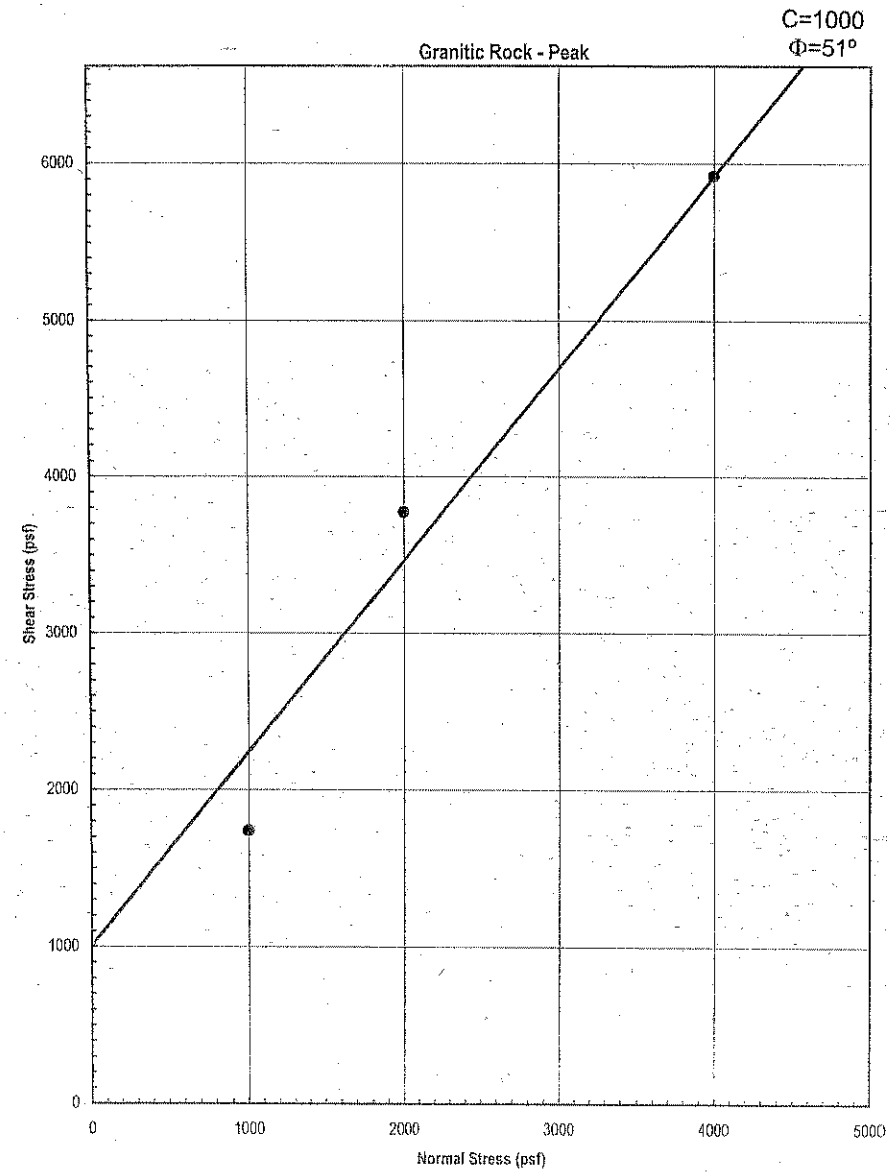

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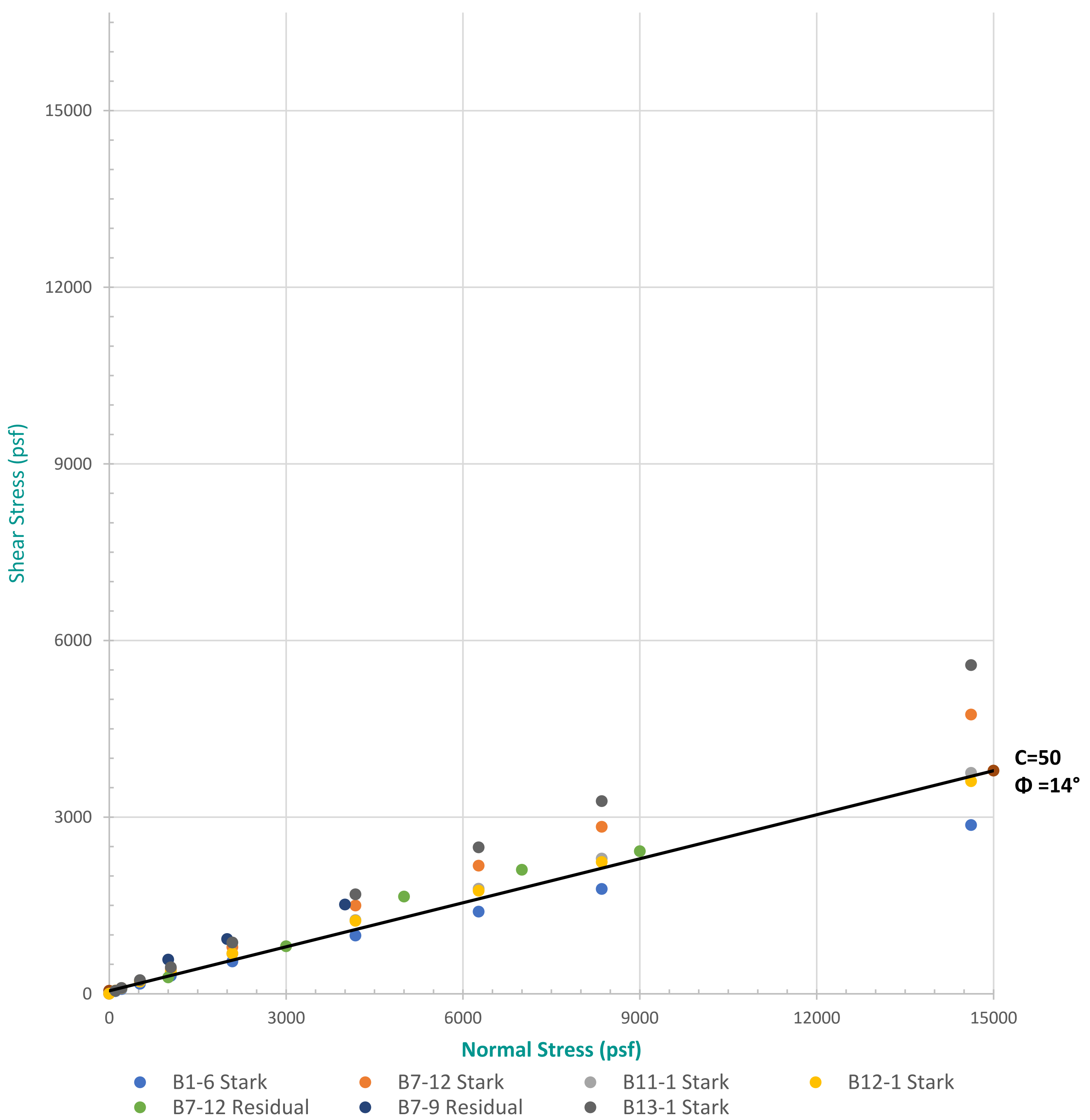
FIGURE C-5

Landslide Debris-Residual and Stark Correlations



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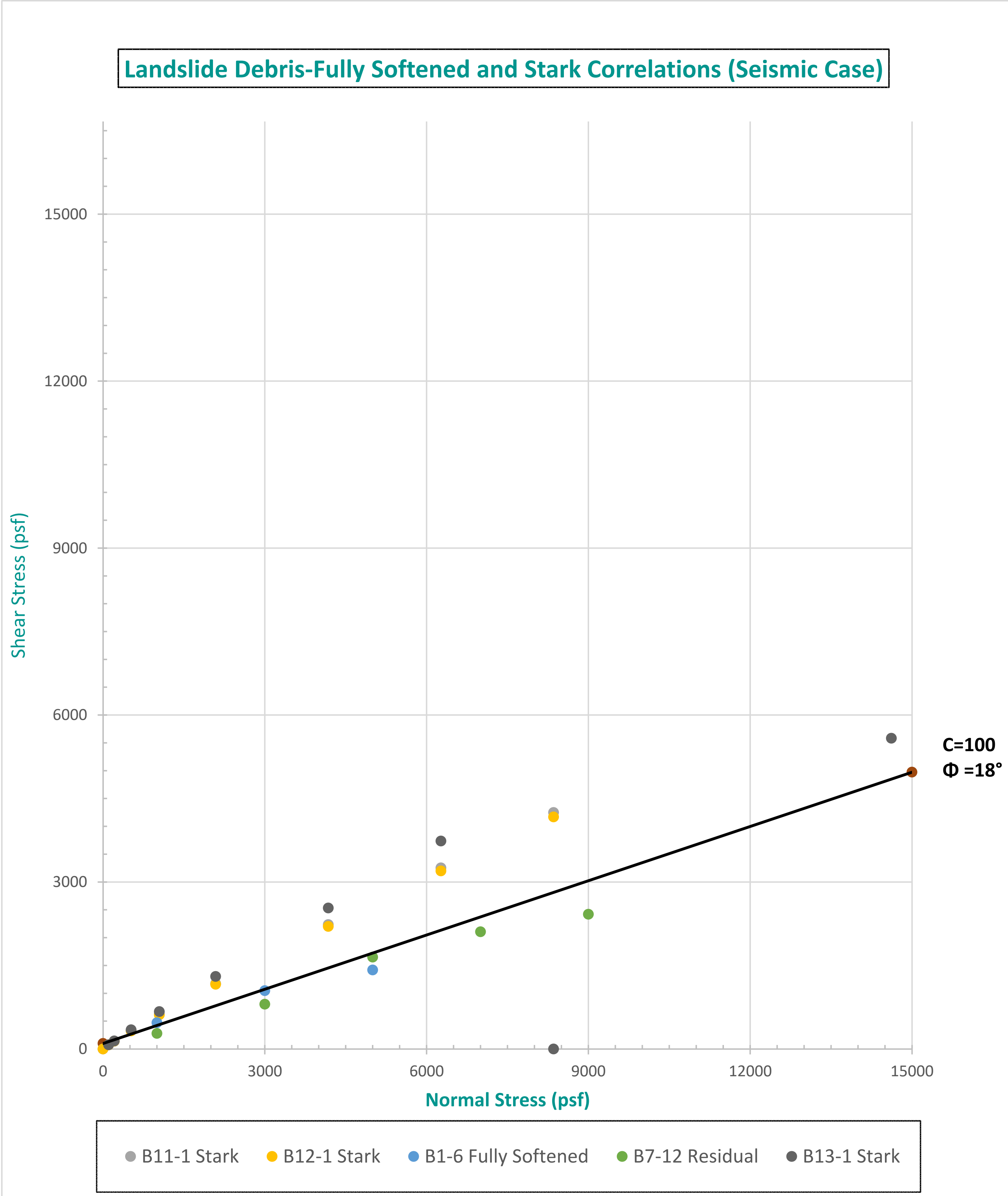
PHONE 858 558-6900 - FAX 858 558-6159

DIRECT SHEAR - AASHTO T-236 & STARK CORRELATIONS (2023)

OLIVE PARK APARTMENTS

PROJECT NO.: G3035-52-01



GEOCON INCORPORATED

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PHONE 858 558-6900 - FAX 858 558-6159

DIRECT SHEAR - AASHTO T-236 & STARK CORRELATIONS (2023)

OLIVE PARK APARTMENTS

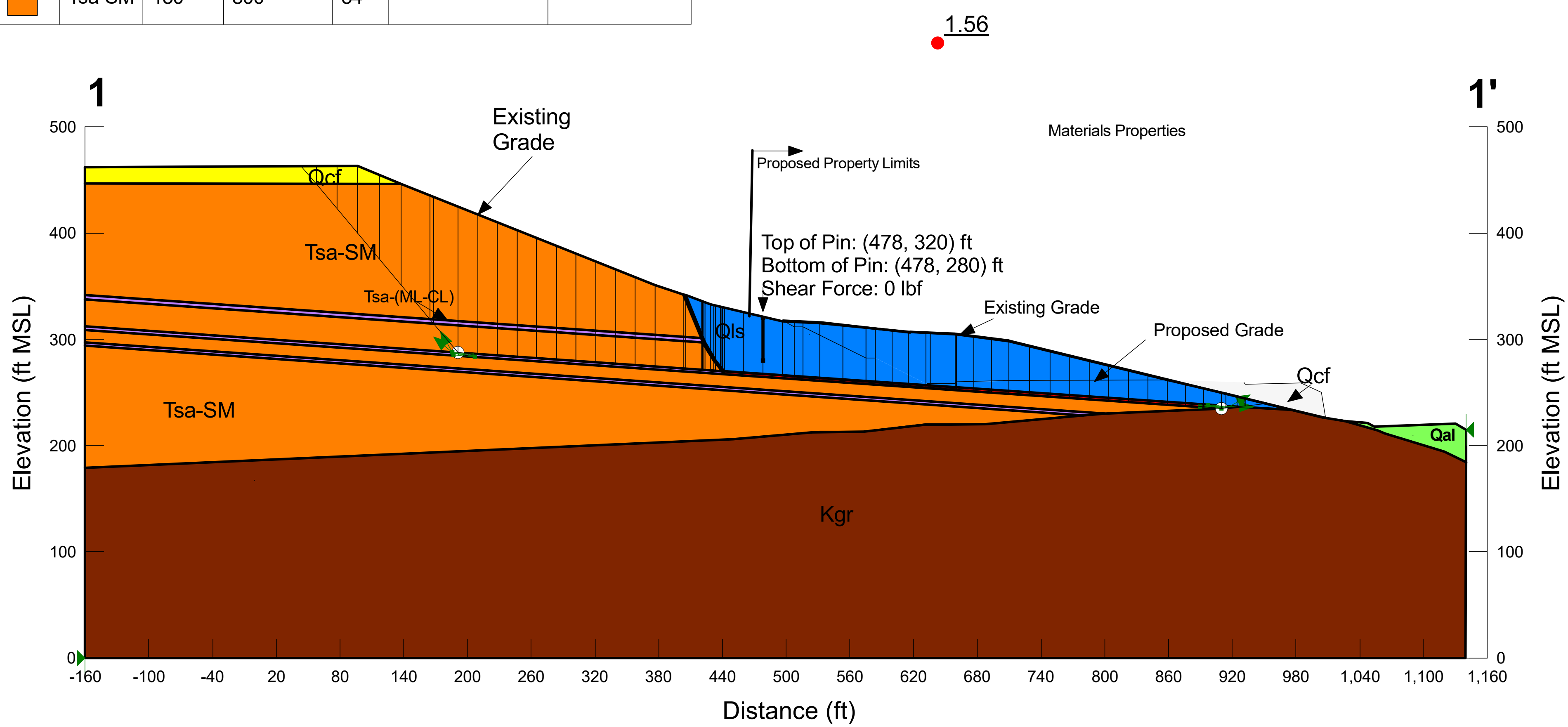
PROJECT NO.: G3035-52-01

Materials Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-SM	130	800	34		

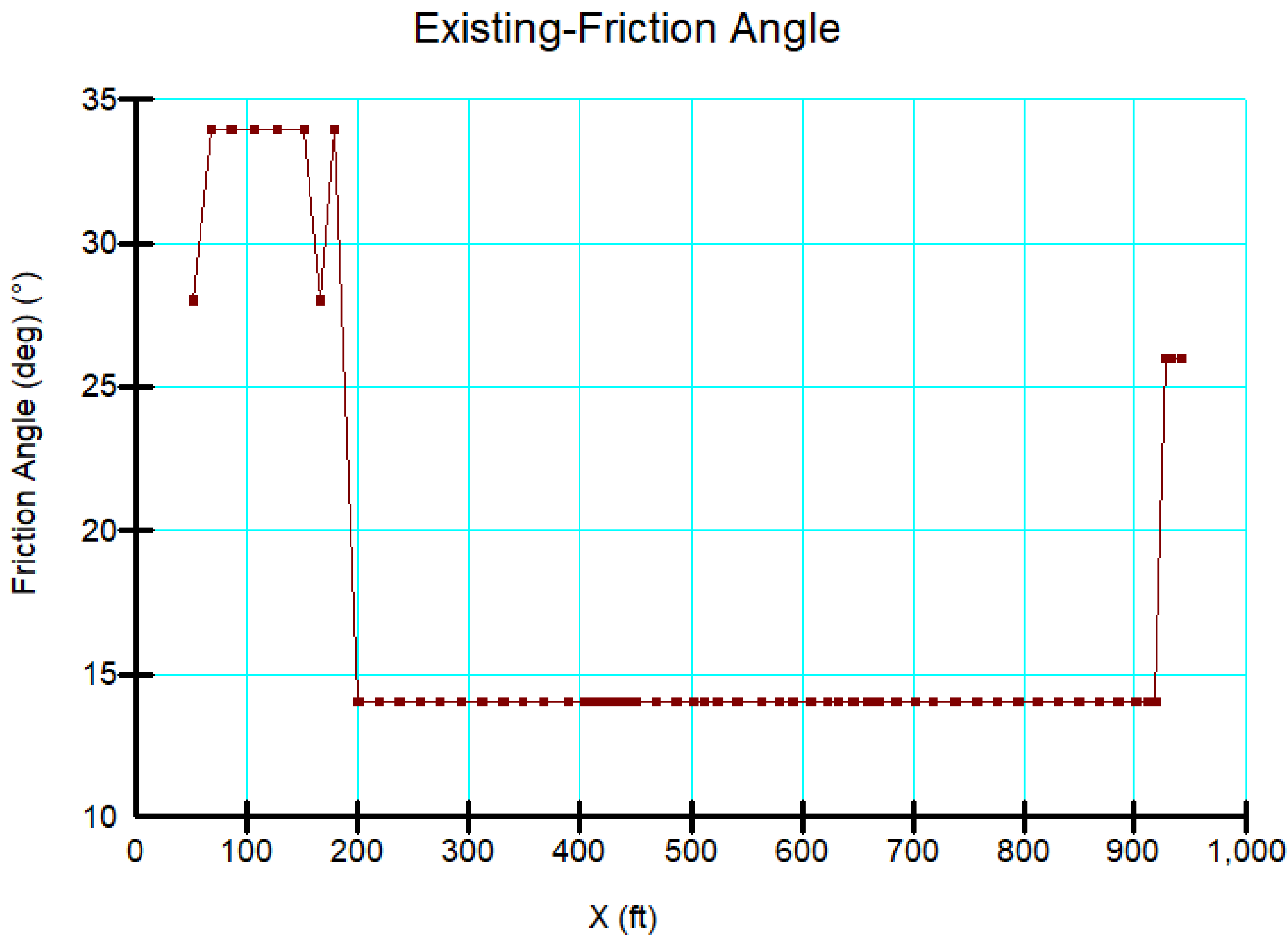
Existing Grade
Static Condition

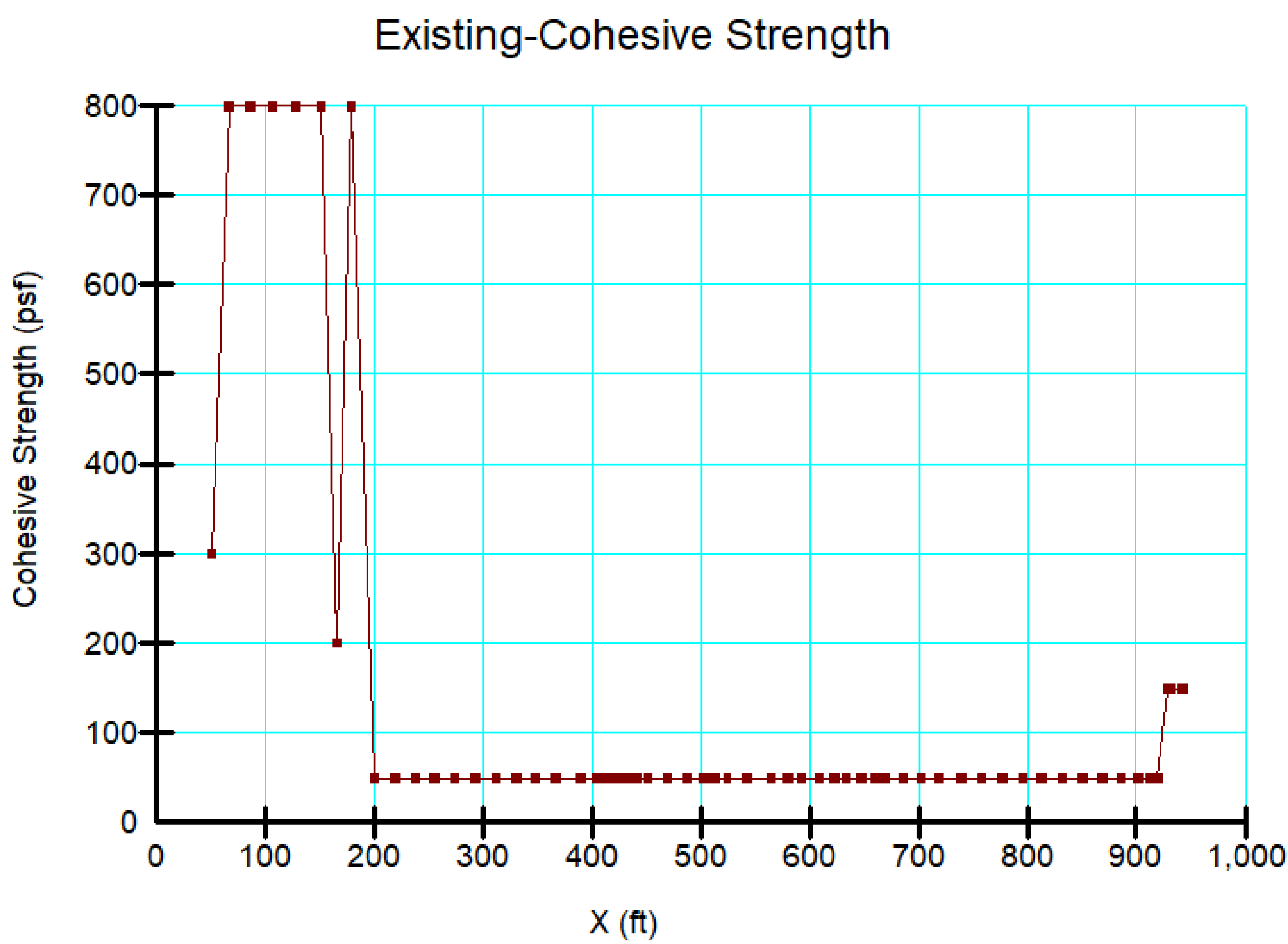
Olive Street
Project No. G3035-52-01
Name: 1-1'-Existing.gsz



Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\1-1' Geo Studio\File Name: 1-1'-Existing.gszDTime: 02:23:25 PMate: 07/25/2024

1-1'


Existing-Friction Angle
Friction Angle (deg) (°)
35
30
25
20
15
10
0
100
200
300
400
500
600
700
800
900
1,000
X (ft)

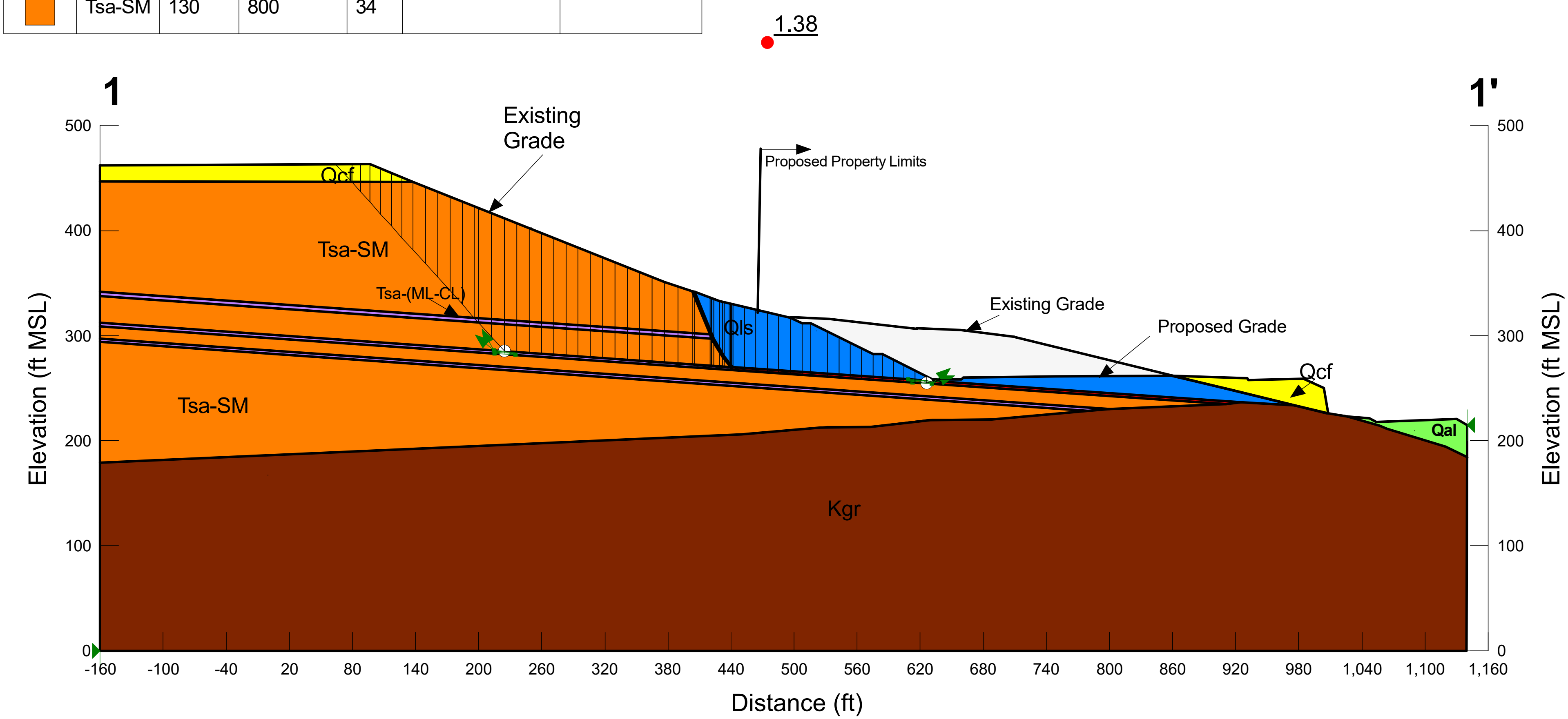

Existing-Cohesive Strength
Cohesive Strength (psf)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
800
900
1,000
X (ft)

Materials Properties:

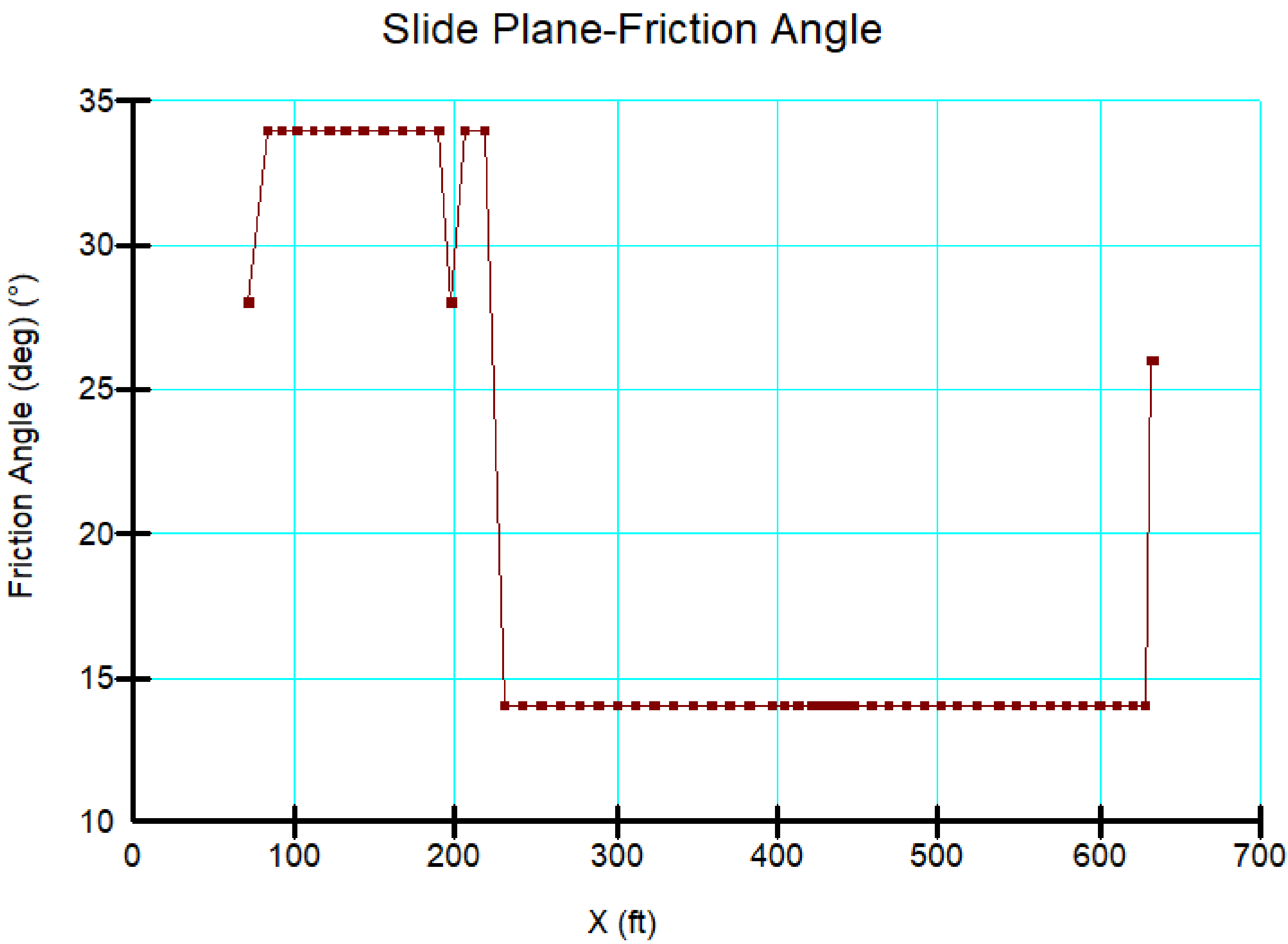
Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-SM	130	800	34		

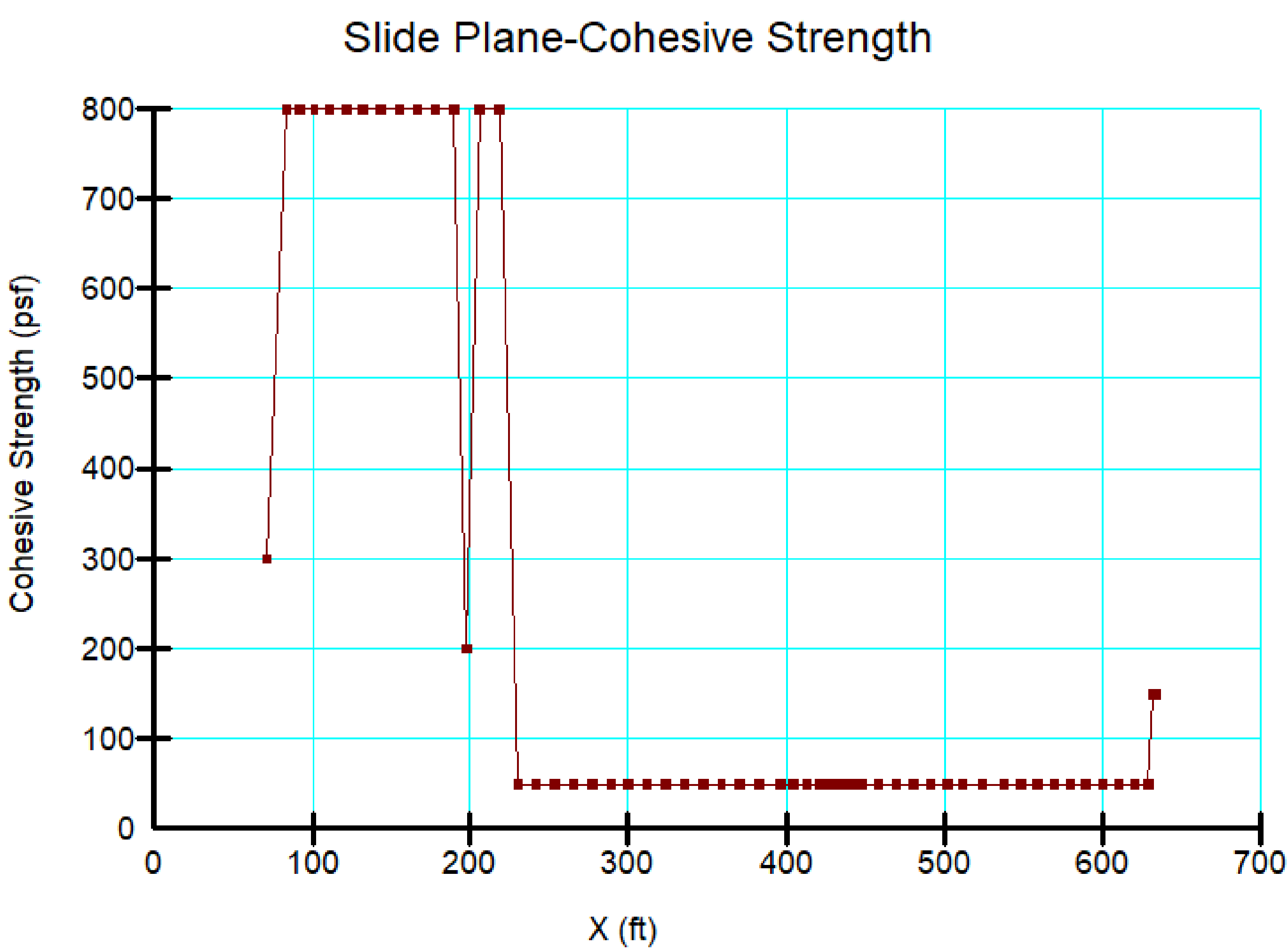
Proposed Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: Case 1_1-1'_Slide Plane.gsz



1-1'


Slide Plane-Friction Angle
Friction Angle (deg) (°)
35
30
25
20
15
10
0
100
200
300
400
500
600
700
X (ft)

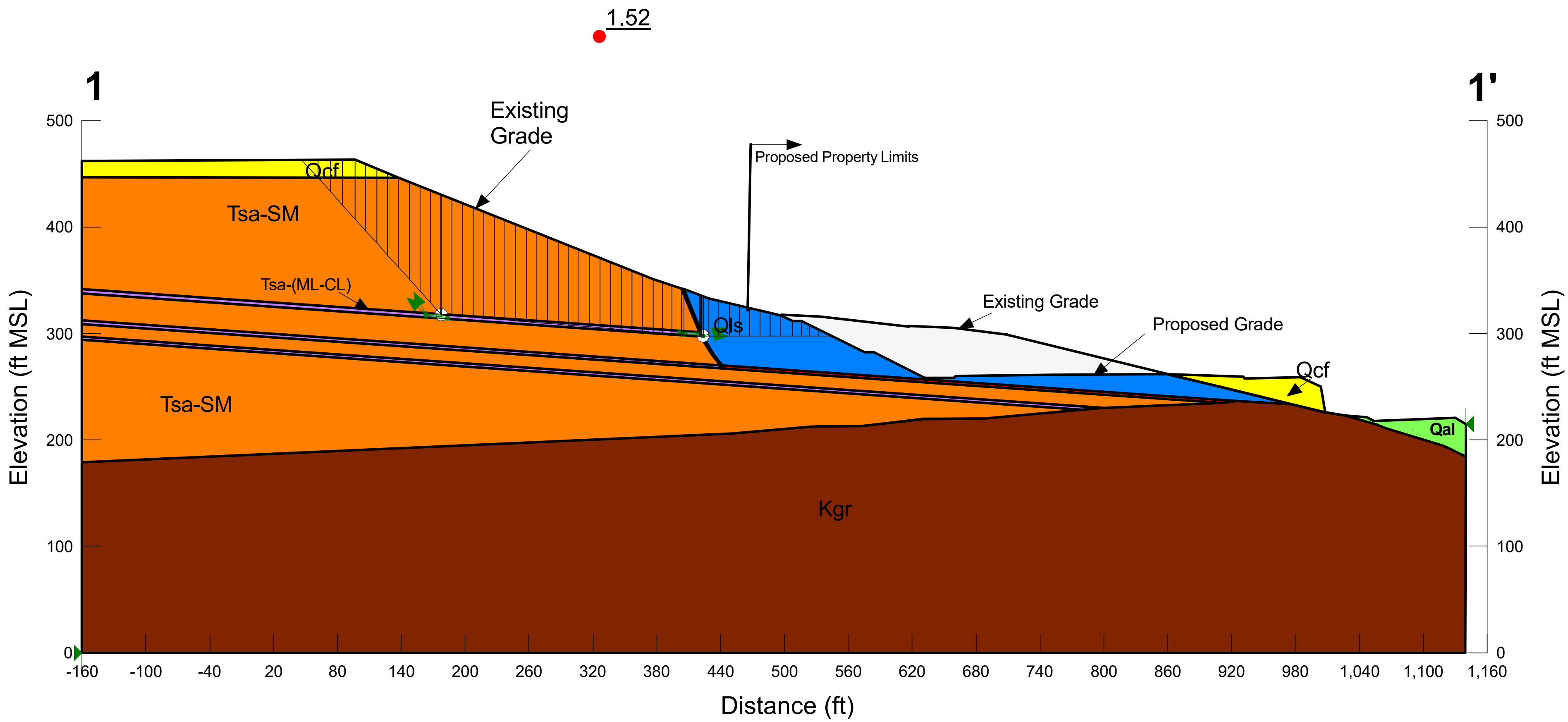

Slide Plane-Cohesive Strength
Cohesive Strength (psf)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
X (ft)

Materials Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-SM	130	800	34		

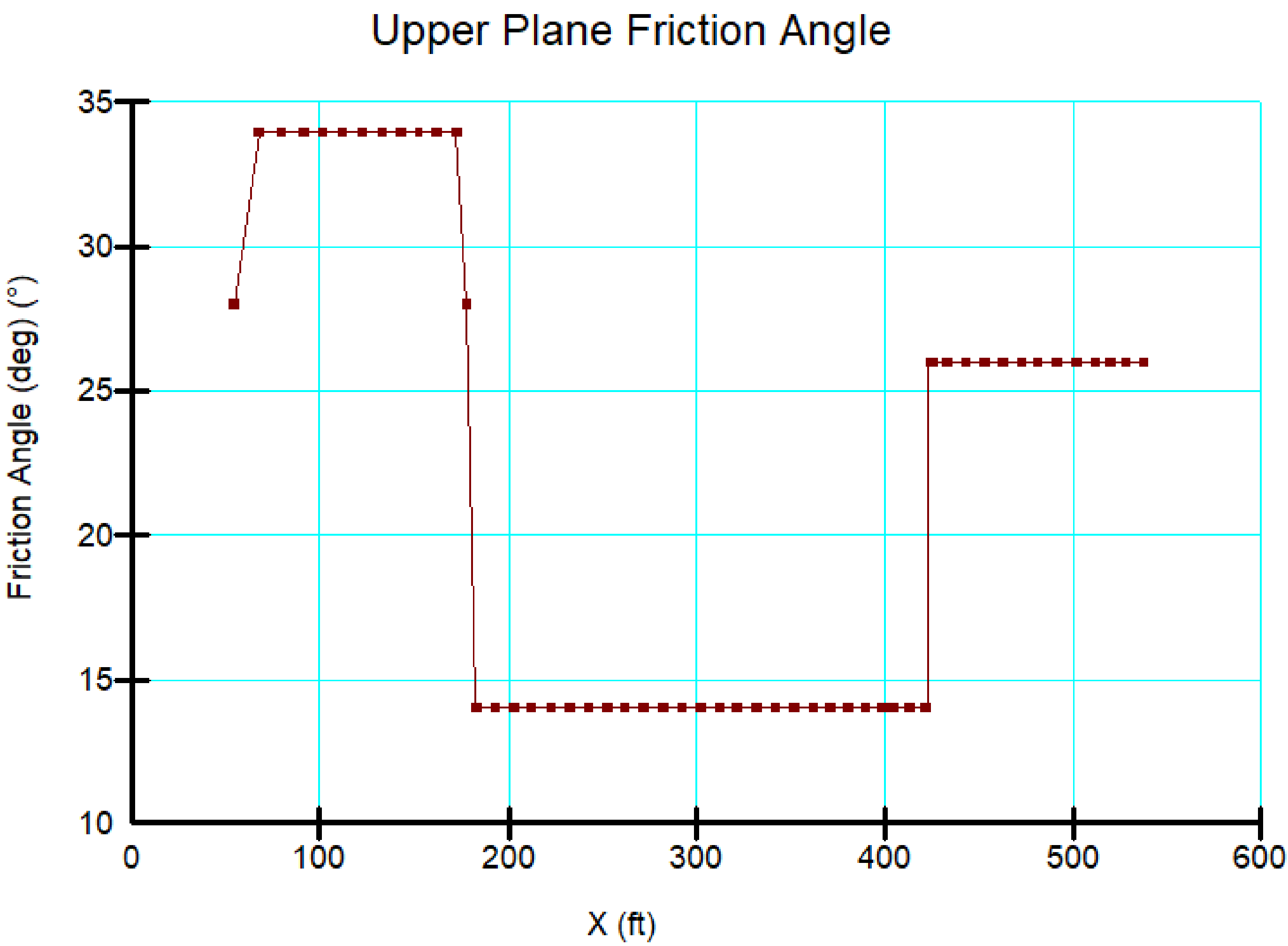
Proposed Grade
Static Condition

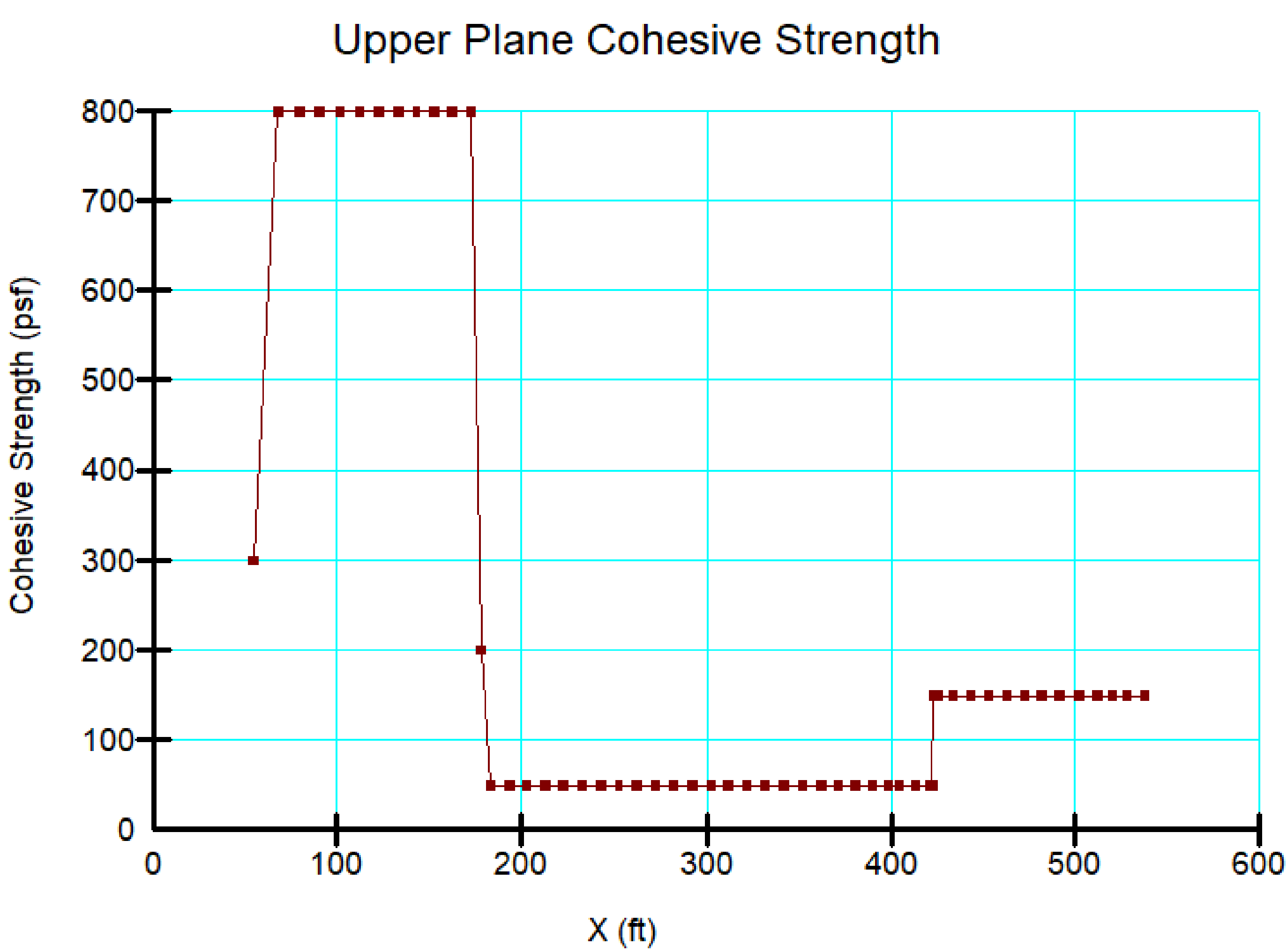
Olive Street
Project No. G3035-52-01
Name: Case 2_1-1'_Upper Plane.gsz



Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\1-1' Geo Studio\File Name: Case 2_1-1'_Upper Plane.gszDTime: 02:39:33 PMate: 07/25/2024

1-1'


Upper Plane Friction Angle
Friction Angle (deg) (°)
35
30
25
20
15
10
0
100
200
300
400
500
600
X (ft)

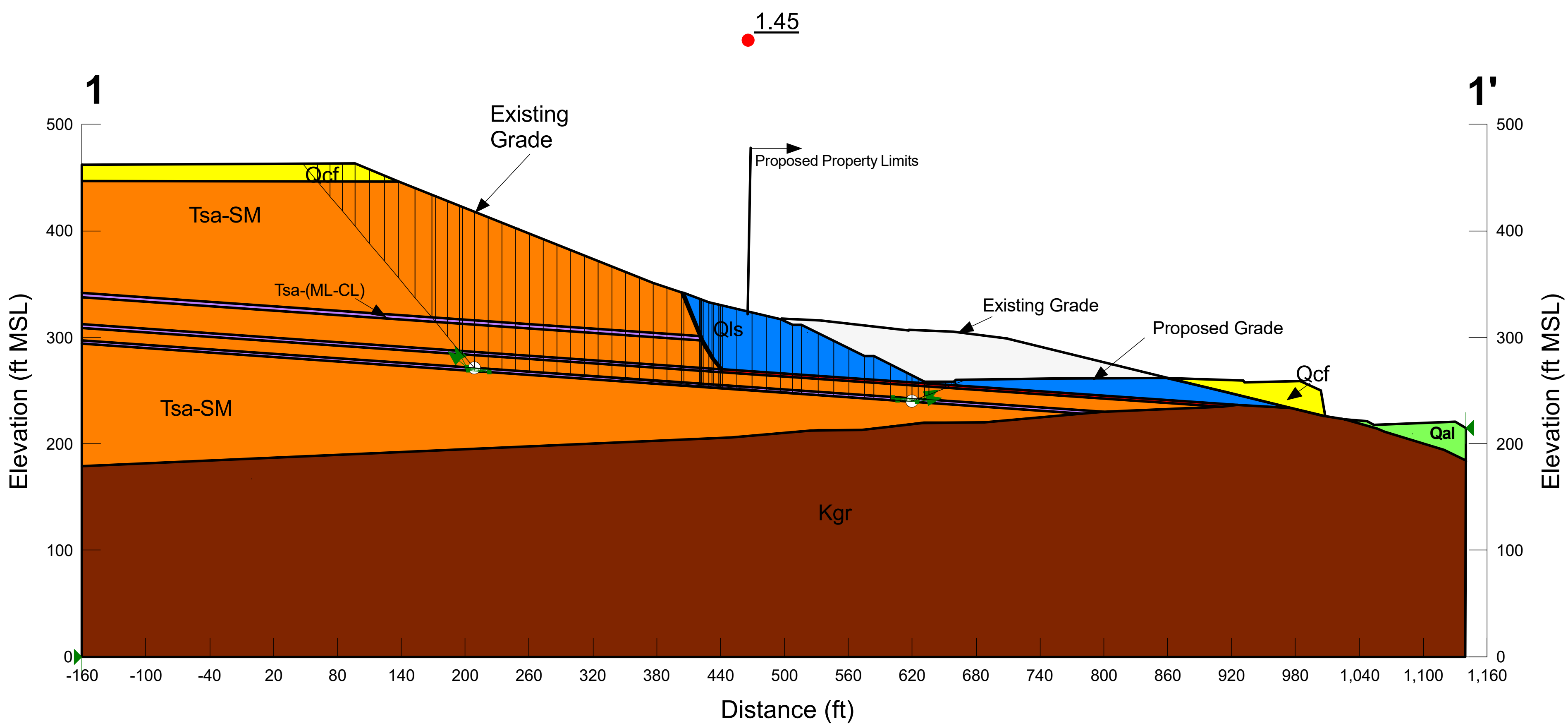

Upper Plane Cohesive Strength
Cohesive Strength (psf)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
X (ft)

Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-SM	130	800	34		

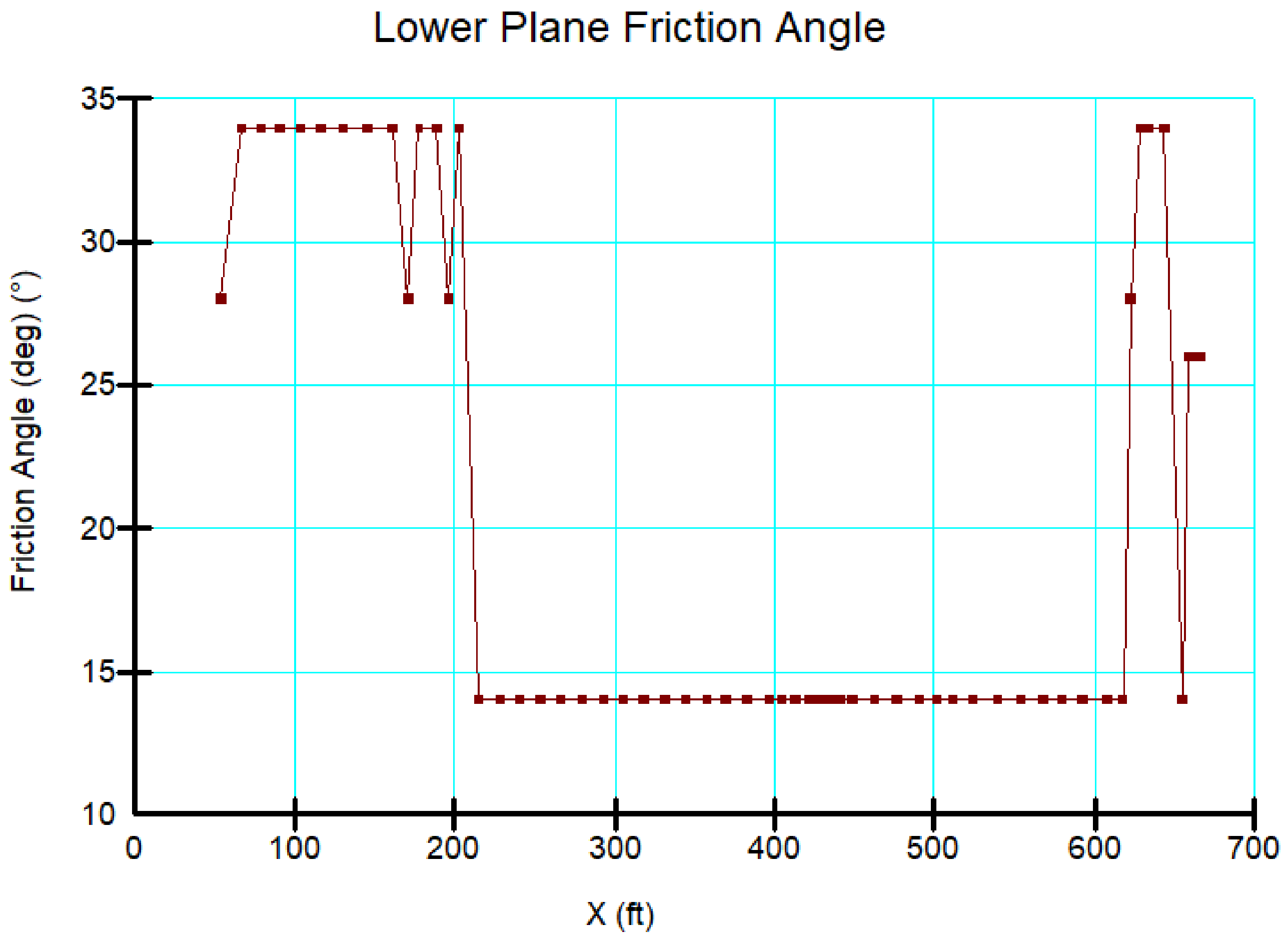
Proposed Grade
Static Condition

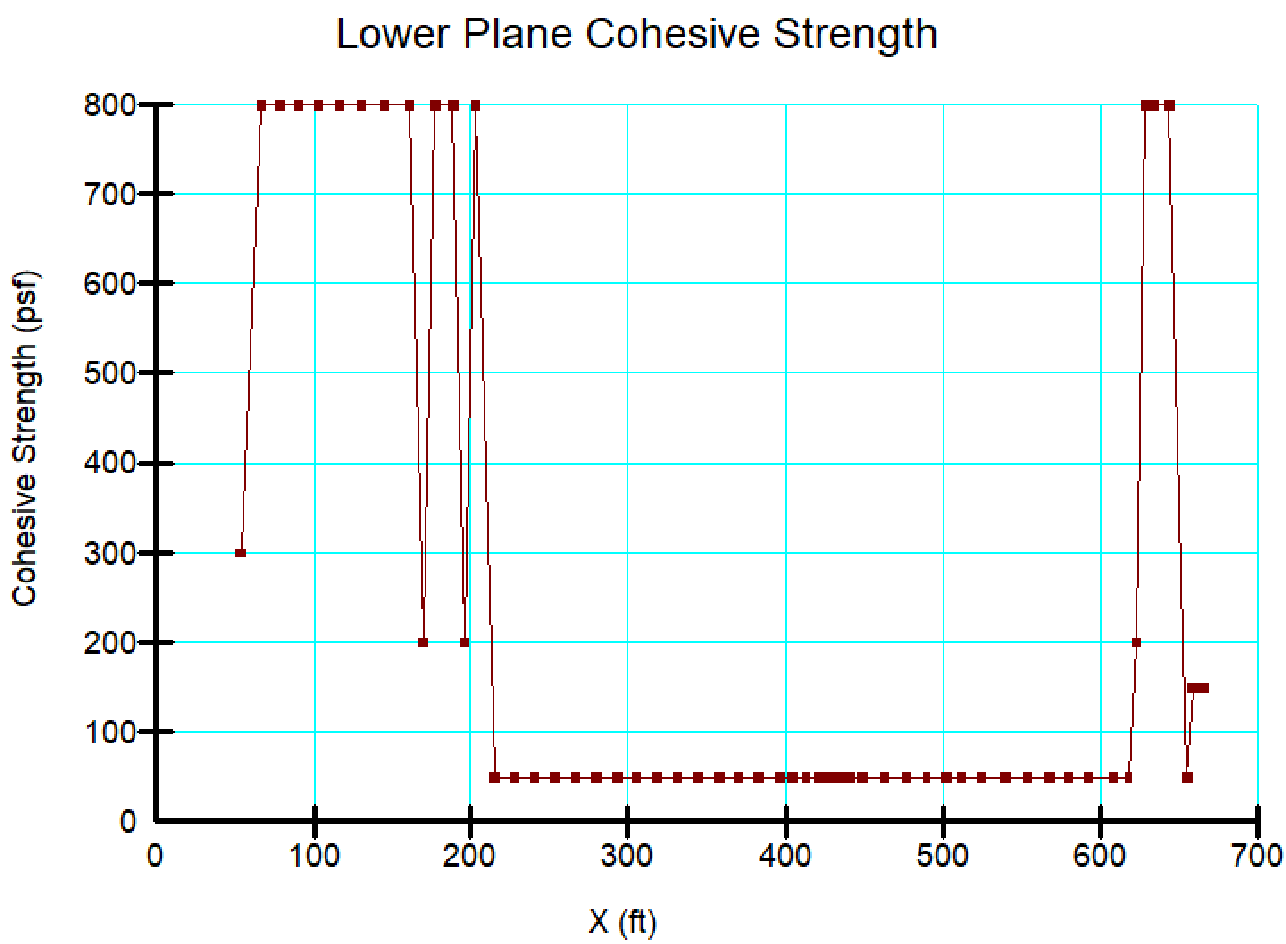
Olive Street
Project No. G3035-52-01
Name: Case 3_1-1'_Lower Plane.gsz



Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\1-1' Geo Studio\File Name: Case 3_1-1'_Lower Plane.gszDTime: 01:55:28 PMate: 07/26/2024

1-1'


Lower Plane Friction Angle
Friction Angle (deg) (°)
35
30
25
20
15
10
0
100
200
300
400
500
600
700
X (ft)

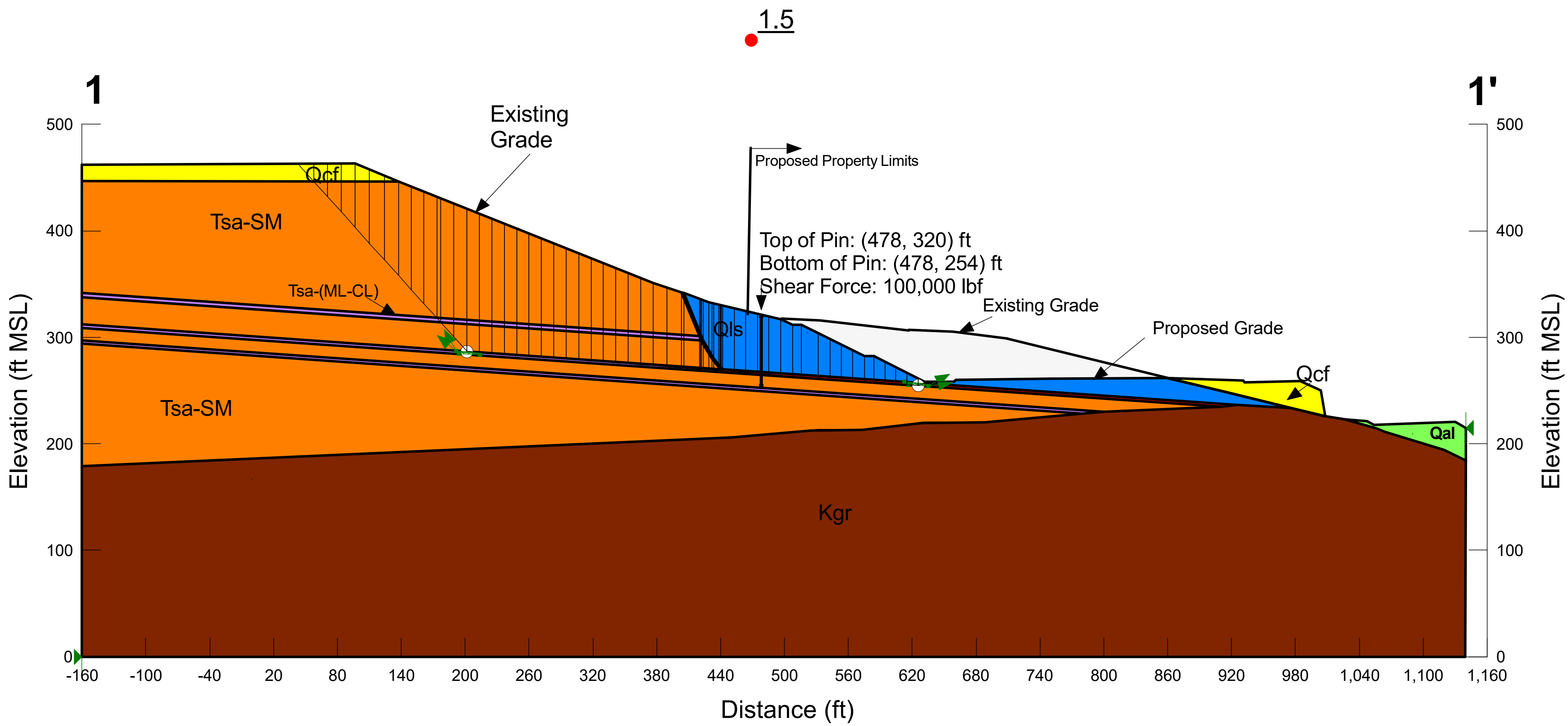

Lower Plane Cohesive Strength
Cohesive Strength (psf)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
X (ft)

Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-SM	130	800	34		

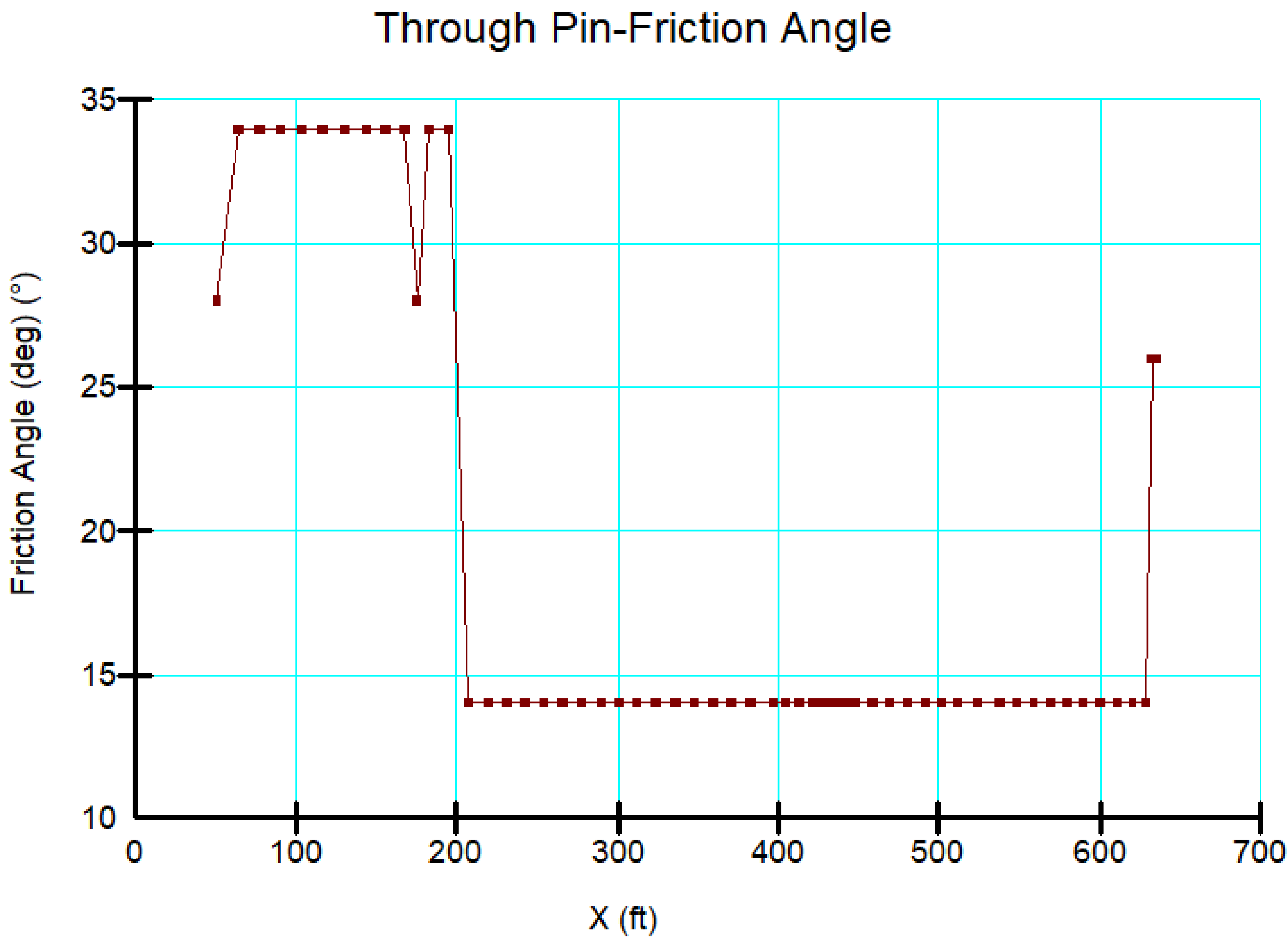
Proposed Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: Case 4_1-1'_Through Pin.gsz

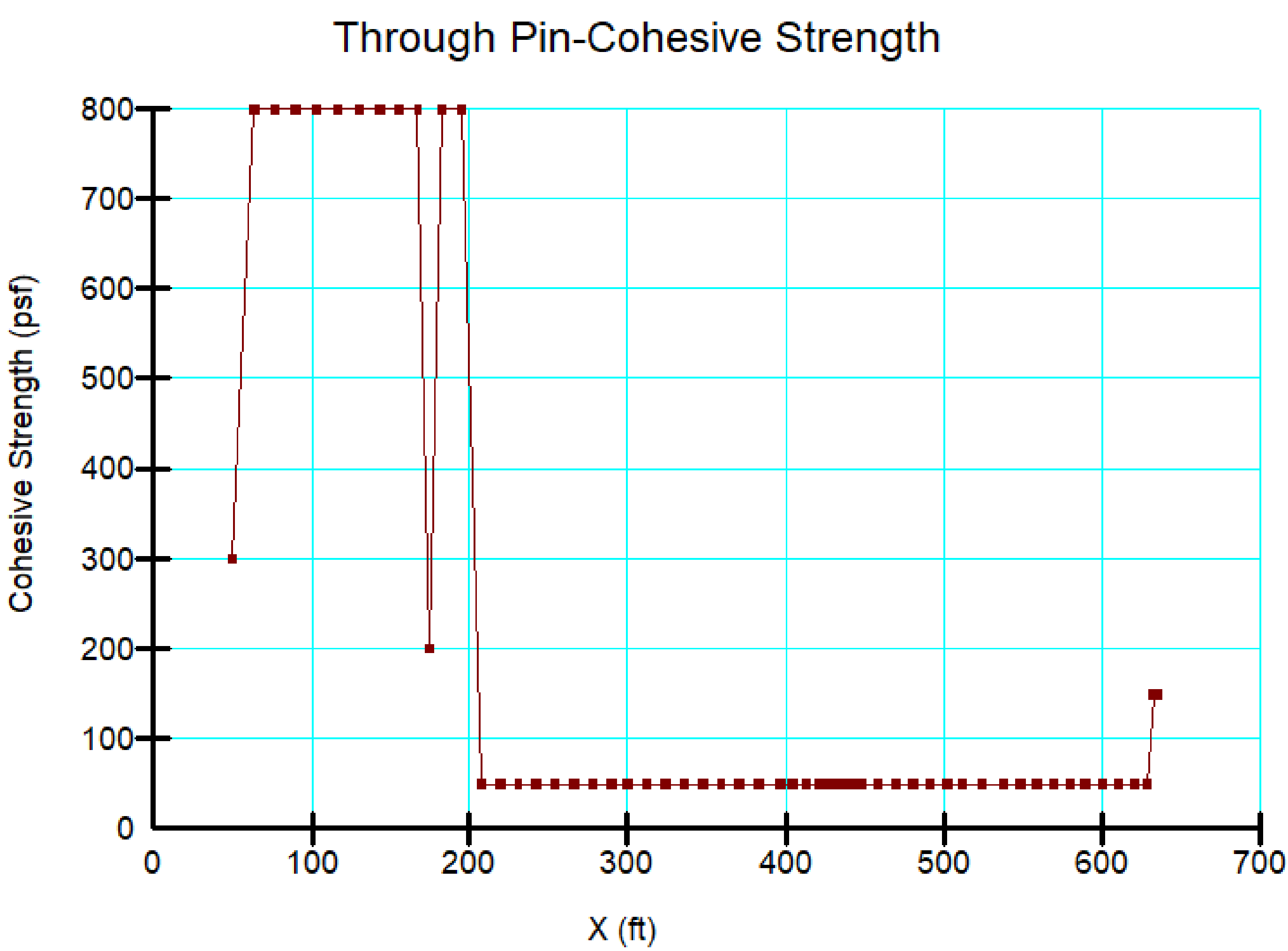


Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\1-1' Geo Studio\File Name: Case 4_1-1'_Through Pin.gszDTime: 02:03:22 PMate: 07/26/2024

1-1'



Through Pin-Friction Angle
Friction Angle (deg) (°)
35
30
25
20
15
10
0
100
200
300
400
500
600
700
X (ft)



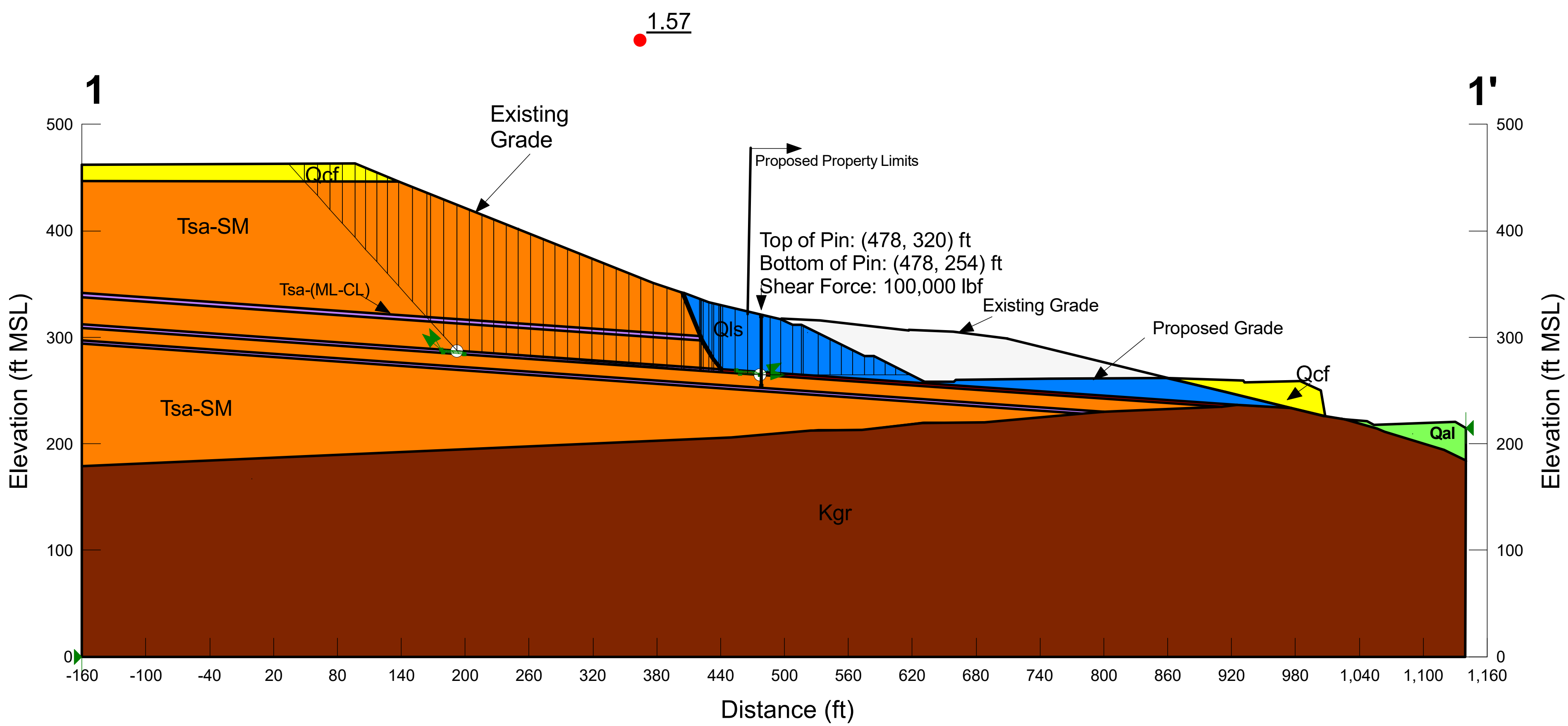
Through Pin-Cohesive Strength
Cohesive Strength (psf)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
X (ft)

Proposed Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: Case 5_1-1'_Behind Pin-Slide Plane.gsz

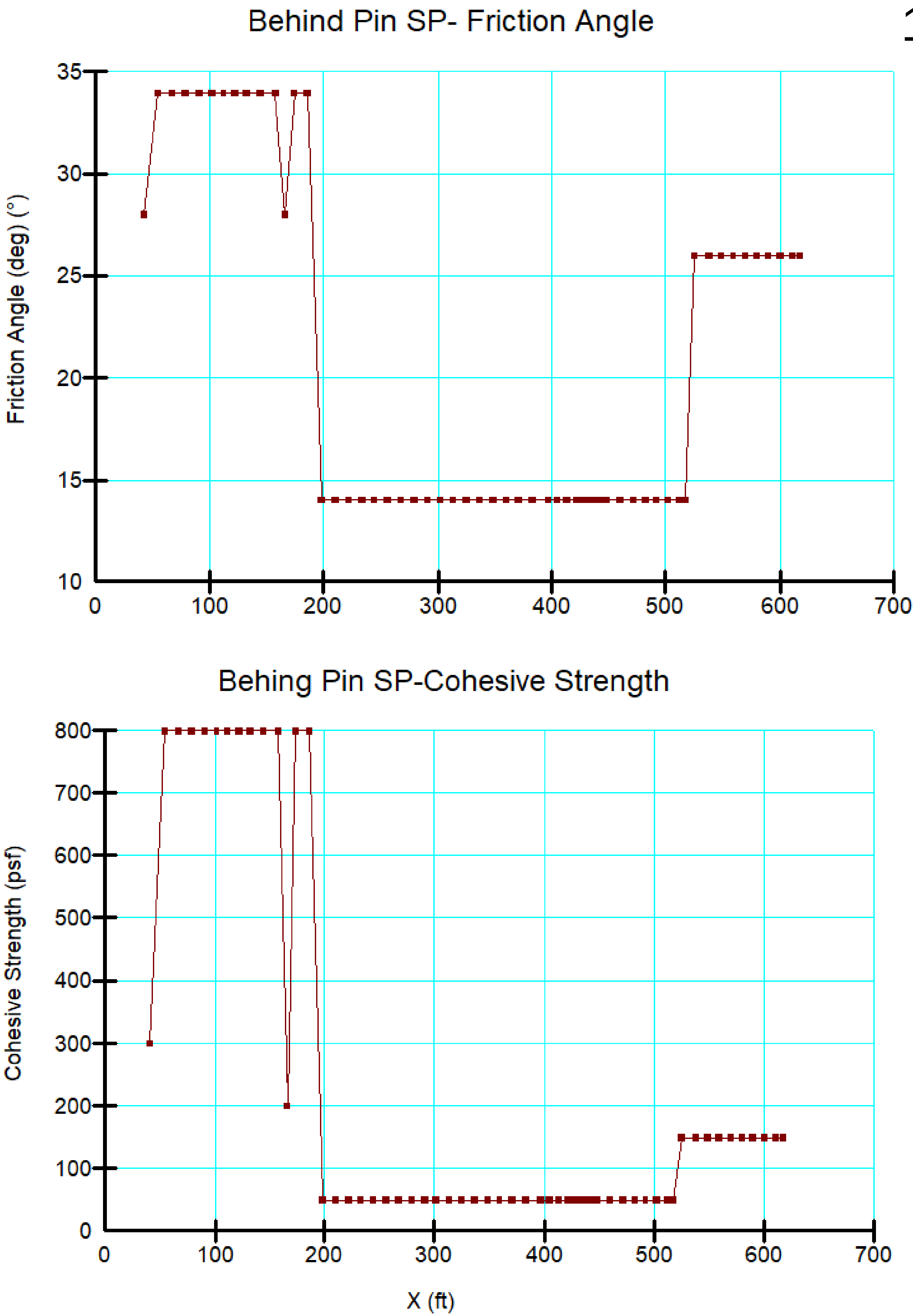
Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-SM	130	800	34		



Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\1-1' Geo Studio\File Name: Case 5_1-1'_Behind Pin-Slide Plane.gszDTime: 10:59:42 AMate: 07/28/2024

1-1'



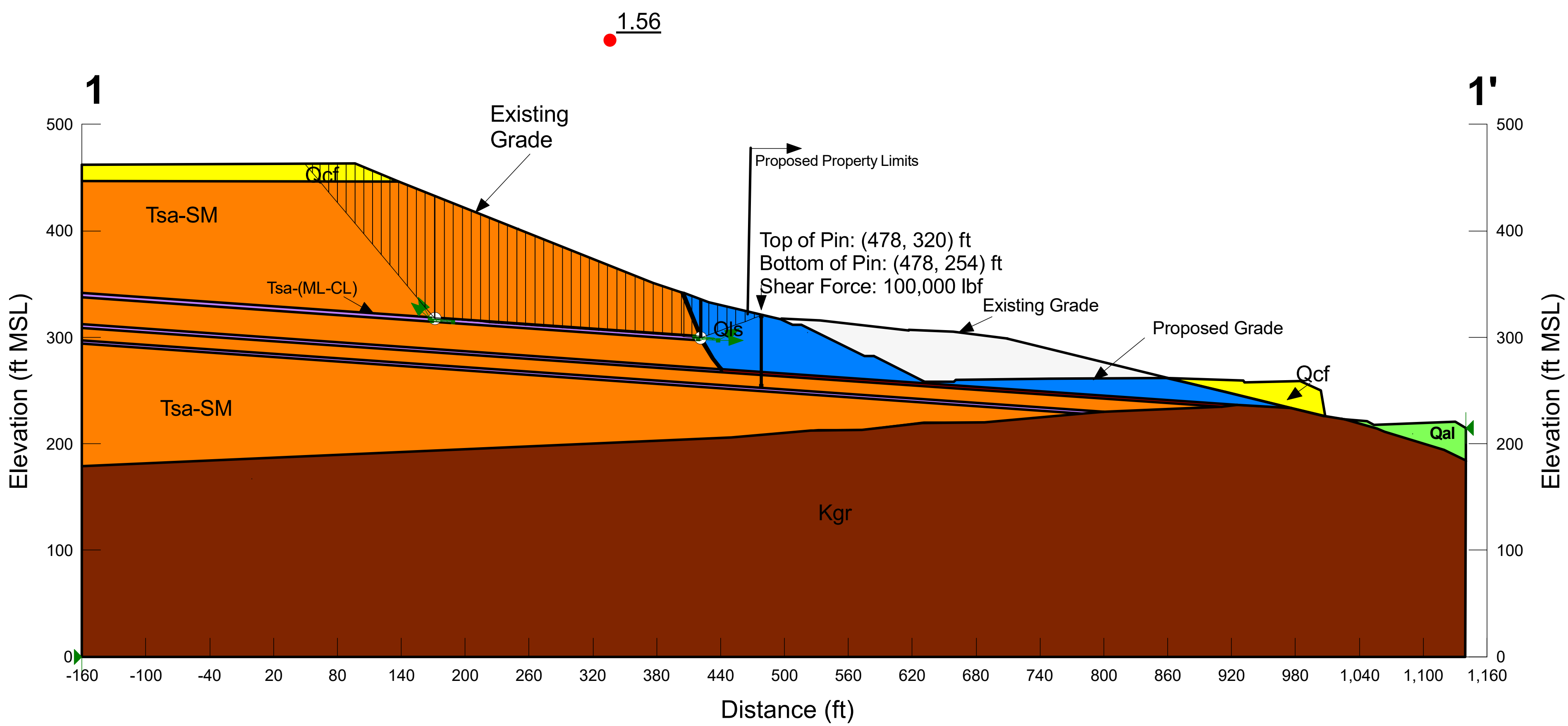
Behind Pin SP- Friction Angle
Friction Angle (deg) (°)
35
30
25
20
15
10
0
100
200
300
400
500
600
700
Behing Pin SP-Cohesive Strength
Cohesive Strength (psf)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
X (ft)

Proposed Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: Case 6_1-1'_Behind Pin-Upper.gsz

Material Properties:

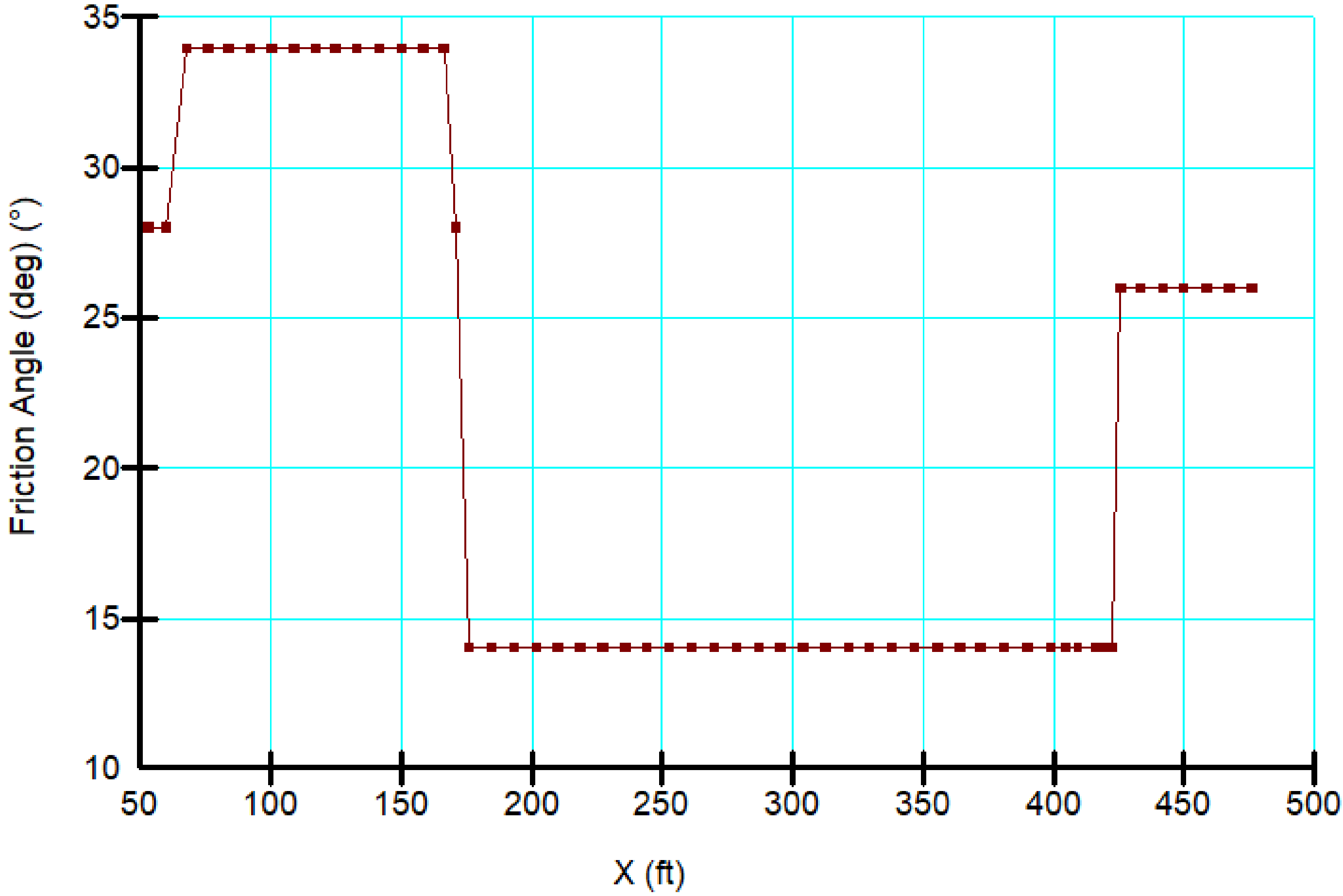
Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-SM	130	800	34		



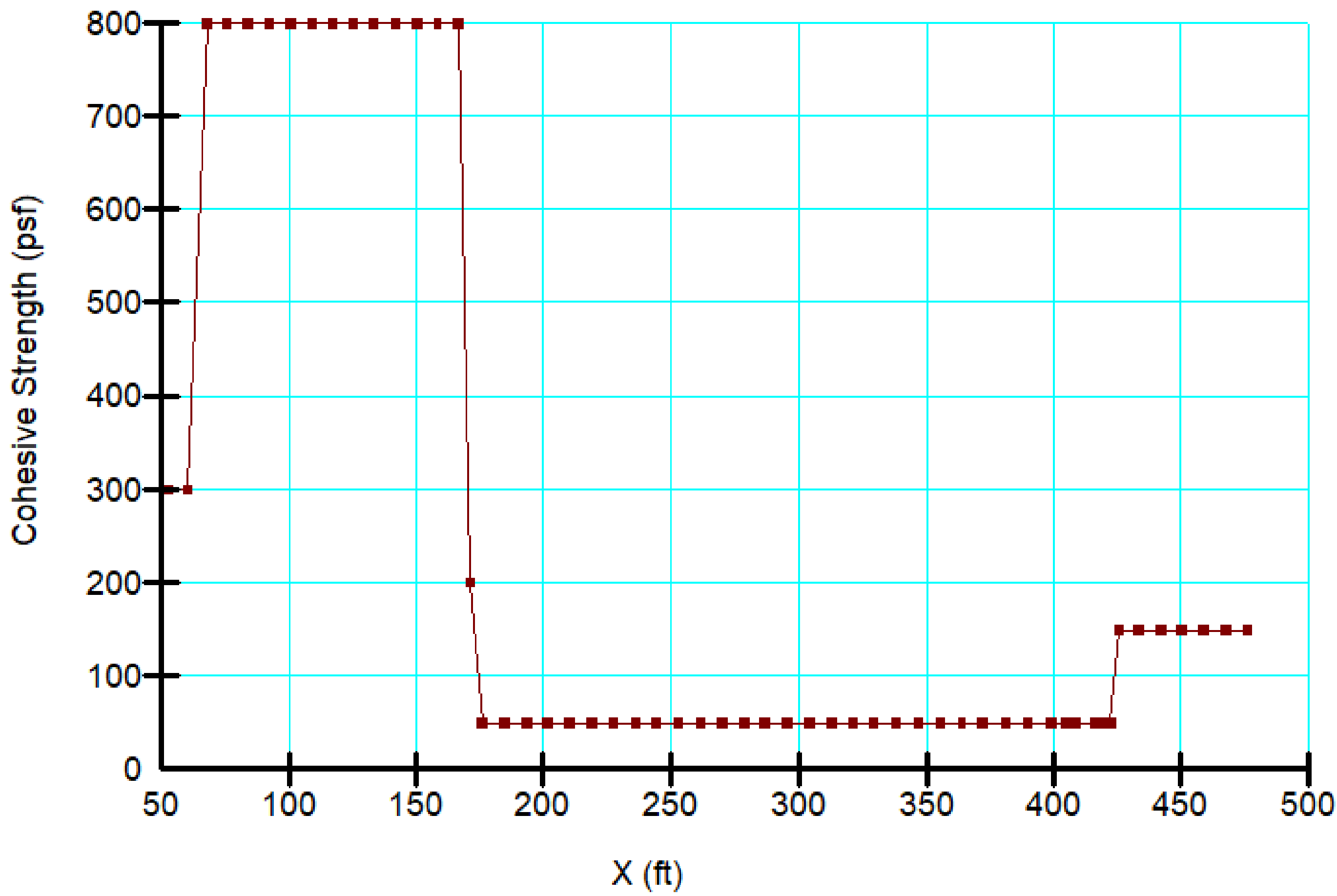
Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\1-1' Geo Studio\File Name: Case 6_1-1'_Behind Pin-Upper.gszDTime: 11:09:01 AMate: 07/28/2024

1-1'

Behind Pin UP-Friction Angle



Behind Plane UP-Cohesive Strength

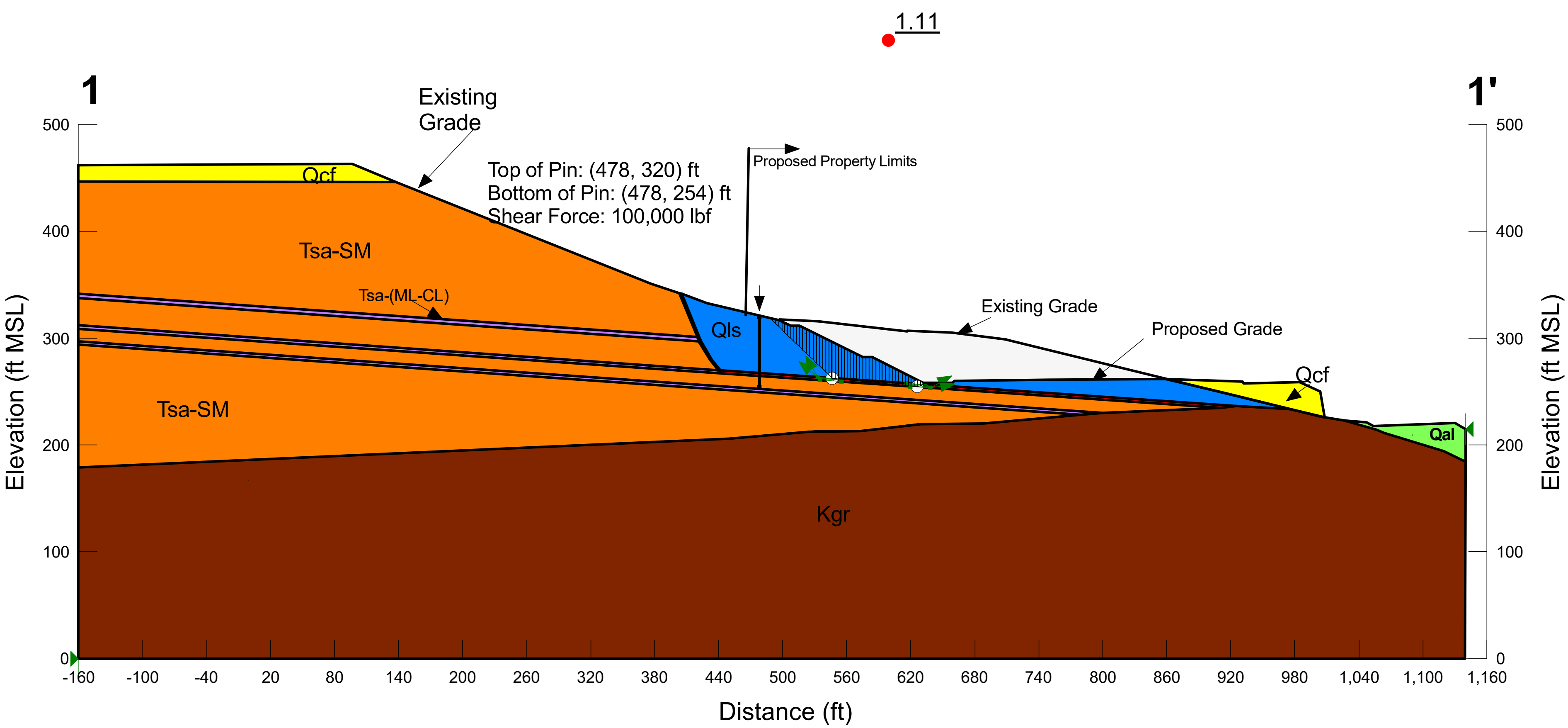


Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-SM	130	800	34		

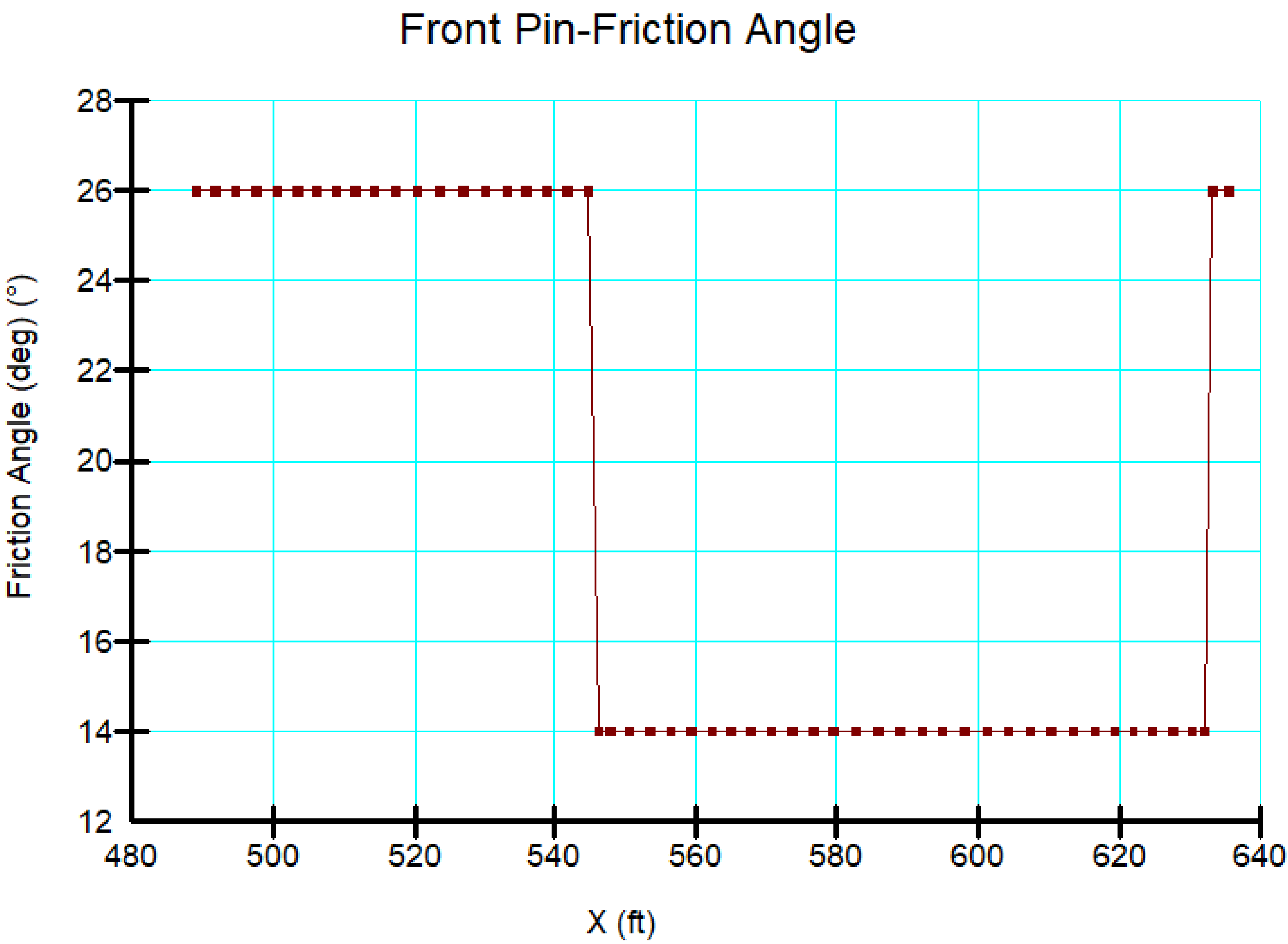
Proposed Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: Case 7_1-1'_Front Pin.gsz

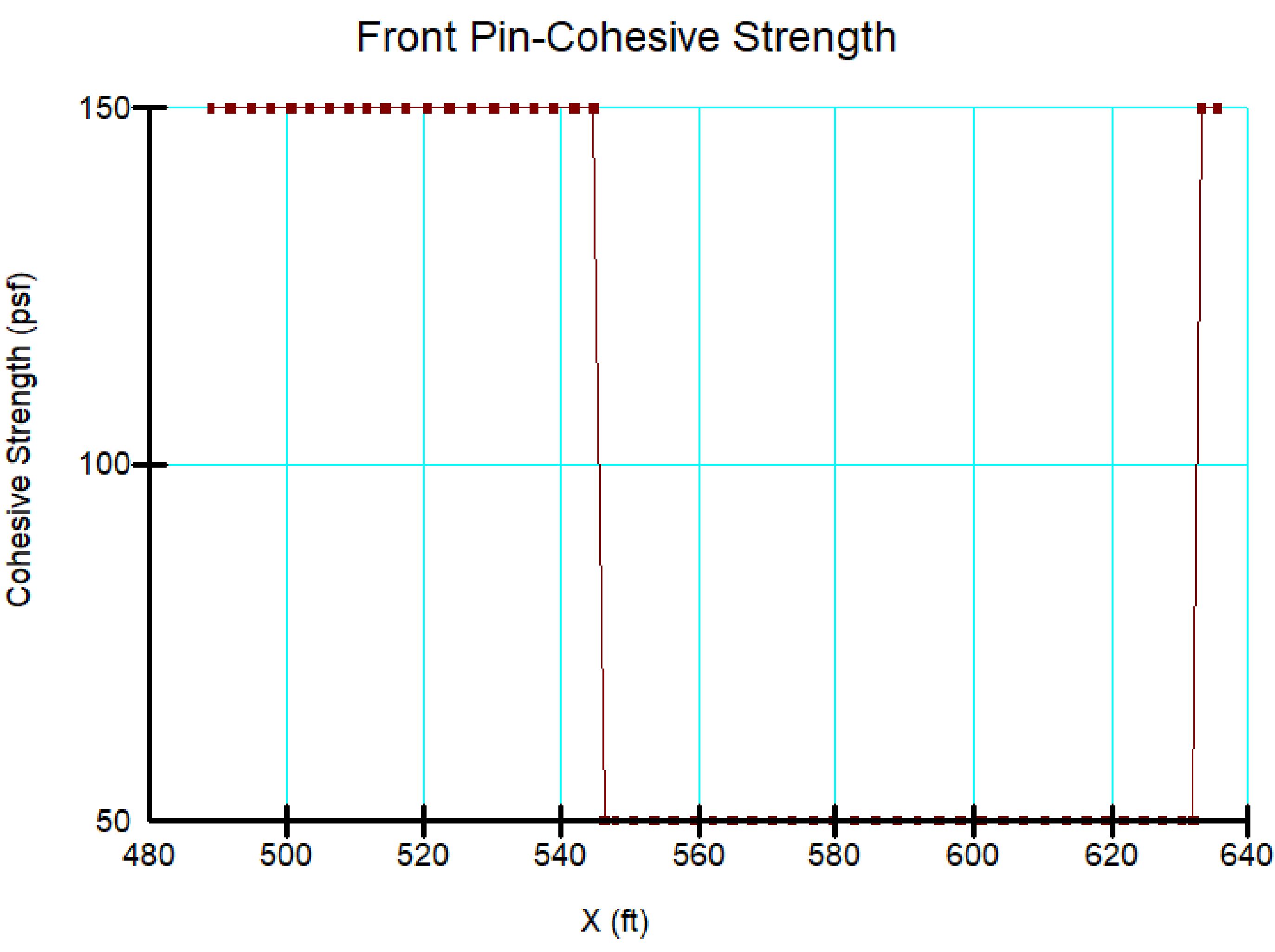


Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\1-1' Geo Studio\File Name: Case 7_1-1'_Front Pin.gszDTime: 11:42:01 AMate: 07/28/2024

1-1'



Front Pin-Friction Angle
Friction Angle (deg) (°)
28
26
24
22
20
18
16
14
12
480
500
520
540
560
580
600
620
640
X (ft)



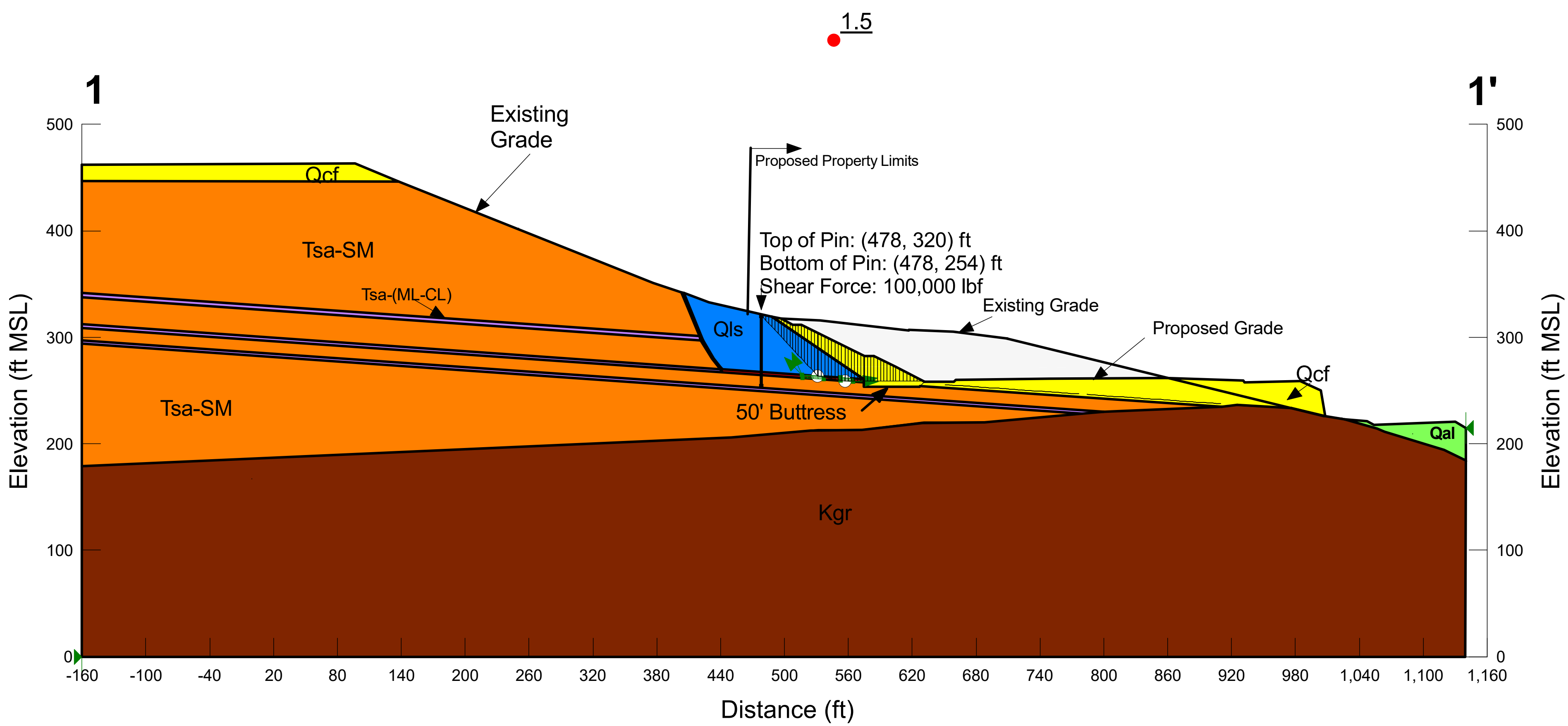
Front Pin-Cohesive Strength
Cohesive Strength (psf)
150
100
50
480
500
520
540
560
580
600
620
640
X (ft)

Proposed Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: Case 8_1-1'_Buttress.gsz

Material Properties:

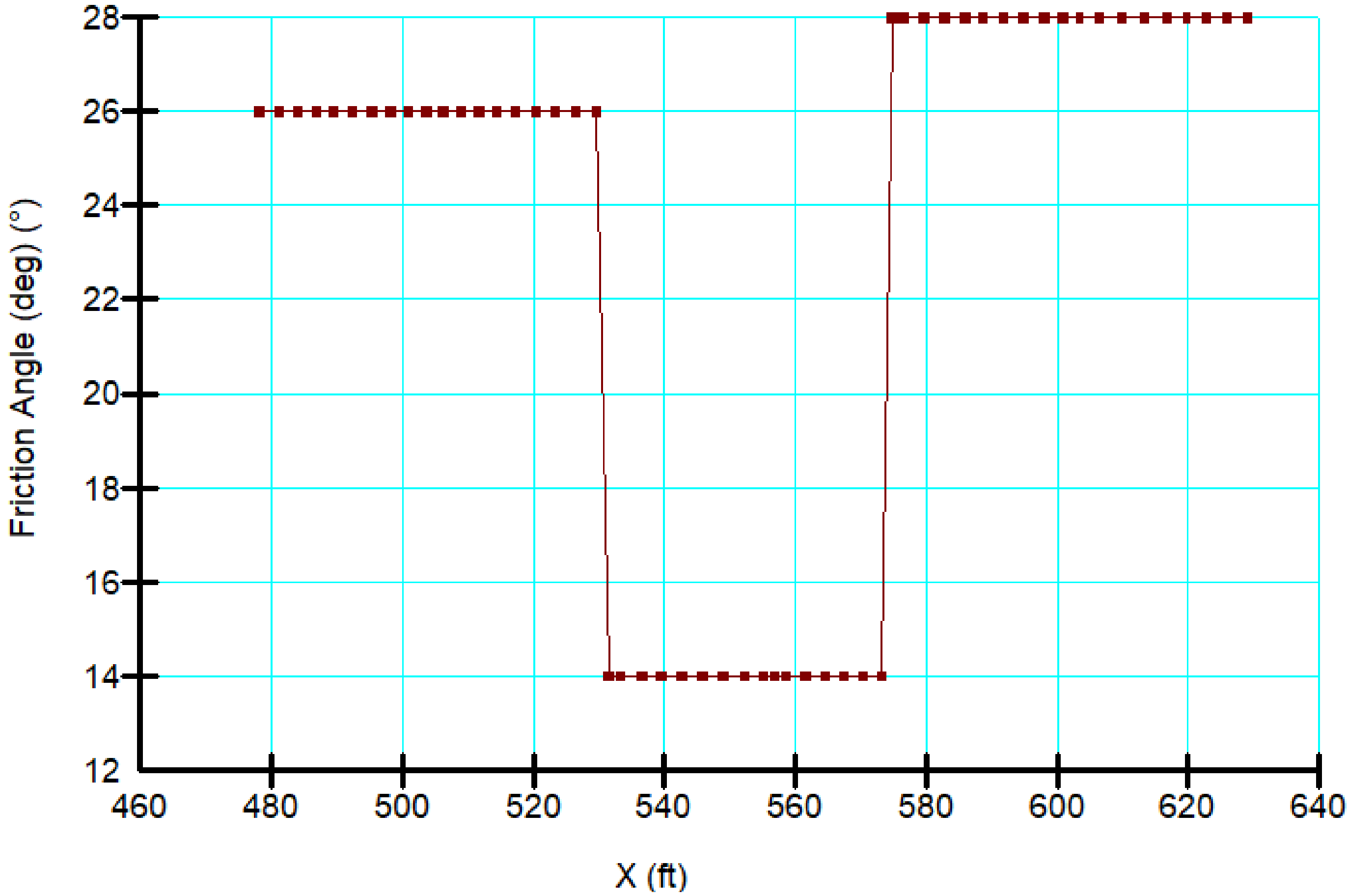
Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-SM	130	800	34		



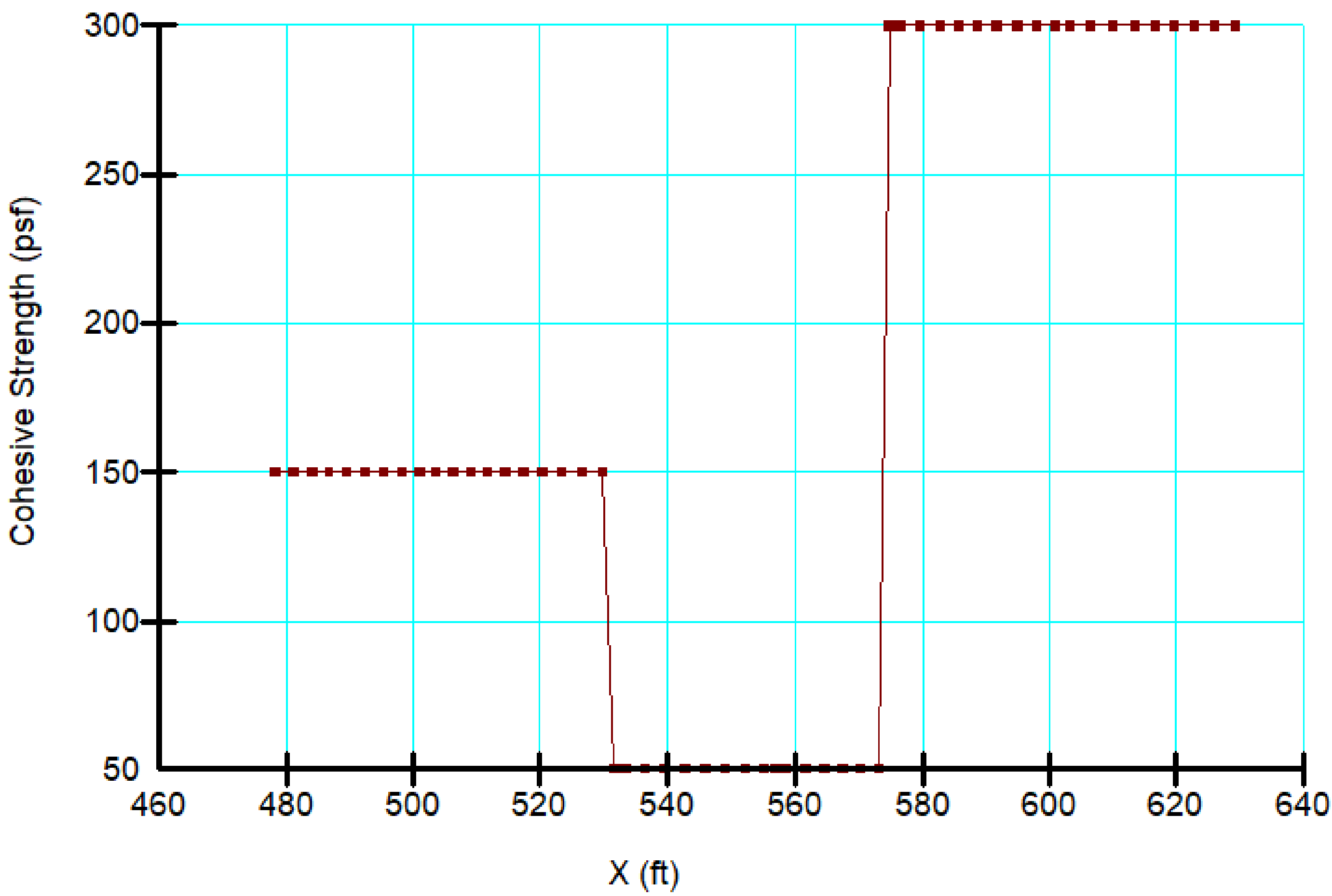
Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\1-1' Geo Studio\File Name: Case 8_1-1'_Buttress.gszDTime: 11:56:15 AMate: 07/28/2024

1-1'

Buttress-Friction Angle



Buttress-Cohesive Strength

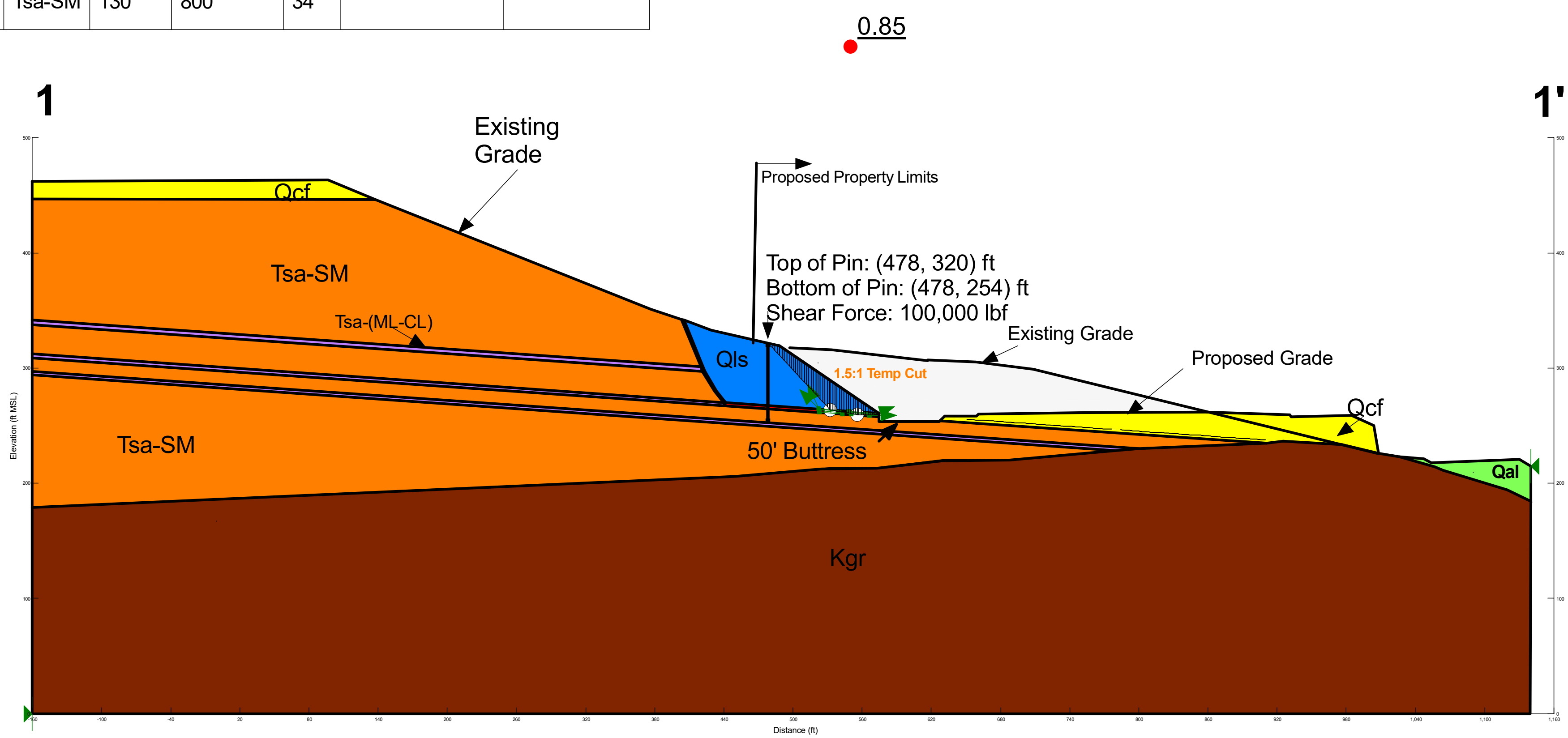


Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-SM	130	800	34		

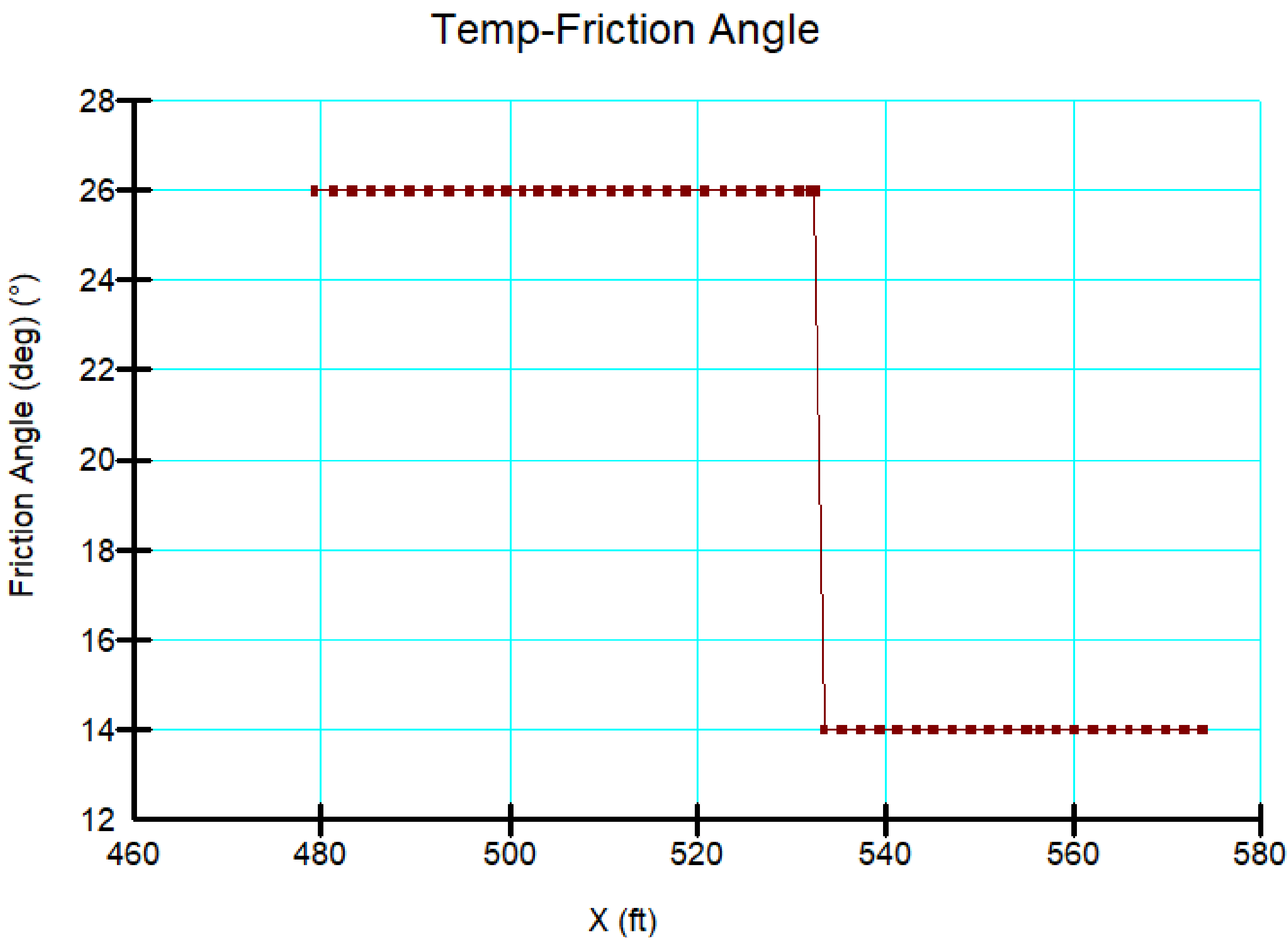
Proposed Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: Case 9_1-1'_Temp-block.gsz

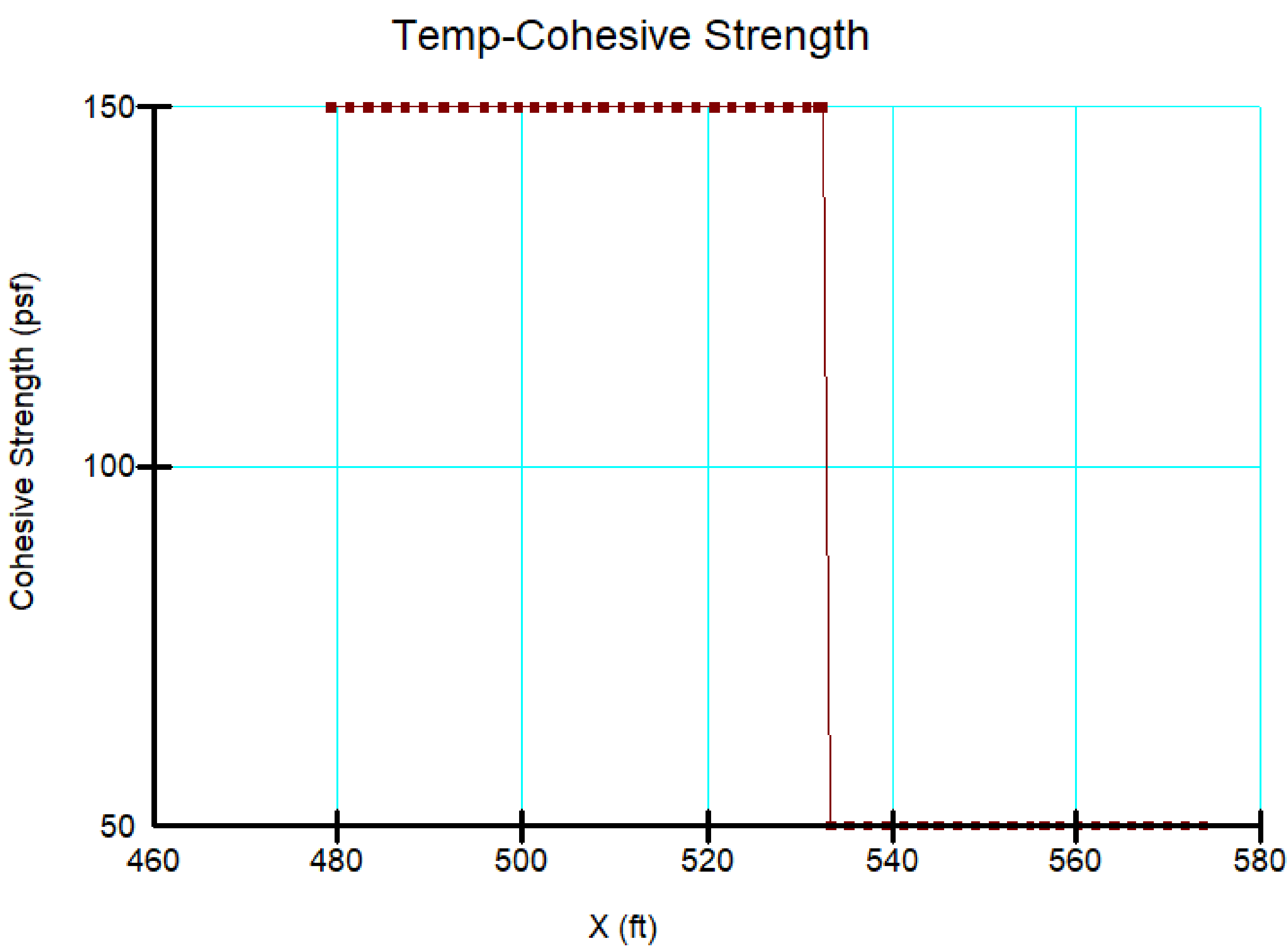


Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\1-1' Geo Studio\File Name: Case 9_1-1'_Temp-block.gszDTime: 12:07:31 PMate: 07/28/2024

1-1'



Temp-Friction Angle
Friction Angle (deg) (°)
28
26
24
22
20
18
16
14
12
460
480
500
520
540
560
580
X (ft)



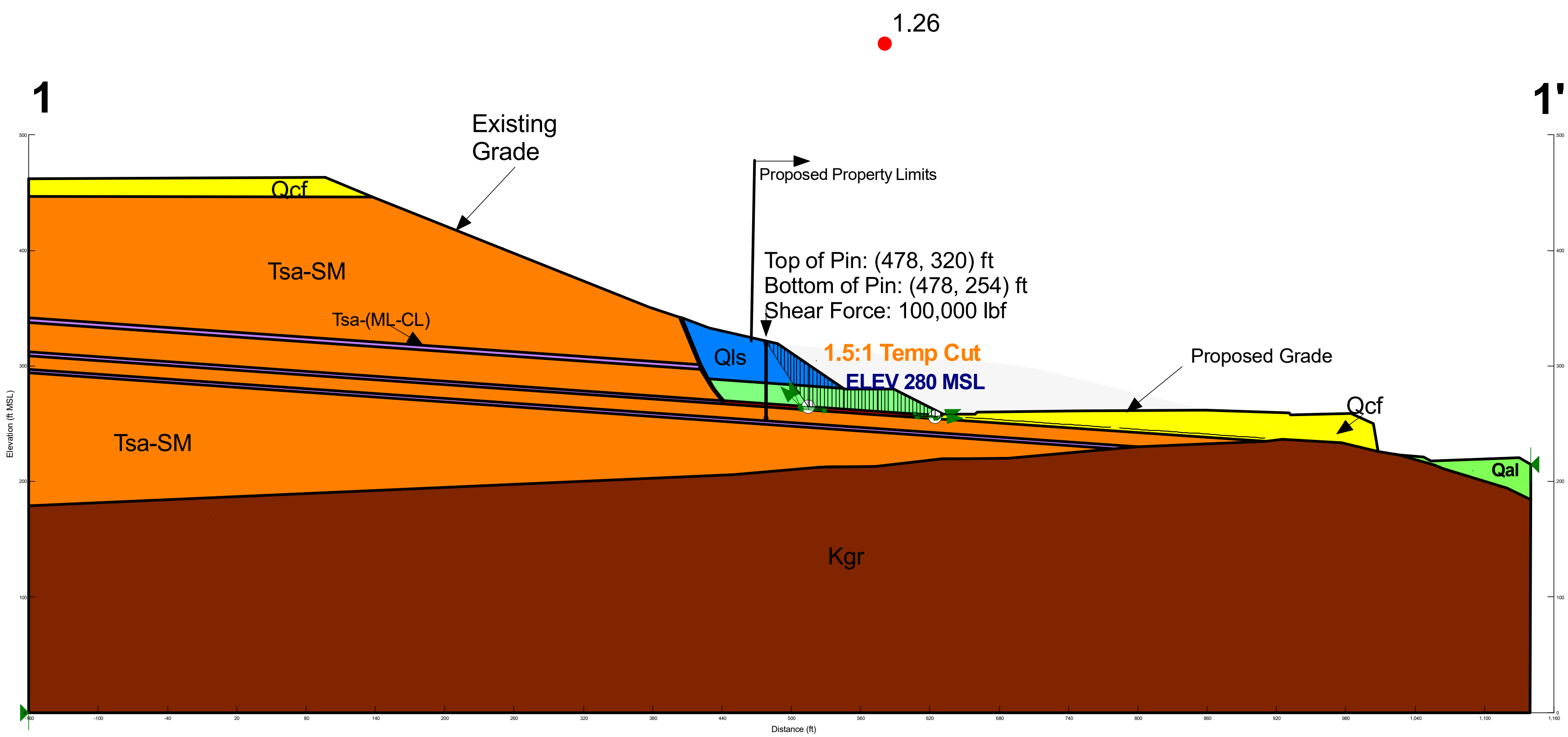
Temp-Cohesive Strength
Cohesive Strength (psf)
150
100
50
460
480
500
520
540
560
580
X (ft)

Material Properties:

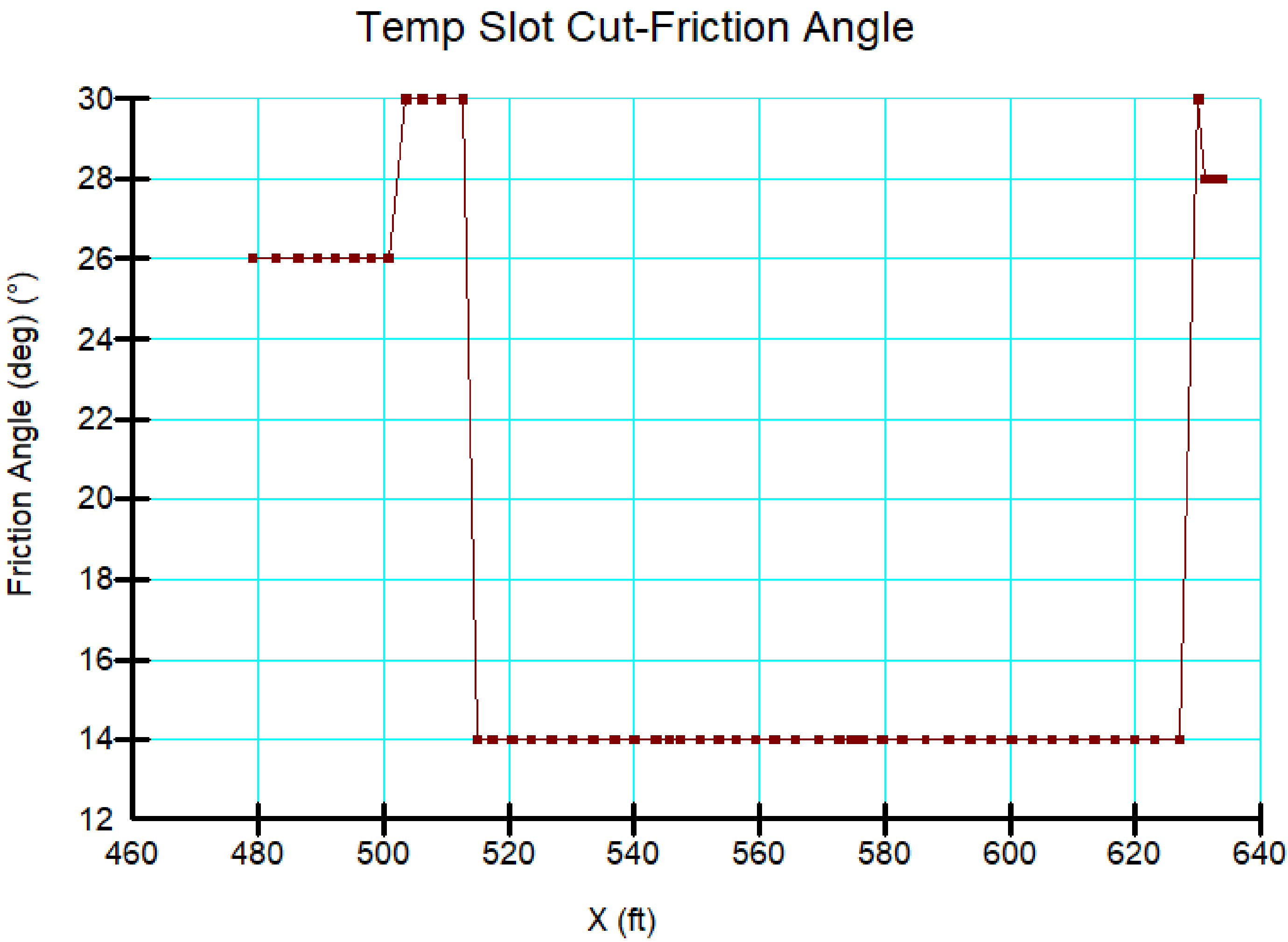
Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Qls-SM	130	300	30		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-SM	130	800	34		

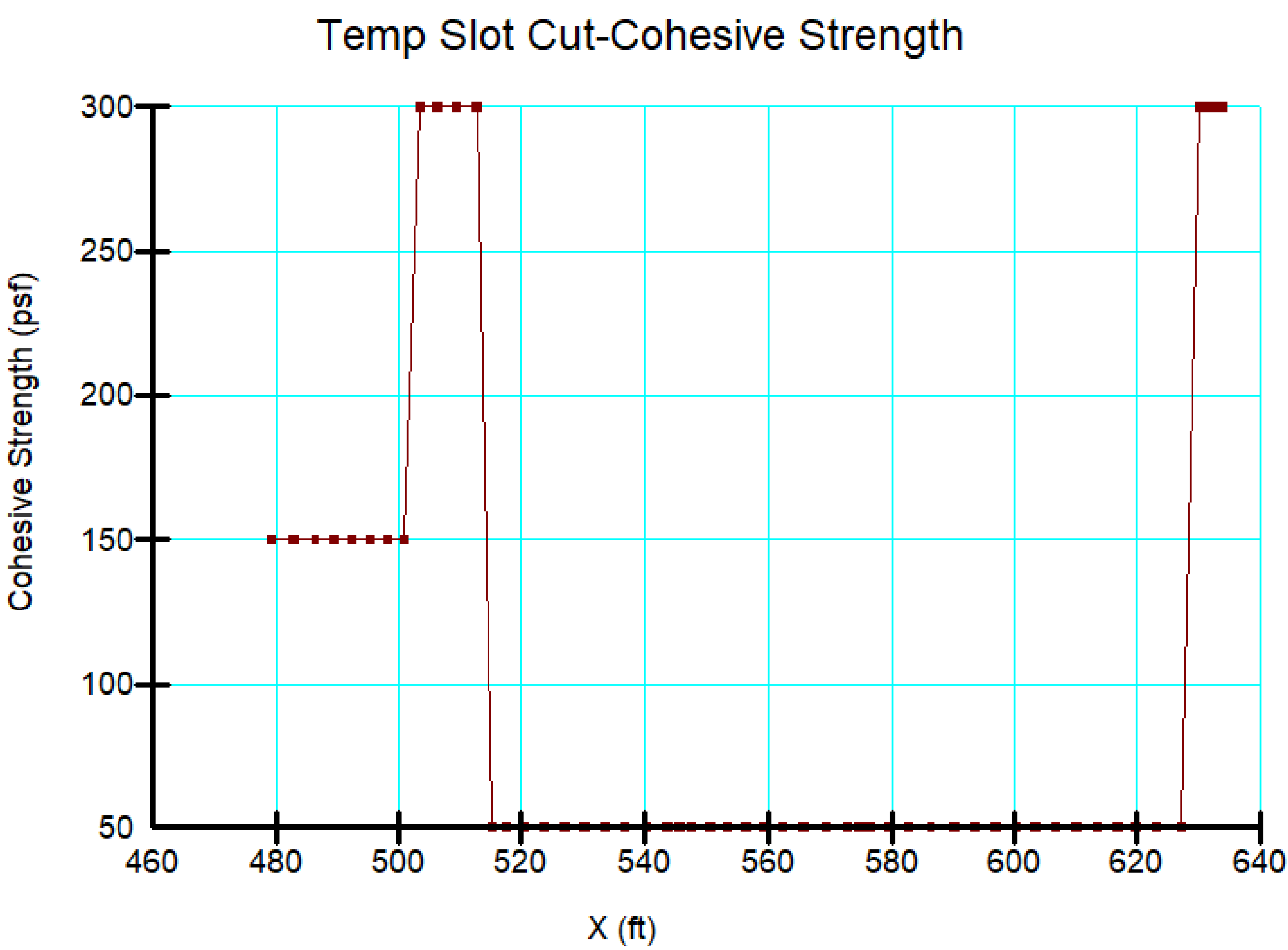
Proposed Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: Case 10_1-1'_Temp-block-Slot Cut.gsz



1-1'


Temp Slot Cut-Friction Angle
Friction Angle (deg) (°)
30
28
26
24
22
20
18
16
14
12
460
480
500
520
540
560
580
600
620
640
X (ft)

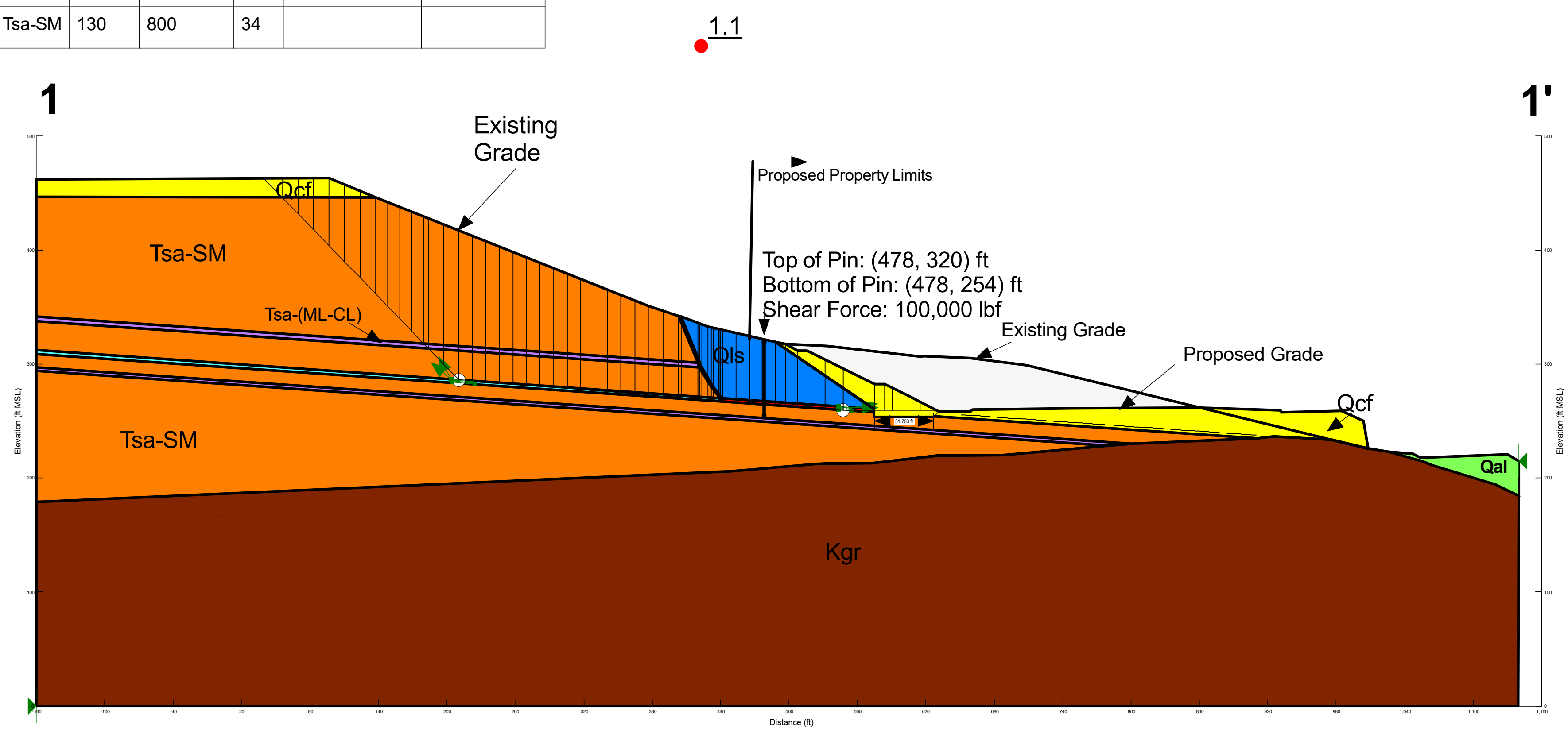

Temp Slot Cut-Cohesive Strength
Cohesive Strength (psf)
300
250
200
150
100
50
460
480
500
520
540
560
580
600
620
640
X (ft)

Proposed Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: Case 11_1-1'_Buttress-Seismic.gsz
Horz Seismic Coef.: 0.15

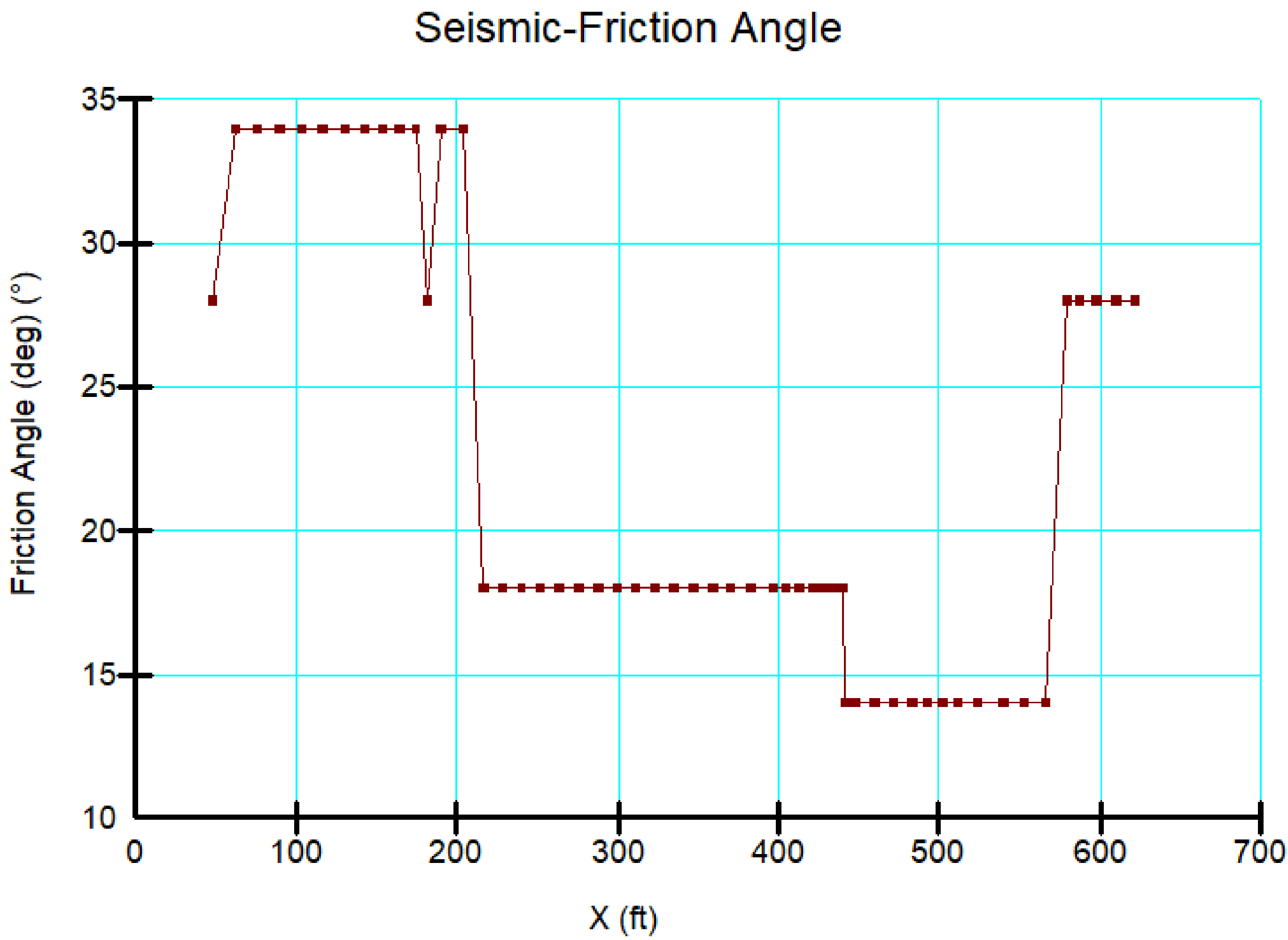
Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-ML FS	130	200	28	Phi-18°	Cohesion-FS 100 (psf)
	Tsa-SM	130	800	34		

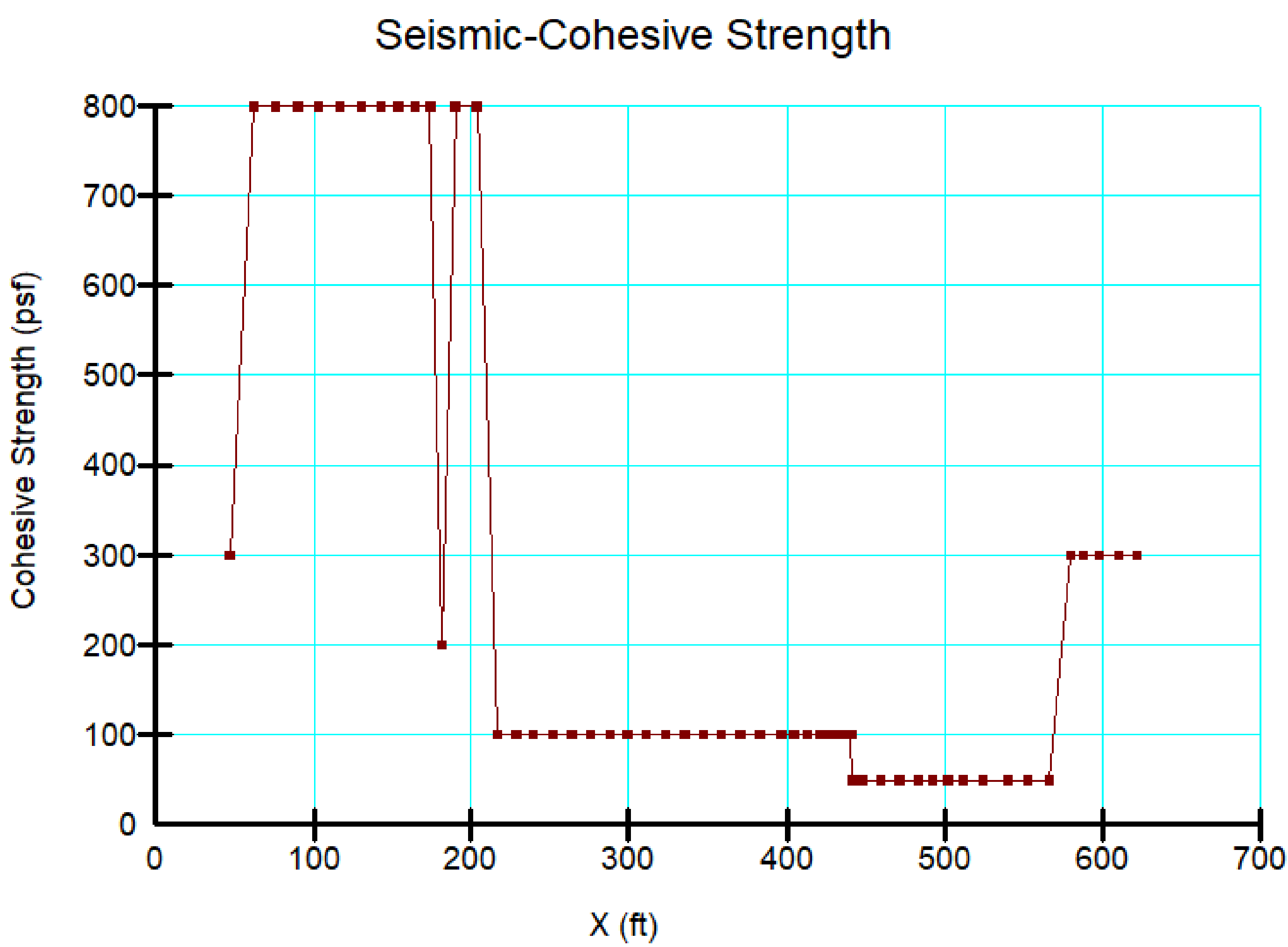


Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\1-1' Geo Studio\File Name: Case 11_1-1'_Buttress-Seismic.gszDTime: 09:44:42 PMate: 07/28/2024

1-1'



Seismic-Friction Angle
Friction Angle (deg) (°)
35
30
25
20
15
10
0
100
200
300
400
500
600
700
X (ft)



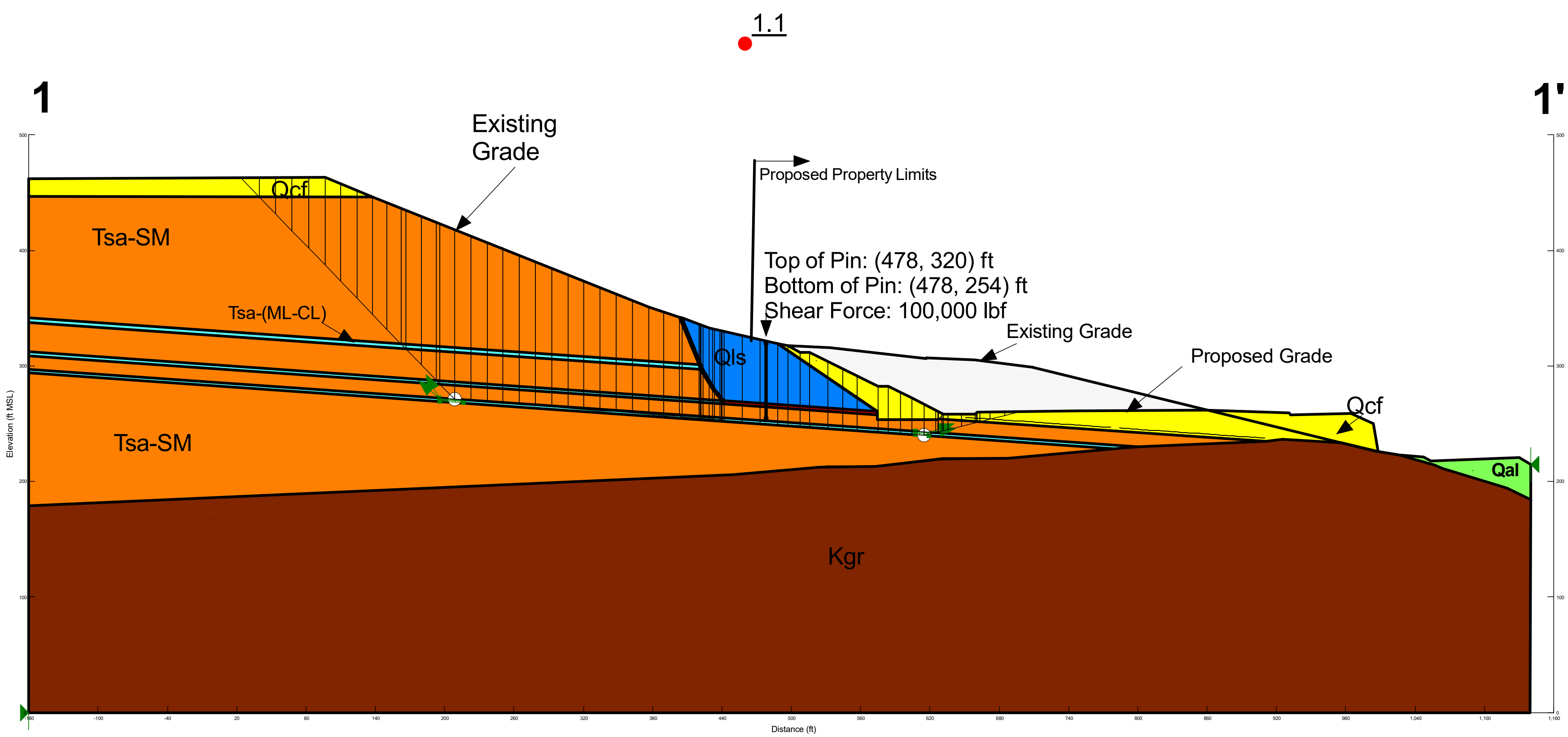
Seismic-Cohesive Strength
Cohesive Strength (psf)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
X (ft)

Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Tsa-ML FS	130	200	28	Phi-18°	Cohesion-FS 100 (psf)
	Tsa-SM	130	800	34		

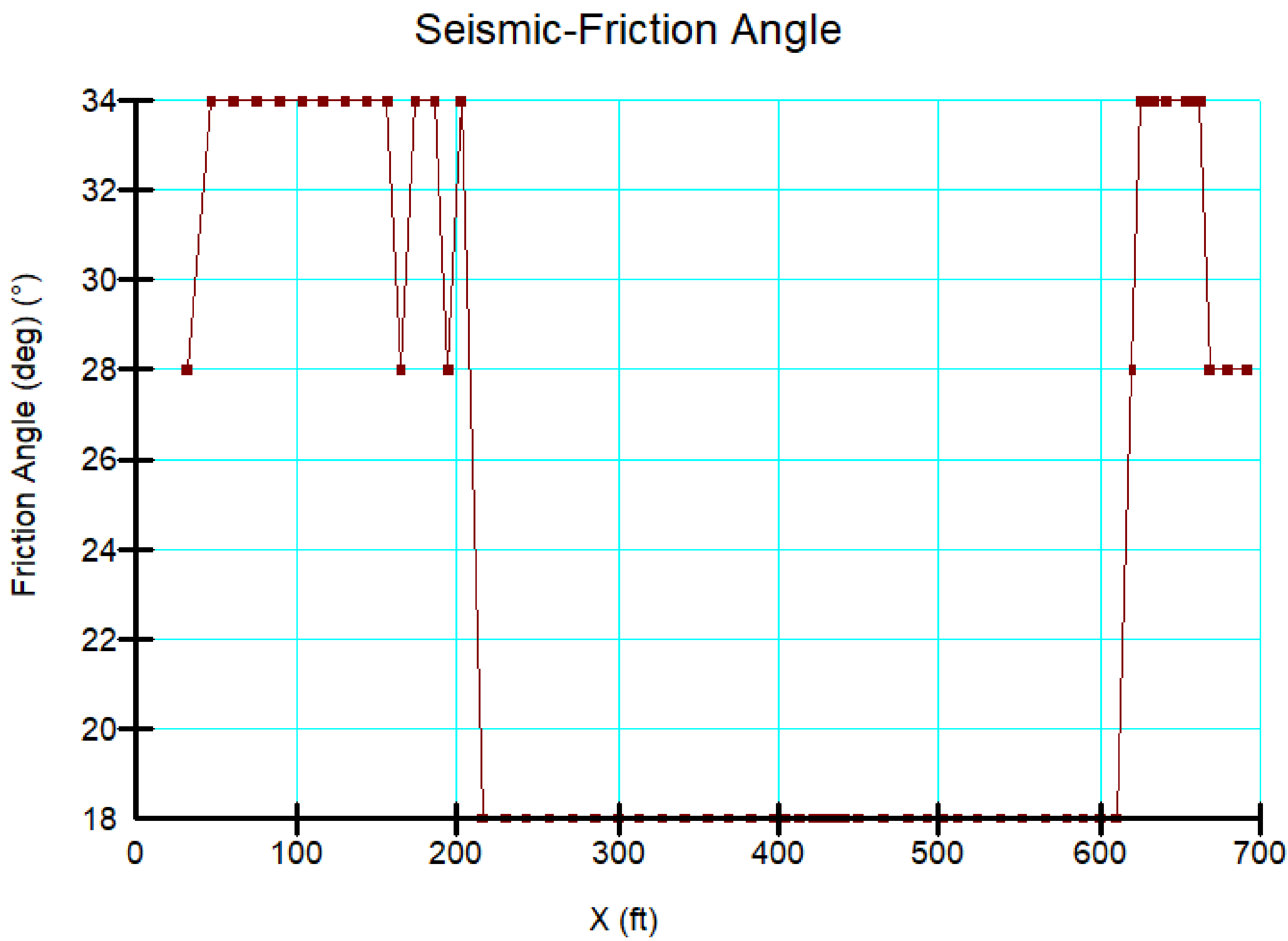
Proposed Grade
Static Condition

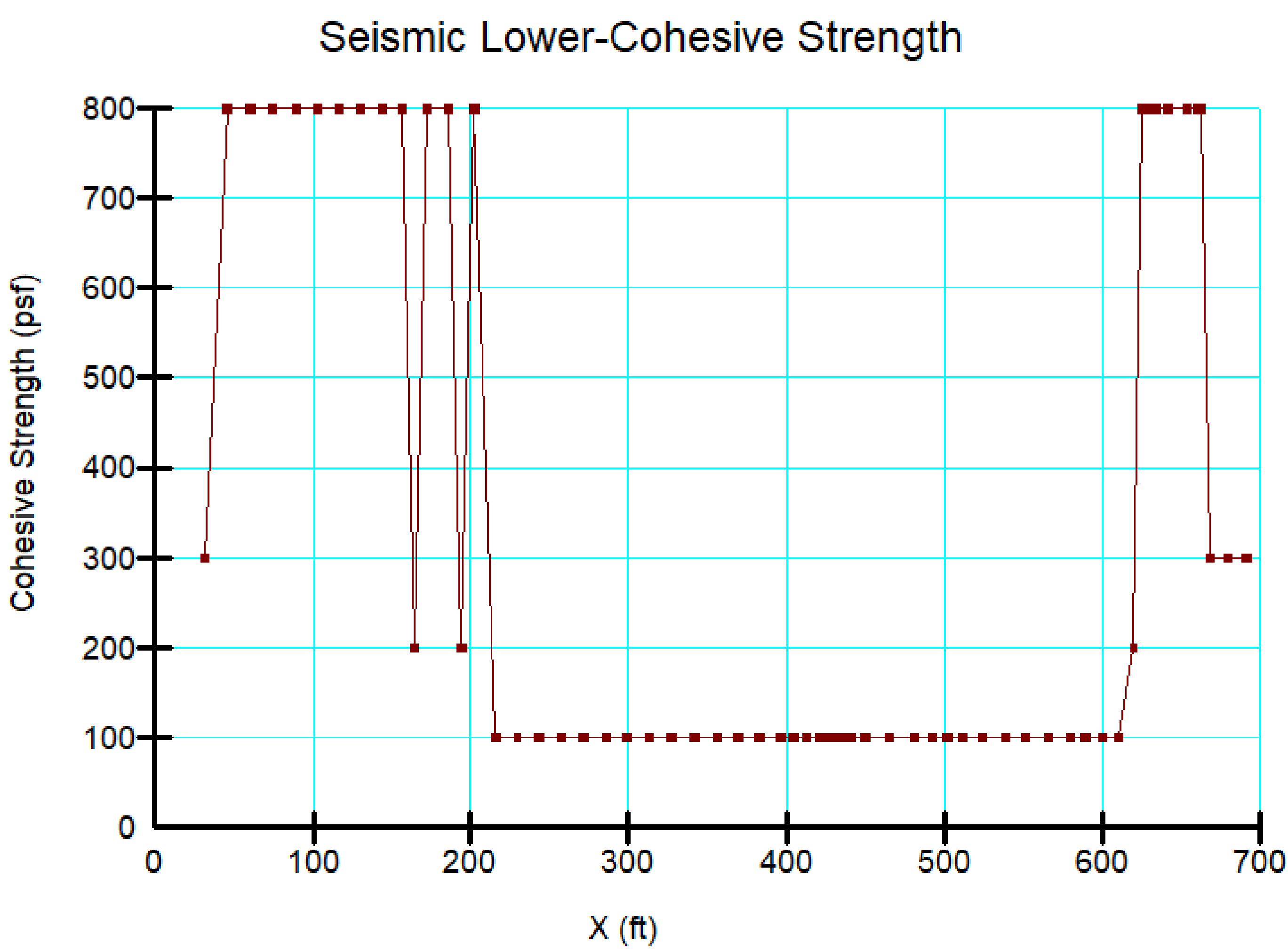
Olive Street
Project No. G3035-52-01
Name: Case 12_1-1'_Seismic-Lower Plane.gsz
Horz Seismic Coef.: 0.15



Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\1-1' Geo Studio\File Name: Case 12_1-1'_Seismic-Lower Plane.gszDTime: 10:00:11 PMate: 07/28/2024

1-1'


Seismic-Friction Angle
Friction Angle (deg) (°)
34
32
30
28
26
24
22
20
18
0
100
200
300
400
500
600
700
X (ft)

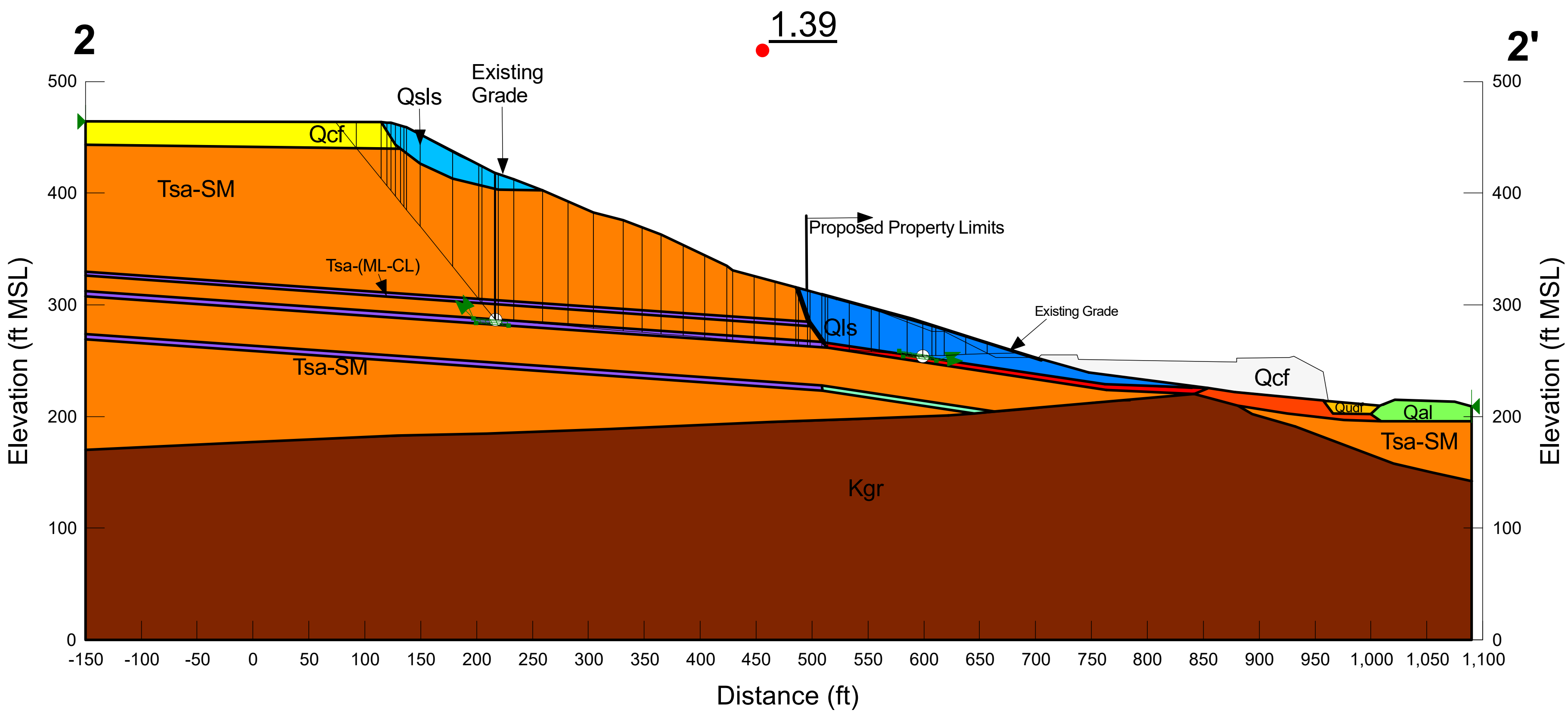

Seismic Lower-Cohesive Strength
Cohesive Strength (psf)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
X (ft)

Material Properties:

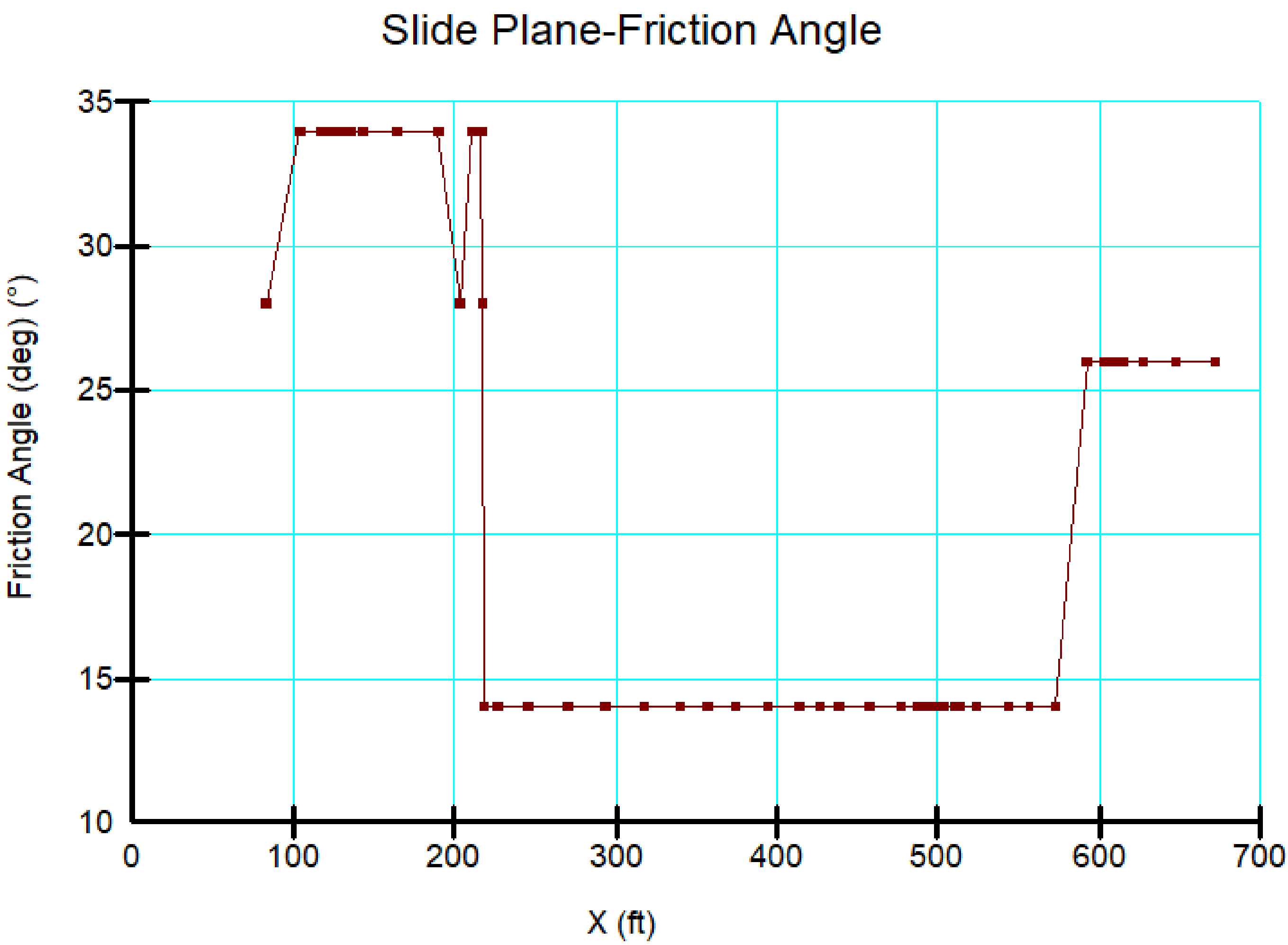
Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qcol	130	150	26		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Qsls	130	150	26		
	Qudf	130	300	28		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-ML 8 Deg	130	200	28	Phi-14, angle 8	Cohesion-50, angle 8
	Tsa-SM	130	800	34		

Existing Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: 2-2'_Existing.gsz

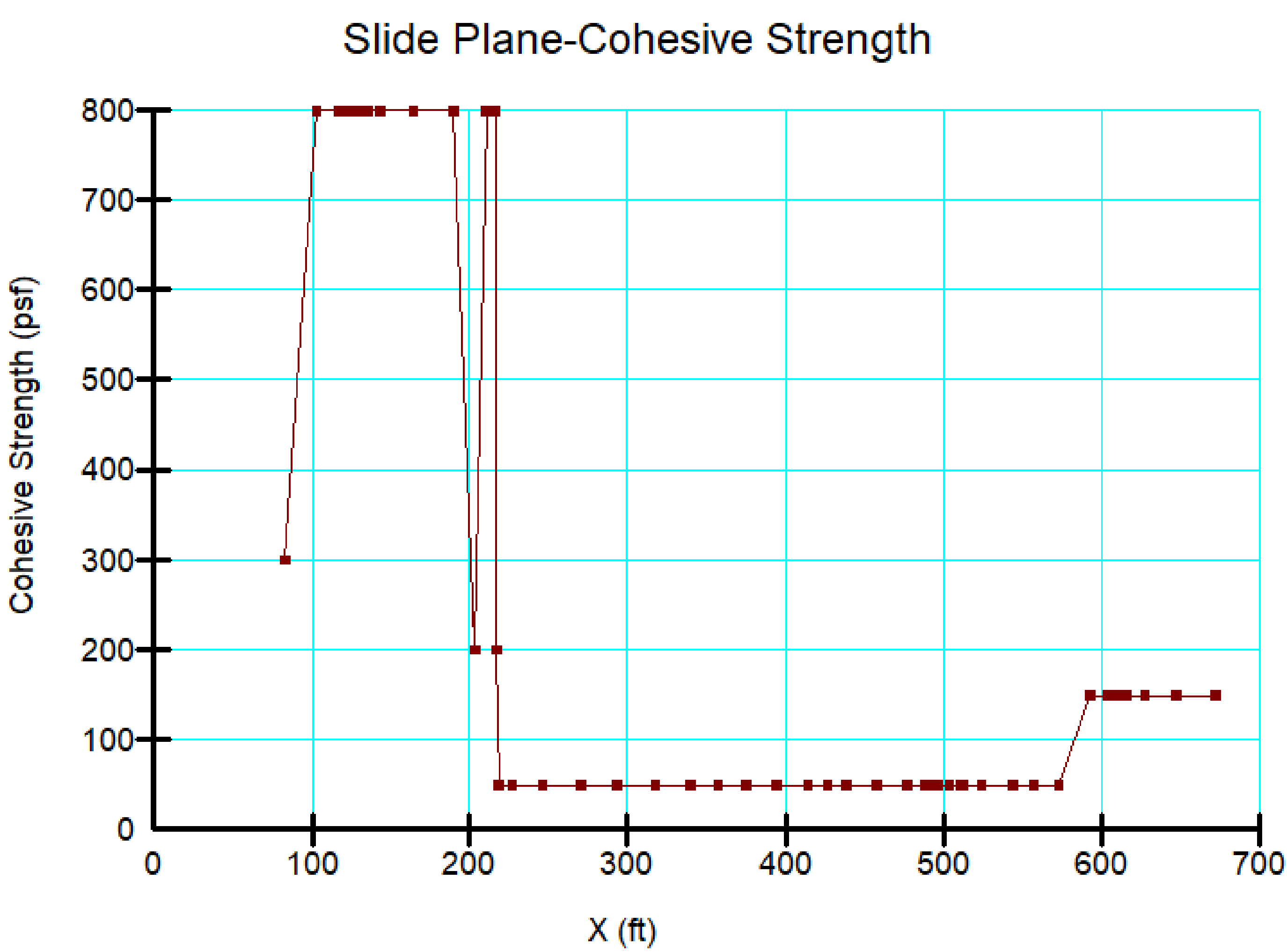


Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\2-2' Geo Studio\File Name: 2-2'_Existing.gszDTime: 09:06:55 PMate: 08/12/2024



Slide Plane-Friction Angle
Friction Angle (deg) (°)
35
30
25
20
15
10
0
100
200
300
400
500
600
700
X (ft)

2-2'



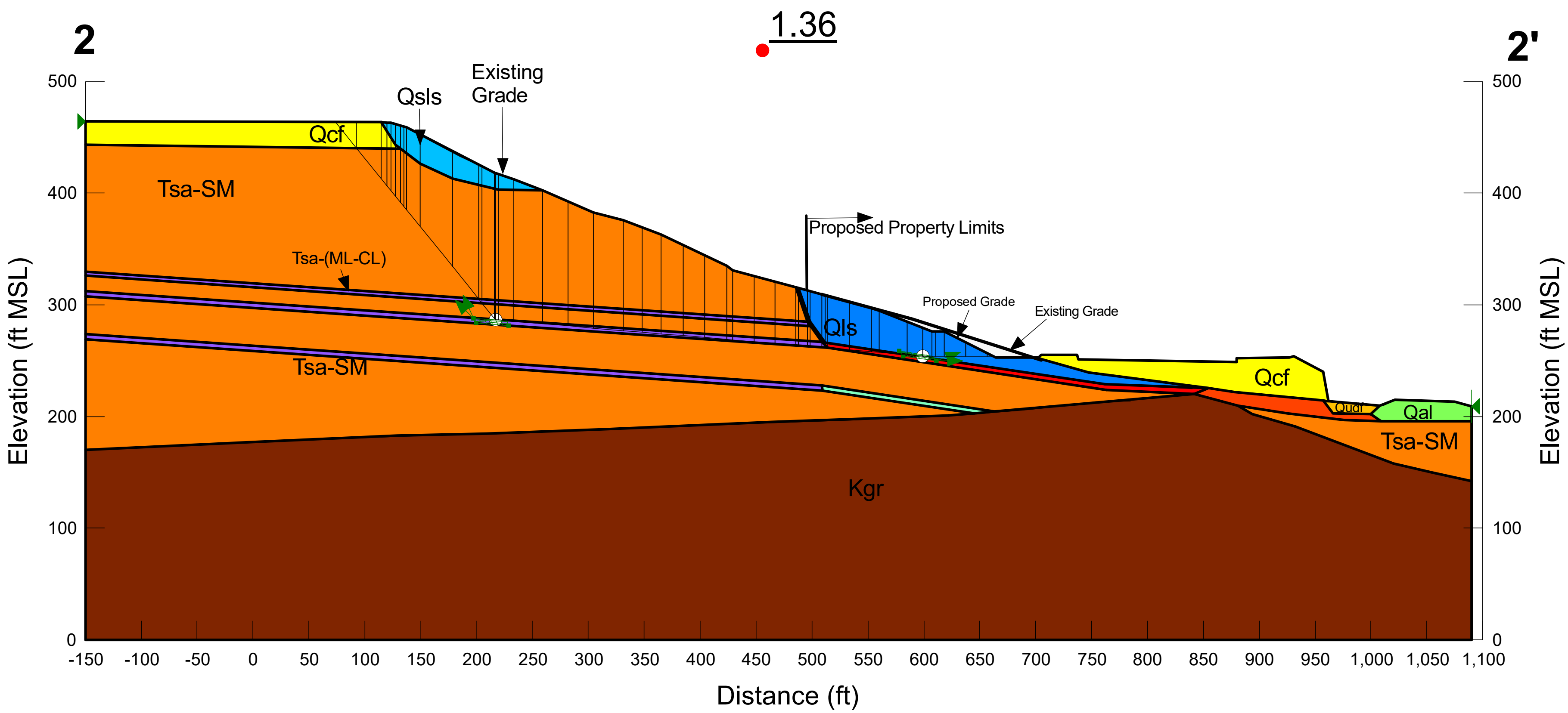
Slide Plane-Cohesive Strength
Cohesive Strength (psf)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
X (ft)

Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qcol	130	150	26		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Qsls	130	150	26		
	Qudf	130	300	28		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-ML 8 Deg	130	200	28	Phi-14, angle 8	Cohesion-50, angle 8
	Tsa-SM	130	800	34		

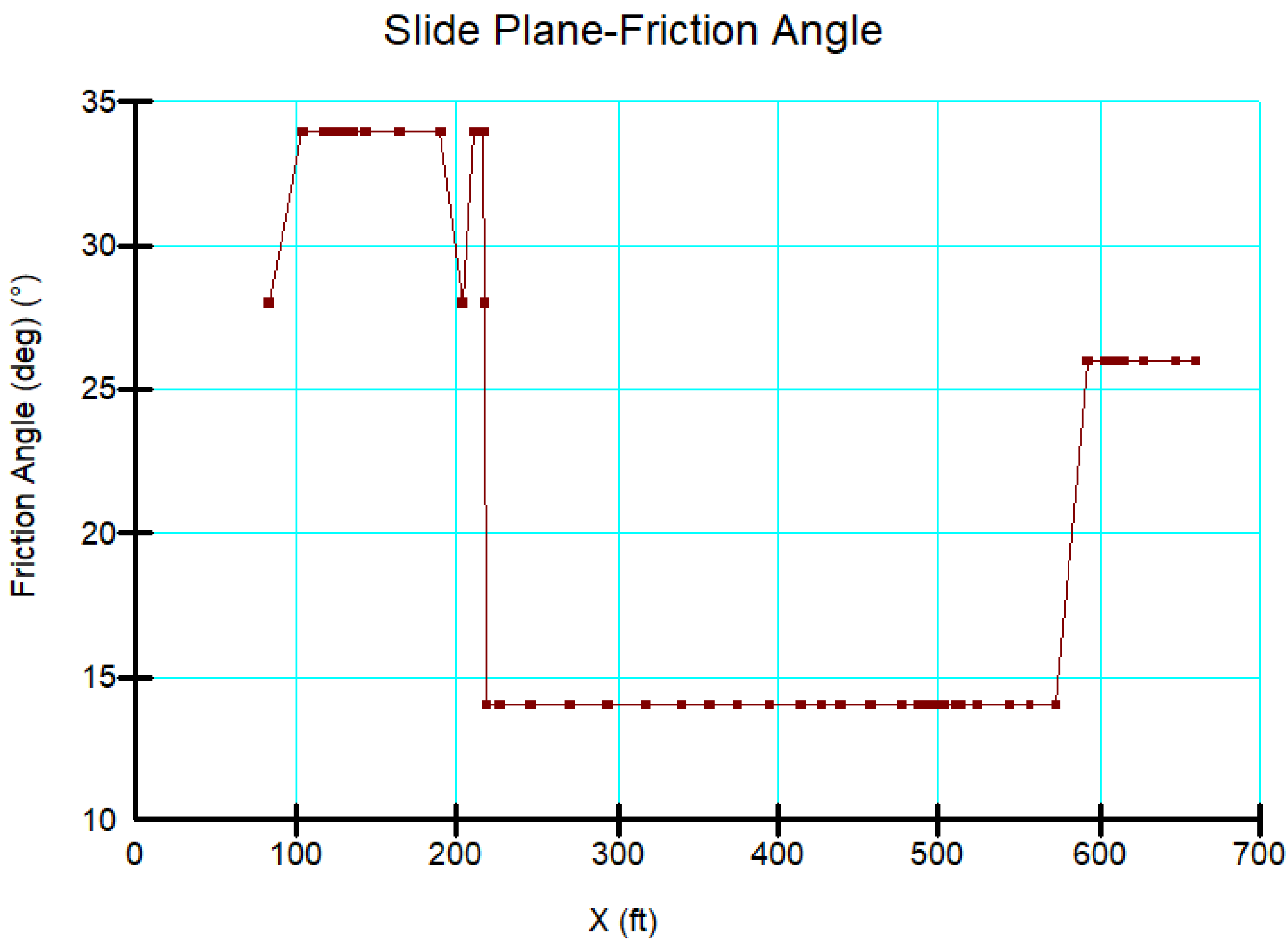
Proposed Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: Case 1_2-2'_Slide Plane.gsz

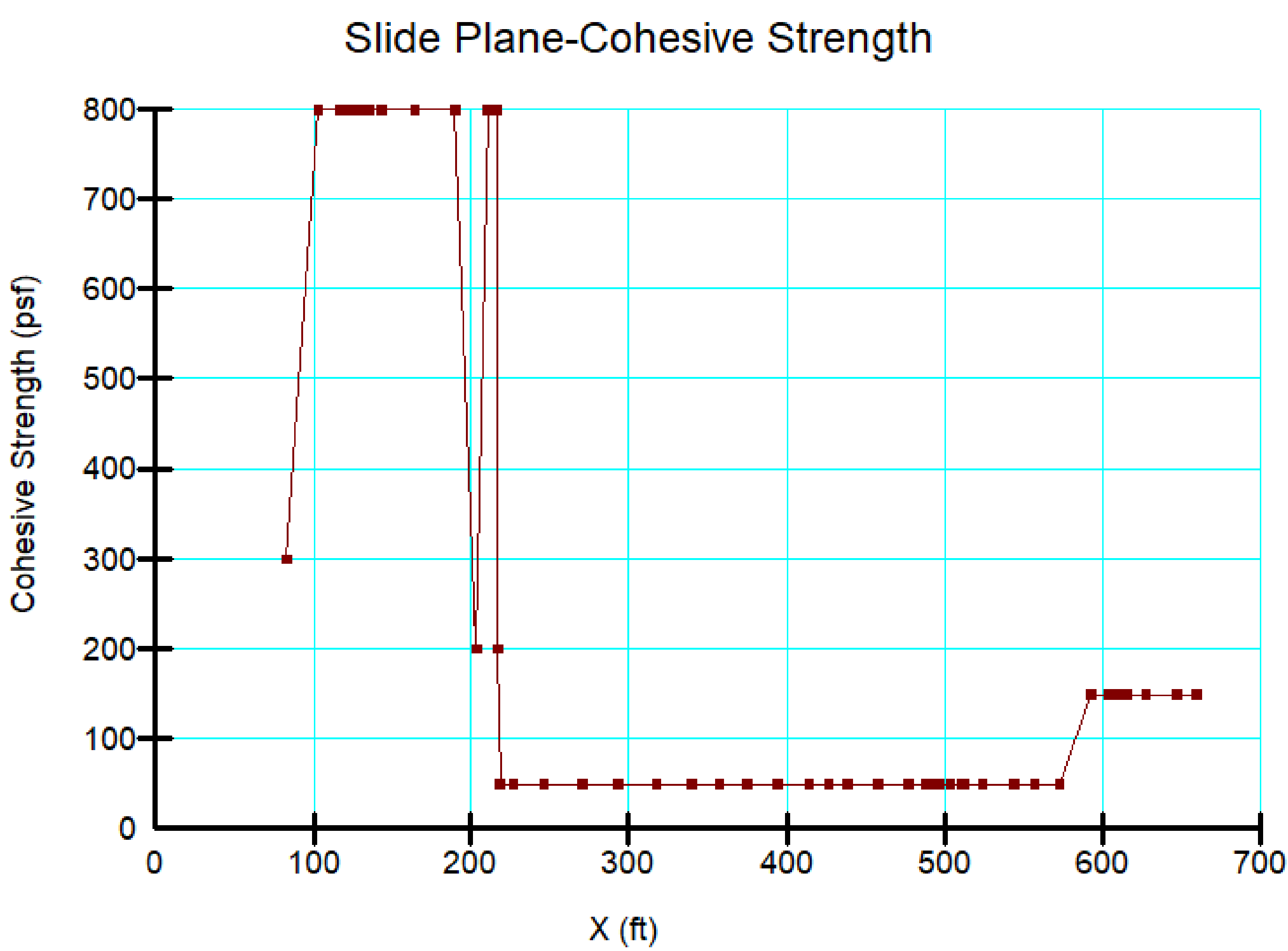


Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\2-2' Geo Studio\File Name: Case 1_2-2'_Slide Plane.gszDTime: 08:16:17 AMate: 07/29/2024

2-2'



Slide Plane-Friction Angle
Friction Angle (deg) (°)
35
30
25
20
15
10
0
100
200
300
400
500
600
700
X (ft)



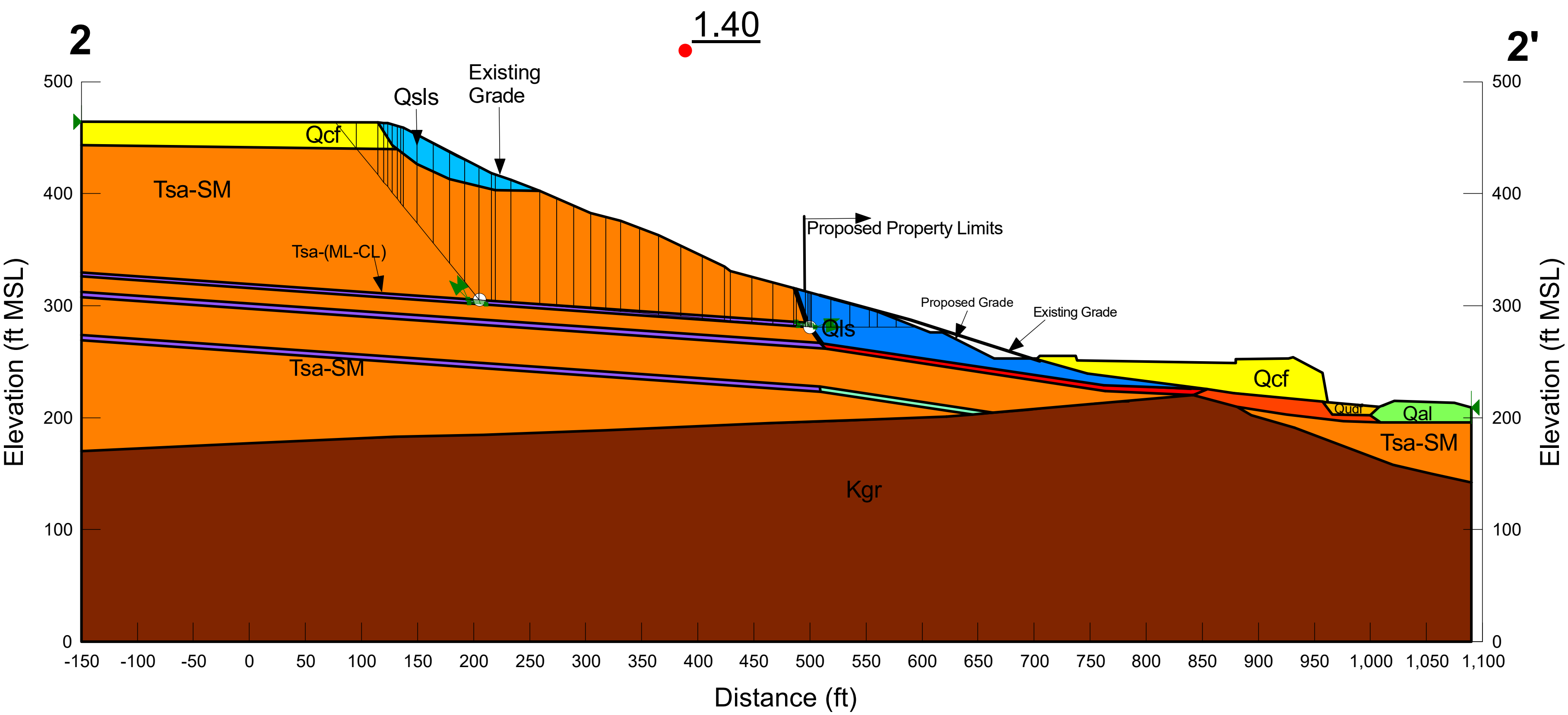
Slide Plane-Cohesive Strength
Cohesive Strength (psf)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
X (ft)

Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qcol	130	150	26		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Qsls	130	150	26		
	Qudf	130	300	28		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-ML 8 Deg	130	200	28	Phi-14, angle 8	Cohesion-50, angle 8
	Tsa-SM	130	800	34		

Proposed Grade
Static Condition

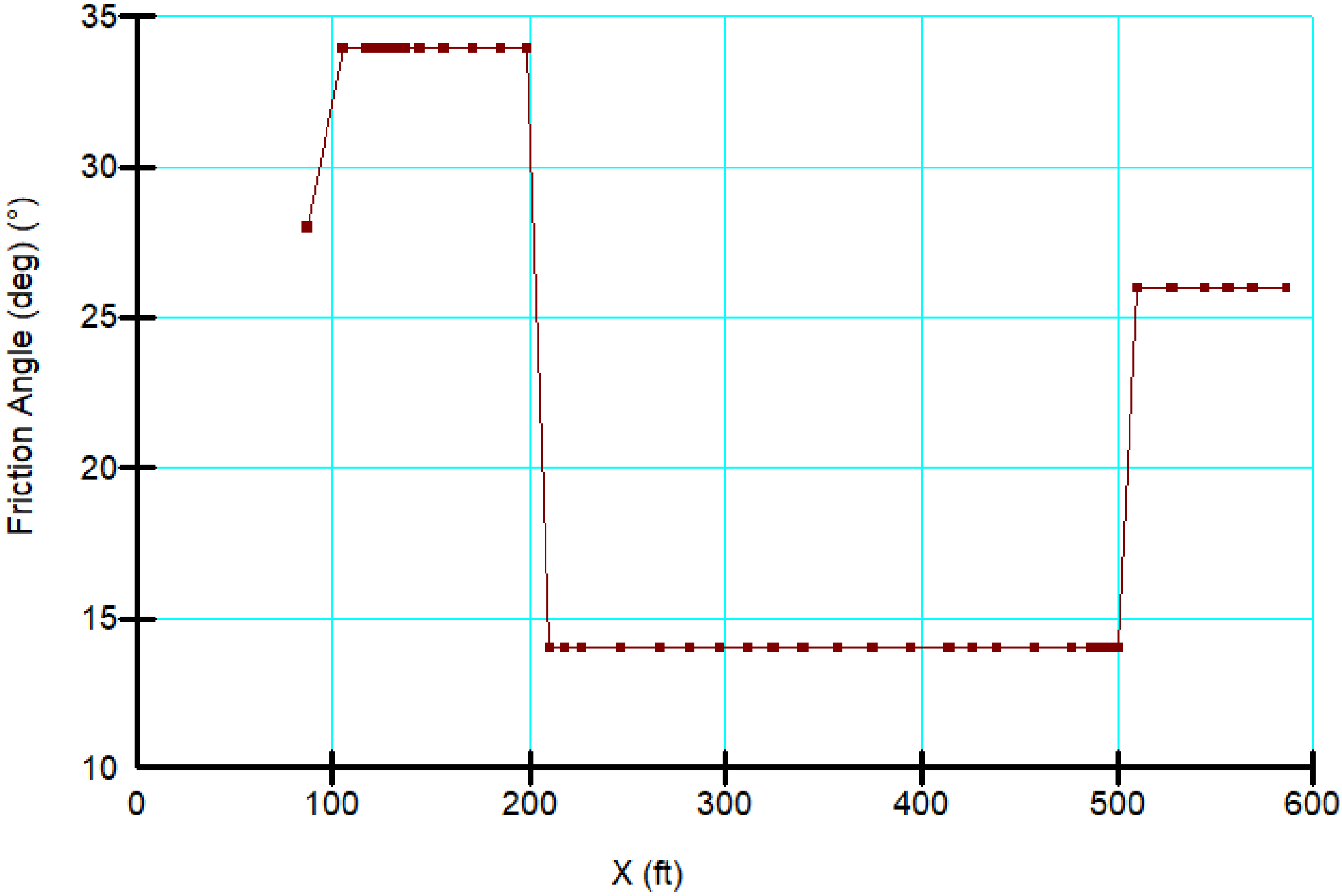
Olive Street
Project No. G3035-52-01
Name: Case 2_2-2'_Upper Plane.gsz



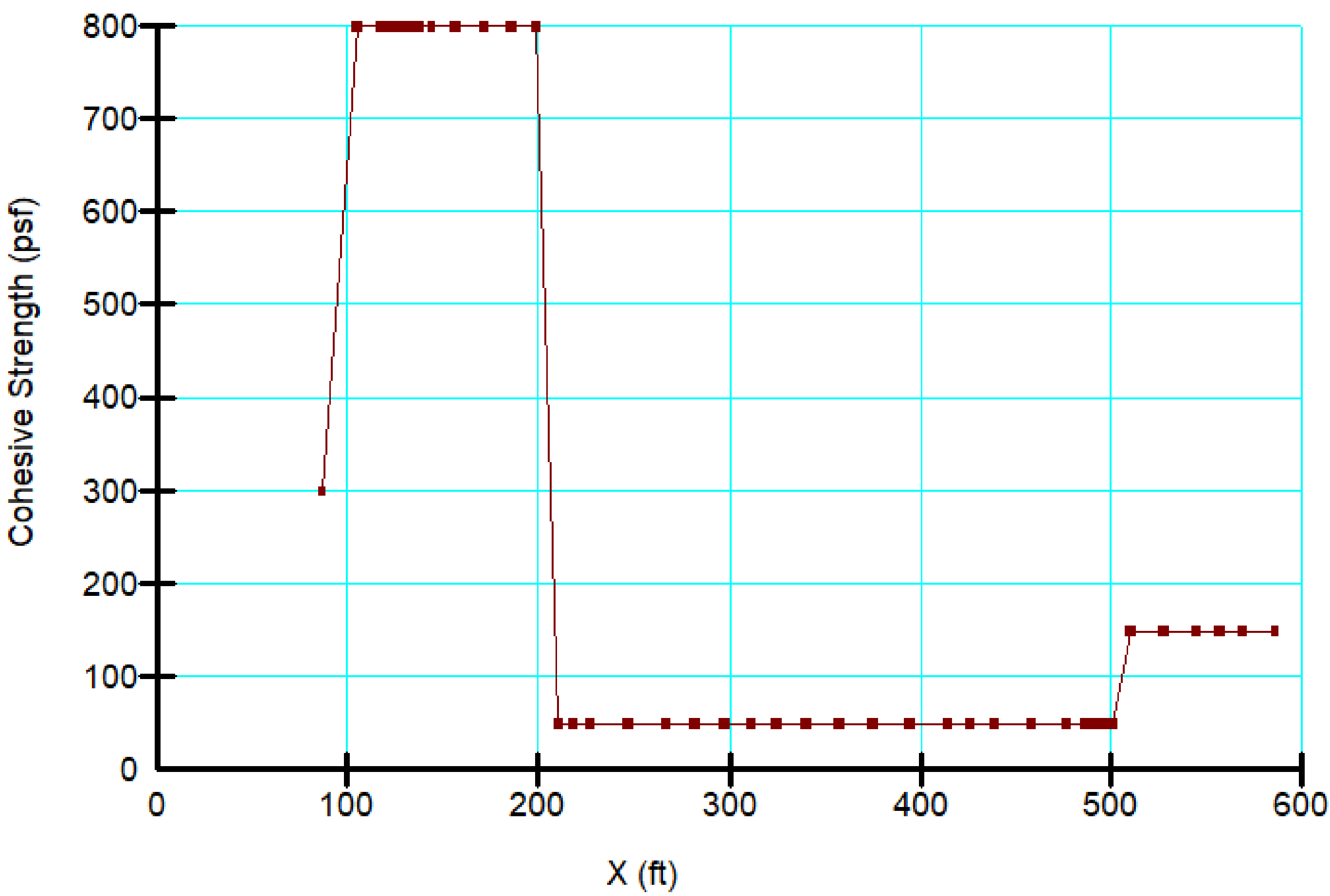
Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\2-2' Geo Studio\File Name: Case 2_2-2'_Upper Plane.gszDTime: 08:31:32 AMate: 07/29/2024

2-2'

Upper Plane-Friction Angle



Upper Plane-Cohesive Strength

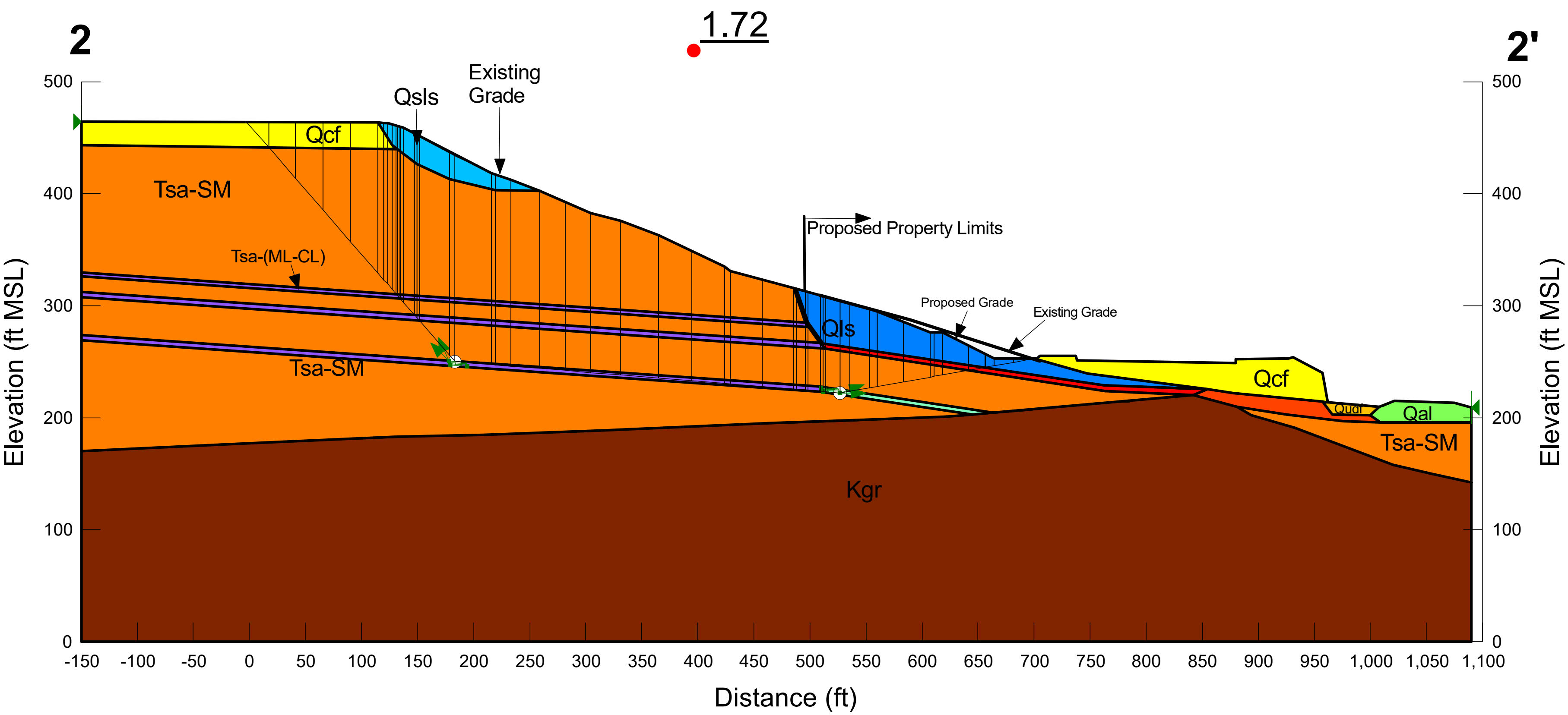


Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qcol	130	150	26		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Qsls	130	150	26		
	Qudf	130	300	28		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-ML 8 Deg	130	200	28	Phi-14, angle 8	Cohesion-50, angle 8
	Tsa-SM	130	800	34		

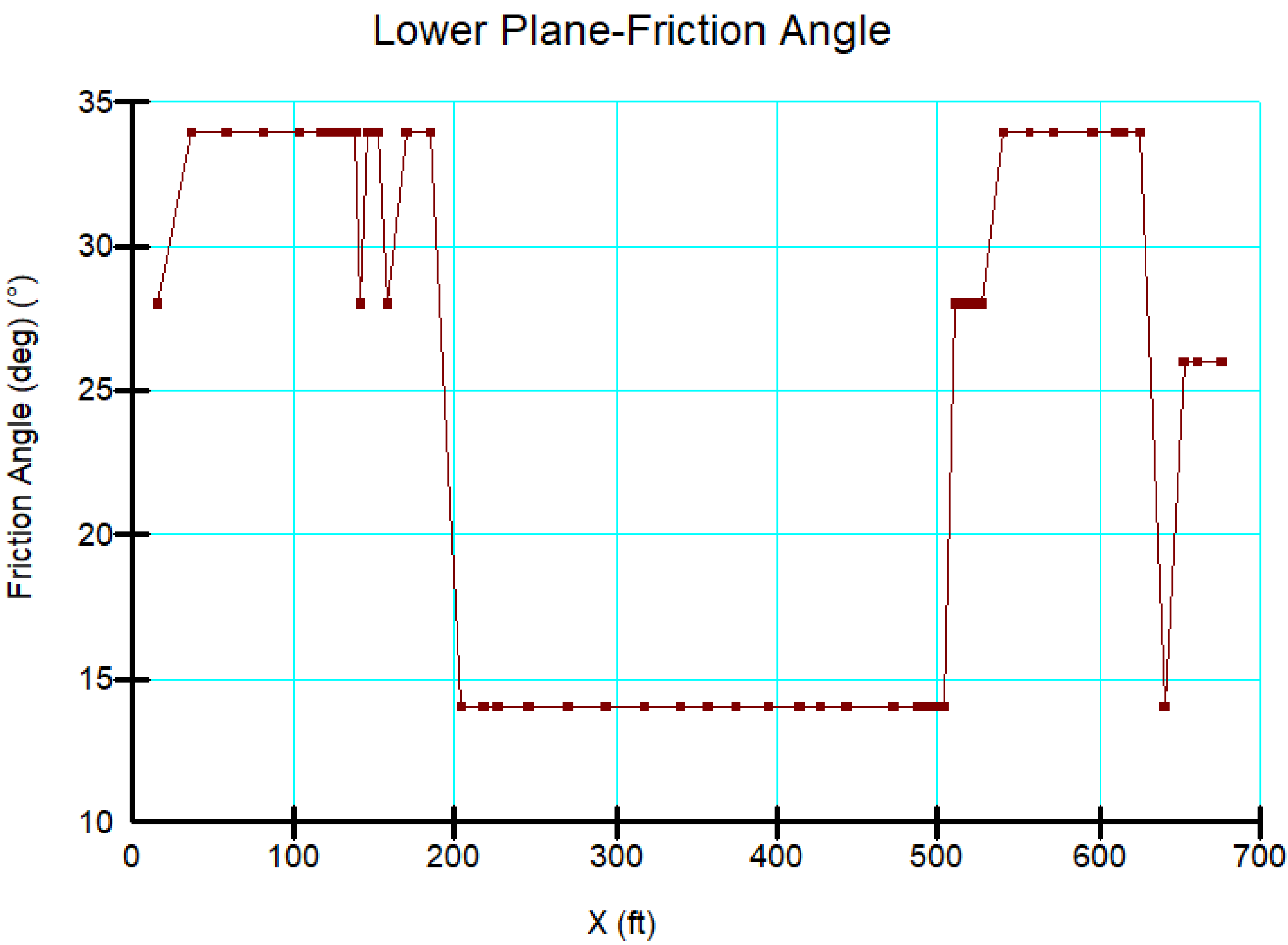
Proposed Grade
Static Condition

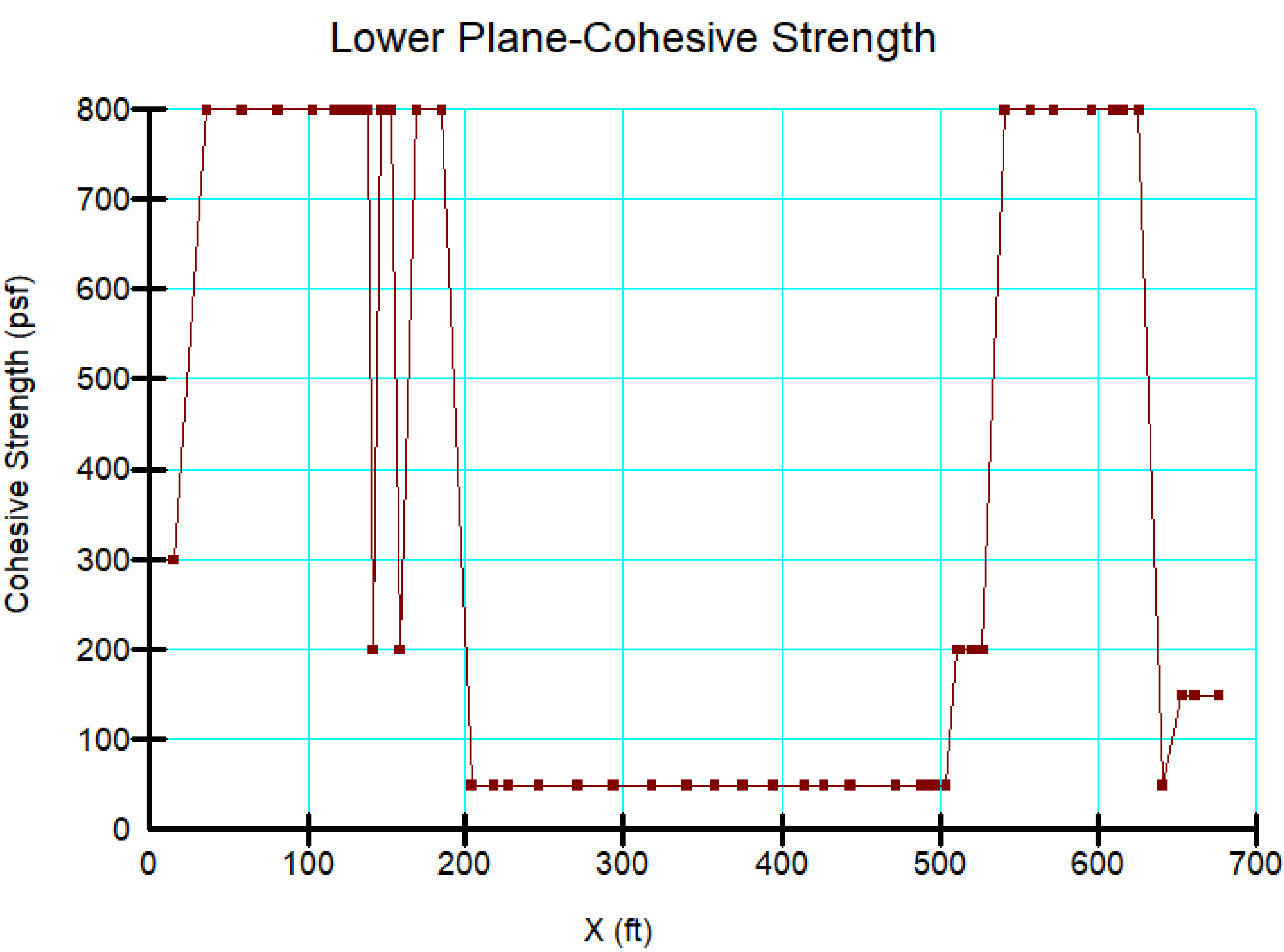
Olive Street
Project No. G3035-52-01
Name: Case 3_2-2'_Lower Plane.gsz



Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\2-2' Geo Studio\File Name: Case 3_2-2'_Lower Plane.gszDTime: 09:38:09 PMate: 08/12/2024

2-2'


Lower Plane-Friction Angle
Friction Angle (deg) (°)
35
30
25
20
15
10
0
100
200
300
400
500
600
700
X (ft)

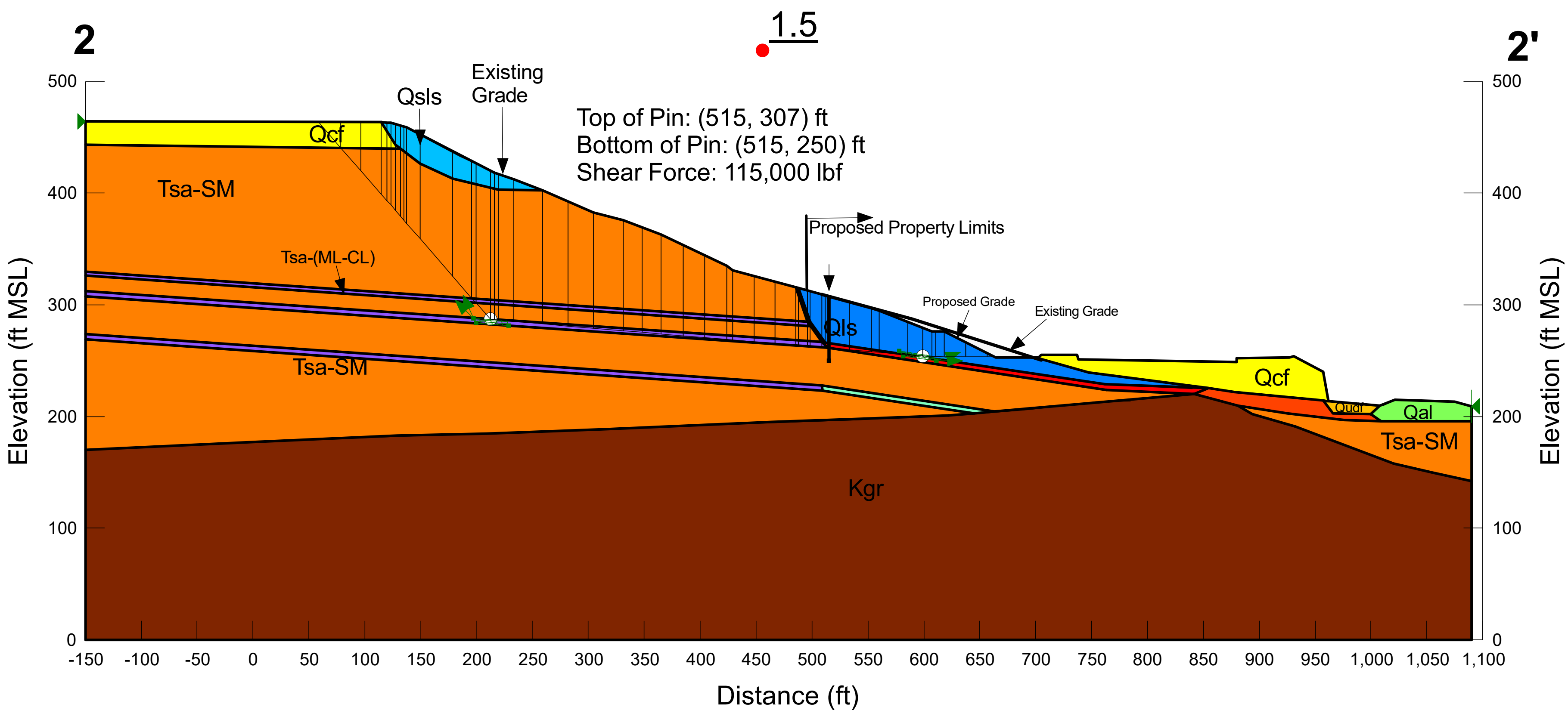

Lower Plane-Cohesive Strength
Cohesive Strength (psf)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
X (ft)

Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qcol	130	150	26		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Qsls	130	150	26		
	Qudf	130	300	28		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-ML 8 Deg	130	200	28	Phi-14, angle 8	Cohesion-50, angle 8
	Tsa-SM	130	800	34		

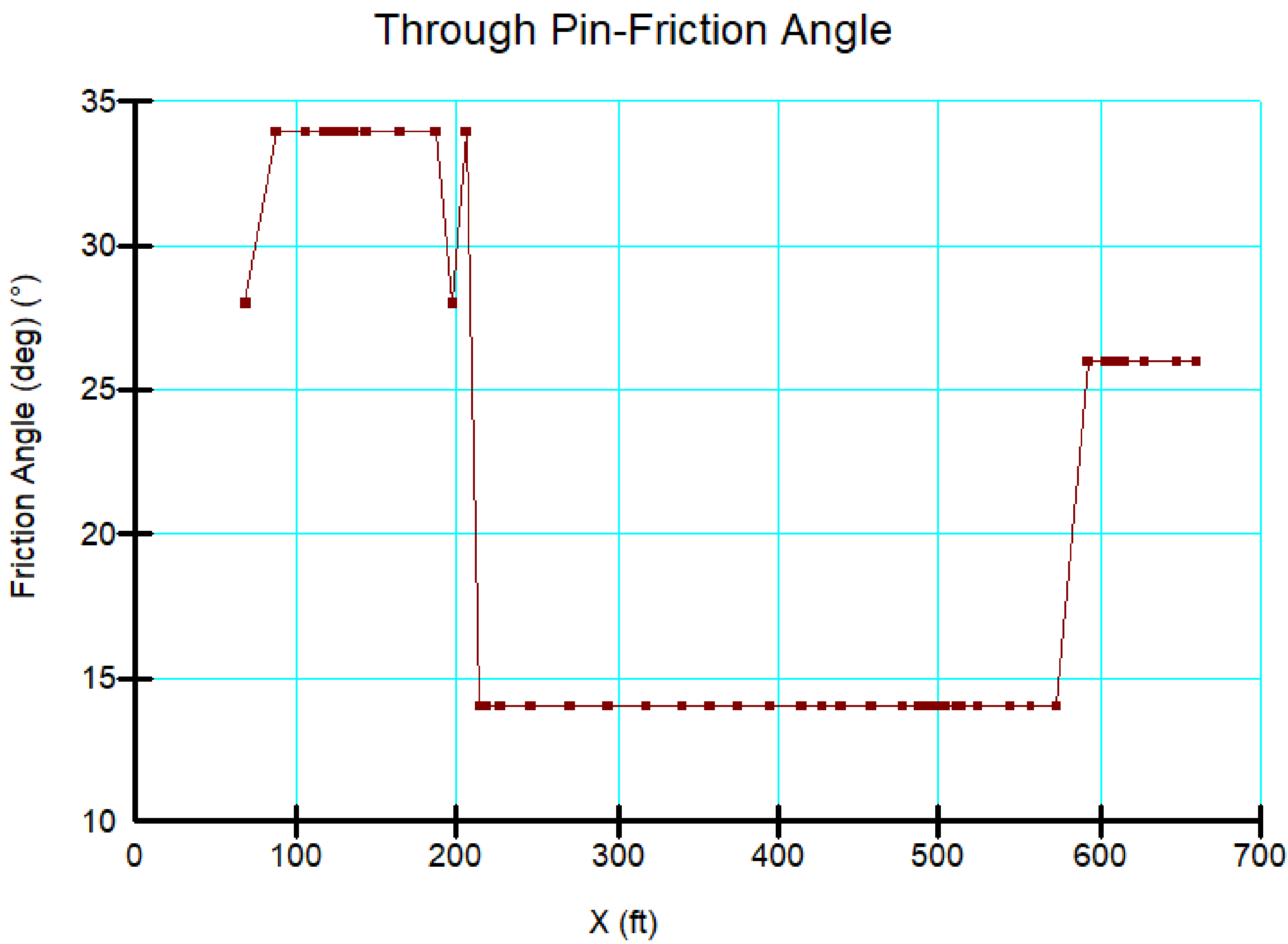
Proposed Grade
Static Condition

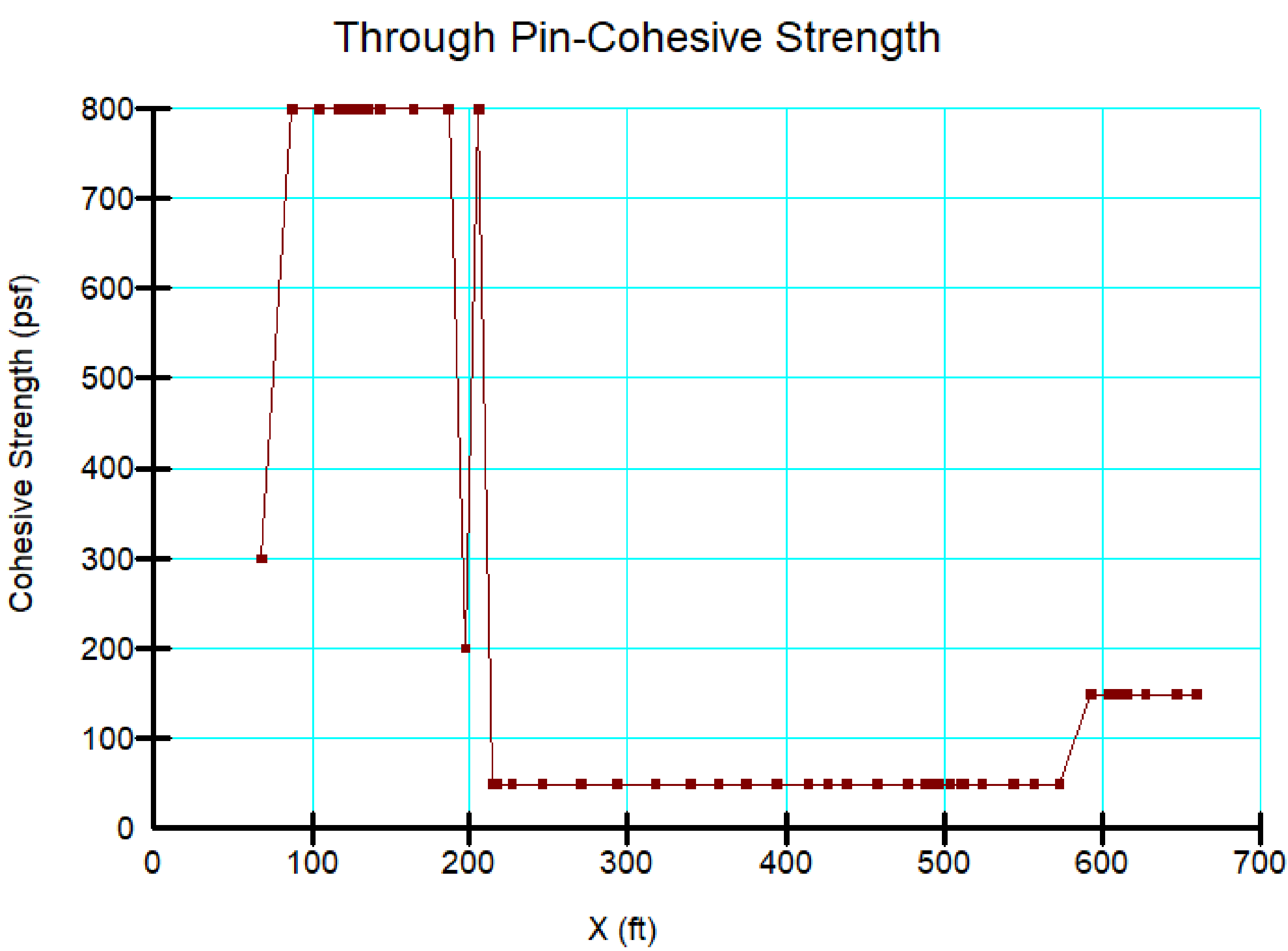
Olive Street
Project No. G3035-52-01
Name: Case 4_2-2'_Through Pin.gsz



Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\2-2' Geo Studio\File Name: Case 4_2-2'_Through Pin.gszDTime: 08:32:25 AMate: 08/09/2024

2-2'


Through Pin-Friction Angle
Friction Angle (deg) (°)
35
30
25
20
15
10
0
100
200
300
400
500
600
700
X (ft)

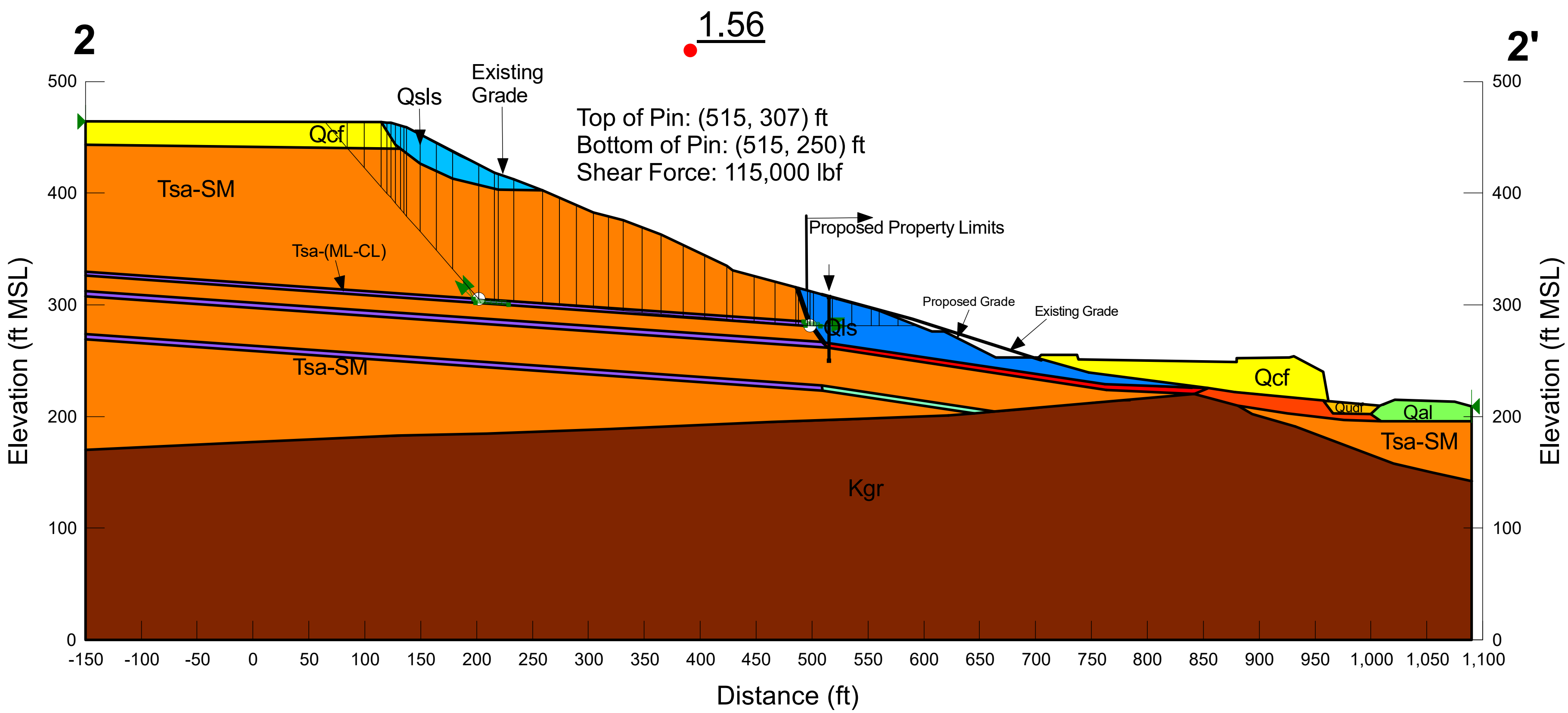

Through Pin-Cohesive Strength
Cohesive Strength (psf)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
X (ft)

Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qcol	130	150	26		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Qsls	130	150	26		
	Qudf	130	300	28		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-ML 8 Deg	130	200	28	Phi-14, angle 8	Cohesion-50, angle 8
	Tsa-SM	130	800	34		

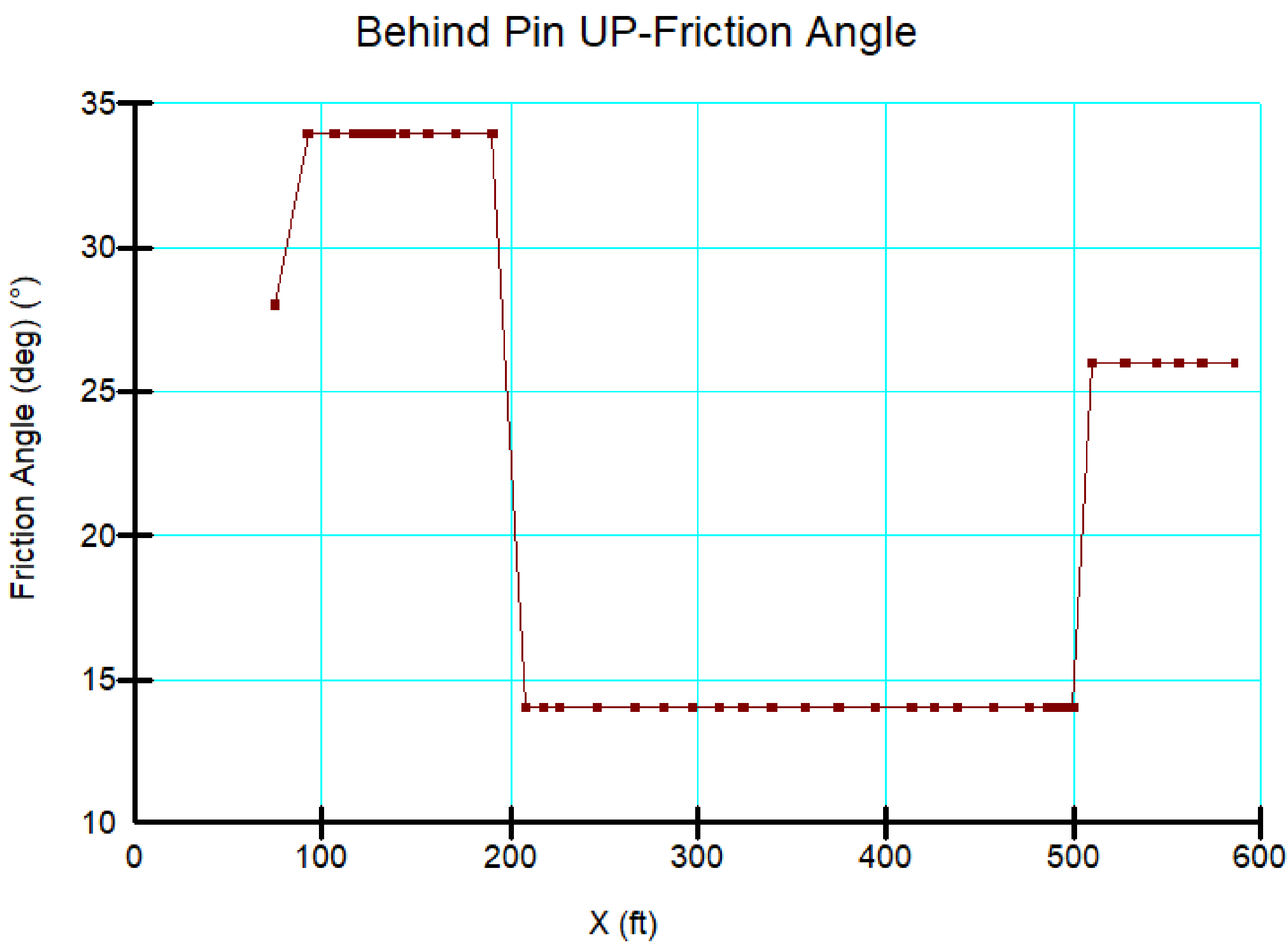
Proposed Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: Case 5_2-2'_Behind Pin-Upper.gsz

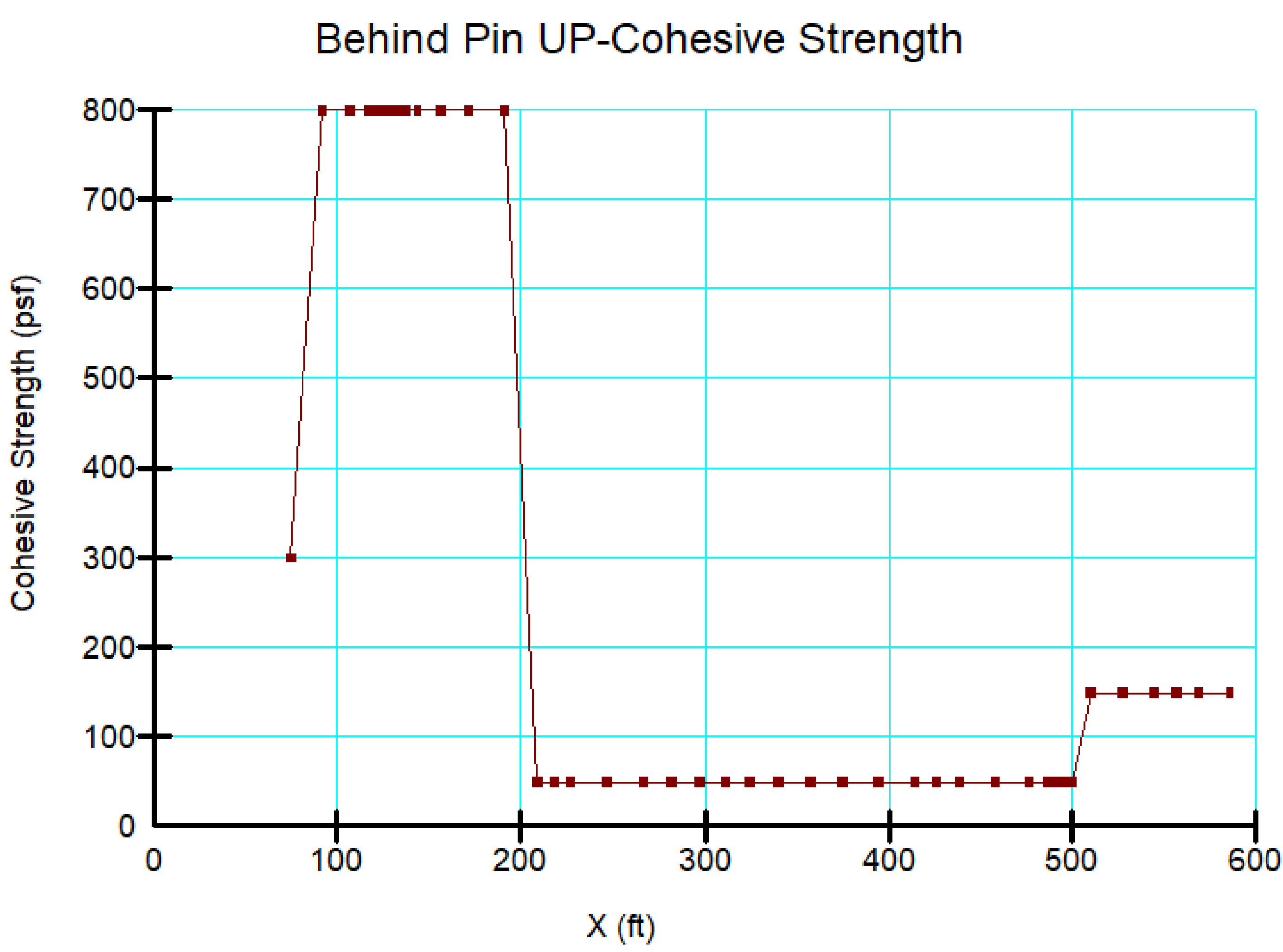


Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\2-2' Geo Studio\File Name: Case 5_2-2'_Behind Pin-Upper.gszDTime: 08:35:04 AMate: 08/09/2024

2-2'



Behind Pin UP-Friction Angle
Friction Angle (deg) (°)
35
30
25
20
15
10
0
100
200
300
400
500
600
X (ft)



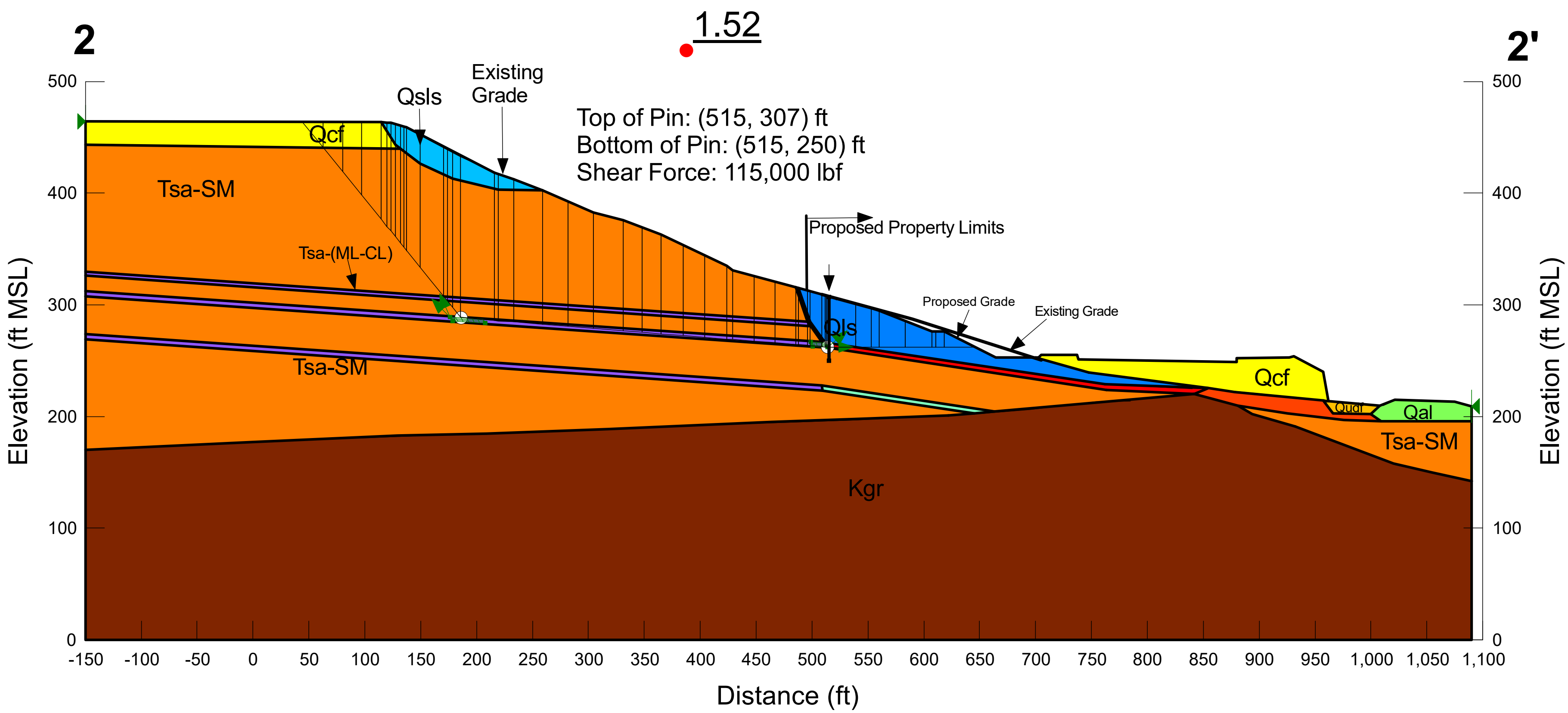
Behind Pin UP-Cohesive Strength
Cohesive Strength (psf)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
X (ft)

Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qcol	130	150	26		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Qsls	130	150	26		
	Qudf	130	300	28		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-ML 8 Deg	130	200	28	Phi-14, angle 8	Cohesion-50, angle 8
	Tsa-SM	130	800	34		

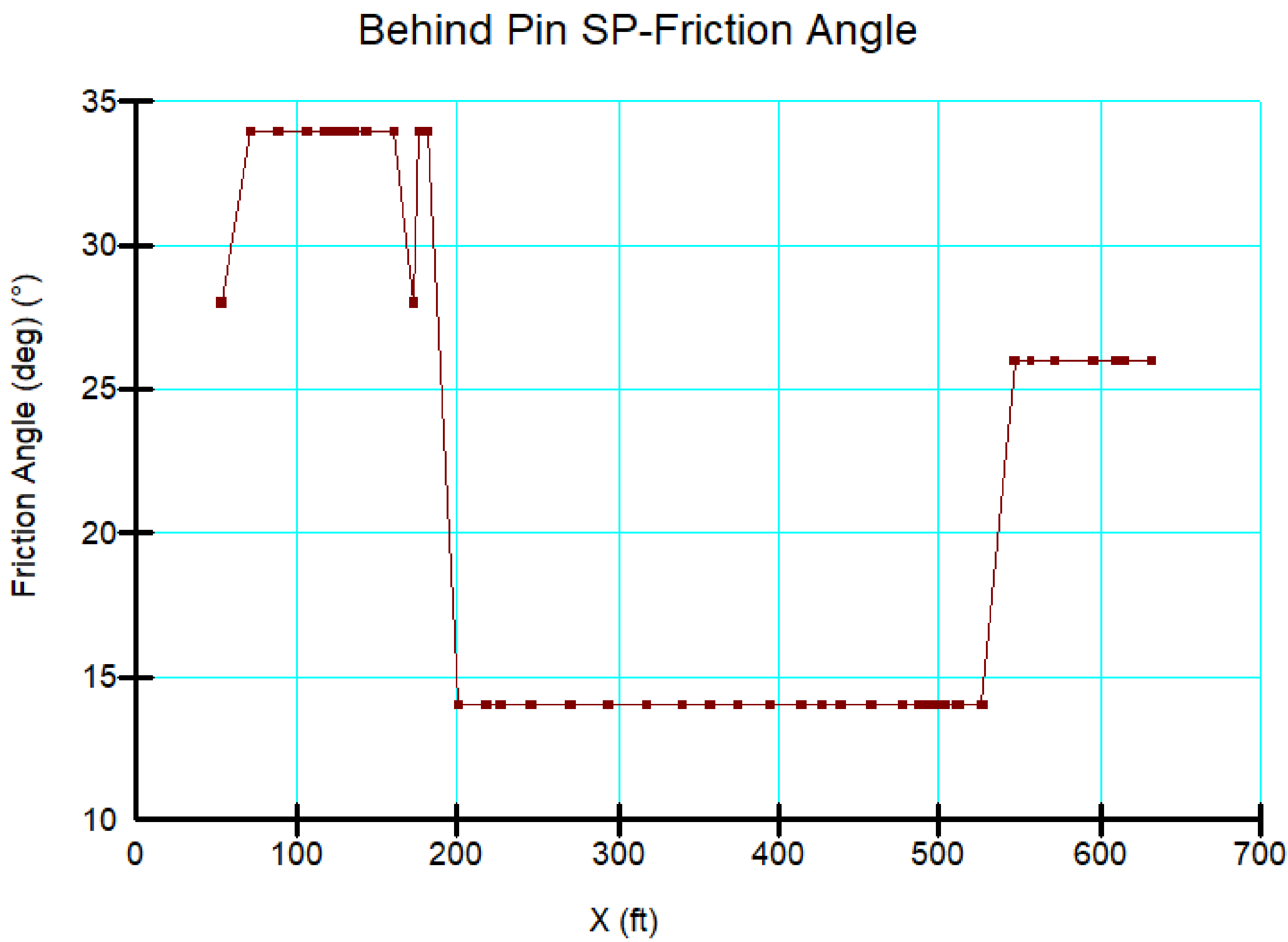
Proposed Grade
Static Condition

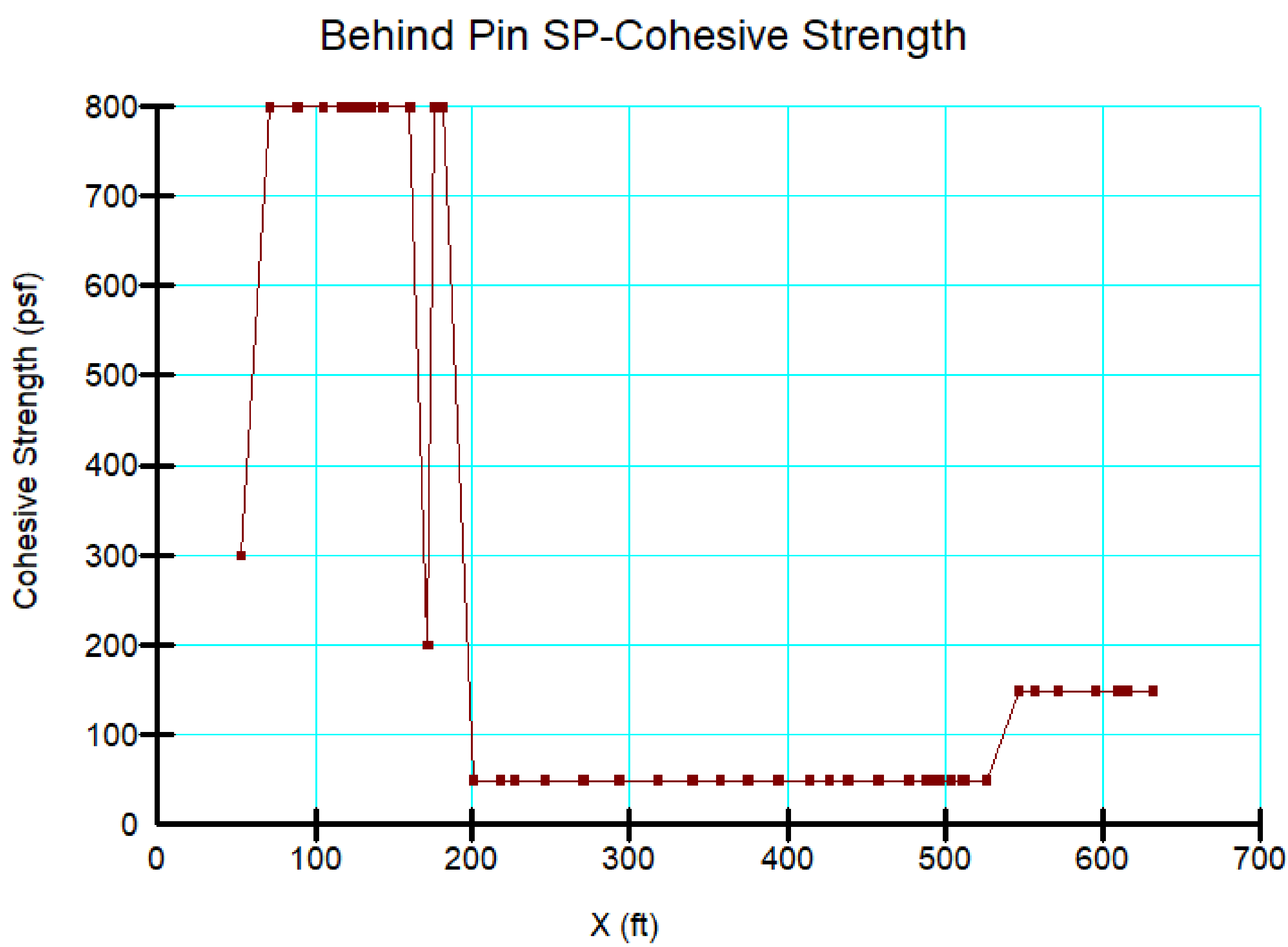
Olive Street
Project No. G3035-52-01
Name: Case 6_2-2'_Behind Pin-Slide Plane.gsz



Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\2-2' Geo Studio\File Name: Case 6_2-2'_Behind Pin-Slide Plane.gszDTime: 08:37:10 AMate: 08/09/2024

2-2'


Behind Pin SP-Friction Angle
Friction Angle (deg) (°)
35
30
25
20
15
10
0
100
200
300
400
500
600
700
X (ft)

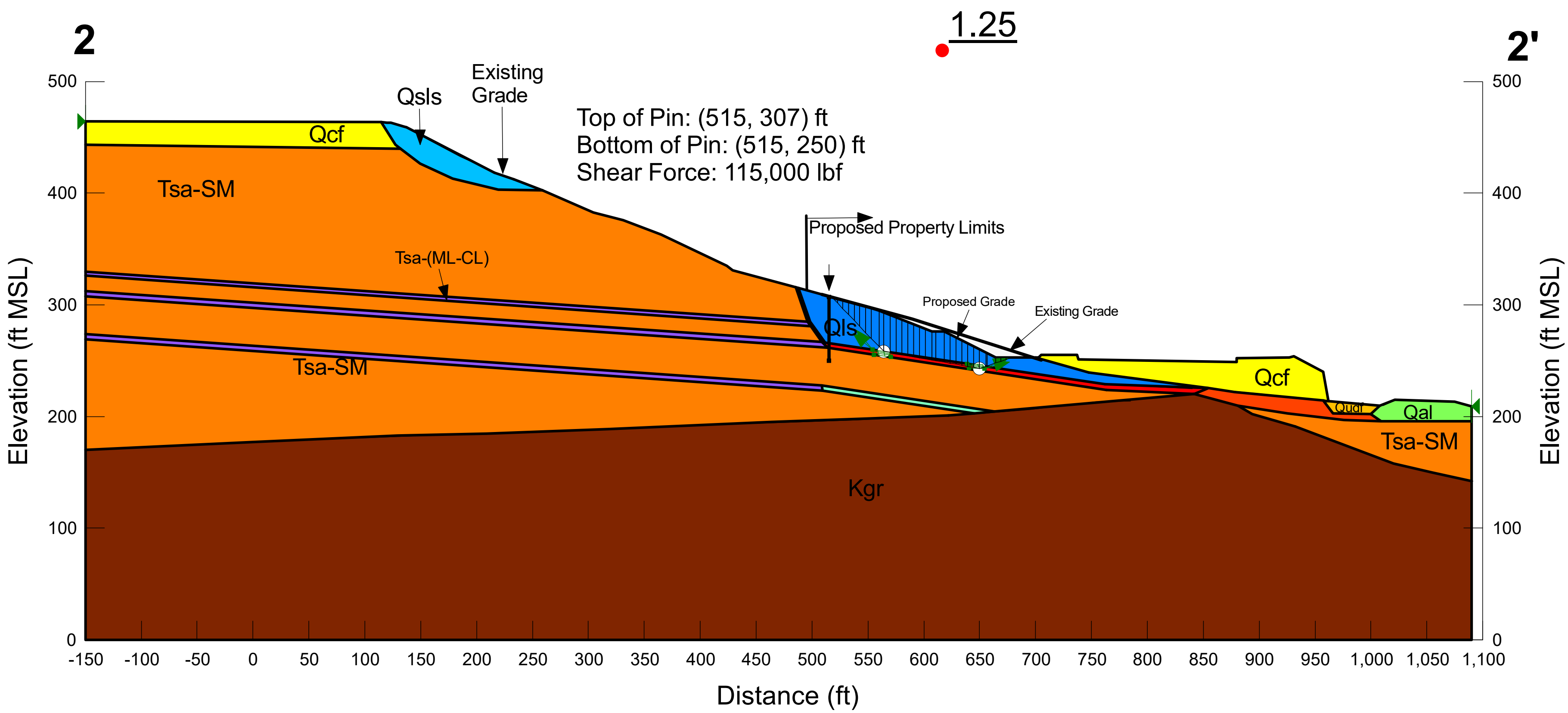

Behind Pin SP-Cohesive Strength
Cohesive Strength (psf)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
X (ft)

Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qcol	130	150	26		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Qsls	130	150	26		
	Qudf	130	300	28		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-ML 8 Deg	130	200	28	Phi-14, angle 8	Cohesion-50, angle 8
	Tsa-SM	130	800	34		

Proposed Grade
Static Condition

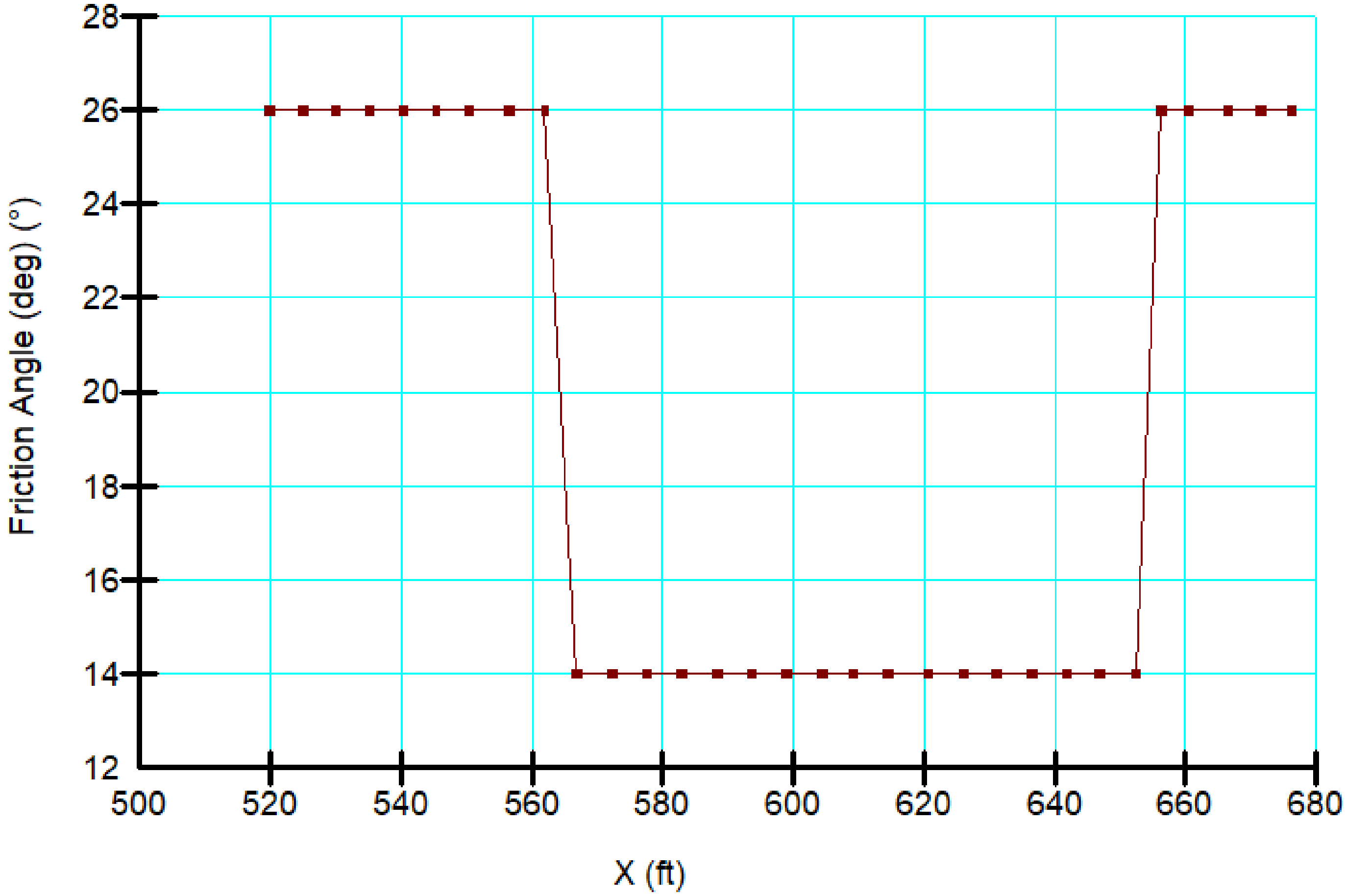
Olive Street
Project No. G3035-52-01
Name: Case 7_2-2'-Front of Pin.gsz



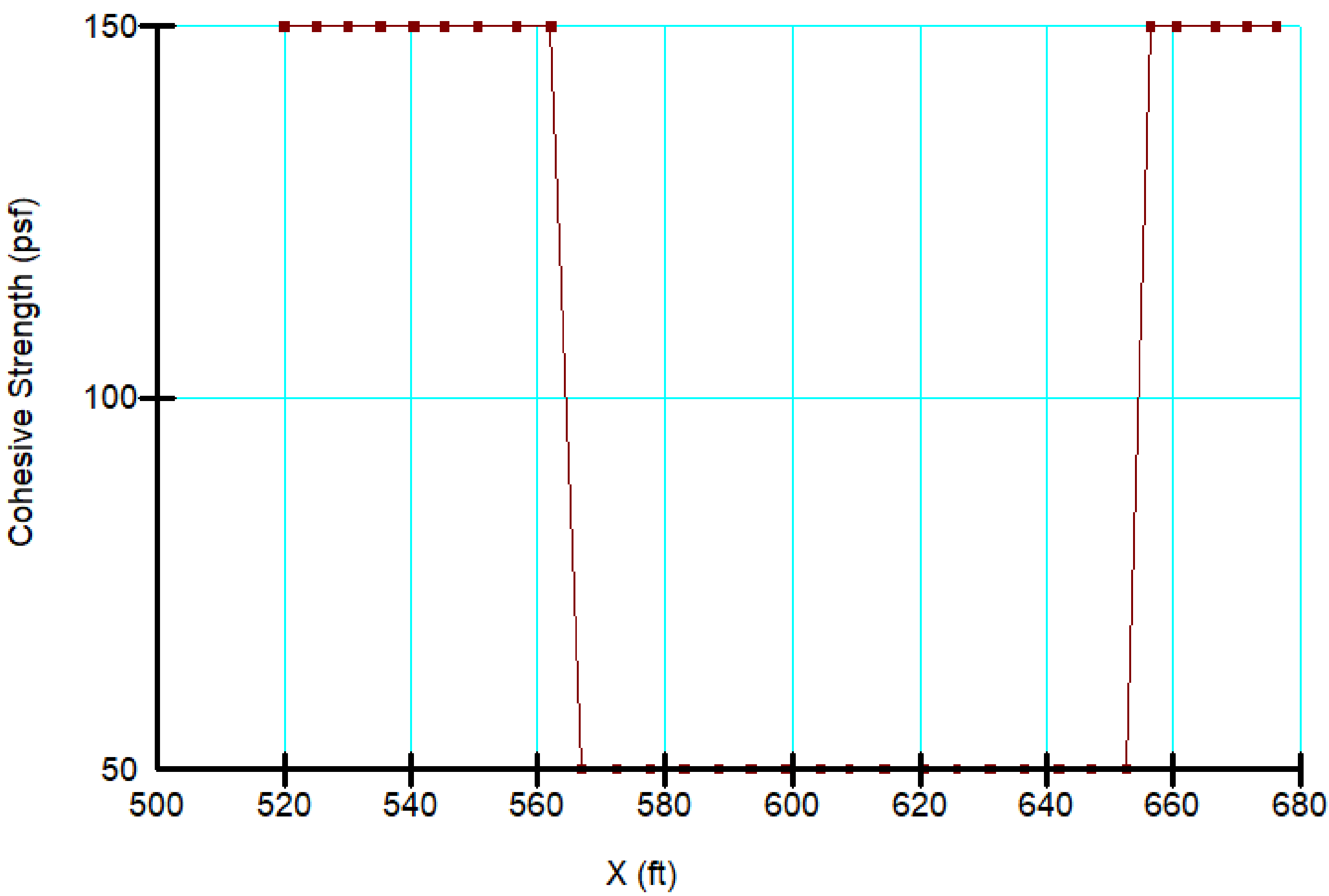
Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\2-2' Geo Studio\File Name: Case 7_2-2'-Front of Pin.gszDTime: 08:42:42 AMate: 08/09/2024

2'

Front of Pin-Friction Angle



Front of Pin-Cohesive Strength

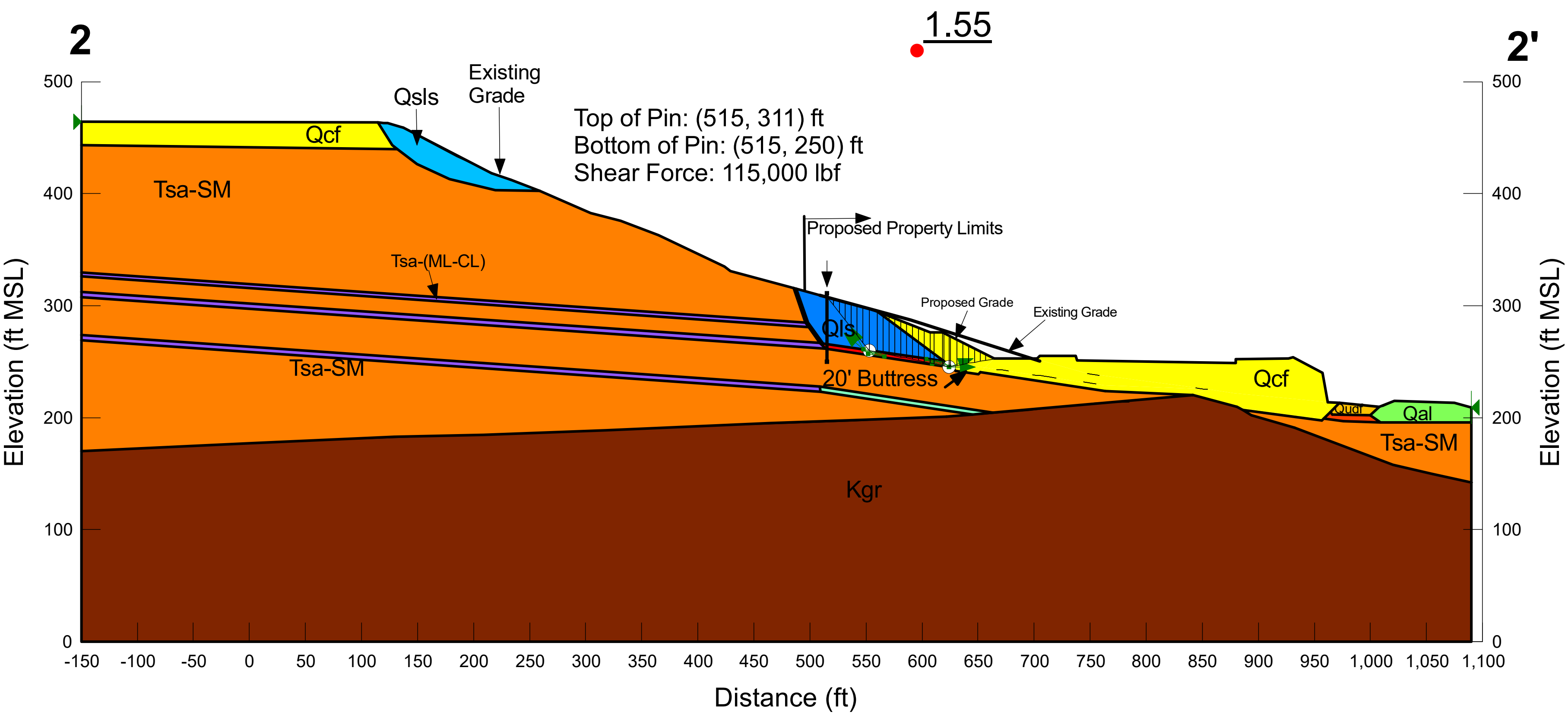


Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qcol	130	150	26		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Qsls	130	150	26		
	Qudf	130	300	28		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-ML 8 Deg	130	200	28	Phi-14, angle 8	Cohesion-50, angle 8
	Tsa-SM	130	800	34		

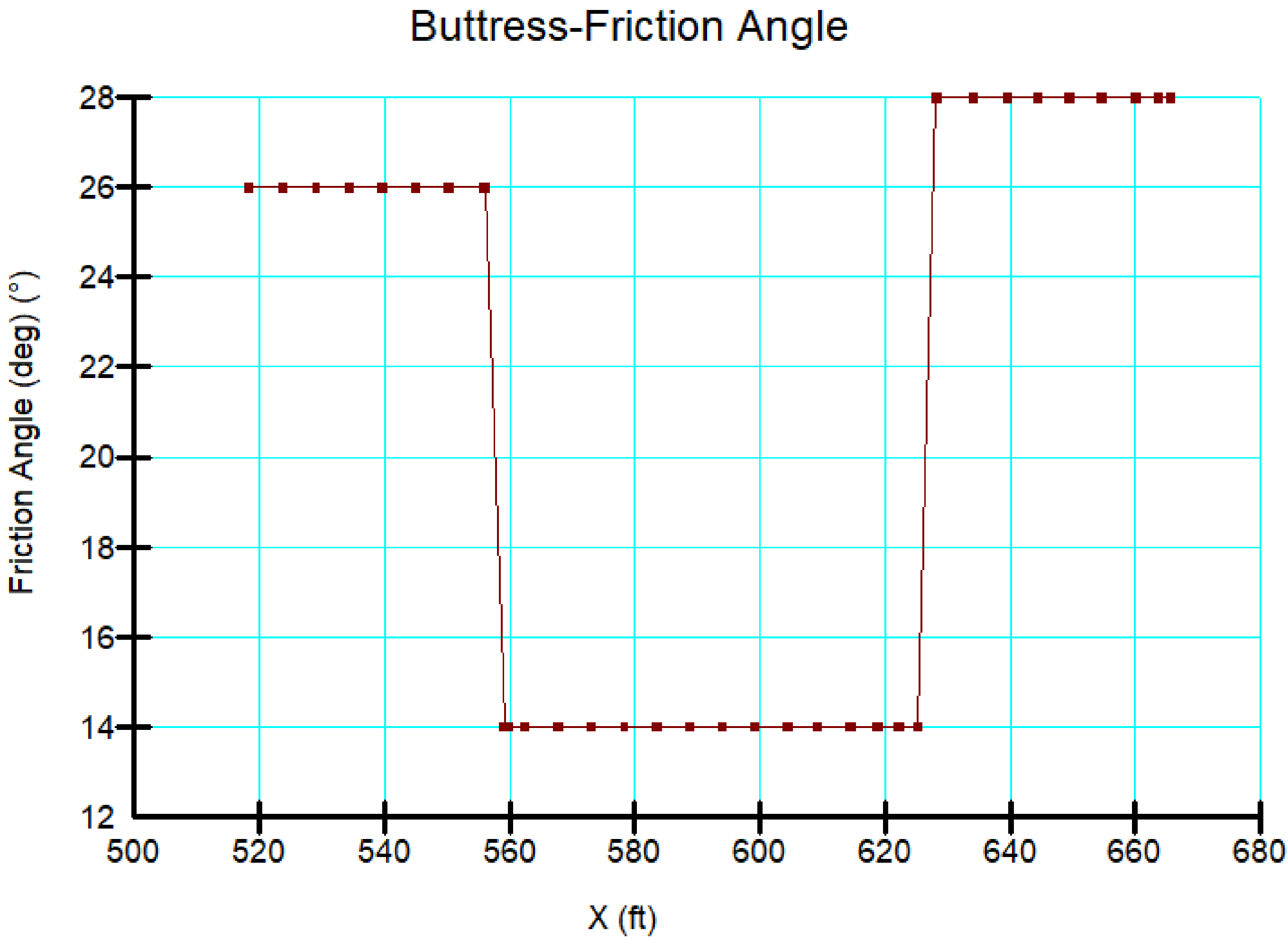
Proposed Grade
Static Condition

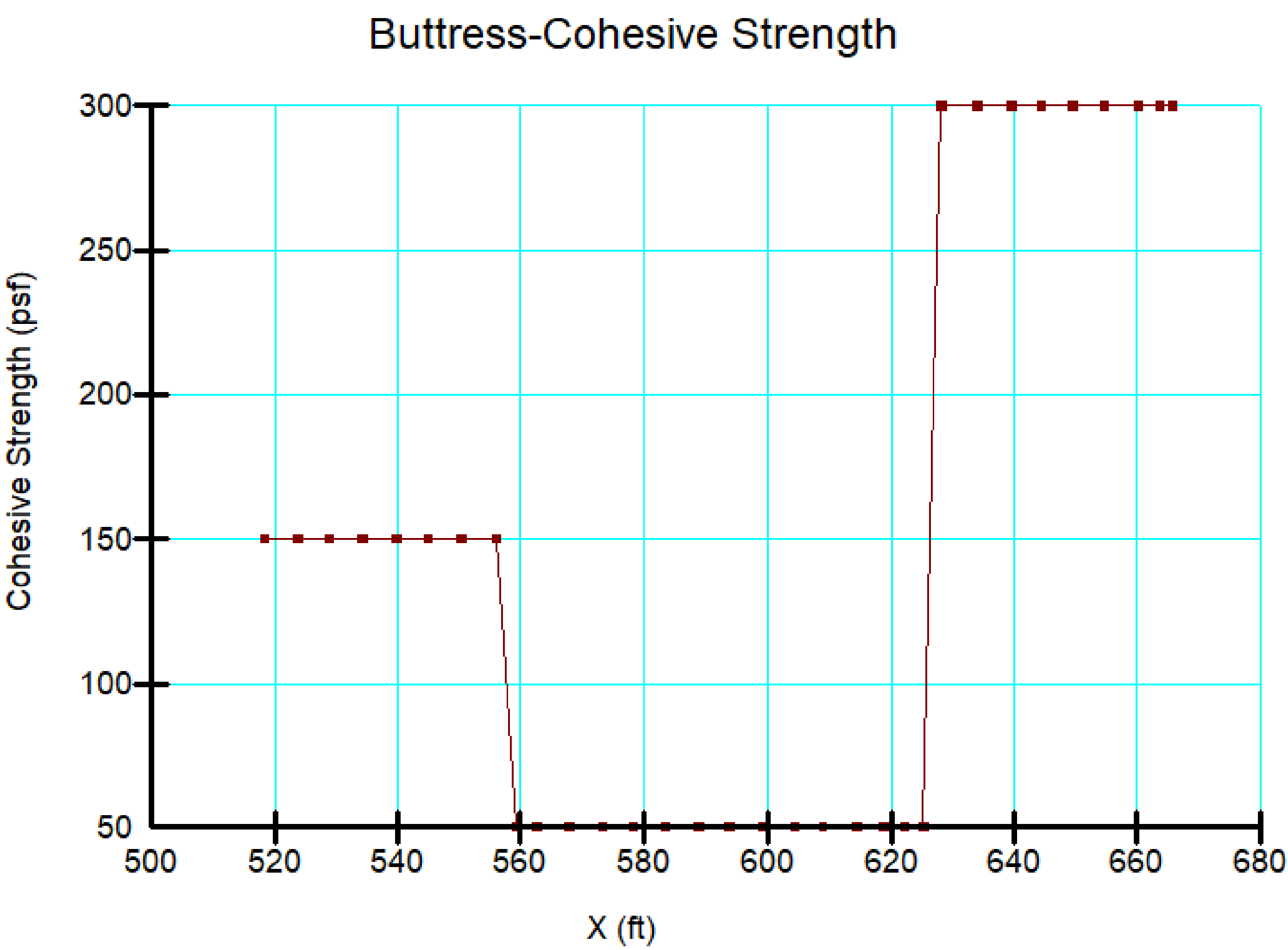
Olive Street
Project No. G3035-52-01
Name: Case 8_2-2'-Buttress.gsz



Directory: S:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2018\G3035-52-01 Olive Street\2024-07-16 Addtional Drilling\2-2' Geo Studio\File Name: Case 8_2-2'-Buttress.gszDTime: 08:48:10 AMate: 08/09/2024

2-2'


Buttress-Friction Angle
Friction Angle (deg) (°)
28
26
24
22
20
18
16
14
12
500
520
540
560
580
600
620
640
660
680
X (ft)

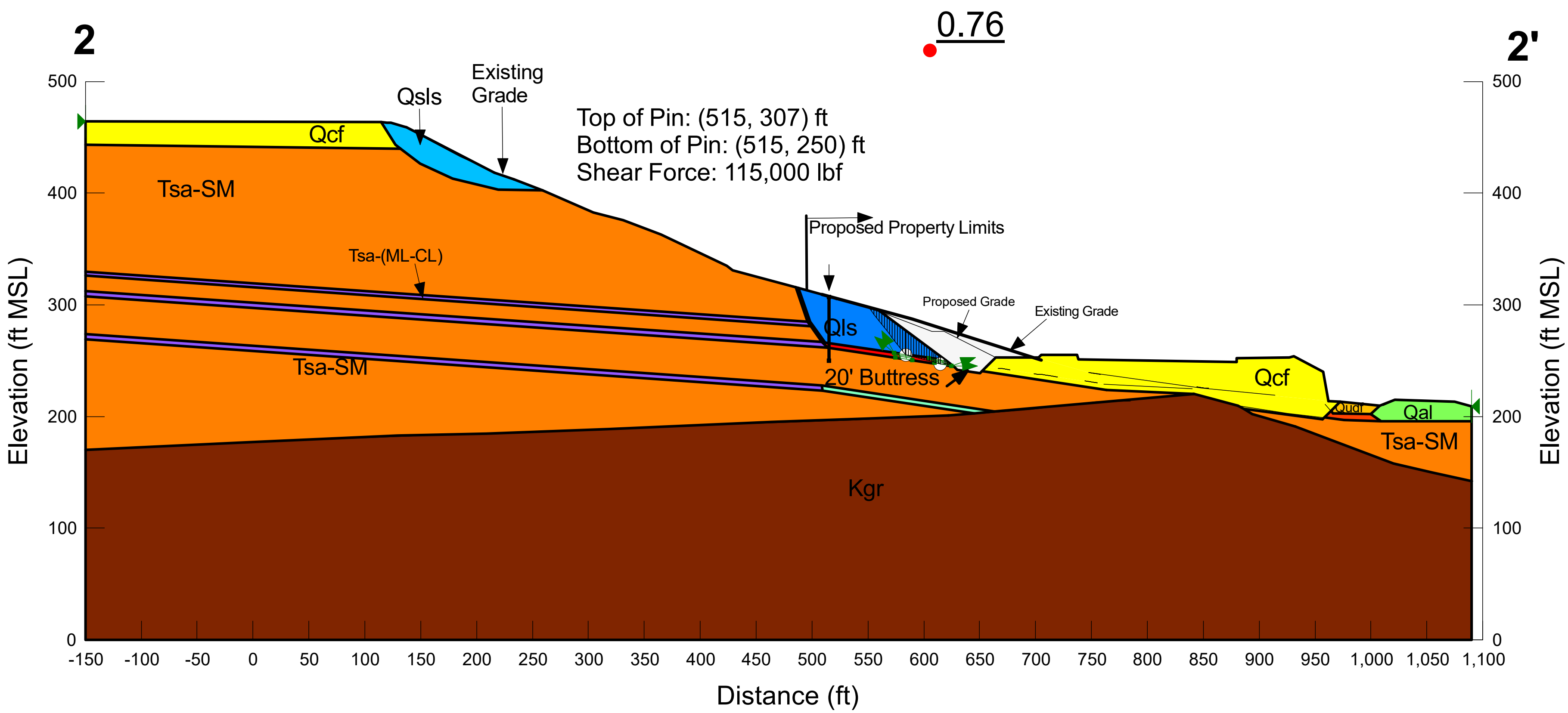

Buttress-Cohesive Strength
Cohesive Strength (psf)
300
250
200
150
100
50
500
520
540
560
580
600
620
640
660
680
X (ft)

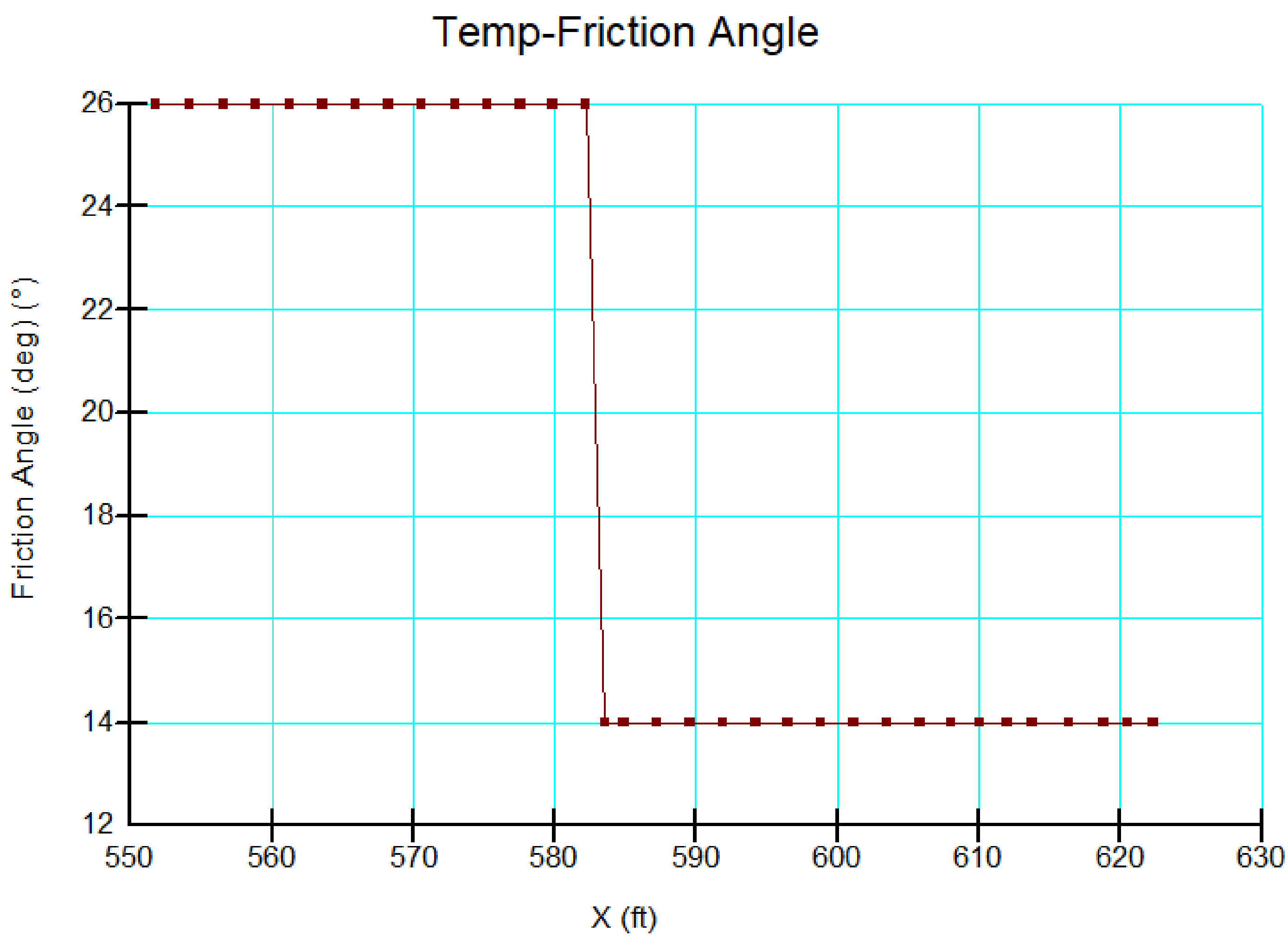
Material Properties:

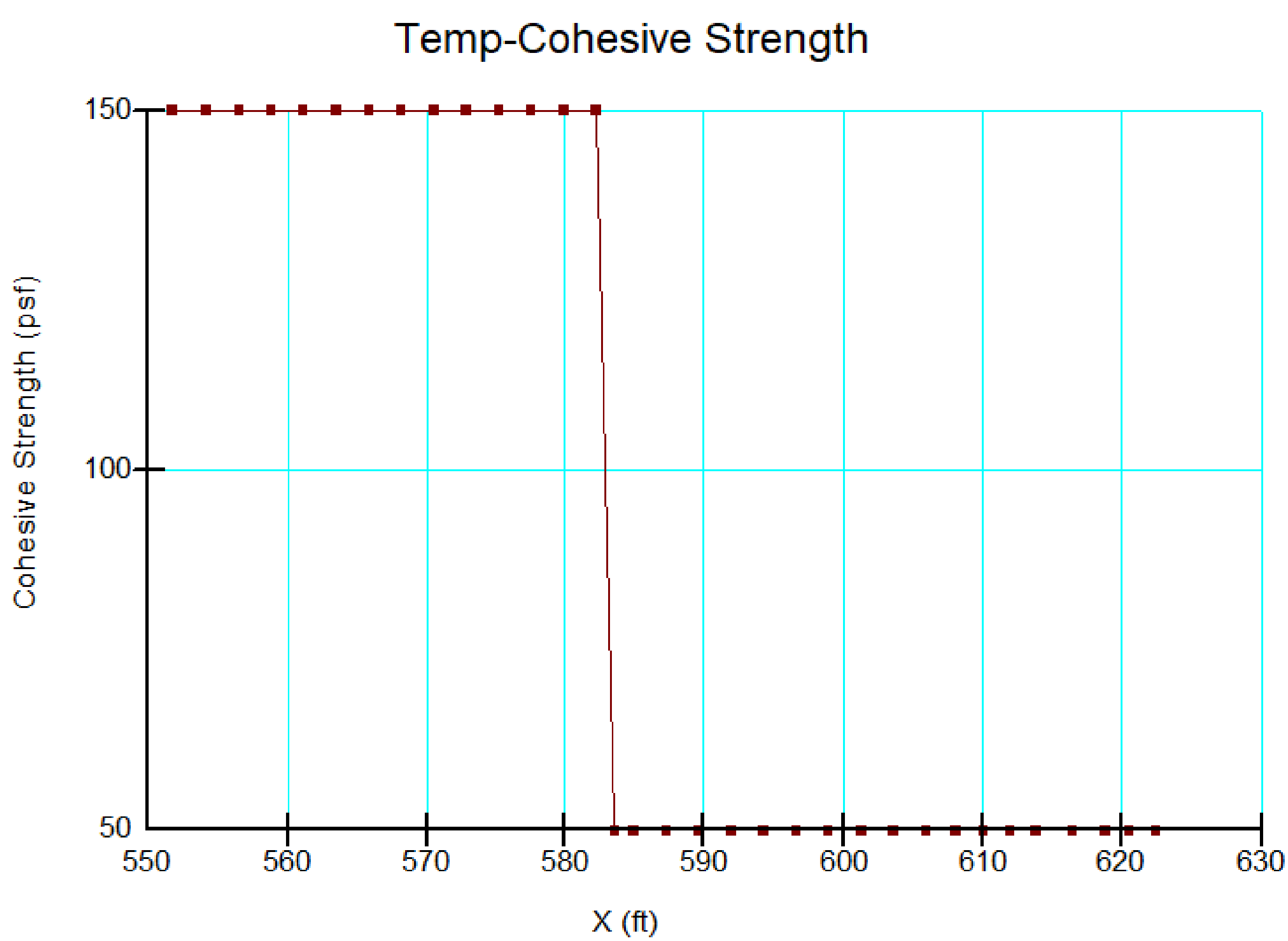
Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qcol	130	150	26		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Qsls	130	150	26		
	Qudf	130	300	28		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-ML 8 Deg	130	200	28	Phi-14, angle 8	Cohesion-50, angle 8
	Tsa-SM	130	800	34		

Proposed Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: Case 9_2-2'-Temp.gsz




Temp-Friction Angle
Friction Angle (deg) (°)
26
24
22
20
18
16
14
12
550
560
570
580
590
600
610
620
630
X (ft)

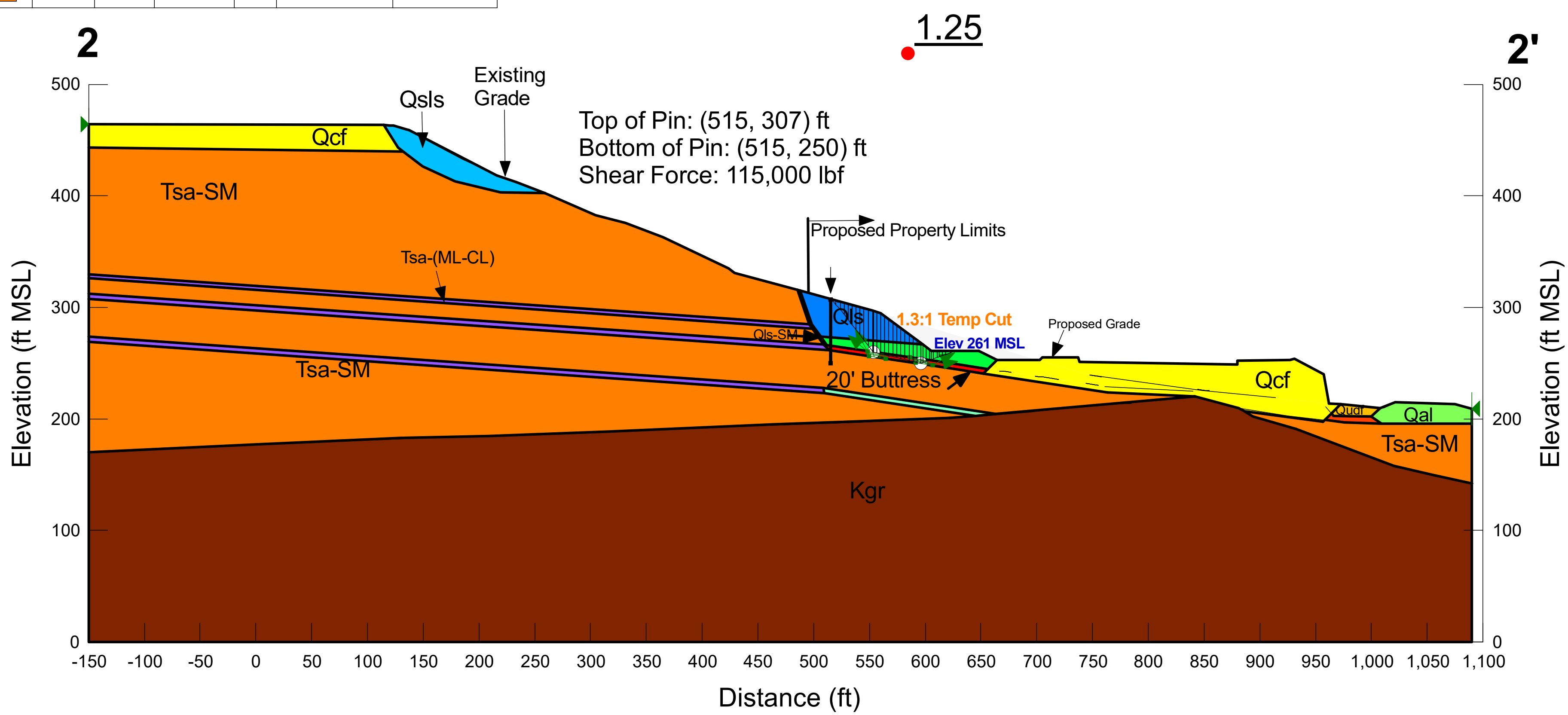

Temp-Cohesive Strength
Cohesive Strength (psf)
150
100
50
550
560
570
580
590
600
610
620
630
X (ft)

Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qcol	130	150	26		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Qls-SM	130	300	30		
	Qsls	130	150	26		
	Qudf	130	300	28		
	Tsa-ML	130	200	28	Phi-14°	Cohesion-50 (psf)
	Tsa-ML 8 Deg	130	200	28	Phi-14, angle 8	Cohesion-50, angle 8
	Tsa-SM	130	800	34		

Proposed Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: Case 10_2-2'-Temp Slot Cut.gsz



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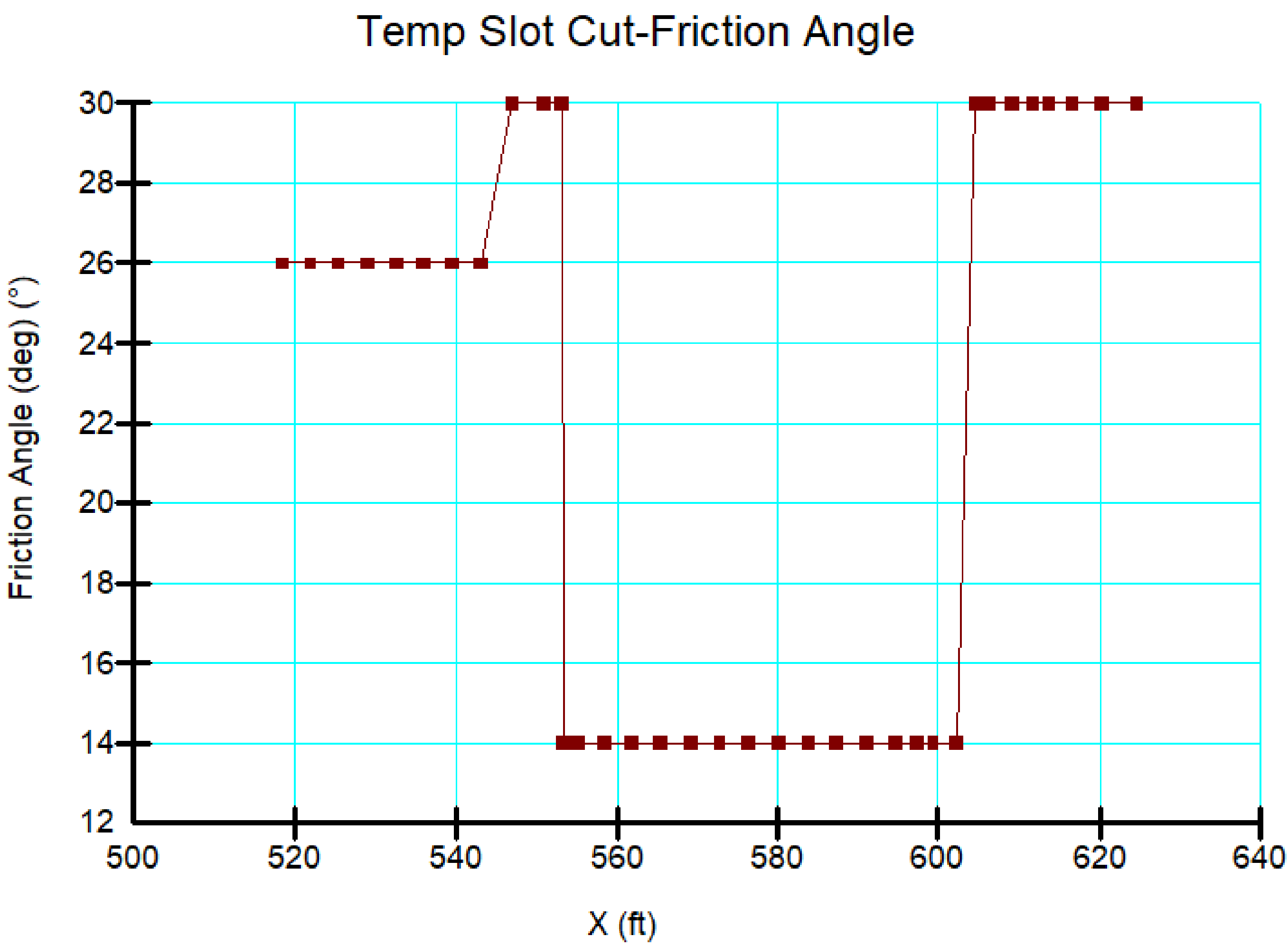
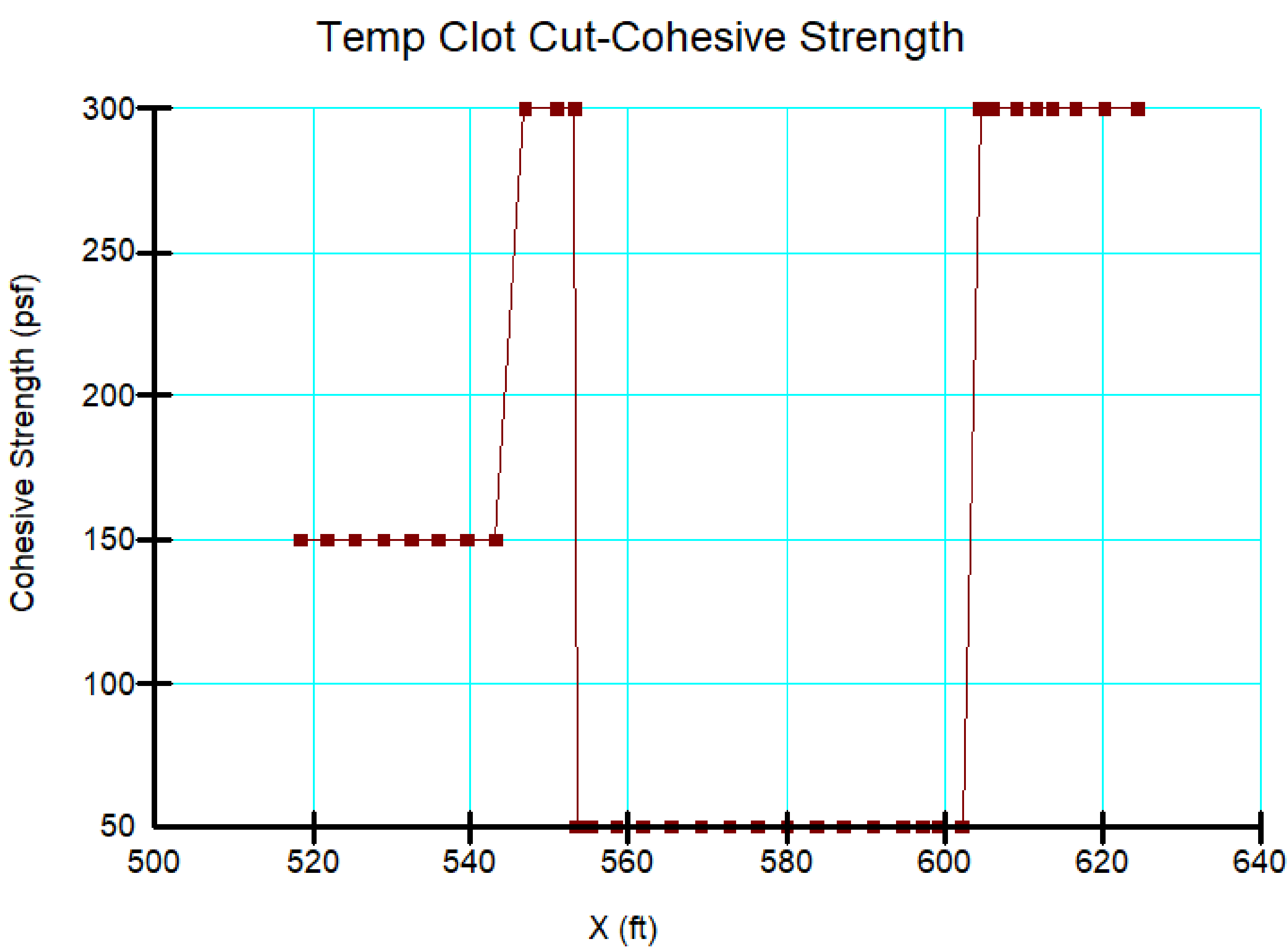
·2'



Temp Slot Cut-Friction Angle
Friction Angle (deg) (°)
30
28
26
24
22
20
18
16
14
12
500
520
540
560
580
600
620
640
X (ft)



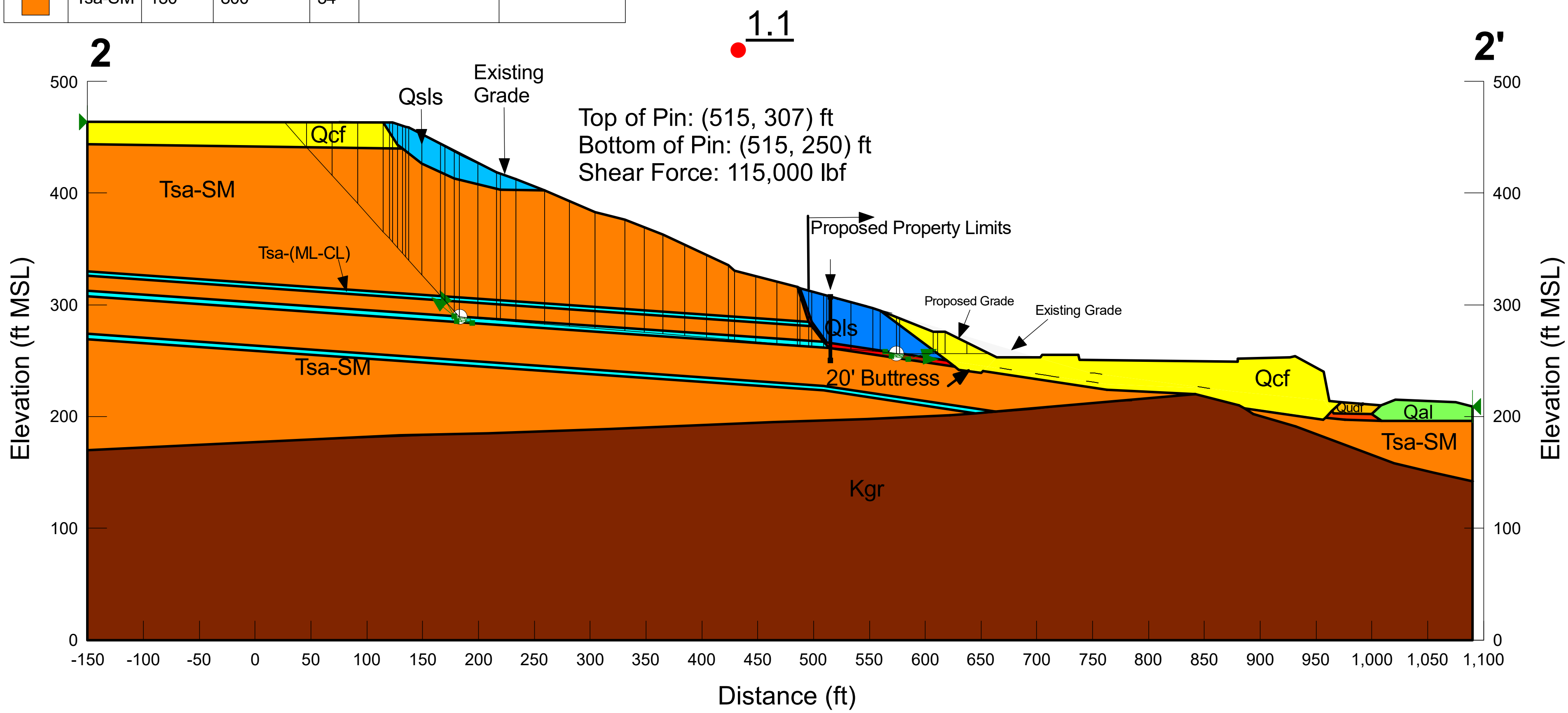
Temp Clot Cut-Cohesive Strength
Cohesive Strength (psf)
300
250
200
150
100
50
500
520
540
560
580
600
620
640
X (ft)

Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Kgr	130	1,000	51		
	Qal	130	150	26		
	Qcf	130	300	28		
	Qcol	130	150	26		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Qsls	130	150	26		
	Qudf	130	300	28		
	Tsa-ML FS	130	200	28	Phi-FS 18°	Cohesion-FS 100 (psf)
	Tsa-SM	130	800	34		

Proposed Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: Case 11_2-2'-Seismic.gsz



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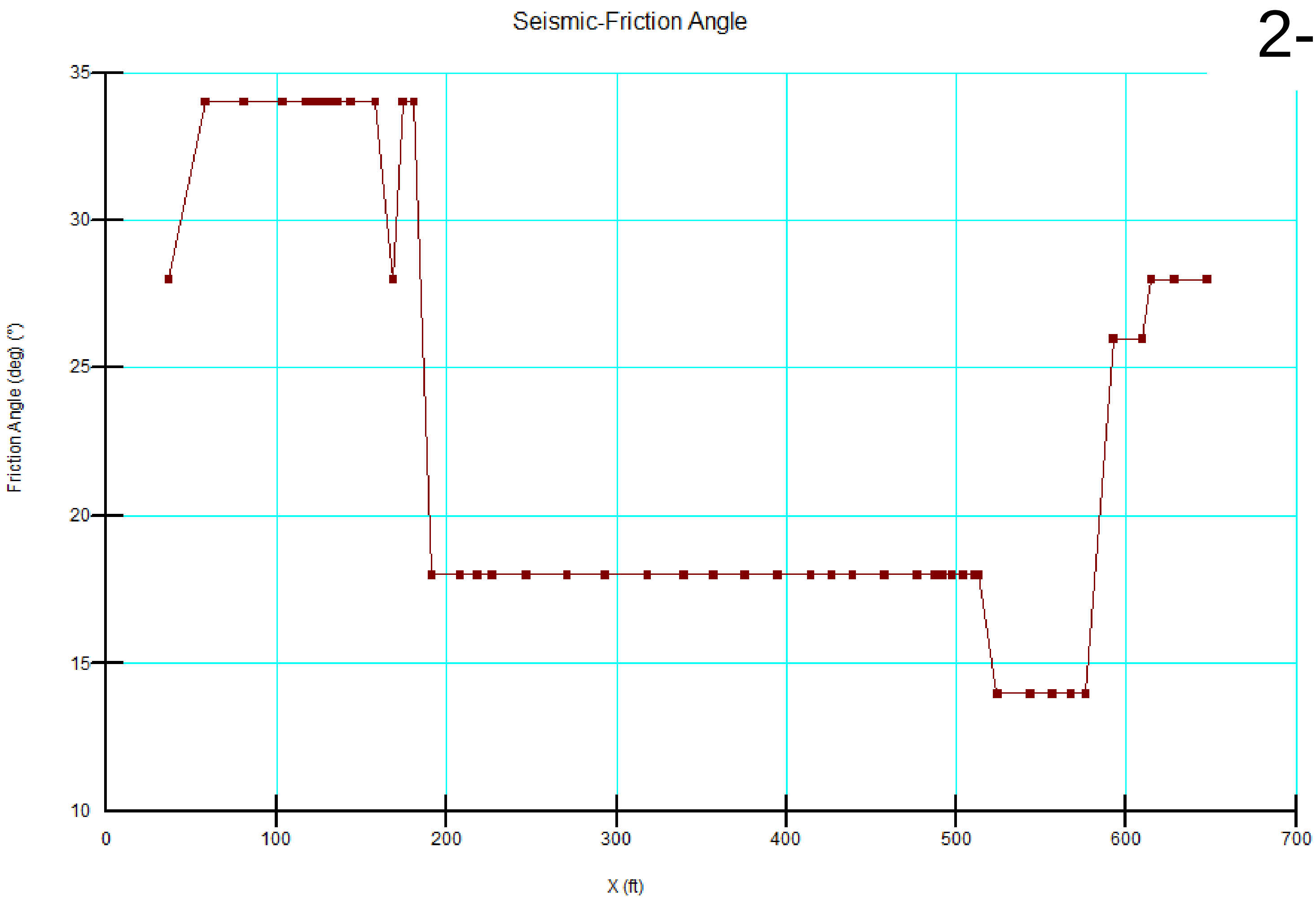
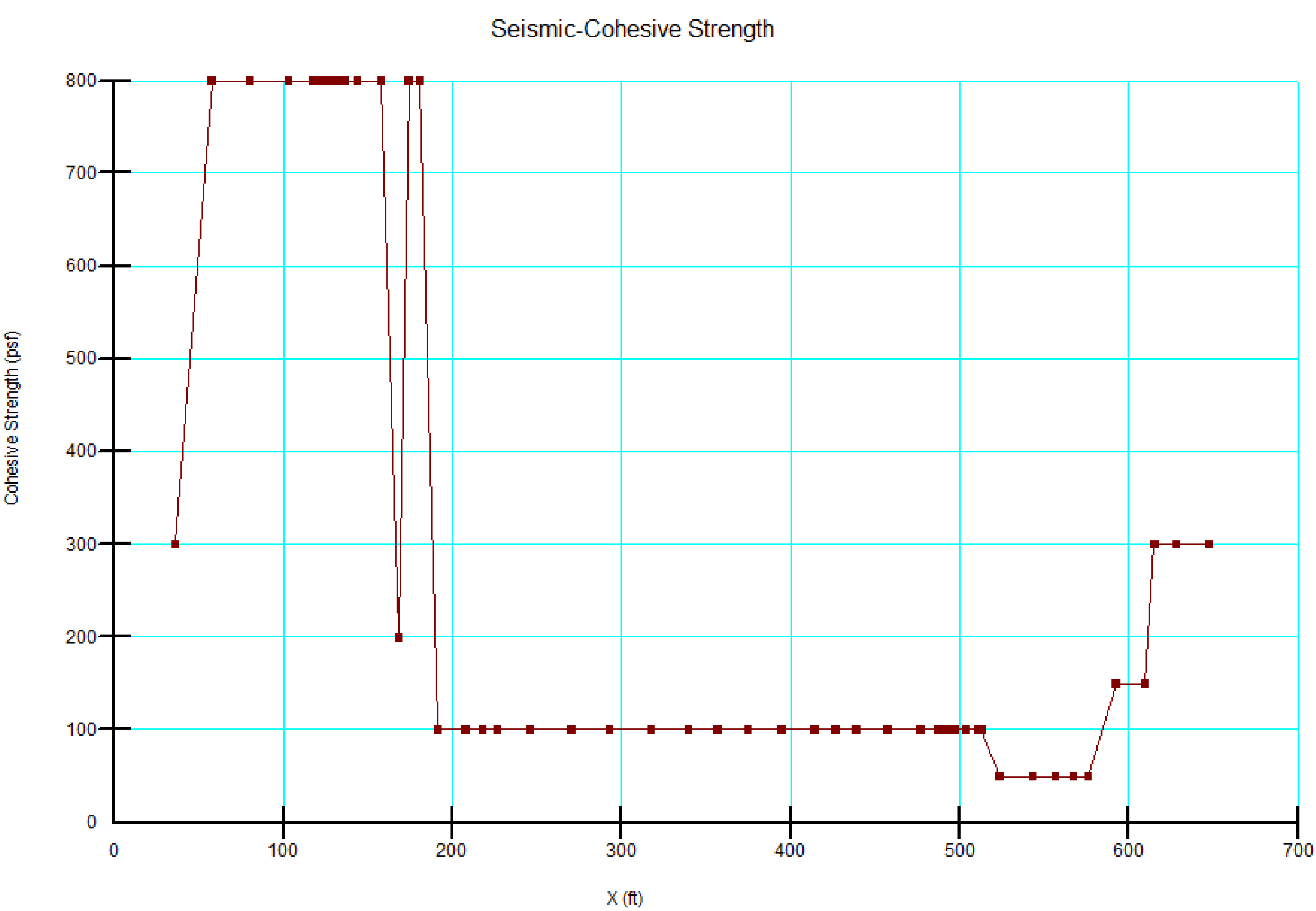
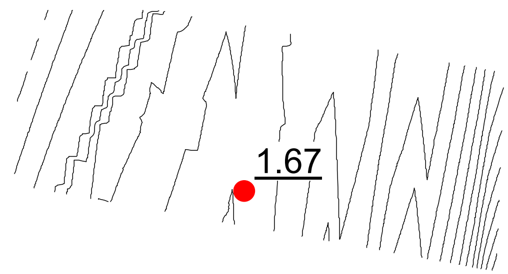
2-2'


Seismic-Friction Angle
Friction Angle (deg) (°)
35
30
25
20
15
10
0
100
200
300
400
500
600
700
X (ft)


Seismic-Cohesive Strength
Cohesive Strength (psf)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
X (ft)

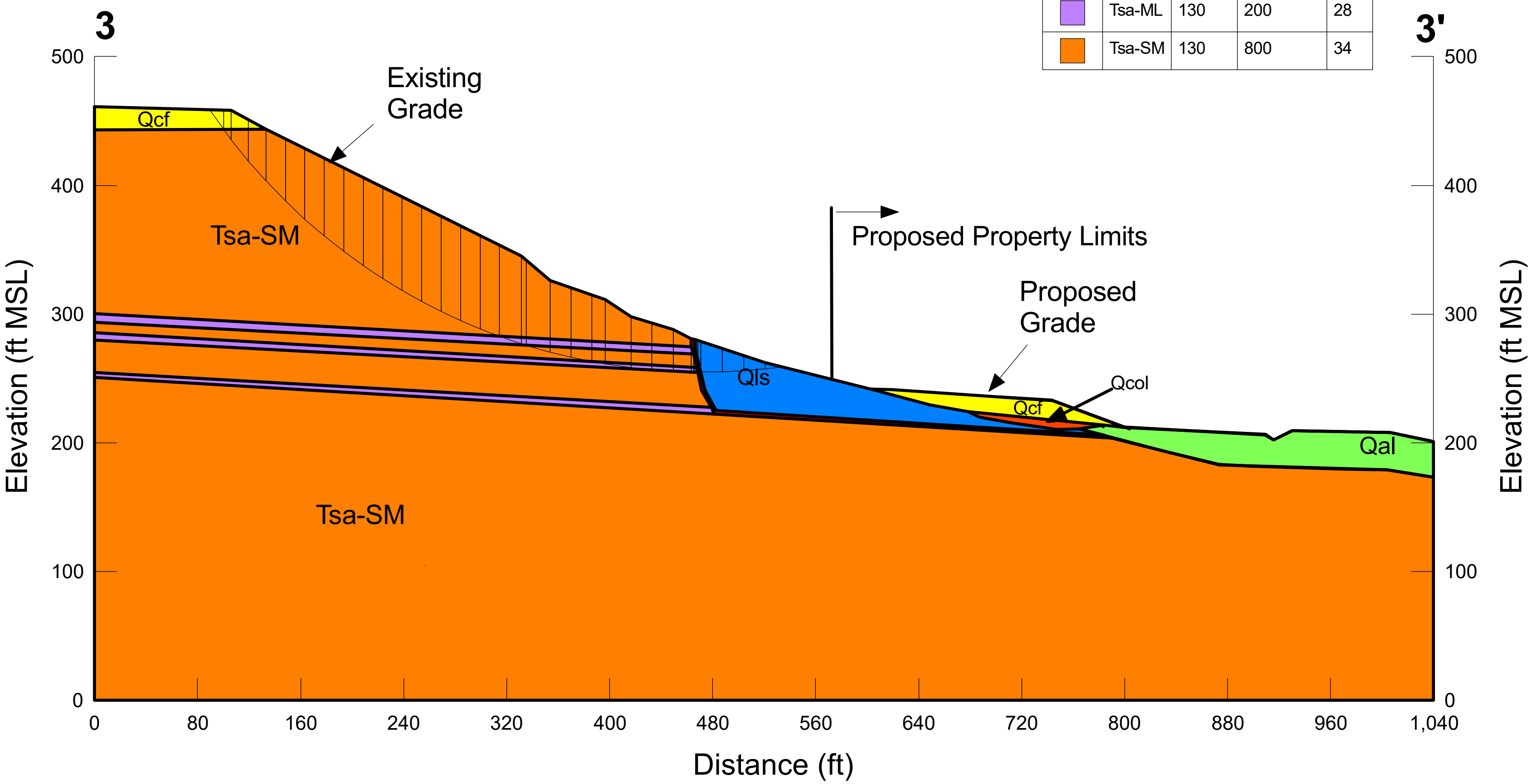
Olive Street
Project No. G3035-52-01
Name: 3-3'-Cir.gsz

Existing Grade
Static Condition



Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Qal	130	150	26
	Qcf	130	300	28
	Qcol	125	150	26
	Qls	130	150	26
	Qlsp	130	50	14
	Tsa-ML	130	200	28
	Tsa-SM	130	800	34



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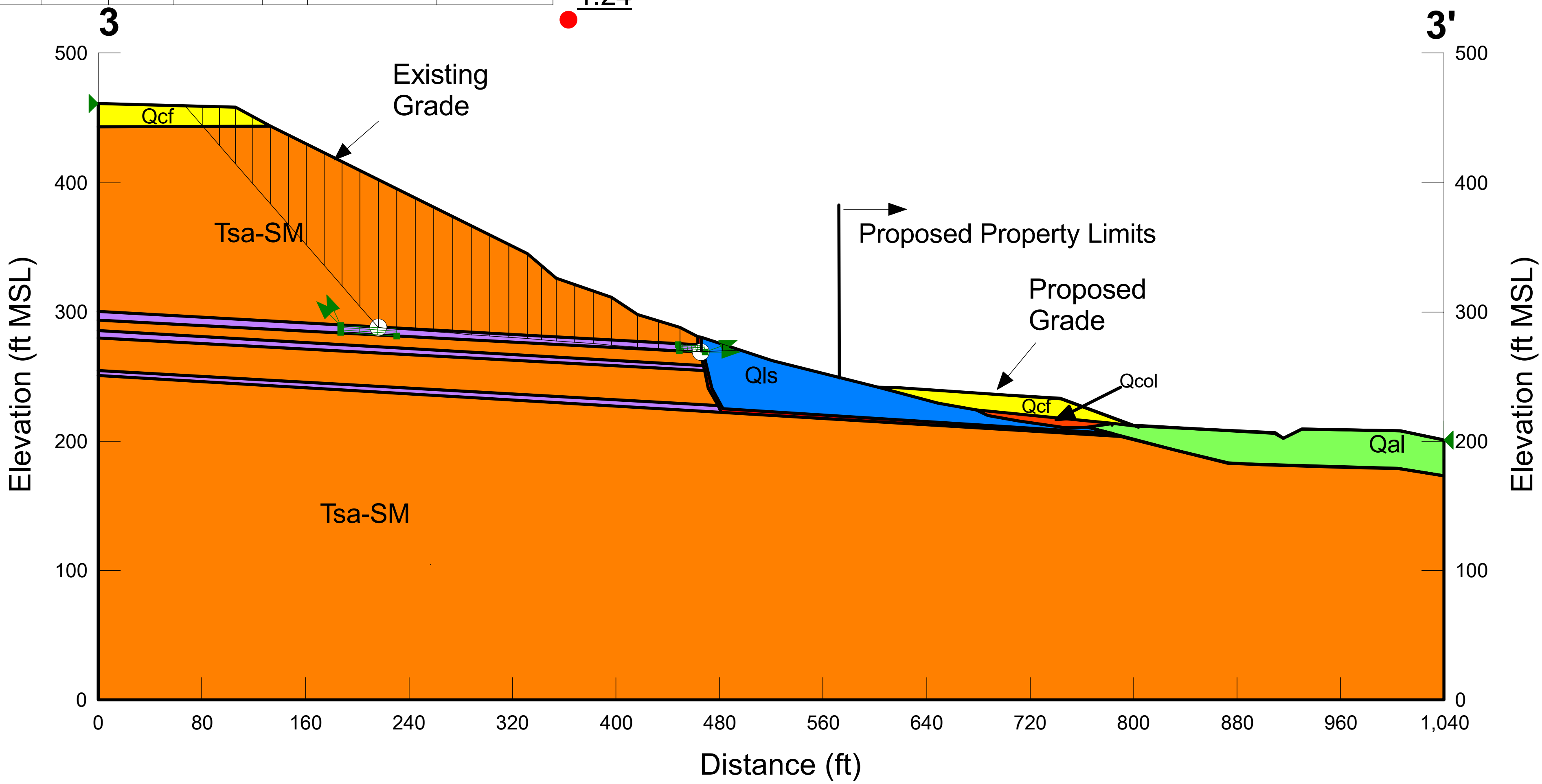
Proposed Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: Case 2_3-3'-Upper Plane.gsz

Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Qal	130	150	26		
	Qcf	130	300	28		
	Qcol	125	150	26		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Tsa-ML	130	200	28	Phi-14 °	Cohesion-50 (psf)
	Tsa-SM	130	800	34		



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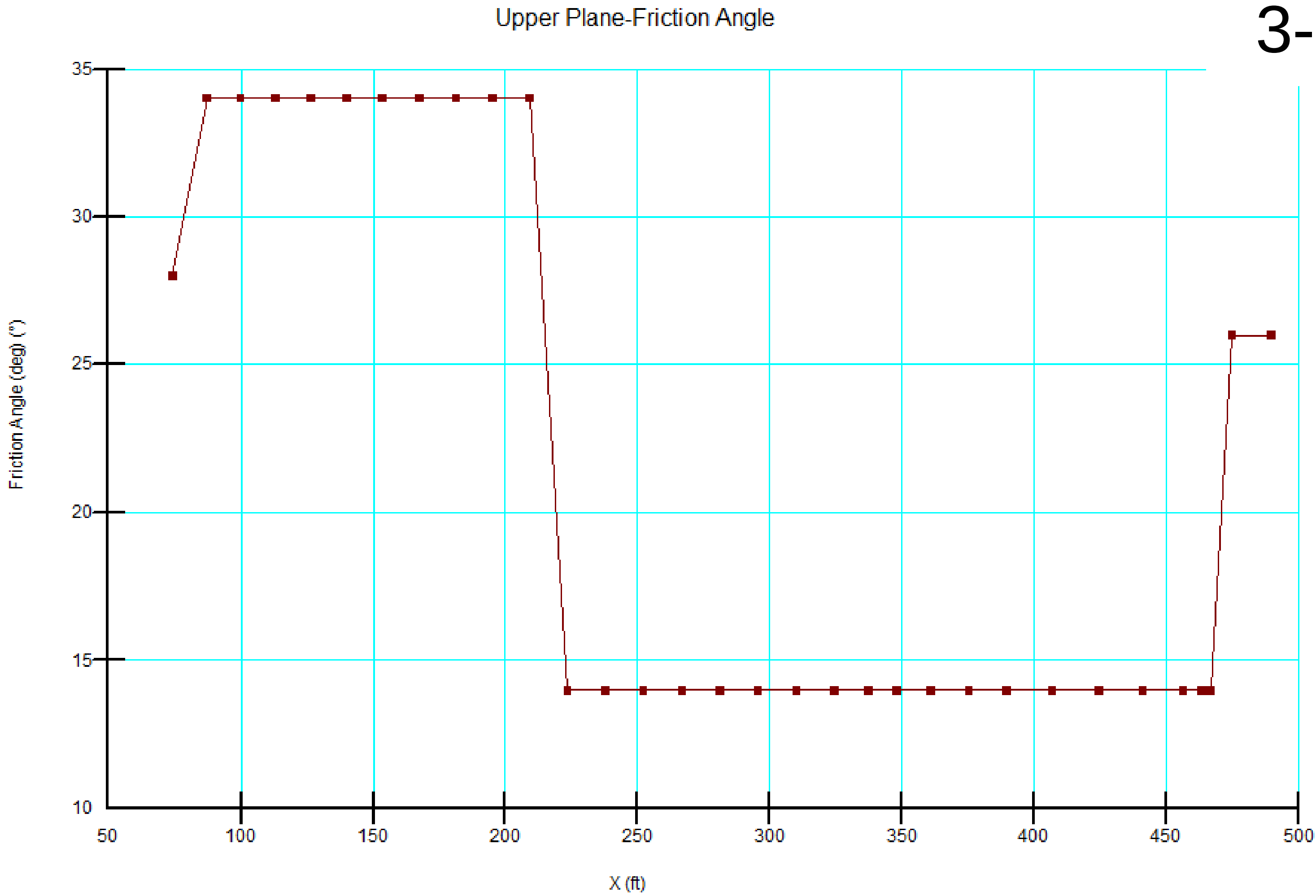
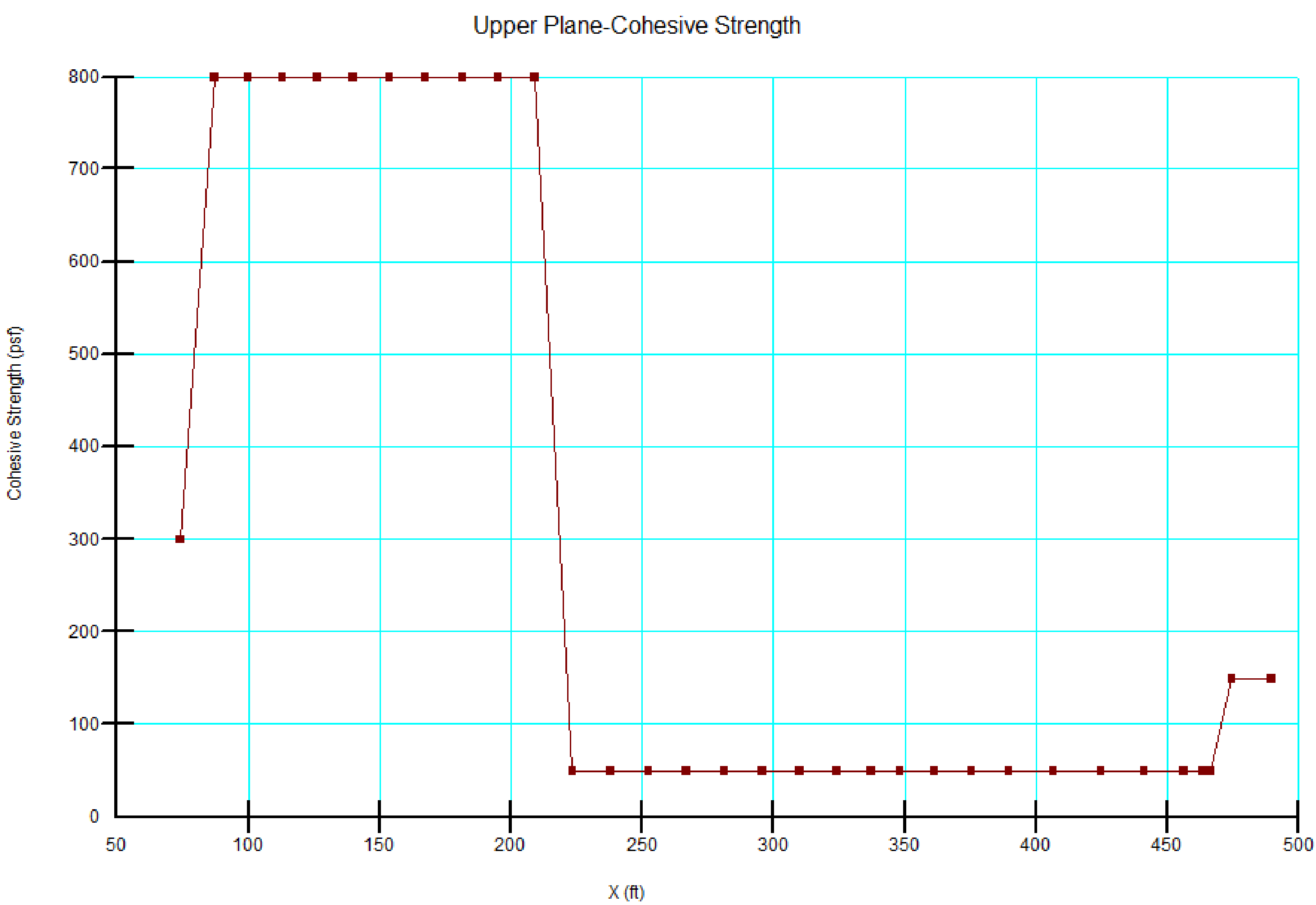

Upper Plane-Friction Angle
Friction Angle (deg) (°)
X (ft)
35
30
25
20
15
10
50
100
150
200
250
300
350
400
450
500

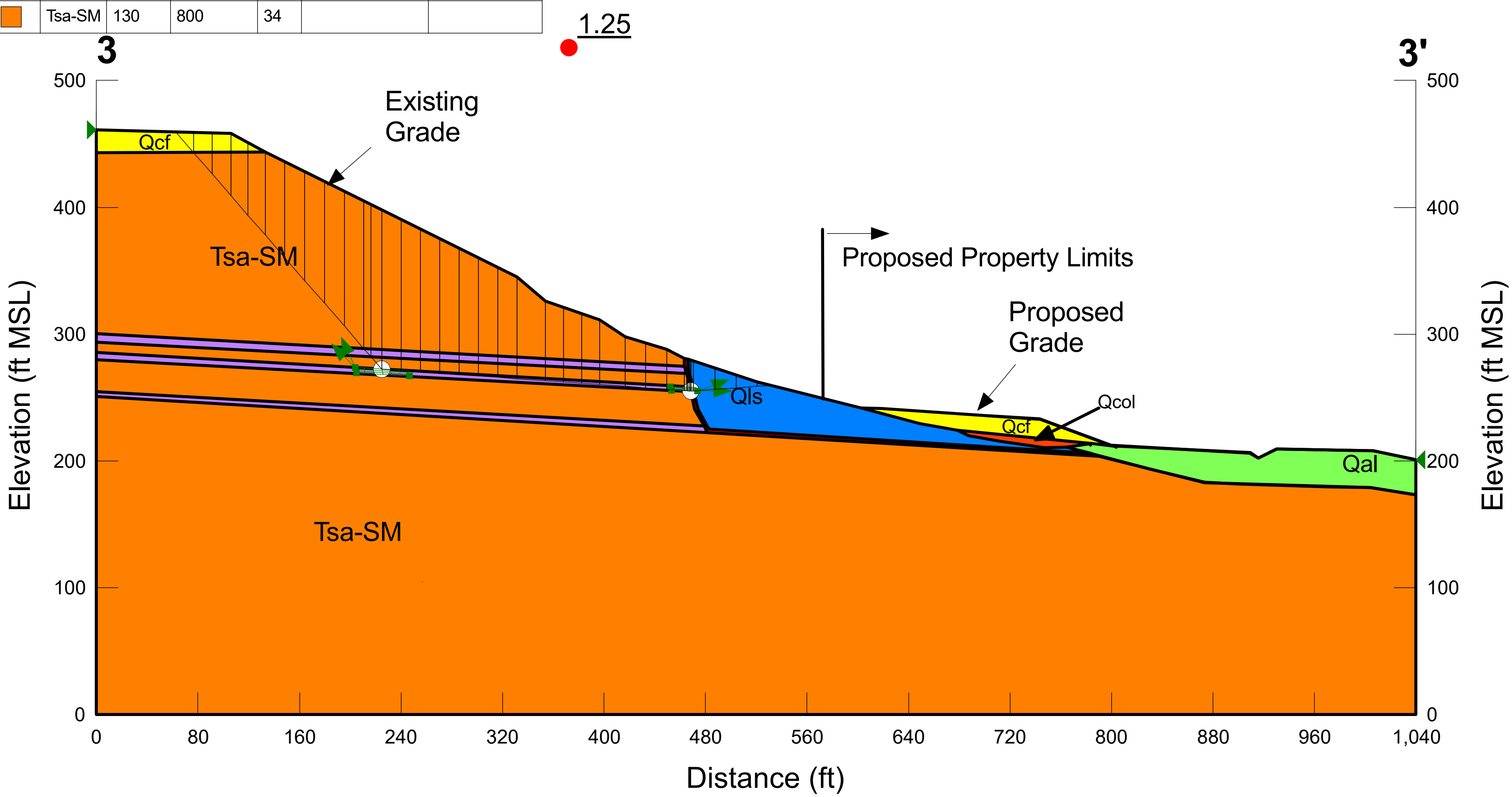

Upper Plane-Cohesive Strength
Cohesive Strength (psf)
X (ft)
800
700
600
500
400
300
200
100
0
50
100
150
200
250
300
350
400
450
500

Proposed Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: Case 3_3-3'-Mid Plane.gsz

Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Qal	130	150	26		
	Qcf	130	300	28		
	Qcol	125	150	26		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Tsa-ML	130	200	28	Phi-14 °	Cohesion-50 (psf)
	Tsa-SM	130	800	34		



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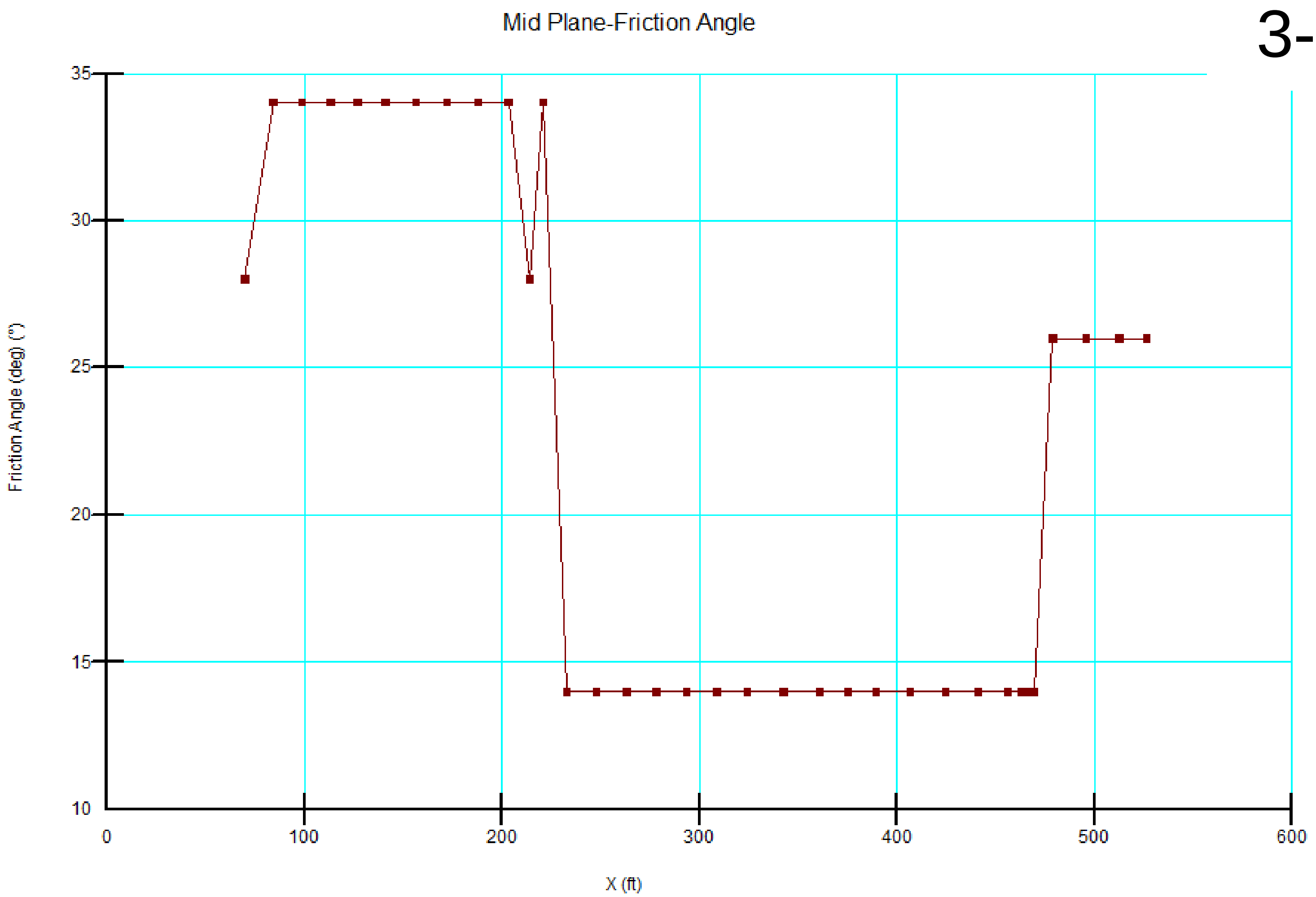
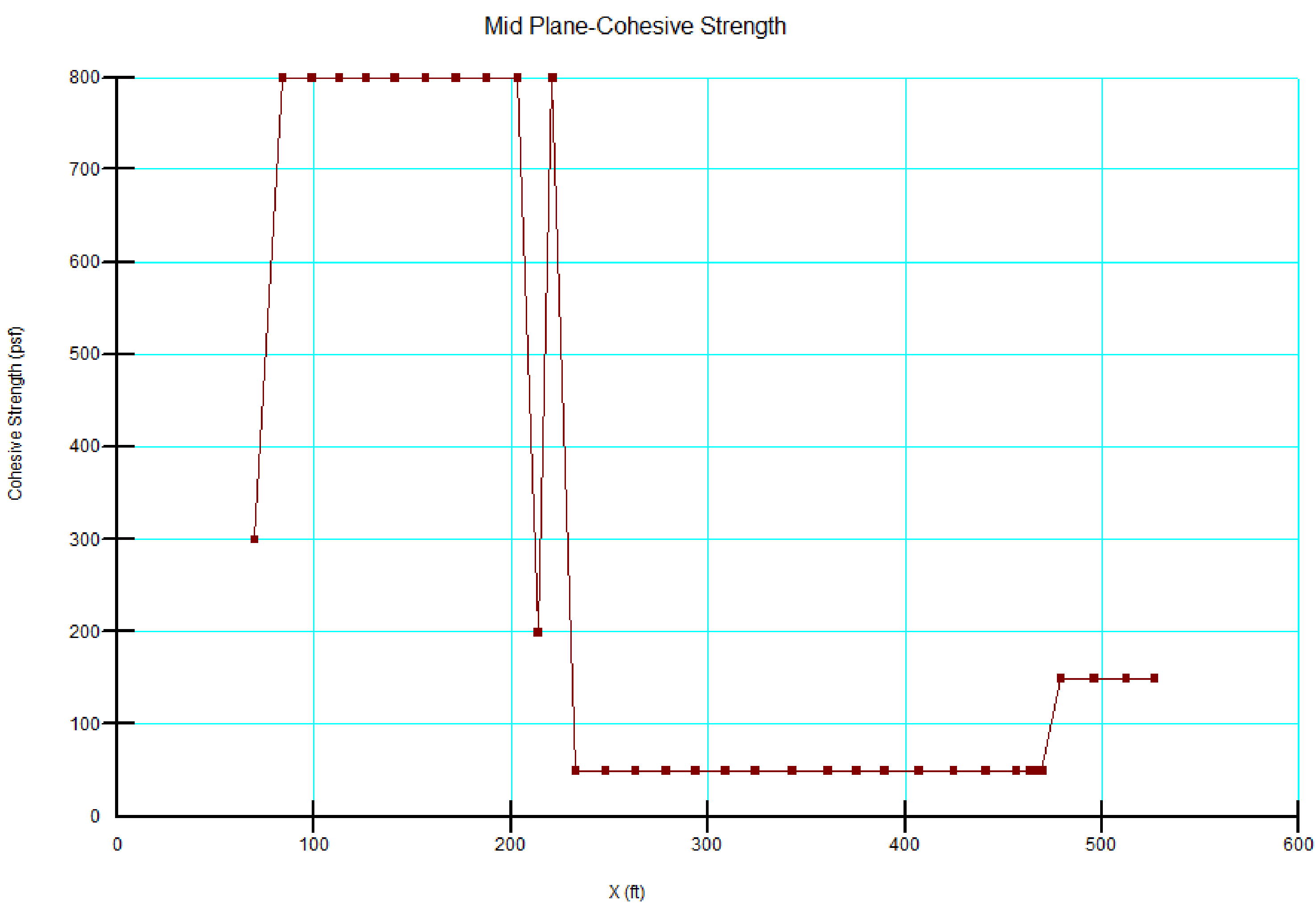
3-3'



Mid Plane-Friction Angle
Friction Angle (deg) (°)
X (ft)
35
30
25
20
15
10
0
100
200
300
400
500
600



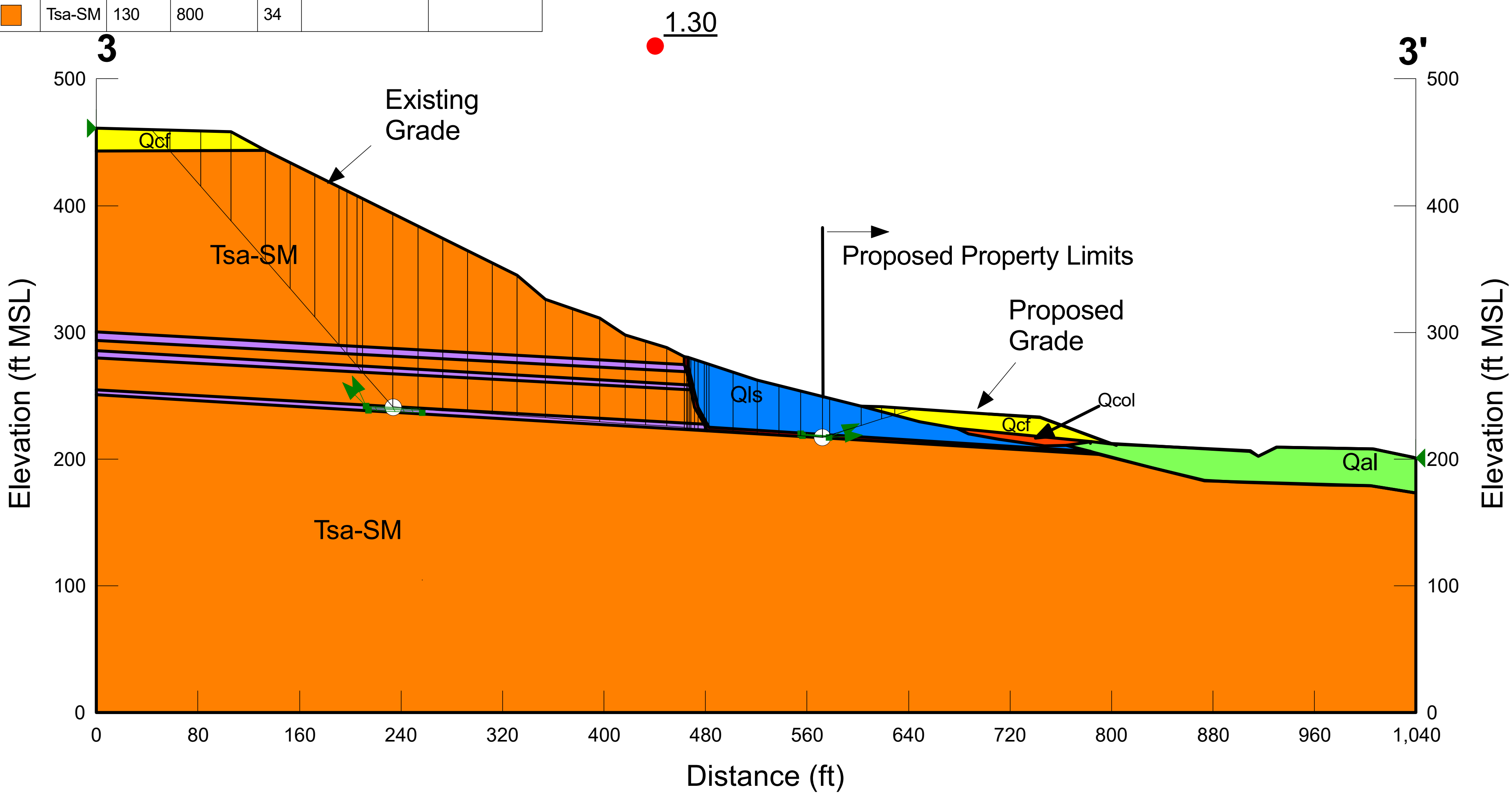
Mid Plane-Cohesive Strength
Cohesive Strength (psf)
X (ft)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600

Proposed Grade
Static Condition

Olive Street
Project No. G3035-52-01
Name: Case 4_3-3'-Slide Plane.gsz

Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-Anisotropic Strength Fn.	C-Anisotropic Strength Fn.
	Qal	130	150	26		
	Qcf	130	300	28		
	Qcol	125	150	26		
	Qls	130	150	26		
	Qlsp	130	50	14		
	Tsa-ML	130	200	28	Phi-14 °	Cohesion-50 (psf)
	Tsa-SM	130	800	34		



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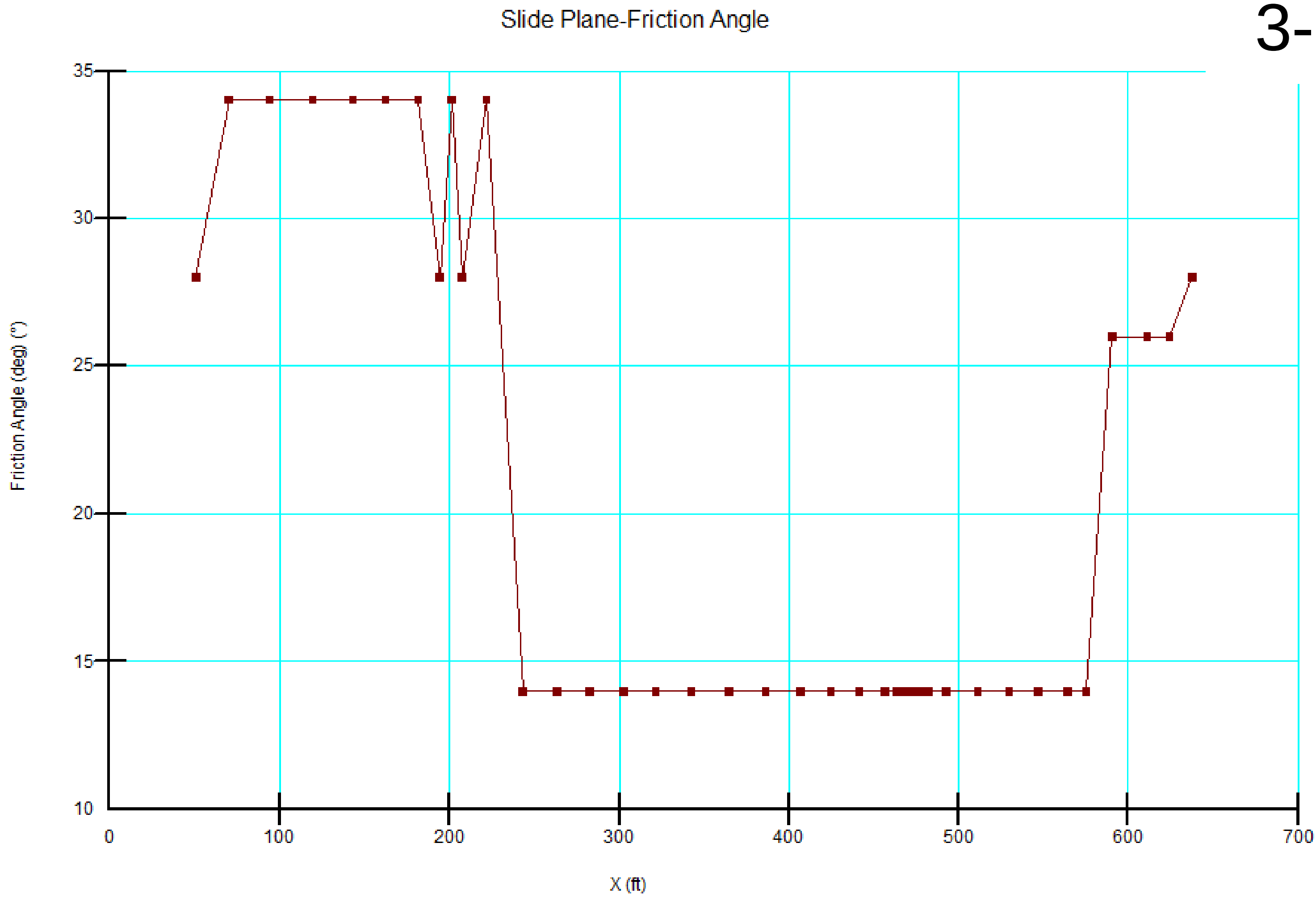
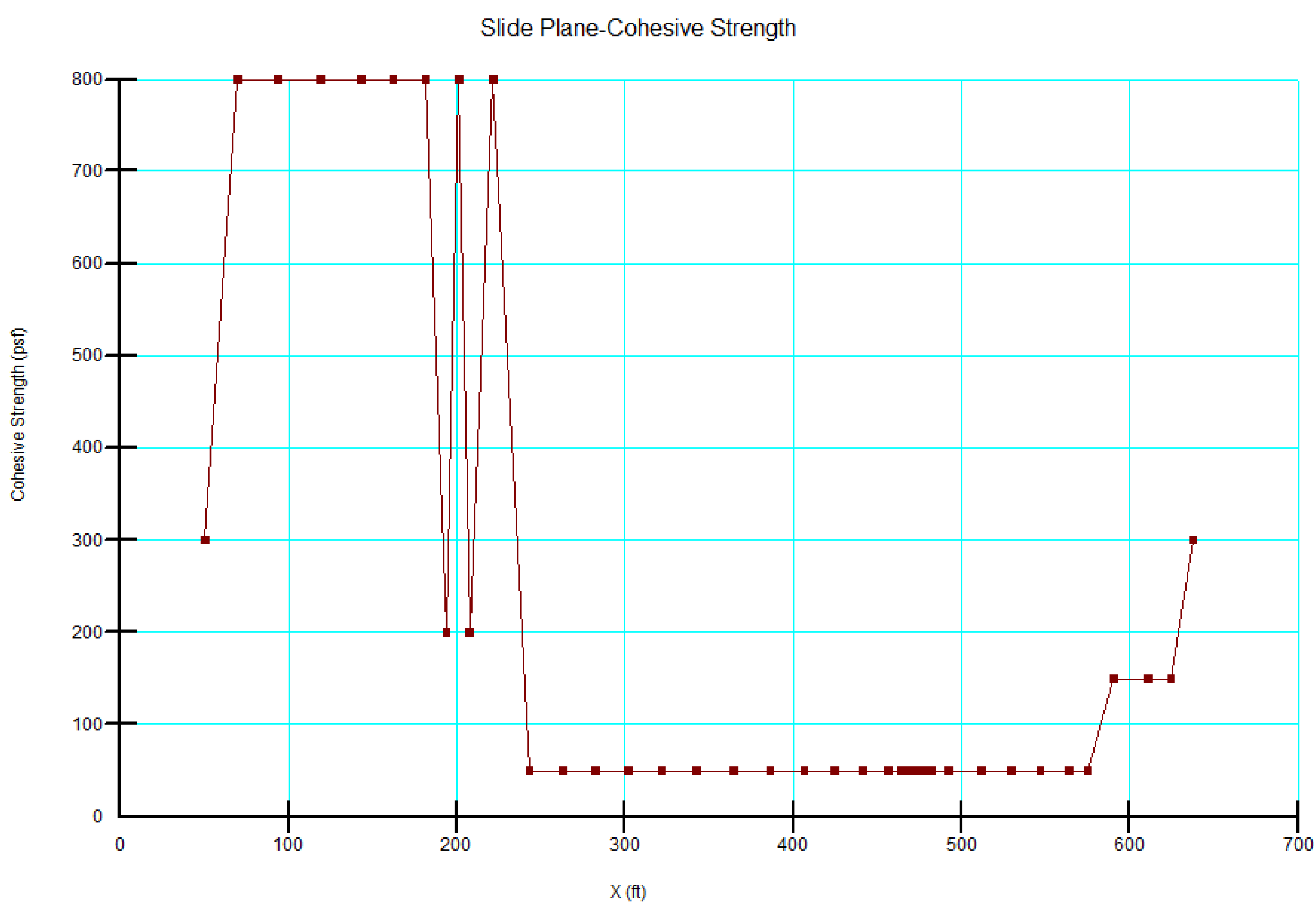
3-3'



Slide Plane-Friction Angle
Friction Angle (deg) (°)
X (ft)
35
30
25
20
15
10
0
100
200
300
400
500
600
700



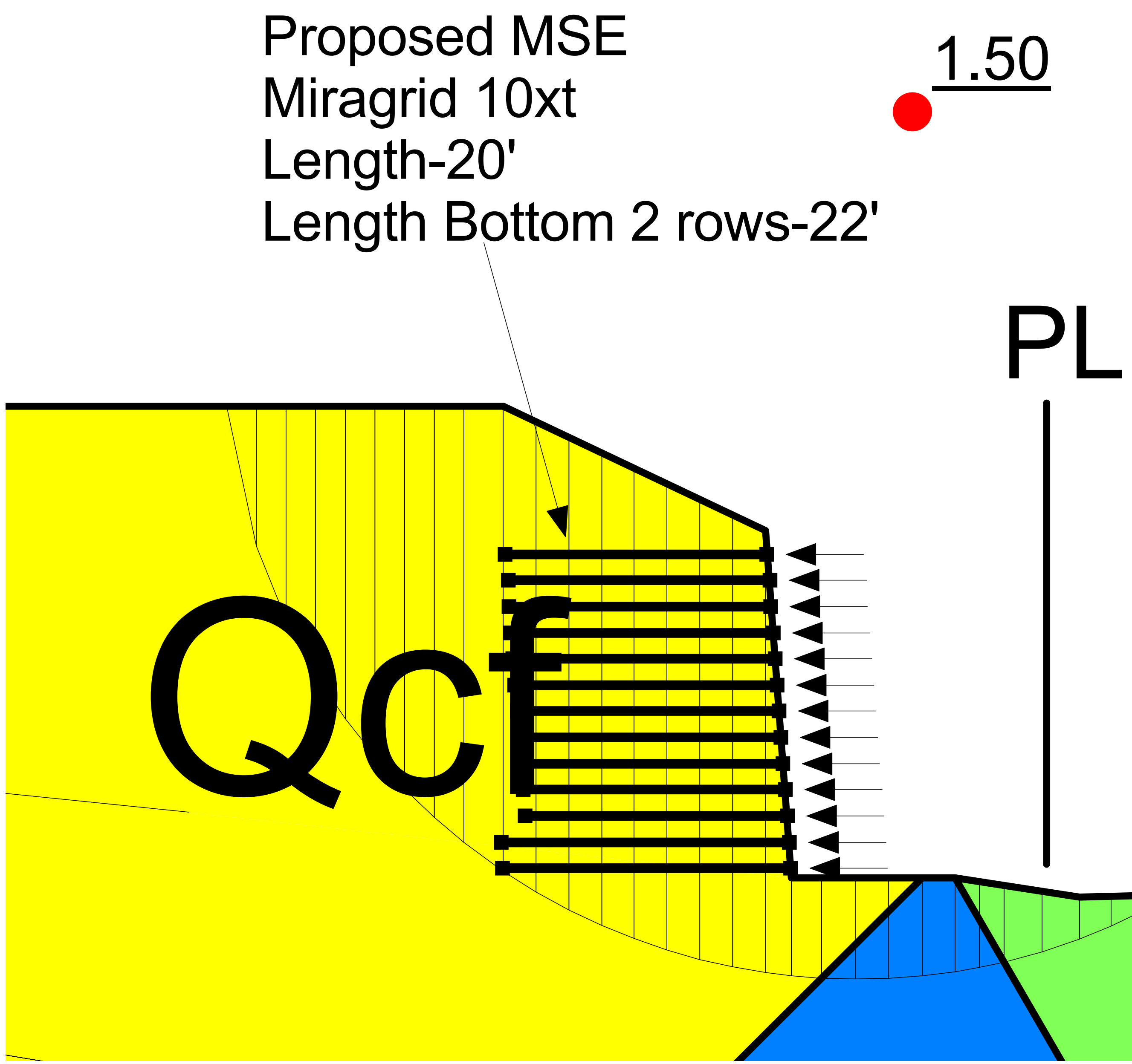
Slide Plane-Cohesive Strength
Cohesive Strength (psf)
X (ft)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700

Olive Street
Project No. G3035-52-01
Name: 2-2'-RW.gsz

Proposed MSE Wall
Static Condition
Cross-section 2-2'
Approx Sta 2+50

Material Properties:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Kgr	130	1,000	51
	Qal	130	150	26
	Qcf	130	300	28
	Qls	130	150	26
	Qlsp	130	50	14
	Qsls	130	150	26
	Qudf	130	300	28
	Tsa-CL-Lower	130	200	28
	Tsa-CL-Upper	130	200	28
	Tsa-ML-Upper	130	200	28
	Tsa-SM	130	800	34



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APPENDIX E

APPENDIX E

RECOMMENDED GRADING SPECIFICATIONS

FOR

OLIVE PARK APARTMENTS
OLIVE DRIVE
OCEANSIDE, CALIFORNIA

PROJECT NO. G3035-52-01

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, and/or adverse weather result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2 **Contractor** shall refer to the Contractor performing the site grading work.

2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than ¾ inch in size.

3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9 and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.

3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition.

4. CLEARING AND PREPARING AREAS TO BE FILLED

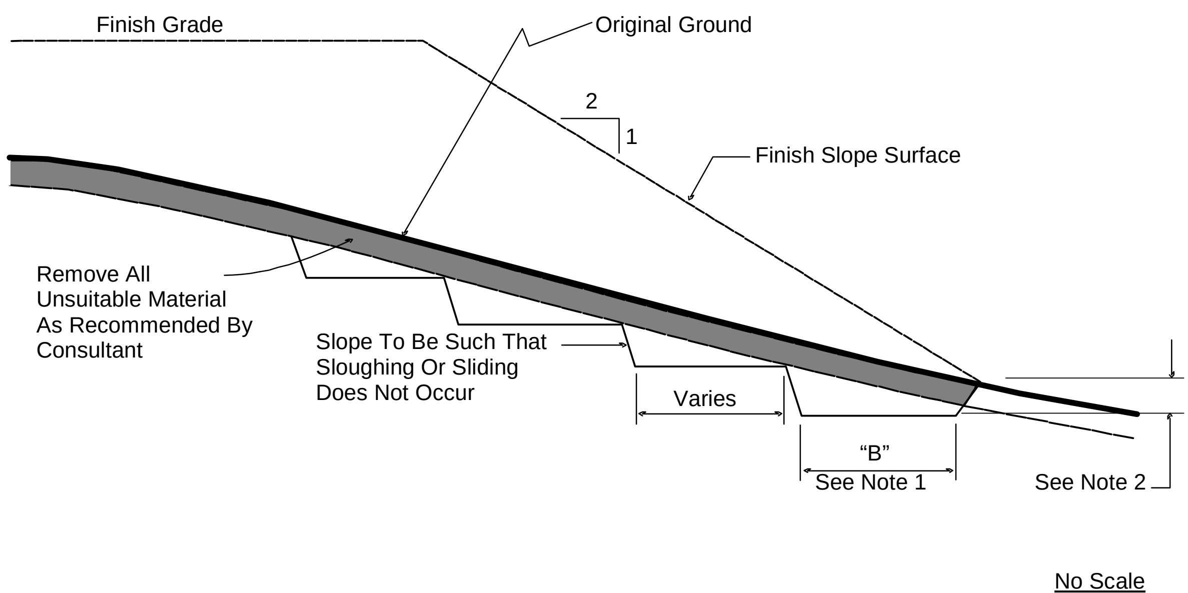
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2 Asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility or in an acceptable area of the project evaluated by Geocon and the property owner. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



DETAIL NOTES: (1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557.

6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:

6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3 Plate bearing tests, in accordance with ASTM D 1196, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of “passes” have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

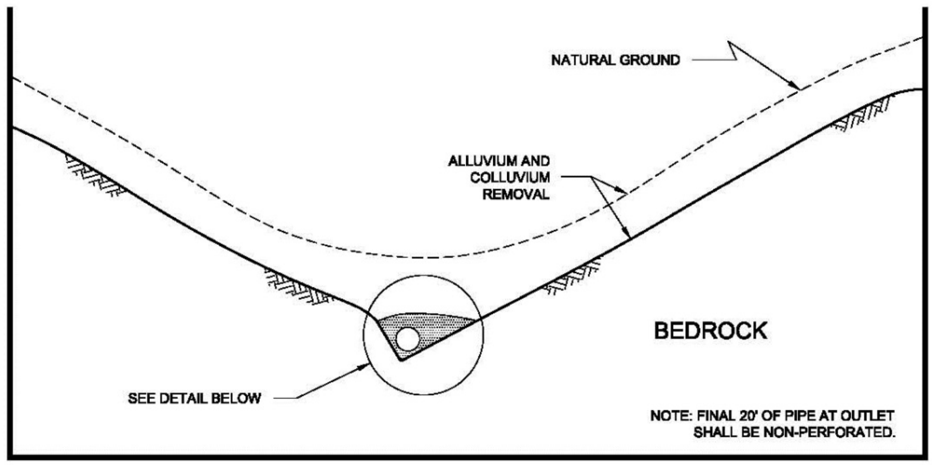
6.3.6 To reduce the potential for “piping” of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

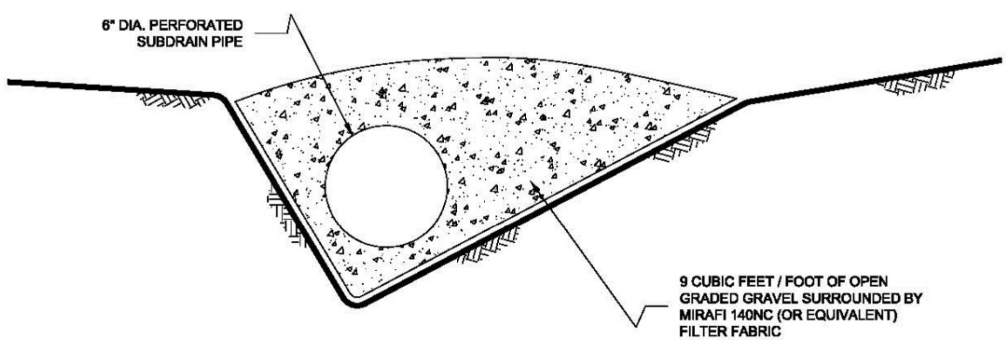
6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

7.1 The geologic units on the site may have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to seepage. The use of canyon subdrains may be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Canyon subdrains with lengths in excess of 500 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Canyon subdrains less than 500 feet in length should use 6-inch-diameter pipes.

TYPICAL CANYON DRAIN DETAIL





NOTES:

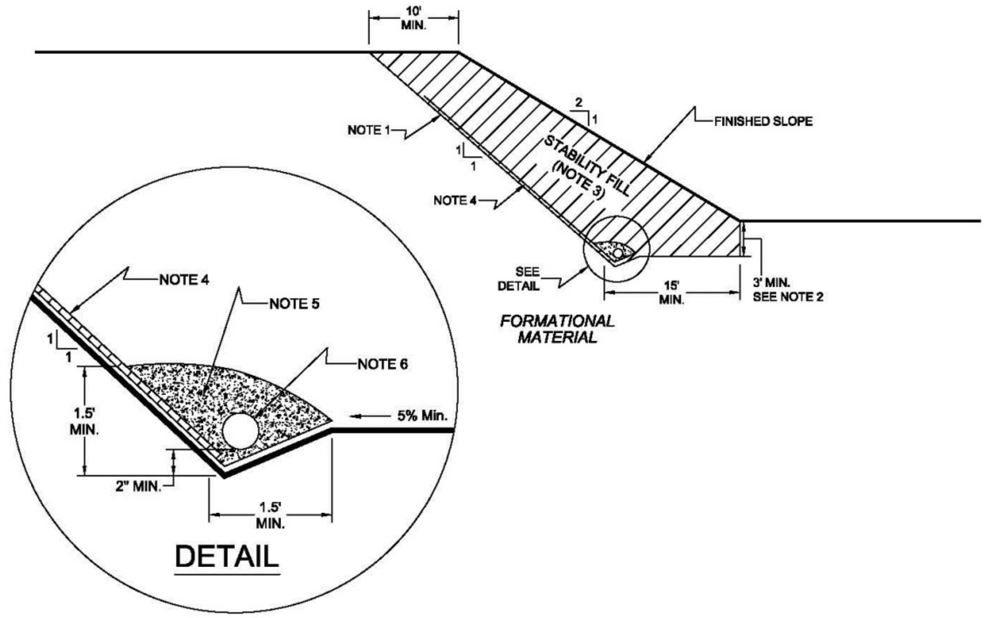
1......8-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

2......6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 500 FEET.

NO SCALE

7.2 Slope drains within stability fill keyways should use 4-inch-diameter (or lager) pipes.

TYPICAL STABILITY FILL DETAIL



NOTES:

1.....EXCAVATE BACKCUT AT 1:1 INCLINATION (UNLESS OTHERWISE NOTED).

2.....BASE OF STABILITY FILL TO BE 3 FEET INTO FORMATIONAL MATERIAL, SLOPING A MINIMUM 5% INTO SLOPE.

3.....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL.

4.....CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN G200N OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE. CLOSER SPACING MAY BE REQUIRED IF SEEPAGE IS ENCOUNTERED.

5.....FILTER MATERIAL TO BE 3/4-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC (MIRAFI 140NC).

6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

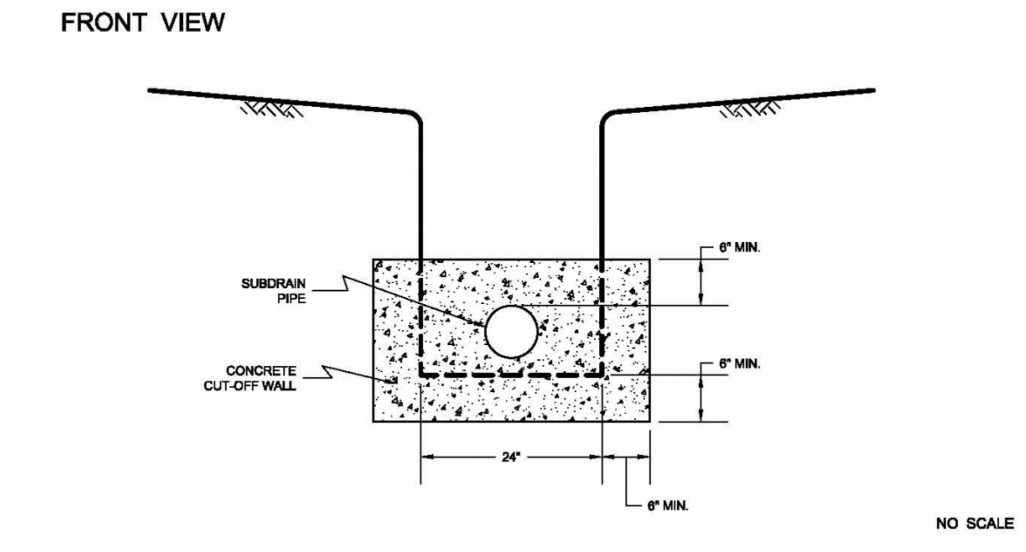
NO SCALE

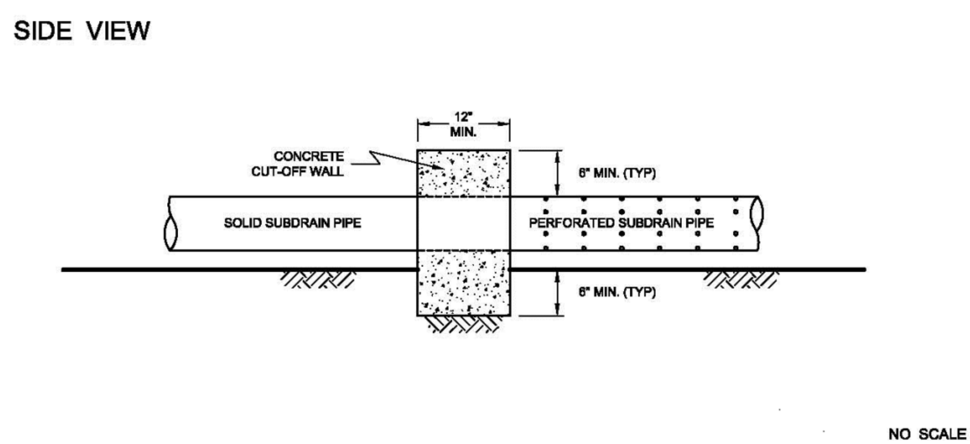
7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing 40-scale grading plans.

7.4 *Rock* fill or *soil-rock* fill areas may require subdrains along their down-slope perimeters to mitigate the potential for buildup of water from construction or landscape irrigation. The subdrains should be at least 6-inch-diameter pipes encapsulated in gravel and filter fabric. *Rock* fill drains should be constructed using the same requirements as canyon subdrains.

7.5 Prior to outletting, the final 20-foot segment of a subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/ perforated interface, a seepage cutoff wall should be constructed on the downslope side of the pipe.

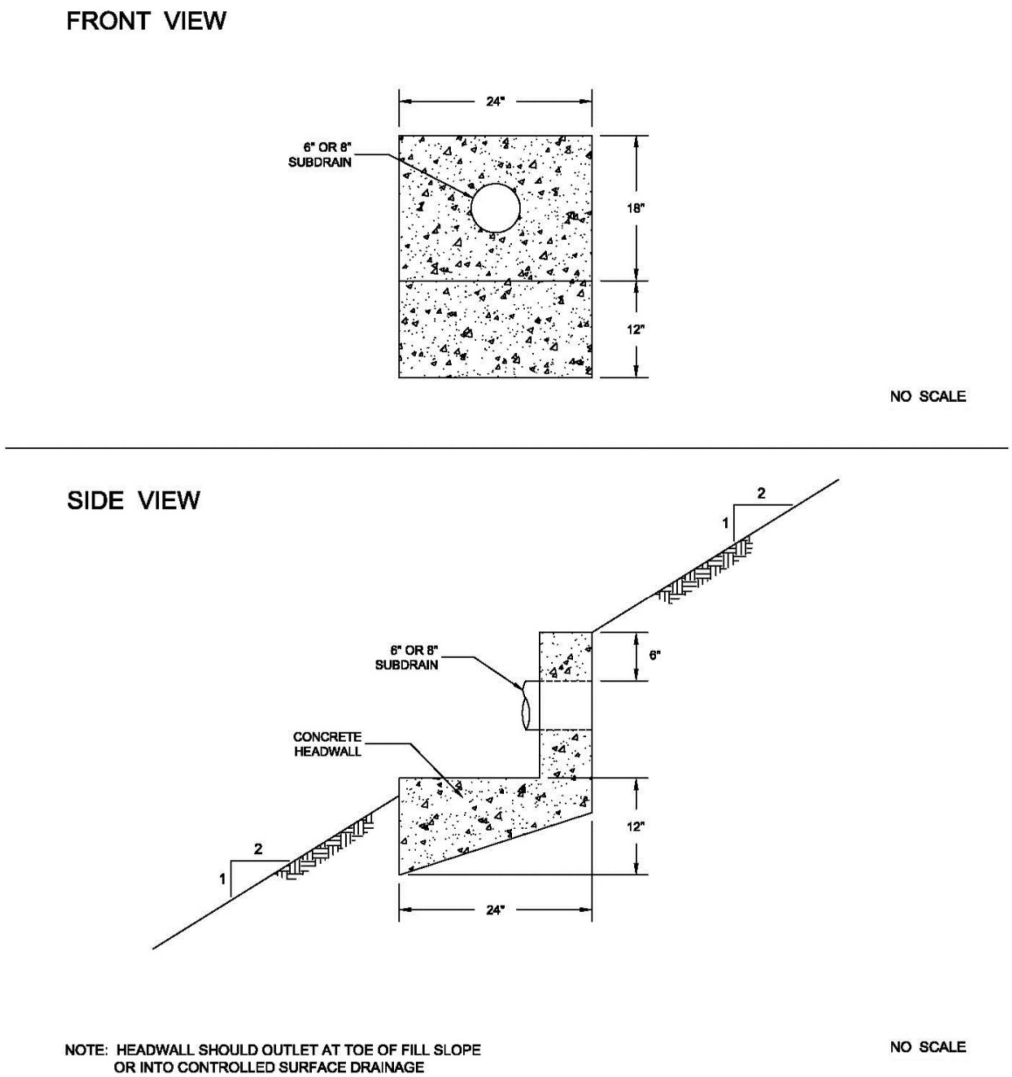
TYPICAL CUT OFF WALL DETAIL





7.6 Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure.

TYPICAL HEADWALL DETAIL



7.7 The final grading plans should show the location of the proposed subdrains. After completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an "as-built" map showing the drain locations. The final outlet and connection locations should be determined during grading operations. Subdrains that will be extended on adjacent projects after grading can be placed on formational material and a vertical riser should be placed at the end of the subdrain. The grading contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The contractor is responsible for the performance of the drains.

8. OBSERVATION AND TESTING

8.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

8.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

8.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

8.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

8.5 We should observe the placement of subdrains, to check that the drainage devices have been placed and constructed in substantial conformance with project specifications.

8.6 Testing procedures shall conform to the following Standards as appropriate:

8.6.1 Soil and Soil-Rock Fills:

8.6.1.1 Field Density Test, ASTM D 1556, *Density of Soil In-Place By the Sand-Cone Method.*

8.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).*

8.6.1.3 Laboratory Compaction Test, ASTM D 1557, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop*.

8.6.1.4. Expansion Index Test, ASTM D 4829, *Expansion Index Test*.

9. PROTECTION OF WORK

9.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

9.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

10. CERTIFICATIONS AND FINAL REPORTS

10.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

10.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

LIST OF REFERENCES

1. *2022 California Building Code, California Code of Regulations, Title 24, Part 2, based on the 2018 International Building Code*, prepared by California Building Standards Commission, dated July 2022.

2. *ACI 302.2R-06, Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials*, prepared by the American Concrete Institute, dated August 2006.

3. *ACI 318-19, Commentary on Building Code Requirements for Structural Concrete,* prepared by the American Concrete Institute, dated May 2019.

4. *ACI 330-21, Commercial Concrete Parking Lots and Site Paving Design and Construction - Guide,* prepared by the American Concrete Institute, dated 2021.

5. American Society of Civil Engineers (ASCE), *ASCE 7-16, Minimum Design Loads and Associated Criteria for Buildings and Other Structures*, 2017.

6. Bay Area Earthquake Alliance, *How Close To a Fault Do You Live?*: Website, https://bayquakealliance.org/howclose/

7. California Geological Survey (2008), *Special Publication 117A, Guidelines For Evaluating and Mitigating Seismic Hazards in California*, Revised and Re-adopted September 11, 2008.

8. California Geologic Survey (CGS), *EQ Zapp: California Earthquake Hazards Zone Application*, online map that queries California Geological Survey mapped earthquake hazard zones, https://www.conservation.ca.gov/cgs/geohazards/eq-zapp

9. County of San Diego, *San Diego County Multi Jurisdiction Hazard Mitigation Plan, San Diego, California – Final Draft,* dated 2017.

10. *Drained Residual and Fully softened Strengths and Standard Deviation – September 1, 2023, http://tstark.net/geotechnical-software*

11. Geotechnical *Investigation, Oceanside Vista, Oceanside, California,* prepared by Geocon Incorporated, dated October 12, 2005 (Project No. 07227-52-02).

12. Historical Aerial Photos. *http://www.historicaerials.com*

13. Kennedy, M. P., and S. S. Tan, 2007, *Geologic Map of the Oceanside 30'x60' Quadrangle, California*, USGS Regional Map Series Map No. 2, Scale 1:100,000.

14. *Preliminary Geotechnical Evaluation for: Oceanside Vista Residential Development, Oceanside, California,* prepared by GeoTek, Inc., dated March 21, 2007 (Project No. 3129SD3)

15. SEAOC, *OSHPD Seismic Design Maps:* Structural Engineers Association of California website, http://seismicmaps.org/

16. Unpublished reports, aerial photographs, and maps on file with Geocon Incorporated.

17. USGS, *Quaternary Fault and Fold Database of the United States*: U.S. Geological Survey website, https://www.usgs.gov/natural-hazards/earthquake-hazards/faults.

18. USGS, *Uniform Hazard Tool*, U.S. Geological Survey website, https://earthquake.usgs.gov/hazards/interactive/.

STORMWATER MANAGEMENT INVESTIGATION

OLIVE PARK APARTMENTS
OLIVE DRIVE
OCEANSIDE, CALIFORNIA

AUGUST 7, 2024
PROJECT NO. G3035-52-01

PREPARED FOR:

CAPSTONE EQUITIES

GEOCON
INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. G3035-52-01
August 7, 2024

Capstone Equities
5600 W Jefferson Boulevard
Los Angeles, California 90016

Attention: Mr. Brian Mikail

Subject: STORM WATER MANAGEMENT INVESTIGATION
OLIVE PARK APARTMENTS
OLIVE DRIVE
OCEANSIDE, CALIFORNIA

Reference: *Update Geotechnical Report, Olive Park Apartments, Olive Drive, Oceanside, California,* prepared by Geocon Incorporated, dated March 12, 2024 (Project No. G3035-52-01).

Dear Mr. Mikail

In accordance with the request of Mr. Spencer LaShells from Hunsaker & Associates Inc., we herein submit the results of our storm water management investigation for the property located west of Olive Drive in the City of Oceanside, California. We understand the City of Oceanside has requested that the infiltration feasibility be investigated for the site.

SITE AND PROJECT DESCRIPTION

The site is an approximately 43-acre, semi-rectangular-shaped property that is elongated in an east-west direction. The site is south of Oceanside Boulevard and the San Diego Northern Railway (SDNR) line, east of an undeveloped property, and north and west of existing residential subdivisions. Additionally, an eastern access road to the site from College Boulevard will be incorporated into the improvements of the development. The Geologic Map, Figure 1, shows the proposed development. The Existing Site Plans (Proposed Development and Access Road) shows the current site conditions.

Existing Site Plan-Proposed Development

Existing Site Plan-Access Road

Topographically, the site is located on slopes that descend northwest to Loma Alta Creek located along the north margin of the site. The DMA Plan, Figure 2, depicts the topography of the site with ascending natural slopes to the south with a maximum height of approximately 200 feet. The site is steeper on the south and becomes flatter to the north. The gentle-gradient creek has a general west-flowing meandering orientation and has locally incised vertical embankments up to 10 feet high at the stream margins. A fill berm related to railroad improvements has been constructed along the northeast margin of the site. Elevations on site vary from a low of approximately 185 feet above Mean Sea Level (MSL) at Loma Alta Creek in the northwest corner of the site to 460 feet MSL at the top of the southeast slope.

SOIL AND GEOLOGIC CONDITIONS

We encountered five surficial soil unit and two geologic units at the site. The occurrence, distribution, and description of each unit encountered is shown on the Geologic Map, Figure 1, and on the boring and trench logs in Appendix A on the referenced report. The surficial soil and geologic units are described herein in order of increasing age. The surficial soils and geologic units are described herein in order of increasing age.

Undocumented Fill (Qudf)

Undocumented fill underlies the northern and western portions of the site. The northern fill areas are associated with a berm that was apparently graded to control water flow in Loma Alta Creek and support the existing rail line. The western undocumented fill area is associated with waterline backfill that traverses the site in a north-south direction. The fill material generally consists of soft, fine to medium, sandy clay with silt and has an estimated maximum thickness of 10 feet. The fill is not considered suitable for support of site development in its present condition and will require remedial grading.

Previously Placed Fill (Qpf)

Previously placed fill is present on the south and northeast portions of the property. The southern fill underlies residential building pads that bound the southern margin of the property along Wooster Drive. The southern fill likely consists of loose, silty, fine- to medium-grained sand, and is estimated to have a maximum thickness of about 25 feet at the top of slope. Improvements are not planned in the vicinity of the southern fill areas. Previously placed fill also underlies the residential development along Olive Drive adjacent to the northeastern corner of the site (as observed in Trench T-14 in the referenced report). The fill consists of loose, moist, clayey sand and is underlain by relatively thick topsoil.

Topsoil (Unmapped)

Topsoil typically blankets the site and consists of brown, sandy clay to sandy silt. Topsoil is generally on the order of 1 to 4 feet thick, but localized areas with greater thicknesses may exist. Due to its relatively thin thickness, topsoil is not shown on the Geologic Map, Figure 1.

Alluvium (Qal)

Alluvium exists on the northern portion of the site in the Loma Alta Creek drainage. The alluvial soil consists of soft, sandy to silty clay and loose silty to clayey sand. The alluvium is locally underlain by and interfingered with landslide deposits. We encountered alluvial materials up to approximately 15½ feet deep and likely extend deeper toward the north. A shallow groundwater table is likely to exist approximately 3 to 5 feet below existing grade in the area of the streambed at the northern portion of the site. The alluvium is compressible, possesses a “very low” to “high” expansion potential (expansion index of 130 or less), possibly subject to liquefaction, and may have low to high permeability. We expect some alluvium will remain in place on the western portion of the property due to grading limitations.

Landslide Deposits (Qls and Qsls)

We encountered and observed landslide deposits in many of the exploratory borings and trenches performed during this study and are mapped underlying the majority of the central and eastern portions of the site, including the areas of proposed development. The deepest landslide debris encountered is about 56 feet thick in Boring B-5. Borings B-6 and B-8 (in the refenced report and west of the proposed development) were unable to penetrate the full extent of landslide debris to a depth of up to 54 feet; therefore, the landslide debris is likely thicker than 56 feet in some areas. The landslide debris is up to approximately 40 feet thick in the vicinity of the proposed development.

Our exploratory borings and field observations suggest portions of the property are underlain by a series of landslides which have occurred within the Santiago Formation. Debris within the larger landslides consists of highly disturbed to relatively intact blocks of sandstone, siltstone, and claystone. Bedding orientations display evidence of displacement and rotation. Portions of the older landslide debris contained secondary mineralization and fracture infilling suggesting that these deposits have been partially “healed.” The slip surfaces were typically located within claystone beds generally parallel to the direction of regional dip. The mechanism for the large-scale landsliding was likely deep-seated block failure along weakened planes within the claystone beds.

The debris composing the smaller, more recent landslides generally consist of loose, moist, olive gray to grayish brown, silty and clayey sands, sandy and clayey silts, and silty to sandy clays. Recent landslide debris typically contains highly disturbed and jumbled bedding, numerous fractures, roots, and sheared and remolded clays.

Landslide deposits are typically unstable within cut slopes and may be susceptible to significant settlement. Therefore, the highly compressible portions of the landslide debris within the proposed development areas should be removed and recompacted during the remedial grading of the site. In general, landslide debris is suitable for reuse as compacted fill provided potentially expansive clay is properly mixed with sandy material where located within about 5 feet of proposed grade.

We observed an isolated area of surficial landslide debris (Qsls) within the previously placed fill areas in the southern portion of the site. The near-surface portions (within 6 feet of the slope face) of the fill slope at the southeast corner of the site have locally failed. Adjacent homeowners have “end dumped” vegetation and other debris over the top of the slope. These deposits are likely the cause of failure of uncompacted “end dump” fill and not indicative of the near-surface soil conditions present along the steep slope portions of the site. We did not perform exploratory borings and trenches in the steep slope portions of the proposed open space areas to the south of the proposed development due to access limitations created by the presence of sensitive habitat.

Santiago Formation (Tsa)

We encountered the middle Eocene-age Santiago Formation underlying surficial soil in the majority of the exploratory excavations performed at the site. The Santiago Formation underlies the majority of the steep slope areas located to the south of the proposed development. The Santiago Formation is generally composed of light colored, massive to poorly bedded, fine- to medium-grained sandstone interbedded with weak siltstone and claystone layers. Claystone beds within the Santiago Formation contain bedding plane shears and internal shearing, some of which displayed out-of-slope bedding orientations. Bedding plane shears can be a contributing factor to slope instability. Cut slopes exposing out-of-slope bedding plane shears will require slope stabilization measures.

The Santiago Formation is considered suitable for foundation and/or fill support. However, the claystone and siltstone units may be susceptible to landsliding and slope instability. Additionally, some sandstone units of the Santiago Formation are poorly cemented and susceptible to erosion. Materials generated from excavations within the silty and sandy portions of the Santiago Formation are suitable for reuse as compacted fill. Claystone that is potentially expansive should be mixed with sandy material, as discussed herein.

Granitic Rock (Kgr)

Cretaceous-age granitic rock is mapped in the general vicinity of the site by Tan and Kennedy (1996) as the Green Valley Tonalite. We encountered granitic rock in Boring B-1 and in Trenches T-6, T-7, and T-11 through T-13 (in the referenced report). The granitic rock consists of yellowish brown to gray, moderately weak to moderately strong, highly to moderately weathered, and displayed a fine-to coarse-grained crystalline texture. Granitic rock is considered suitable for the support of structures and/or compacted fill.

STORM WATER MANAGEMENT INVESTIGATION

We understand storm water management devices will be used in accordance with the *2022 City of Oceanside BMP Design Manual*. If not properly constructed, there is a potential for distress to improvements and properties located hydrologically down gradient or adjacent to these devices. Factors such as the amount of water to be detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeological study at the site. If infiltration of storm water runoff occurs, downstream properties may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other undesirable impacts as a result of water infiltration.

Hydrologic Soil Group

The United States Department of Agriculture (USDA), Natural Resources Conservation Services, possesses general information regarding the existing soil conditions for areas within the United States. The USDA website also provides the Hydrologic Soil Group. The following table presents the descriptions of the hydrologic soil groups. If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. In addition, the USDA website also provides an estimated saturated hydraulic conductivity for the existing soil.

HYDROLOGIC SOIL GROUP DEFINITIONS

Soil Group	Soil Group Definition
A	Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
B	Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
C	Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
D	Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

The property is underlain by man-made previously placed fill and cemented stadium conglomerate and should be classified as Soil Group D. The following table presents the information from the USDA website for the subject property. The Hydrologic Soil Group Map presents output from the USDA website showing the limits of the soil units.

USDA WEB SOIL SURVEY – HYDROLOGIC SOIL GROUP*

Map Unit Name	Map Unit Symbol	Approximate Percentage of Property	Hydrologic Soil Group	k_{SAT} of Most Limiting Layer (Inches/ Hour)
Corralitos loamy sand, 0 to 5 percent slopes	CsB	10	A	5.95-19.98
Diablo clay, 15 to 30 percent slopes, eroded, warm MAAT	DaE2	2	C	0.06-0.20
Diablo clay, 30 to 50 percent slopes, warm MAAT, MLRA 20	DaF	4	C	0.06-0.20
Gaviota fine sandy loam, 30 to 50 percent slopes	GaF	27	D	1.98-5.95
Las Flores loamy fine sand, 9 to 15 percent slopes, eroded	LeD2	36	D	0.00-0.06
Salinas clay loam, 0 to 2 percent slopes, warm MAAT, MLRA 19	SbA	21	C	0.00-0.14

*The areas of the property that possess fill materials should be considered to possess a Hydrologic Soil Group D.

Hydrologic Soil Group Map – Proposed Development

Hydrologic Soil Group Map – Access Road

In Situ Testing

The majority of the proposed development is underlain by landslide debris and landslide prone formational material. Additionally, groundwater within the alluvium is within 10 feet from existing grade and the proposed development will consist of fills greater than 5 feet across the entire site once the landslide debris is removed. Based on historic aerials, the access road appears to have been graded with fill and is adjacent to a slope down to the existing train tracks. Therefore, we did not perform infiltration tests within the granitic rock or Santiago Formation due to the proximity to groundwater, proposed fill depths, proximity to slopes, and geologic hazards that exist on site. Infiltration would be considered infeasible due to the presence of landslide debris across the site. If infiltration of storm water runoff occurs, downstream properties may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other undesirable impacts because of water infiltration.

GEOTECHNICAL CONSIDERATIONS

Groundwater Elevations

We encountered groundwater during the previous field investigation in several of our borings at depths ranging from 9 to 45 feet below existing grade (elevation 183 to 199 feet MSL). Therefore, infiltration in these areas are considered infeasible.

Soil or Groundwater Contamination

We are unaware of contaminated soil or groundwater contamination on the property. Therefore, infiltration associated with this risk would be considered feasible.

Expansive Soils

Based on previous laboratory testing, the soil encountered in the field investigation is “non-expansive” (expansion index [EI] of 20 or less) and “expansive” (EI greater than 20) as defined by 2022 California Building Code (CBC) Section 1803.5.3. We expect most of the soil on site will have a “very low” to “medium” expansion potential (expansion index of 90 or less). Infiltration would be feasible when considering the expansion potential of the soil on the property.

Formational Soil Properties

The on-site landslides have occurred within the weak claystone and/or siltstone beds of the Santiago Formation. The lower portions of the landslide debris in the western portion of the site were observed to be saturated and prone to significant caving and seepage. Therefore, due to slope instability and weak claystone/siltstone beds in the Santiago Formation infiltration should be considered infeasible on site.

New or Existing Utilities

Utilities are present within the existing roadways to the east on Olive Drive. Full or partial infiltration should not be allowed in the areas of the utilities to help prevent potential damage/distress to improvements. Mitigation measures to prevent water from infiltrating the utilities consist of setbacks, installing cutoff walls around the utilities and installing subdrains and/or installing liners.

Existing and Planned Structures

Existing railroad tracks and residential structures exist to the north and west of the site, respectively. Water should not be allowed to infiltrate in areas where it could affect the existing and neighboring properties and existing and adjacent structures, improvements, and roadways. Mitigation for existing structures consists of not allowing water infiltration within a 1:1 plane from existing foundations and extending the infiltration areas at least 10 feet from the existing foundations and into formational materials.

CONCLUSIONS AND RECOMMENDATIONS

Storm Water Evaluation Narrative

As discussed herein, the property consisted of mostly landslide debris, fill materials, and Santiago Formation with slide prone weak claystone/siltstone beds. Additionally, we encountered groundwater in the alluvium materials within 10 feet from existing grade. In order to develop the site, the landslide materials will be removed and replaced with properly compacted fill. This would result in most of the site being underlain by fills greater than 5 feet subsequent to grading and site development. In our experience, fill does not possess infiltration rates appropriate with infiltration. Therefore, the areas where infiltration could potentially be feasible are limited based on existing structures, groundwater, fill greater than 5 feet, and slide prone formational materials. The potential for additional landsliding would increase if infiltration were allowed in the existing landslide debris or formational materials.

Storm Water Evaluation Conclusion

Based on the geologic conditions exhibited in the Santiago Formation, shallow groundwater, areas of the site underlain by landslide debris, proposed fills greater than 5 feet, and existing structures we opine full and partial infiltration on the property is considered infeasible and the property possesses a "No Infiltration" condition.

Storm Water Management Devices

Liners and subdrains should be incorporated into the design and construction of the planned storm water devices. The liners should be impermeable (e.g. High-density polyethylene, HDPE, with a thickness of about 30 mil or equivalent Polyvinyl Chloride, PVC) to prevent water migration. The subdrains should be perforated within the liner area, installed at the base and above the liner, be at least 3 inches in diameter and consist of Schedule 40 PVC pipe. The subdrains outside of the liner should consist of solid pipe. The penetration of the liners at the subdrains should be properly waterproofed. The subdrains should be connected to a proper outlet. The devices should also be installed in accordance with the manufacturer's recommendations.

Storm Water Standard Worksheets

We evaluated the proposed project with respect to the infiltration restrictions contained in Table D.1-1 in Appendix D of the City of Oceanside BMP Design Manual (see following table).

CONSIDERATIONS FOR GEOTECHNICAL ANALYSIS OF INFILTRATION RESTRICTIONS

Restriction Element		Is Element Applicable? (Yes/No)
Mandatory Considerations	BMP is within 100' of Contaminated Soils	No
	BMP is within 100' of Industrial Activities Lacking Source Control	No
	BMP is within 100' of Well/Groundwater Basin	No
	BMP is within 50' of Septic Tanks/Leach Fields	No
	BMP is within 10' of Structures/Tanks/Walls	No
	BMP is within 10' of Sewer Utilities	No
	BMP is within 10' of Groundwater Table	No
	BMP is within Hydric Soils	No
	BMP is within Highly Liquefiable Soils and has Connectivity to Structures	No
	BMP is within 1.5 Times the Height of Adjacent Steep Slopes (≥25%)	No
	City Staff has Assigned "Restricted" Infiltration Category	No

<table>
<tr><th colspan="2">Restriction Element</th><th>Is Element Applicable? (Yes/No)</th></tr>
<tr><td rowspan="6">Optional Considerations</td><td>BMP is within Predominantly Type D Soil</td><td>Yes</td></tr>
<tr><td>BMP is within 10’ of Property Line</td><td>No</td></tr>
<tr><td>BMP is within Fill Depths of ≥5’ (Existing or Proposed)</td><td>Yes</td></tr>
<tr><td>BMP is within 10’ of Underground Utilities</td><td>No</td></tr>
<tr><td>BMP is within 250’ of Ephemeral Stream</td><td>No</td></tr>
<tr><td>Other (Provide detailed geotechnical support) – Landslide debris and slide prone formational materials (See discussion herein)</td><td>Yes</td></tr>
<tr><td rowspan="2">Result</td><td>Based on examination of the best available information, I have <u>not identified any restrictions</u> above.</td><td></td></tr>
<tr><td>Based on examination of the best available information, I have <u>identified one or more restrictions</u> above.</td><td>X Restricted</td></tr>
</table>

The BMP manual also has a worksheet (Table D.2-4 of Appendix D) that helps the project civil engineer estimate the factor of safety based on several factors. The following table describes the suitability assessment input parameters related to the geotechnical engineering aspects for the factor of safety determination.

GUIDANCE FOR DETERMINING INDIVIDUAL FACTOR VALUES – PART A

Consideration	High Concern – 3 Points	Medium Concern – 2 Points	Low Concern – 1 Point
Infiltration Test Method	Any	At least 2 tests of any kind within 50’ of BMP	At least 4 tests within BMP footprint, OR Large/Small Scale Pilot Infiltration Testing over at least 5% of BMP footprint.
Soil Texture Class	Unknown, Silty, or Clayey	Loamy	Granular/Slightly Loamy
Site Variability	Unknown or High	Moderately Homogenous	Significantly Homogenous
Depth to Groundwater/ Obstruction	<5’ below BMP	5-15’ below BMP	>15’ below BMP

The following table presents the estimated safety factor values for the evaluation of the factor of safety. This table only presents the suitability assessment safety factor (Part A) of the worksheet. The project civil engineer should evaluate the safety factor for design (Part B) and use the combined safety factor for the design infiltration rate.

DETERMINATION OF SAFETY FACTOR

Consideration		Assigned Weight (w)	Factor Value (v)	Product (p = w x v)
Suitability Assessment (A)	Infiltration Testing Method	0.25	3	0.75
	Soil Texture Class	0.25	2	0.50
	Site Variability	0.25	3	0.75
	Depth to Groundwater/Obstruction	0.25	2	0.50
	Suitability Assessment Safety Factor, $S_A = \sum p$			2.5
Design (B)	Pretreatment	*	Refer to Table D.2-4	*
	Resiliency	*		*
	Compaction	*		*
	Design Safety Factor, $S_B = \sum p$			*
Safety Factor, $S = S_A \times S_B$ (Must be always greater than or equal to 2)				*

*The civil engineer should evaluate the “Design (B)” factors and the Safety Factor, S.

We also included herein the original I-8 Form from previous submittals for consistency with the current submittal process. The DMA Plan, Figure 2, shows the setback areas as discussed herein. We opine infiltration is not feasible for this property.

If you have any questions regarding this correspondence, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Nikolas Garcia, EIT
Senior Staff Engineer

Shawn Foy Weedon, GE 2714
Vice President/Senior Engineer

NG:SFW:arm

(e-mail) Addressee

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.		X
Provide basis: The majority of the proposed development is underlain by landslide debris and landslide prone formational material. Additionally, groundwater within the alluvium is within 10 feet from existing grade and the proposed development will consist of fills greater than 5 feet across the entire site once the landslide debris is removed. Therefore, we did not perform infiltration tests within the granitic rock or Santiago Formation due to the proximity to groundwater, proposed fill depths, and geologic hazards that exist on site and Infiltration would be considered infeasible across the site. 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		X
Provide basis: The majority of the proposed development is underlain by landslide debris and landslide prone formational material. Additionally, groundwater within the alluvium is within 10 feet from existing grade and the proposed development will consist of fills greater than 5 feet across the entire site once the landslide debris is removed. Therefore, infiltration should be considered infeasible due to the risk of slope stability, fill thickness and groundwater mounding. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Worksheet C.4-1 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		X
Provide basis: We encountered groundwater within the alluvium materials within 10 feet from existing grade. Therefore, infiltration should not be allowed in these areas. 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	X	
Provide basis: Geocon Incorporated does not expect infiltration will cause water balance issues such as seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters. 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		No Full 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 the City to substantiate findings.

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.		X

Provide basis:

The majority of the proposed development is underlain by landslide debris and landslide prone formational material. Additionally, groundwater within the alluvium is within 10 feet from existing grade and the proposed development will consist of fills greater than 5 feet across the entire site once the landslide debris is removed. Therefore, we did not perform infiltration tests within the granitic rock or Santiago Formation due to the proximity to groundwater, proposed fill depths, and geologic hazards that exist on site and Infiltration would be considered infeasible across the site.

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.

Criteria	Screening Question	Yes	No
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		X

Provide basis:

The majority of the proposed development is underlain by landslide debris and landslide prone formational material. Additionally, groundwater within the alluvium is within 10 feet from existing grade and the proposed development will consist of fills greater than 5 feet across the entire site once the landslide debris is removed. Therefore, we did not perform infiltration tests within the granitic rock or Santiago Formation due to the proximity to groundwater, proposed fill depths, and geologic hazards that exist on site and Infiltration would be considered infeasible across the site.

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.

<table>
<tr><th colspan="4">Worksheet C.4-1 Page 4 of 4</th></tr>
<tr><th>Criteria</th><th>Screening Question</th><th>Yes</th><th>No</th></tr>
<tr><td>7</td><td>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</td><td></td><td>X</td></tr>
<tr><td colspan="4">Provide basis:

We encountered groundwater within the alluvium materials within 10 feet from existing grade. Therefore, infiltration should not be allowed in these areas.

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.</td></tr>
<tr><td>8</td><td>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.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis:

Geocon Incorporated does not provide a study regarding water rights. However, these rights are not typical in the San Diego County area.

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.</td></tr>
<tr><td>Part 2 Result*</td><td colspan="2">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.</td><td>No Infiltration</td></tr>
</table>

*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 the City to substantiate findings.

B-1	
@5'	S:N59W/14NE
@13'	C:N38W/8SW
@22'	B:N16E/5SE

B-2	
@19'	S:N29E/6NW
@21'	B:N42W/5NE
@32'	B:N16W/6NE
@48'	S:N56W/12SW
@63'	C:N22E/7SE
@69.5'	S:N41W/11SW
@70.5'	S:N13W/15SW

B-3	
@19'	C:N64W/3NE
@20'	B:N7E/4NW
@32'	C:N75E/6NW
@34'	F:N54W/32SW
@35.5'	C:N29W/5NE
@35.5'	S:N68W/3NE
@56'	B:N10E/8SE
@70.5'	C:N18W/8SW

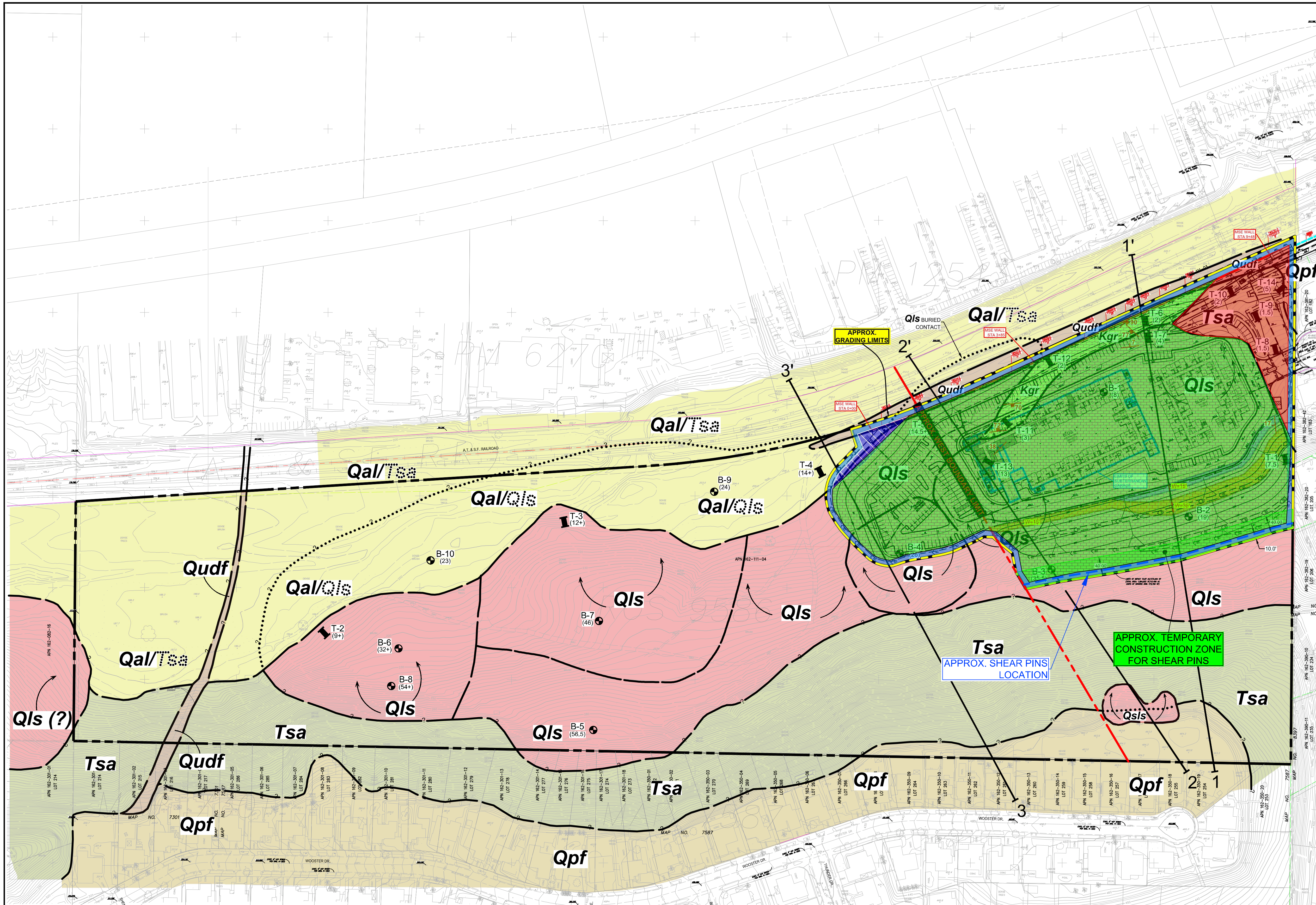
B-4	
@7'	B:N70E/22NW
@13'	S:N51E/36NW
@15.5'	C:N29E/16NW
@24'	S:N59W/14NE
@41.5'	C:N44W/6SW

B-5	
@47.5'	B:N81W/44SW
@55'	B:N81W/17SW
@56'	S:N11W/4NE
@65'	B:N17E/4NW

B-6	
@9.5'	C:N14W/46NE
@19'	B:N28E/38SE

B-7	
@ 7'	B:N56W/40SW
@17.5'	B:N85E/27NW
@21.5'	C:N83E/21SE
@45'	S:N46W/4NE

B-8	
@35'	B:N4E/53NW



...10 Foot Property Setback (Infiltration Infeasible)

...Shallow Groundwater Setback (Infiltration Infeasible)

...Landslide Debris/Proposed Fill Greater Than 5 Feet Setback (Infiltration Infeasible)

...Slide Prone Formational Materials Setback (Infiltration Infeasible)

0' 100' 200' 300' 400'

SCALE 1"=100' (On 36x24)

GEOCON LEGEND

- Qudf ........UNDOCUMENTED FILL
- Qpf ....PREVIOUSLY PLACED FILL
- Qal ....ALLUVIUM
- Qsls ....SURFICIAL LANDSLIDE DEBRIS
- Qls ....LANDSLIDE DEBRIS (Dotted Where Buried, Queried Where Uncertain)
- Tsa ....SANTIAGO FORMATION (Dotted Where Buried)
- Kgr ....GRANITIC ROCK (Dotted Where Buried)
- B-10 ....APPROX. LOCATION OF EXPLORATORY BORINGS
- T-14 ....APPROX. LOCATION OF EXPLORATORY TRENCHES
- (56.5) ....APPROX. DEPTH TO FORMATIONAL MATERIAL (In Feet)
- 77 ....APPROX. ORIENTATION OF GEOLOGIC STRUCTURE
- 38 ....APPROX. ORIENTATION OF CONTACT BETWEEN GEOLOGIC UNITS
- ....APPROX. LOCATION OF SHEAR PINS
- 3 3' ....APPROX. LOCATION OF GEOLOGIC CROSS SECTION
- W=35' ....APPROX. WIDTH OF KEY (In Feet)
- ....APPROX. LOCATION OF GEOLOGIC CONTACT (Dotted Where Buried; Queried Where Uncertain)
- ....APPROX. LOCATION OF BUTTRESS KEY WIDTH
- ....APPROX. LOCATION OF STABILITY FILL KEY WIDTH

GEOLOGIC MAP

OLIVE PARK APARTMENTS
OCEANSIDE, CALIFORNIA

GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SCALE 1" = 100'	DATE 08-07-2024	
PROJECT NO. G3035 - 52 - 01		FIGURE 1
SHEET 1 OF 1		

Figure 2 - DMA PLAN

LEGEND

...Shallow Groundwater Setback (Infiltration Infeasible)

...Landslide Debris/Proposed Fill Greater Than 5 Feet Setback (Infiltration Infeasible)

...Slide Prone Formational Materials Setback (Infiltration Infeasible)

...Fill Greater Than 5 Feet and Slope Setback (Infiltration Infeasible)

N

ATTACHMENT 7
Storm Water Quality Assessment Form

This is the cover sheet for Attachment 7.

City of Oceanside – Engineering Division – Clean Water Program

STORM WATER QUALITY ASSESSMENT FOR PLANNING, ENGINEERING, AND BUILDING PERMIT APPLICATIONS

All applications for Planning, Engineering, or Building Division permits are required to complete this assessment form and include it as part of the initial permit application submittal. Staff will review the permit application content to determine the applicability of State and City storm water requirements. Please note a storm water assessment cannot be provided without a complete permit application package.

Section 1 – Project Information	
Applicant Name: Capstone Equities	Phone Number:
Project Name: Olive Park Apartments	Project Site Address: College Boulevard and Olive Drive, Oceanside, CA 92056
Permit Applications Number(s):	Assessor Parcel Number(s): 162-111-04-00
Project Description: 43.50 acre-site-City of Oceanside. Partially developed, 20 single family detached structures	Project Disturbed Area (square feet): 439208
Existing Impervious Area (square feet):	Created or Replaced Impervious Area (square feet): 252,571 sft

Section 2 – Identify Applicable Priority Development Project Categories (Check All Boxes that Apply)	
☑	**New Development Project** – A project that creates 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.
☐	**Redevelopment Project** – A project that creates and/or replaces 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.
☐	**Restaurants** – 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); where new or redevelopment projects create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☐	**Hillside Development** – Category includes development on any natural slope that is twenty-five percent or greater; where new or redevelopment projects create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☑	**Parking Lots** – 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; where new or redevelopment projects create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☑	**Streets, Roads, Highways, Freeways, and Driveways** – Category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles; where new or redevelopment projects that create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☐	**Water Quality Environmentally Sensitive Area** – New or redevelopment projects that create and/or replace 2,500 square feet or more of impervious surface (collectively over the entire project site), and discharge directly to a Water Quality Environmentally Sensitive Area (WQESA). "Discharge directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the WQESA, 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).
☐	**Automotive Repair Shop** – Category is defined as a facility that is categorized in any one of the following Standard Industrial Classification (SIC) codes: 5013, 5014, 5541, 7532-7534, or 7536-7539, where new or redevelopment projects create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☐	**Retail Gasoline Outlet (RGOs)** – Category includes RGOs that meet the following criteria (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day; where new or redevelopment projects create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☑	**Development Projects greater than one acre** – New or redevelopment projects that result in the disturbance of one or more acres of land and are expected to generate pollutants post construction.

Section 3 – Identify Projects Not Subject to Permanent Stormwater Requirements (Check All Boxes that Apply)	
☐	The project consists of work entirely within an existing structure.
☐	The project consists of construction of overhead or underground utilities (no new impervious surfaces).
☐	The project consists of routine maintenance.
☐	The project consists of less than 50 yards of grading and presents no opportunities to improve water quality.
Section 4 – Project Category Determination	
☑	**Priority Development Project**: If any item in Section 2 is applicable, the project is a Priority Development Project. **Please prepare a PDP SWQMP for the project.**
☐	**Standard Development Project**: If none of the items in Section 2 or 3 are applicable, the project is a Standard Development Project. **Please prepare an SDP SWQMP.**
☐	**Project Not Subject to Permanent Stormwater Requirements:** If any item in Section 3 is applicable, the project is not subject to Permanent Stormwater Requirements. **Please submit the project plans with this form.** **Note:** Projects in this category are subject to typical pollution prevention measures outlined by the pollution prevention checklist on the following page.

Section 5 – Applicant Certification	
Name of Responsible Party: Brian Mikail	Title: Manager
Email Address (optional)	Phone Number: 310-666-6860
I understand and acknowledge the City of Oceanside has adopted minimum requirements, as mandated by the San Diego Regional Water Quality Control Board – Order No. R9-2013-0001, as amended by Order Nos. R9-2015-0001 and R9-2015-0100 (NPDES NO. CAS0109266) for mitigating impacts associated with urban runoff, including storm water from construction and land development activities. I certify this assessment has been accurately completed to the best of my knowledge and is consistent with the proposed project. I acknowledge that non-compliance with the City Best Management Practice (BMP) Design Manual, Grading Ordinance, and Erosion Control Ordinance may result in enforcement action by the City, the California State Water Resources Control Board, and/or the San Diego Regional Water Quality Control Board. Enforcement action may include stop work orders, notice of violation, fines, or other actions.	
Applicant Signature:	Date: 8/9/24

Stormwater Pollution Prevention Measures for Projects Not Subject to Permanent Stormwater Requirements

Project Activity	Yes	No	Required Pollution Prevention
Trash & Waste Generation *****REQUIRED FOR ALL PROJECTS*****	☐	☐	• Train/inform all employees of pollution prevention requirements • Collect and contain all construction trash, waste, and debris • Promptly contain and clean any spill on site • Routinely inspect site, remove loose trash and prevent spills • Properly dispose of any hazardous materials • Do not wash down surfaces unless water is collected or directed to landscape • Permanent trash collection areas require full structure/enclosure
Digging of Dirt – excavation, trenching, or grading	☐	☐	• Do not allow dirt to migrate into street, sidewalk, or storm drain • Preserve existing vegetation where feasible • Perimeter site controls such as silt fence or straw wattles • Cover exposed dirt using mulch, tarps, or erosion control devices • Install and secure tarps over dirt piles • Routinely sweep site to remove dirt
Landscaping and Irrigation Systems	☐	☐	• Do not store landscape materials in street • Do not allow dirt to migrate into street, sidewalk, or storm drain • Test irrigation system and prevent runoff/overspray • Install and secure tarps over piles of mulch or soil • Routinely sweep site to remove mulch or soil • Do not wash down surfaces unless water is collected or directed to landscape
Concrete, Paint, Mortar, or Stucco Work	☐	☐	• Contain wet mixing areas within confined area • Do not allow material to travel into site soil, street, or storm drain • Properly dispose of waste material
Temporary Storage of Materials Outside	☐	☐	• Elevate material off ground where possible, such as on pallets • Install and secure tarps over materials
Demolition of Structures	☐	☐	• Follow Required Pollution Prevention for "Digging of Dirt"
New Structure – house addition, shed, etc.	☐	☐	• Follow Required Pollution Prevention for "Digging of Dirt" • Direct downspouts to landscape, where feasible • Consider rainwater harvesting • Preserve existing vegetation and drainage patterns, where feasible
Patio, Driveway, or Sidewalk	☐	☐	• Consider use of pervious pavers or pervious concrete (refer to Section 3 of page 4 for routine maintenance information) • Direct runoff to landscape areas, where feasible
Re-Roofing	☐	☐	• Contain removed roof debris in waste containers • Follow Required Pollution Prevention for "Temporary Storage of Materials Outside"
Washing of Material, Equipment, or Surface	☐	☐	• Do not wash down surfaces unless water is collected or directed to landscape
Draining of Water Heater, Pool, or Spa	☐	☐	• Direct drain water to landscape areas where possible • Contact Stormwater Division if considering draining to sanitary system cleanout or storm drain system (760-643-2804)
Storm Drain at Industrial or Commercial Property	☐	☐	• Install "No Dumping" or similar signage at each storm drain inlet

Completion Guidance

Please note – the Applicant is required to complete and submit this form as part of the project application. For definitions and additional information, please refer to the City of Oceanside BMP Design Manual. For assistance, please contact Development Services Staff at (760) 435-4373.

Section 1 – Project Information

1. Applicant Name – provide name of Individual completing form, i.e. Owner or Owner Representative
2. Phone Number – provide phone number of Individual completing form, i.e. Owner or Owner Representative
3. Project Name – provide project name (consistent with project application)
4. Project Site Address – provide a physical address for the proposed project, or nearest cross street
5. Permit Application Number(s) – provide all applicable permit application numbers
6. Assessor Parcel Number(s) – provide Assessor Parcel Number(s); refer to title documents or contact City Staff for assistance
7. Project Description – provide a brief project description (e.g. single-family dwelling, retail business, repair shop, etc)
8. Project Disturbed Area – provide the disturbed area for the entire project, including onsite and offsite work
9. Existing Impervious Area – provide the total existing impervious area within the property and project boundary
10. Created or Replaced Impervious Area – provide the total area of all newly created or replaced impervious surfaces within the project area

Section 2 – Identify Applicable Priority Development Project Categories

1. Review each category and check the appropriate boxes that apply to your project.
2. General identification of Automotive Repair Shop SIC (Standard Industrial Classifications) as follows:
   5013 – Motor vehicle supplies and new parts, 5014 – Tires and tubes, 5541 – Gasoline service stations, 7532 – Top and body repair, and paint shops, 7533 – Auto exhaust system repair shops, 7534 – Tire retreading and repair shops, 7536 – Automotive glass replacement shops, 7537 – Automotive transmission repair shops, 7538 – General automotive repair shops, 7539 – Automotive repair shops-not elsewhere classified
3. Contact Staff for assistance in determining applicability of the Water Quality Environmentally Sensitive Area (WQESA) category

Section 3 – Identify Projects Not Subject to Permanent Stormwater Requirements

1. Please refer to Page 1-6 of the City of Oceanside BMP Design Manual for a complete list of routine maintenance activities.
2. Activities that expose native subgrade in the process of replacing impervious surfaces, are not considered routine maintenance.

Section 4 – Project Category Determination

1. PDP SWQMP – Priority Development Project Stormwater Quality Management Plan
2. SDP SWQMP – Standard Development Project Stormwater Quality Management Plan
3. Contact Staff for assistance in determining the Project Category

Section 5 – Applicant Certification

1. Name of Responsible Party – provide name of Owner
2. Title of Responsible Party – provide responsible party's title, if applicable
3. Phone Number – provide phone number of Owner
4. Email Address (Optional) – provide email address
5. Applicant Signature – provide signature of Individual completing form, i.e. Owner or Owner Representative
6. Date – provide date current date

[Insert other supporting documentation here]