Water Quality Management Plan

For:

Hardt & Brier Business Park

APN: 0281-301-17, 0281-311-06, 07, 08, 11, 12, 18 & 19

Prepared for:

Oak Properties

9747 Business Park Ave

San Diego, CA 92131

858.578.2467

Prepared by:

Ware Malcomb

3911 Sorrento Valley Blvd Suite 120

San Diego, CA 92121

858.638.7277

Submittal Date: **<u>May 11th, 2023</u>**

Revision Date: _____

Approval Date:______________________

Project Owner's Certification

This Water Quality Management Plan (WQMP) has been prepared for Oak Properties by Ware Malcomb. The WQMP is intended to comply with the requirements of the City of San Bernardino and the NPDES Areawide Stormwater Program requiring the preparation of a WQMP. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with San Bernardino County's Municipal Storm Water Management Program and the intent of the NPDES Permit for San Bernardino County and the incorporated cities of San Bernardino County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors in interest and the city/county shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

"I certify under a penalty of law that the provisions (implementation, operation, maintenance, and funding) of the WQMP have been accepted and that the plan will be transferred to future successors."

.

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 0281-301-17, 0281-311-06, 07, 08, 11, 12, 18 & 19

Owner's Signature			
Owner Name: Mike Gay			
Title	Owner		
Company	Oak Properties		
Address	9747 Business Park Ave, San Diego, CA 92131		
Email	mikegay@oakproperties.net		
Telephone #	858.578.2467		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 0281-301-17, 0281-311-06, 07, 08, 11, 12, 18 & 19

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of Regional Water Quality Control Board Order No. R8-2010-0036."

Engineer: Samuel Bellomio, PE, QSD		PE Stamp Below
Title	Project Manager	
Company	Ware Maclomb	
Address	3911 Sorrento Valley Blvd Suite 120, San Diego, CA 92121	
Email	sbellomio@waremalcomb.com	
Telephone #	858.638.7277 x1360	
Signature		
Date		

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Section 1 Discretionary Permit(s)

<table>
<tr><th colspan="6">Form 1-1 Project Information</th></tr>
<tr><td colspan="2">Project Name</td><td colspan="4">San Bernardino Business Park</td></tr>
<tr><td colspan="2">Project Owner Contact Name:</td><td colspan="4">Oak Properties</td></tr>
<tr><td>Mailing Address:</td><td>9747 Business Park Ave, San Diego, CA 92131</td><td>E-mail Address:</td><td>mikegay@oakproperties.net</td><td>Telephone:</td><td>858.578.2467</td></tr>
<tr><td colspan="2">Permit/Application Number(s):</td><td></td><td>Tract/Parcel Map Number(s):</td><td colspan="2"></td></tr>
<tr><td colspan="2">Additional Information/ Comments:</td><td colspan="4"></td></tr>
<tr><td colspan="2">Description of Project:</td><td colspan="4">Construction of (4) industrial buildings and associated parking, hardscape, BMPs and landscape.</td></tr>
<tr><td colspan="2">Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.</td><td colspan="4"></td></tr>
</table>

Section 2 Project Description

2.1 Project Information

This section of the WQMP should provide the information listed below. The information provided for Conceptual/ Preliminary WQMP should give sufficient detail to identify the major proposed site design and LID BMPs and other anticipated water quality features that impact site planning. Final Project WQMP must specifically identify all BMP incorporated into the final site design and provide other detailed information as described herein.

The purpose of this information is to help determine the applicable development category, pollutants of concern, watershed description, and long term maintenance responsibilities for the project, and any applicable water quality credits. This information will be used in conjunction with the information in Section 3, Site Description, to establish the performance criteria and to select the LID BMP or other BMP for the project or other alternative programs that the project will participate in, which are described in Section 4.

Form 2.1-1 Description of Proposed Project

1 Development Category (Select all that apply):

☒ Significant re-development involving the addition or replacement of 5,000 ft^2 or more of impervious surface on an already developed site	☒ New development involving the creation of 10,000 ft^2 or more of impervious surface collectively over entire site	☐ Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	☐ Restaurants (with SIC code 5812) where the land area of development is 5,000 ft^2 or more
☐ Hillside developments of 5,000 ft^2 or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	☐ Developments of 2,500 ft^2 of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	☒ Parking lots of 5,000 ft^2 or more exposed to storm water	☐ Retail gasoline outlets that are either 5,000 ft^2 or more, or have a projected average daily traffic of 100 or more vehicles per day

☐ Non-Priority / Non-Category Project *May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements*.

2 Project Area (ft2):	256,479	3 Number of Dwelling Units:	N/A	4 SIC Code:	1541

5 Is Project going to be phased? Yes ☐ No ☒ *If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.*

6 Does Project include roads? Yes ☐ No ☒ *If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for WQMP)*

2.2 Property Ownership/Management

Describe the ownership/management of all portions of the project and site. State whether any infrastructure will transfer to public agencies (City, County, Caltrans, etc.) after project completion. State if a homeowners or property owners association will be formed and be responsible for the long-term maintenance of project stormwater facilities. Describe any lot-level stormwater features that will be the responsibility of individual property owners.

Form 2.2-1 Property Ownership/Management
Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:
Mike Gay Oak Properties 9747 Business Park Ave. San Diego, CA 92131 858.578.2467 mikegay@oakproperties.net

2.3 Potential Stormwater Pollutants

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-3 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	
Nutrients - Phosphorous	E ☒	N ☐	
Nutrients - Nitrogen	E ☒	N ☐	
Noxious Aquatic Plants	E ☒	N ☐	
Sediment	E ☒	N ☐	
Metals	E ☒	N ☐	
Oil and Grease	E ☒	N ☐	
Trash/Debris	E ☒	N ☐	
Pesticides / Herbicides	E ☒	N ☐	
Organic Compounds	E ☒	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4 Water Quality Credits

A water quality credit program is applicable for certain types of development projects if it is not feasible to meet the requirements for on-site LID. Proponents for eligible projects, as described below, can apply for water quality credits that would reduce project obligations for selecting and sizing other treatment BMP or participating in other alternative compliance programs. Refer to Section 6.2 in the TGD for WQMP to determine if water quality credits are applicable for the project.

<table>
<tr><th colspan="4">Form 2.4-1 Water Quality Credits</th></tr>
<tr><td colspan="4">1 Project Types that Qualify for Water Quality Credits: Select all that apply</td></tr>
<tr><td>☐ Redevelopment projects that reduce the overall impervious footprint of the project site. [Credit = % impervious reduced]</td><td>Higher density development projects
☐Vertical density [20%]
☐7 units/ acre [5%]</td><td>☐ Mixed use development, (combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that demonstrate environmental benefits not realized through single use projects) [20%]</td><td>☐Brownfield redevelopment (redevelop real property complicated by presence or potential of hazardous contaminants) [25%]</td></tr>
<tr><td>☐ Redevelopment projects in established historic district, historic preservation area, or similar significant core city center areas [10%]</td><td>☐ Transit-oriented developments (mixed use residential or commercial area designed to maximize access to public transportation) [20%]</td><td>☐ In-fill projects (conversion of empty lots & other underused spaces < 5 acres, substantially surrounded by urban land uses, into more beneficially used spaces, such as residential or commercial areas) [10%]</td><td>☐ Live-Work developments (variety of developments designed to support residential and vocational needs) [20%]</td></tr>
<tr><td colspan="4">2 Total Credit % 0% (Total all credit percentages up to a maximum allowable credit of 50 percent)</td></tr>
<tr><td>Description of Water Quality Credit Eligibility (if applicable)</td><td colspan="3"></td></tr>
</table>

Section 3 Site and Watershed Description

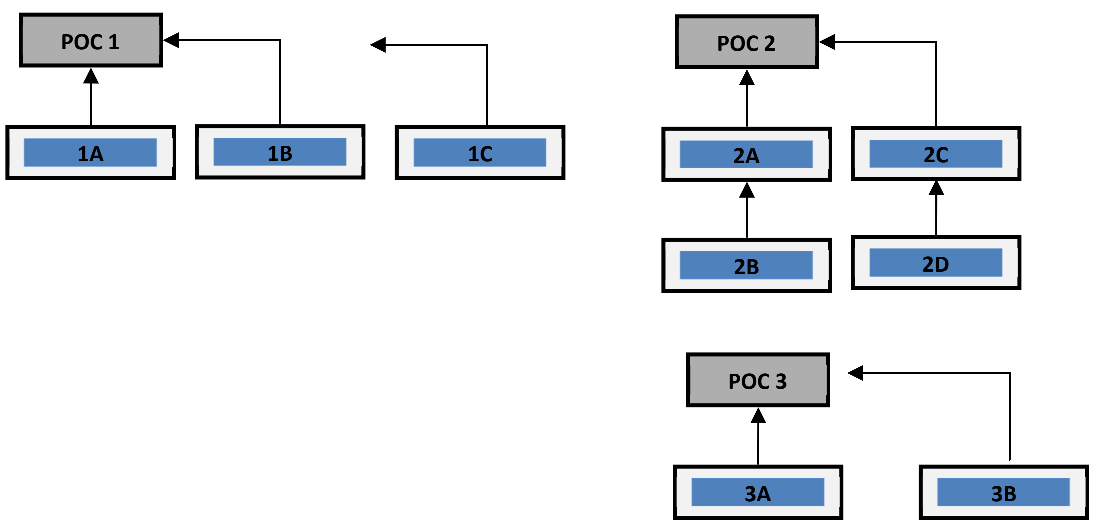
Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed DMAs) is conveyed to the site outlet(s). Refer to Section 3.2 in the TGD for WQMP. The form below is provided as an example. Then complete Forms 3.2 and 3.3 for each DA on the project site.

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34°04'20.2"N	Longitude 117°15'50.3"W	Thomas Bros Map page

1 San Bernardino County climatic region: ☒ Valley ☐ Mountain

2 Does the site have more than one drainage area (DA): Yes☒ No☐ *If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached*



Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA

Form 3-2 Existing Hydrologic Characteristics for DA 1				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DA-1			
1 DMA drainage area (ft^2)	110,879			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use* *http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	2			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	B			
5 Longest flowpath length (ft)	600			
6 Longest flowpath slope (ft/ft)	0.008			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Grass			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	Fair			

Form 3-2 Existing Hydrologic Characteristics for DA 2

For Drainage Area 2's sub-watershed DMA, provide the following characteristics	DA-2			
1 DMA drainage area (ft^2)	54,041			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use* *http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	2			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	B			
5 Longest flowpath length (ft)	355			
6 Longest flowpath slope (ft/ft)	0.006			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Grass			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	Fair			

Form 3-2 Existing Hydrologic Characteristics for DA 3				
For Drainage Area 3's sub-watershed DMA, provide the following characteristics	DA-3			
1 DMA drainage area (ft^2)	91,559			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use* *http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	2			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	B			
5 Longest flowpath length (ft)	495			
6 Longest flowpath slope (ft/ft)	0.011			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Grass			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	Fair			

Form 3-3 Watershed Description for Drainage Area

Receiving waters *Refer to Watershed Mapping Tool - http://permitrack.sbcounty.gov/wap/* *See 'Drainage Facilities" link at this website*	Warm Creek, Santa Ana River Reach 4
Applicable TMDLs *Refer to Local Implementation Plan*	Pathogens
303(d) listed impairments *Refer to Local Implementation Plan and Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/ and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml*	Pathogens
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	N/A
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	
Hydrologic Conditions of Concern	☒ Yes *Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal* ☐ No
Watershed–based BMP included in a RWQCB approved WAP	☐ Yes *Attach verification of regional BMP evaluation criteria in WAP* • *More Effective than On-site LID* • *Remaining Capacity for Project DCV* • *Upstream of any Water of the US* • *Operational at Project Completion* • *Long-Term Maintenance Plan* ☒ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

Non-structural and structural source control BMP are required to be incorporated into all new development and significant redevelopment projects. Form 4.1-1 and 4.1-2 are used to describe specific source control BMPs used in the WQMP or to explain why a certain BMP is not applicable. Table 7-3 of the TGD for WQMP provides a list of applicable source control BMP for projects with specific types of potential pollutant sources or activities. The source control BMP in this table must be implemented for projects with these specific types of potential pollutant sources or activities.

The preparers of this WQMP have reviewed the source control BMP requirements for new development and significant redevelopment projects. The preparers have also reviewed the specific BMP required for project as specified in Forms 4.1-1 and 4.1-2. All applicable non-structural and structural source control BMP shall be implemented in the project.

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Landscape Management BMPs	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	
N6	Local Water Quality Ordinances	☒	☐	
N7	Spill Contingency Plan	☒	☐	
N8	Underground Storage Tank Compliance	☒	☐	
N9	Hazardous Materials Disclosure Compliance	☒	☐	

Form 4.1-1 Non-Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	☒	☐	
N11	Litter/Debris Control Program	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☐	☒	No loading docks proposed
N14	Catch Basin Inspection Program	☒	☐	
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	No non-structural measures proposed
N17	Comply with all other applicable NPDES permits	☒	☐	

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One: Included	Check One: Not Applicable	Describe BMP Implementation OR, If not applicable, state reason
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☒	☐	
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	No dock areas
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No maintenance bays
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle wash areas
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☒	☐	

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One: Included	Check One: Not Applicable	Describe BMP Implementation OR, If not applicable, state reason
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No equipment wash areas
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling areas
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillside landscaping
S14	Wash water control for food preparation areas	☐	☒	No food preparation areas
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No community car wash racks

4.1.2 Preventative LID Site Design Practices

Site design practices associated with new LID requirements in the MS4 Permit should be considered in the earliest phases of a project. Preventative site design practices can result in smaller DCV for LID BMP and hydromodification control BMP by reducing runoff generation. Describe site design and drainage plan including:

- A narrative of site design practices utilized or rationale for not using practices
- A narrative of how site plan incorporates preventive site design practices
- Include an attached Site Plan layout which shows how preventative site design practices are included in WQMP

Refer to Section 5.2 of the TGD for WQMP for more details.

Form 4.1-3 Preventative LID Site Design Practices Checklist
Site Design Practices *If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets*
Minimize impervious areas: Yes ☒ No ☐ Explanation: Minimum street widths, parking stall sizes and walkway widths
Maximize natural infiltration capacity: Yes ☒ No ☐ Explanation: Infiltration BMPs for B type soils
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: Maintain existing drainage patterns and time of concentration through the use of BMPs
Disconnect impervious areas: Yes ☒ No ☐ Explanation: Permeable area proposed throughout site to accept runoff
Protect existing vegetation and sensitive areas: Yes ☒ No ☐ Explanation: Maintain existing vegetation where possible
Re-vegetate disturbed areas: Yes ☒ No ☐ Explanation: Replant any disturbed areas with vegetation where possible
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: Compaction at BMP minimized
Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☒ No ☐ Explanation: Swales proposed over underground piping when possible
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: Landscape areas staked off during construction

4.2 Project Performance Criteria

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in the MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection of any downstream waterbody segments with a HCOC.

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), the San Bernardino County Stormwater Program requires use of the P_6 method (MS4 Permit Section XI.D.6a.ii) – Form 4.2-1

- For HCOC pre- and post-development hydrologic calculation, the San Bernardino County Stormwater Program requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi^2), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for HCOC performance criteria.

Refer to Section 4 in the TGD for WQMP for detailed guidance and instructions.

4.2.1 LID BMP Performance Criteria for Design Capture Volume

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)		
1 Project area DA 1 (ft^2): 110,879	2 Imperviousness after applying preventative site design practices (Imp%): 71.4%	3 Runoff Coefficient (Rc): 0.51 *R_c = 0.858(Imp%)^3-0.78(Imp%)^2+0.774(Imp%)+0.04*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.489 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.72 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 6,690 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 2)

1 Project area DA 1 (ft^2): 54,041	2 Imperviousness after applying preventative site design practices (Imp%): 65.6%	3 Runoff Coefficient (Rc): 0.45 *R_c = 0.858(Imp%)^3-0.78(Imp%)^2+0.774(Imp%)+0.04*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr-1hr}$ (in): 0.489 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.72 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 2,924 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 3)

1 Project area DA 1 (ft^2): 91,559	2 Imperviousness after applying preventative site design practices (Imp%): 75.1%	3 Runoff Coefficient (Rc): 0.54 *R_c = 0.858(Imp%)^3-0.78(Imp%)^2+0.774(Imp%)+0.04*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr-1hr}$ (in): 0.489 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.72 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 5,906 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

4.2.2 Summary of HCOC Assessment

Form 4.2-2 Summary of HCOC Assessment (DA 1)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes ☒ No ☐

Go to: *http://permitrack.sbcounty.gov/wap/*

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below *(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)*

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** 2,238.60 *Form 4.2-3 Item 12*	**2** 14.67 *Form 4.2-4 Item 13*	**3** 1.49 *Form 4.2-5 Item 10*
Post-developed	**4** 5,719.61 *Form 4.2-3 Item 13*	**5** 8.47 *Form 4.2-4 Item 14*	**6** 3.29 *Form 4.2-5 Item 14*
Difference	**7** *3,195.04* *Item 4 – Item 1*	**8** 6.2 *Item 2 – Item 5*	**9** 1.80 *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** 143% *Item 7 / Item 1*	**11** 42% *Item 8 / Item 2*	**12** 121% *Item 9 / Item 3*

Form 4.2-2 Summary of HCOC Assessment (DA 2)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes ☒ No ☐

Go to: http://permitrack.sbcounty.gov/wap/

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below

(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** 1,091.06 *Form 4.2-3 Item 12*	**2** 13.18 *Form 4.2-4 Item 13*	**3** 0.95 *Form 4.2-5 Item 10*
Post-developed	**4** 2,415.83 *Form 4.2-3 Item 13*	**5** 8.05 *Form 4.2-4 Item 14*	**6** 1.45 *Form 4.2-5 Item 14*
Difference	**7** *1,203.98* *Item 4 – Item 1*	**8** 5.13 *Item 2 – Item 5*	**9** 0.50 *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** 110% *Item 7 / Item 1*	**11** 0.39% *Item 8 / Item 2*	**12** 53% *Item 9 / Item 3*

Form 4.2-2 Summary of HCOC Assessment (DA 3)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes ☒ No ☐

Go to: *http://permitrack.sbcounty.gov/wap/*

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below

(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** 1,848.54 *Form 4.2-3 Item 12*	**2** 13.23 *Form 4.2-4 Item 13*	**3** 1.21 *Form 4.2-5 Item 10*
Post-developed	**4** 5,137.42 *Form 4.2-3 Item 13*	**5** 5.43 *Form 4.2-4 Item 14*	**6** 3.01 *Form 4.2-5 Item 14*
Difference	**7** 3,288.88 *Item 4 – Item 1*	**8** 7.80 *Item 2 – Item 5*	**9** 1.80 *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** 178% *Item 7 / Item 1*	**11** 59% *Item 8 / Item 2*	**12** 149% *Item 9 / Item 3*

4.2.3 HCOC Assessment for Runoff Volume

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 1)								
Weighted Curve Number Determination for: Pre-developed DA	1A	1B	1C					
1a Land Cover type	Grass	Grass	Grass					
2a Hydrologic Soil Group (HSG)	B	B	B					
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	24,733	12,277	73,869					
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	69	69	69					
Weighted Curve Number Determination for: Post-developed DA	1A	1B	1C					
1b Land Cover type	Industrial	Industrial	Industrial					
2b Hydrologic Soil Group (HSG)	B	B	B					
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	24,733	12,277	73,869					
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	80.28	77.19	80.84					

5 Pre-Developed area-weighted CN: 69	**7** Pre-developed soil storage capacity, S (in): 4.49 *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): 0.90 *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN: 80.31	**8** Post-developed soil storage capacity, S (in): 2.45 *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): 0.49 *I_a = 0.2 * Item 8*

11 Precipitation for 2 yr, 24 hr storm (in): 2.07
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3): 2,238.60
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft^3): 5,719.61
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet HCOC Requirement, (ft^3): 3,195.04
*V_{HCOC} = (Item 13 * 0.95) – Item 12*

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 2)

Weighted Curve Number Determination for: Pre-developed DA	2A	2B	2C	2D				
1a Land Cover type	Grass	Grass	Grass	Grass				
2a Hydrologic Soil Group (HSG)	B	B	B	B				
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	12,373	18,652	12,469	10,547				
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	69	69	69	69				
Weighted Curve Number Determination for: Post-developed DA	2A	2B	2C	2D				
1b Land Cover type	Industrial	Industrial	Industrial	Industrial				
2b Hydrologic Soil Group (HSG)	B	B	B	B				
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	12,373	18,652	12,469	10,547				
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	80.15	77.83	79.70	75.37				

5 Pre-Developed area-weighted CN: 69	**7** Pre-developed soil storage capacity, S (in): 4.49 *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): 0.90 *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN: 78.31	**8** Post-developed soil storage capacity, S (in): 2.77 *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): 0.55 *I_a = 0.2 * Item 8*

11 Precipitation for 2 yr, 24 hr storm (in): 2.07
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3): 1,091.06
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft^3): 2,415.83
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet HCOC Requirement, (ft^3): 1,203.98
*V_{HCOC} = (Item 13 * 0.95) – Item 12*

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 3)

Weighted Curve Number Determination for: Pre-developed DA	3A	3B						
1a Land Cover type	Grass	Grass						
2a Hydrologic Soil Group (HSG)	B	B						
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	48,921	42,638						
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	69	69						
Weighted Curve Number Determination for: Post-developed DA	3A	3B						
1b Land Cover type	Industrial	Industrial						
2b Hydrologic Soil Group (HSG)	B	B						
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	48,921	42,638						
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	81.44	81.63						

5 Pre-Developed area-weighted CN: 69	**7** Pre-developed soil storage capacity, S (in): 4.49 *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): 0.90 *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN: 81.53	**8** Post-developed soil storage capacity, S (in): 2.27 *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): 0.45 *I_a = 0.2 * Item 8*

11 Precipitation for 2 yr, 24 hr storm (in): 2.07
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3): 1,848.54
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft^3): 5,137.42
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet HCOC Requirement, (ft^3): 3,032.02
*V_{HCOC} = (Item 13 * 0.95) – Item 12*

4.2.4 HCOC Assessment for Time of Concentration

4.2.5 HCOC Assessment for Peak Runoff

PRE-DEVELOPED CONDITIONS
2-YEAR STORM RATIONAL METHOD

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                San Bernardino County Rational Hydrology Program

                    (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2019 Version 9.1
       Rational Hydrology Study        Date: 10/01/21
------------------------------------------------------------------------
PRE DEVELOPMENT - POC 1
2 YEAR - RATIONAL METHOD ANALYSIS
BY WARE MALCOMB
FILE:EXPOC1Q2.RSD3
------------------------------------------------------------------------


Program License Serial Number 6491

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is     2.0
   10 Year storm 1 hour rainfall  =      0.768(In.)
  100 Year storm 1 hour rainfall  =      1.220(In.)
Computed rainfall intensity:
Storm year =     2.00   1 hour rainfall =     0.452 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      101.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Initial subarea data:
Initial area flow distance =    50.000(Ft.)
Top (of initial area) elevation =  1053.520(Ft.)
Bottom (of initial area) elevation =  1053.070(Ft.)
Difference in elevation =     0.450(Ft.)
Slope =    0.00900  s(%)=       0.90
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.440 min.
Rainfall intensity =      1.725(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.689
Subarea runoff =      0.026(CFS)
Total initial stream area =       0.022(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.404(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.148(Ft.), Average velocity =   0.719(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             25.00              0.00
       3             50.00              0.50
```

```
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =      0.792(CFS)
  '     '       flow top width =     14.849(Ft.)
  '     '    velocity=    0.719(Ft/s)
  '     '       area =      1.102(Sq.Ft)
  '     '       Froude number =     0.465

Upstream point elevation =  1053.070(Ft.)
Downstream point elevation =  1049.810(Ft.)
Flow length =   355.000(Ft.)
Travel time  =    8.23 min.
Time of concentration =   14.67 min.
Depth of flow =   0.148(Ft.)
Average velocity =   0.719(Ft/s)
Total irregular channel flow =     0.792(CFS)
Irregular channel normal depth above invert elev. =   0.148(Ft.)
Average velocity of channel(s) =   0.719(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.052(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.555
Subarea runoff =      1.460(CFS) for    2.523(Ac.)
Total runoff =      1.486(CFS)
Effective area this stream =        2.54(Ac.)
Total Study Area (Main Stream No. 1) =        2.54(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.188(Ft.), Average velocity =   0.841(Ft/s)
End of computations, Total Study Area =            2.54 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

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            San Bernardino County Rational Hydrology Program

                 (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2019 Version 9.1
       Rational Hydrology Study        Date: 10/01/21
------------------------------------------------------------------------
PRE DEVELOPMENT - POC 2
2 YEAR - RATIONAL METHOD ANALYSIS
BY WARE MALCOMB
FILE:EXPOC2Q2.RSD3
------------------------------------------------------------------------


Program License Serial Number 6491

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is     2.0
   10 Year storm 1 hour rainfall  =      0.768(In.)
  100 Year storm 1 hour rainfall  =      1.220(In.)
Computed rainfall intensity:
Storm year =     2.00   1 hour rainfall =     0.452 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      201.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Initial subarea data:
Initial area flow distance =    50.000(Ft.)
Top (of initial area) elevation =  1054.920(Ft.)
Bottom (of initial area) elevation =  1053.510(Ft.)
Difference in elevation =     1.410(Ft.)
Slope =    0.02820  s(%)=       2.82
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.125 min.
Rainfall intensity =      1.978(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.716
Subarea runoff =      0.024(CFS)
Total initial stream area =        0.017(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.404(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.126(Ft.), Average velocity =   0.668(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             25.00              0.00
       3             50.00              0.50
```

```
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =      0.532(CFS)
  '     '       flow top width =     12.613(Ft.)
  '     '    velocity=    0.668(Ft/s)
  '     '       area =      0.795(Sq.Ft)
  '     '       Froude number =     0.469

Upstream point elevation =  1053.510(Ft.)
Downstream point elevation =  1050.320(Ft.)
Flow length =   323.000(Ft.)
Travel time  =    8.05 min.
Time of concentration =   13.18 min.
Depth of flow =   0.126(Ft.)
Average velocity =   0.668(Ft/s)
Total irregular channel flow =     0.532(CFS)
Irregular channel normal depth above invert elev. =   0.126(Ft.)
Average velocity of channel(s) =   0.668(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.122(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.576
Subarea runoff =      0.921(CFS) for    1.443(Ac.)
Total runoff =      0.945(CFS)
Effective area this stream =        1.46(Ac.)
Total Study Area (Main Stream No. 1) =        1.46(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.156(Ft.), Average velocity =   0.772(Ft/s)
End of computations, Total Study Area =            1.46 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

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              San Bernardino County Rational Hydrology Program

                  (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2019 Version 9.1
       Rational Hydrology Study        Date: 10/01/21
------------------------------------------------------------------------
PRE DEVELOPMENT - POC 3
2 YEAR - RATIONAL METHOD ANALYSIS
BY WARE MALCOMB
FILE:EXPOC3Q2.RSD3
------------------------------------------------------------------------


Program License Serial Number 6491

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is     2.0
   10 Year storm 1 hour rainfall  =      0.768(In.)
  100 Year storm 1 hour rainfall  =      1.220(In.)
Computed rainfall intensity:
Storm year =     2.00   1 hour rainfall =     0.452 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      301.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Initial subarea data:
Initial area flow distance =    50.000(Ft.)
Top (of initial area) elevation =  1053.250(Ft.)
Bottom (of initial area) elevation =  1053.140(Ft.)
Difference in elevation =     0.110(Ft.)
Slope =    0.00220  s(%)=       0.22
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.536 min.
Rainfall intensity =      1.457(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.651
Subarea runoff =      0.020(CFS)
Total initial stream area =        0.021(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.404(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      302.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.132(Ft.), Average velocity =   0.752(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             25.00              0.00
       3             50.00              0.50
```

```
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =      0.658(CFS)
  '     '       flow top width =     13.227(Ft.)
  '     '     velocity=    0.752(Ft/s)
  '     '        area =      0.875(Sq.Ft)
  '     '       Froude number =     0.516

Upstream point elevation =  1053.140(Ft.)
Downstream point elevation =  1050.650(Ft.)
Flow length =   212.000(Ft.)
Travel time  =    4.70 min.
Time of concentration =   13.23 min.
Depth of flow =   0.132(Ft.)
Average velocity =   0.752(Ft/s)
Total irregular channel flow =     0.658(CFS)
Irregular channel normal depth above invert elev. =   0.132(Ft.)
Average velocity of channel(s) =   0.752(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.120(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.576
Subarea runoff =      1.194(CFS) for    1.863(Ac.)
Total runoff =      1.214(CFS)
Effective area this stream =        1.88(Ac.)
Total Study Area (Main Stream No. 1) =        1.88(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.166(Ft.), Average velocity =   0.877(Ft/s)
End of computations, Total Study Area =           1.88 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

PRE-DEVELOPED CONDITIONS
100-YEAR STORM RATIONAL METHOD

```
                San Bernardino County Rational Hydrology Program

                    (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2019 Version 9.1
       Rational Hydrology Study        Date: 09/30/21
------------------------------------------------------------------------
PRE DEVELOPMENT - POC 1
100 YEAR - RATIONAL METHOD ANALYSIS
BY WARE MALCOMB
FILE:EXPOC1Q100.RSD3
------------------------------------------------------------------------


Program License Serial Number 6491

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
   10 Year storm 1 hour rainfall  =      0.768(In.)
  100 Year storm 1 hour rainfall  =      1.220(In.)
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.220 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      101.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Initial subarea data:
Initial area flow distance =    50.000(Ft.)
Top (of initial area) elevation =  1053.520(Ft.)
Bottom (of initial area) elevation =  1053.070(Ft.)
Difference in elevation =     0.450(Ft.)
Slope =    0.00900  s(%)=       0.90
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.440 min.
Rainfall intensity =      4.655(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.873
Subarea runoff =      0.089(CFS)
Total initial stream area =       0.022(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.140(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.197(Ft.), Average velocity =   0.869(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             50.00              0.00
```

```
       3            100.00              0.50
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =      3.383(CFS)
  '     '       flow top width =     39.470(Ft.)
  '     '    velocity=    0.869(Ft/s)
  '     '       area =      3.895(Sq.Ft)
  '     '       Froude number =     0.487

Upstream point elevation =  1053.070(Ft.)
Downstream point elevation =  1049.810(Ft.)
Flow length =   355.000(Ft.)
Travel time  =    6.81 min.
Time of concentration =   13.25 min.
Depth of flow =   0.197(Ft.)
Average velocity =   0.869(Ft/s)
Total irregular channel flow =     3.383(CFS)
Irregular channel normal depth above invert elev. =   0.197(Ft.)
Average velocity of channel(s) =   0.869(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      3.019(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.858
Subarea runoff =      6.506(CFS) for    2.523(Ac.)
Total runoff =      6.595(CFS)
Effective area this stream =        2.54(Ac.)
Total Study Area (Main Stream No. 1) =        2.54(Ac.)
Area averaged Fm value =    0.140(In/Hr)
Depth of flow =   0.253(Ft.), Average velocity =   1.026(Ft/s)
End of computations, Total Study Area =           2.54 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

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              San Bernardino County Rational Hydrology Program

                 (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2019 Version 9.1
       Rational Hydrology Study        Date: 09/30/21
------------------------------------------------------------------------
PRE DEVELOPMENT - POC 2
100 YEAR - RATIONAL METHOD ANALYSIS
BY WARE MALCOMB
FILE:EXPOC2Q100.RSD3
------------------------------------------------------------------------


Program License Serial Number 6491

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
   10 Year storm 1 hour rainfall  =      0.768(In.)
  100 Year storm 1 hour rainfall  =      1.220(In.)
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.220 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      201.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Initial subarea data:
Initial area flow distance =    50.000(Ft.)
Top (of initial area) elevation =  1054.920(Ft.)
Bottom (of initial area) elevation =  1053.510(Ft.)
Difference in elevation =     1.410(Ft.)
Slope =    0.02820  s(%)=      2.82
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.125 min.
Rainfall intensity =      5.339(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.876
Subarea runoff =      0.080(CFS)
Total initial stream area =        0.017(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.140(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.163(Ft.), Average velocity =   0.792(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00              0.50
       2            50.00              0.00
```

```
       3            100.00              0.50
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =      2.093(CFS)
  '     '       flow top width =     32.515(Ft.)
  '     '    velocity=    0.792(Ft/s)
  '     '       area =      2.643(Sq.Ft)
  '     '       Froude number =     0.489

Upstream point elevation =  1053.510(Ft.)
Downstream point elevation =  1050.320(Ft.)
Flow length =   323.000(Ft.)
Travel time  =    6.80 min.
Time of concentration =   11.92 min.
Depth of flow =   0.163(Ft.)
Average velocity =   0.792(Ft/s)
Total irregular channel flow =     2.093(CFS)
Irregular channel normal depth above invert elev. =   0.163(Ft.)
Average velocity of channel(s) =   0.792(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      3.217(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.861
Subarea runoff =      3.963(CFS) for    1.443(Ac.)
Total runoff =      4.043(CFS)
Effective area this stream =        1.46(Ac.)
Total Study Area (Main Stream No. 1) =        1.46(Ac.)
Area averaged Fm value =    0.140(In/Hr)
Depth of flow =   0.208(Ft.), Average velocity =   0.933(Ft/s)
End of computations, Total Study Area =            1.46 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

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             San Bernardino County Rational Hydrology Program

                 (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2019 Version 9.1
       Rational Hydrology Study        Date: 09/30/21
------------------------------------------------------------------------
PRE DEVELOPMENT - POC 3
100 YEAR - RATIONAL METHOD ANALYSIS
BY WARE MALCOMB
FILE:EXPOC3Q100.RSD3
------------------------------------------------------------------------


Program License Serial Number 6491

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
   10 Year storm 1 hour rainfall  =      0.768(In.)
  100 Year storm 1 hour rainfall  =      1.220(In.)
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.220 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      301.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Initial subarea data:
Initial area flow distance =    50.000(Ft.)
Top (of initial area) elevation =  1053.250(Ft.)
Bottom (of initial area) elevation =  1053.140(Ft.)
Difference in elevation =     0.110(Ft.)
Slope =    0.00220  s(%)=       0.22
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.536 min.
Rainfall intensity =      3.931(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.868
Subarea runoff =      0.072(CFS)
Total initial stream area =        0.021(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.140(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      302.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.171(Ft.), Average velocity =   0.894(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00              0.50
       2            50.00              0.00
```

```
      3            100.00              0.50
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =      2.618(CFS)
  '     '       flow top width =     34.233(Ft.)
  '     '    velocity=    0.894(Ft/s)
  '     '       area =      2.930(Sq.Ft)
  '     '       Froude number =     0.538

Upstream point elevation =  1053.140(Ft.)
Downstream point elevation =  1050.650(Ft.)
Flow length =   212.000(Ft.)
Travel time  =    3.95 min.
Time of concentration =   12.49 min.
Depth of flow =   0.171(Ft.)
Average velocity =   0.894(Ft/s)
Total irregular channel flow =     2.618(CFS)
Irregular channel normal depth above invert elev. =   0.171(Ft.)
Average velocity of channel(s) =   0.894(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      3.128(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.860
Subarea runoff =      4.995(CFS) for    1.863(Ac.)
Total runoff =      5.067(CFS)
Effective area this stream =       1.88(Ac.)
Total Study Area (Main Stream No. 1) =       1.88(Ac.)
Area averaged Fm value =    0.140(In/Hr)
Depth of flow =   0.219(Ft.), Average velocity =   1.054(Ft/s)
End of computations, Total Study Area =           1.88 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

POST-DEVELOPED CONDITIONS
UNMITIGATED 2-YEAR STORM RATIONAL METHOD

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                San Bernardino County Rational Hydrology Program

                    (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2012 Version 7.2
       Rational Hydrology Study        Date: 07/25/22
------------------------------------------------------------------------
POST DEVELOPMENT - POC1 UNMIT
2 YEAR - RATIONAL METHOD
BY WARE MALCOMB
FILE: POC1Q2.RSB
------------------------------------------------------------------------


Program License Serial Number 6312

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is     2.0
Computed rainfall intensity:
Storm year =     2.00   1 hour rainfall =     0.452 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 1


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      115.000 to Point/Station      116.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Initial subarea data:
Initial area flow distance =    33.000(Ft.)
Top (of initial area) elevation =  1051.590(Ft.)
Bottom (of initial area) elevation =  1051.420(Ft.)
Difference in elevation =     0.170(Ft.)
Slope =    0.00515  s(%)=       0.52
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    3.531 min.
Rainfall intensity =      2.473(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.865
Subarea runoff =      0.039(CFS)
Total initial stream area =        0.018(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.095(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      116.000 to Point/Station      117.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.093(Ft.), Average velocity =   1.088(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00              0.50
       2            30.00              0.00
       3            60.00              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
```

```
Sub-Channel flow  =      0.570(CFS)
  '     '       flow top width =     11.208(Ft.)
  '     '    velocity=    1.089(Ft/s)
  '     '       area =      0.523(Sq.Ft)
  '     '       Froude number =     0.888

Upstream point elevation =  1051.420(Ft.)
Downstream point elevation =  1049.980(Ft.)
Flow length =   267.000(Ft.)
Travel time  =    4.09 min.
Time of concentration =    7.62 min.
Depth of flow =   0.093(Ft.)
Average velocity =   1.088(Ft/s)
Total irregular channel flow =     0.570(CFS)
Irregular channel normal depth above invert elev. =   0.093(Ft.)
Average velocity of channel(s) =   1.088(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Rainfall intensity =      1.559(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.845
Subarea runoff =      0.972(CFS) for    0.749(Ac.)
Total runoff =      1.011(CFS)
Effective area this stream =        0.77(Ac.)
Total Study Area (Main Stream No. 1) =        0.77(Ac.)
Area averaged Fm value =    0.095(In/Hr)
Depth of flow =   0.116(Ft.), Average velocity =   1.256(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      117.000 to Point/Station      112.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1049.980(Ft.)
Downstream point/station elevation =  1044.000(Ft.)
Pipe length  =   299.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.011(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.011(CFS)
Normal flow depth in pipe =    4.14(In.)
Flow top width inside pipe =    8.97(In.)
Critical Depth =    5.53(In.)
Pipe flow velocity =      5.10(Ft/s)
Travel time through pipe =    0.98 min.
Time of concentration (TC) =     8.60 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      112.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.767(Ac.)
Runoff from this stream =      1.011(CFS)
Time of concentration =    8.60 min.
Rainfall intensity =     1.450(In/Hr)
Area averaged loss rate (Fm) =    0.0951(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      111.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
```

```
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Initial subarea data:
Initial area flow distance =    19.000(Ft.)
Top (of initial area) elevation =  1051.130(Ft.)
Bottom (of initial area) elevation =  1050.750(Ft.)
Difference in elevation =     0.380(Ft.)
Slope =    0.02000  s(%)=       2.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    2.159 min.
Rainfall intensity =      3.323(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.874
Subarea runoff =      0.038(CFS)
Total initial stream area =        0.013(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.095(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      112.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.111(Ft.), Average velocity =   1.032(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00             0.50
       2            30.00             0.00
       3            60.00             0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      0.765(CFS)
  '     '       flow top width =     13.342(Ft.)
  '     '    velocity=    1.032(Ft/s)
  '     '       area =      0.742(Sq.Ft)
  '     '       Froude number =     0.771

Upstream point elevation =  1050.750(Ft.)
Downstream point elevation =  1049.840(Ft.)
Flow length =   237.000(Ft.)
Travel time  =    3.83 min.
Time of concentration =    5.99 min.
Depth of flow =   0.111(Ft.)
Average velocity =   1.032(Ft/s)
Total irregular channel flow =     0.765(CFS)
Irregular channel normal depth above invert elev. =   0.111(Ft.)
Average velocity of channel(s) =   1.032(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Rainfall intensity =      1.802(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.853
Subarea runoff =      1.400(CFS) for    0.923(Ac.)
Total runoff =      1.438(CFS)
Effective area this stream =        0.94(Ac.)
Total Study Area (Main Stream No. 1) =        1.70(Ac.)
```

```
Area averaged Fm value =    0.095(In/Hr)
Depth of flow =   0.141(Ft.), Average velocity =   1.208(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      112.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.936(Ac.)
Runoff from this stream =      1.438(CFS)
Time of concentration =    5.99 min.
Rainfall intensity =     1.802(In/Hr)
Area averaged loss rate (Fm) =    0.0951(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min)  (In/Hr)     (In/Hr)


1      1.01     0.767      8.60    0.095      1.450
2      1.44     0.936      5.99    0.095      1.802
Qmax(1) =
          1.000 *    1.000 *     1.011) +
          0.794 *    1.000 *     1.438) + =       2.152
Qmax(2) =
          1.259 *    0.697 *     1.011) +
          1.000 *    1.000 *     1.438) + =       2.324

Total of 2 streams to confluence:
Flow rates before confluence point:
       1.011       1.438
Maximum flow rates at confluence using above data:
        2.152        2.324
Area of streams before confluence:
        0.767        0.936
Effective area values after confluence:
        1.703        1.470
Results of confluence:
Total flow rate =      2.324(CFS)
Time of concentration =     5.988 min.
Effective stream area after confluence =      1.470(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.095(In/Hr)
Study area total (this main stream) =       1.70(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      113.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1049.840(Ft.)
Downstream point/station elevation =  1049.000(Ft.)
Pipe length  =     5.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.324(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     2.324(CFS)
Normal flow depth in pipe =    3.63(In.)
Flow top width inside pipe =    8.83(In.)
Critical Depth =    8.14(In.)
Pipe flow velocity =     13.91(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     5.99 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      113.000 to Point/Station      114.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1049.000(Ft.)
```

```
Downstream point/station elevation =  1048.000(Ft.)
Pipe length  =    31.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.324(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     2.324(CFS)
Normal flow depth in pipe =    5.99(In.)
Flow top width inside pipe =    8.49(In.)
Critical Depth =    8.14(In.)
Pipe flow velocity =      7.44(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =     6.06 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      114.000 to Point/Station      104.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Depth of flow =   0.233(Ft.), Average velocity =   1.712(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2              0.00              0.00
       3             20.00              0.40
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      2.324(CFS)
  '     '       flow top width =     11.651(Ft.)
  '     '    velocity=    1.712(Ft/s)
  '     '       area =      1.358(Sq.Ft)
  '     '       Froude number =     0.884

Upstream point elevation =  1048.000(Ft.)
Downstream point elevation =  1047.000(Ft.)
Flow length =   247.000(Ft.)
Travel time  =    2.40 min.
Time of concentration =    8.47 min.
Depth of flow =   0.233(Ft.)
Average velocity =   1.712(Ft/s)
Total irregular channel flow =     2.324(CFS)
Irregular channel normal depth above invert elev. =   0.233(Ft.)
Average velocity of channel(s) =   1.712(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.470(Ac.)
Runoff from this stream =      2.324(CFS)
Time of concentration =    8.47 min.
Rainfall intensity =     1.463(In/Hr)
Area averaged loss rate (Fm) =    0.0951(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
```

```
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Initial subarea data:
Initial area flow distance =    31.000(Ft.)
Top (of initial area) elevation =  1051.000(Ft.)
Bottom (of initial area) elevation =  1050.700(Ft.)
Difference in elevation =     0.300(Ft.)
Slope =    0.00968  s(%)=       0.97
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    3.036 min.
Rainfall intensity =      2.708(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.868
Subarea runoff =      0.031(CFS)
Total initial stream area =        0.013(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.095(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      107.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.056(Ft.), Average velocity =   0.617(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00             1.00
       2              3.00             0.00
       3             10.00             0.00
       4             13.00             1.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =      0.248(CFS)
  '     '       flow top width =      7.336(Ft.)
  '     '    velocity=    0.617(Ft/s)
  '     '       area =      0.401(Sq.Ft)
  '     '       Froude number =     0.465

Upstream point elevation =  1050.700(Ft.)
Downstream point elevation =  1048.750(Ft.)
Flow length =   191.000(Ft.)
Travel time  =    5.16 min.
Time of concentration =    8.19 min.
Depth of flow =   0.056(Ft.)
Average velocity =   0.617(Ft/s)
Total irregular channel flow =     0.248(CFS)
Irregular channel normal depth above invert elev. =   0.056(Ft.)
Average velocity of channel(s) =   0.617(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Rainfall intensity =      1.493(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.843
Subarea runoff =      0.343(CFS) for    0.284(Ac.)
Total runoff =      0.374(CFS)
Effective area this stream =        0.30(Ac.)
Total Study Area (Main Stream No. 2) =        2.00(Ac.)
Area averaged Fm value =    0.095(In/Hr)
Depth of flow =   0.072(Ft.), Average velocity =   0.724(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      103.000
```

```
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1048.750(Ft.)
Downstream point/station elevation =  1048.000(Ft.)
Pipe length  =    39.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.374(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.374(CFS)
Normal flow depth in pipe =    2.93(In.)
Flow top width inside pipe =    6.00(In.)
Critical Depth =    3.73(In.)
Pipe flow velocity =      3.92(Ft/s)
Travel time through pipe =    0.17 min.
Time of concentration (TC) =     8.36 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.297(Ac.)
Runoff from this stream =      0.374(CFS)
Time of concentration =    8.36 min.
Rainfall intensity =     1.475(In/Hr)
Area averaged loss rate (Fm) =    0.0951(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      101.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Initial subarea data:
Initial area flow distance =    20.000(Ft.)
Top (of initial area) elevation =  1051.000(Ft.)
Bottom (of initial area) elevation =  1050.700(Ft.)
Difference in elevation =     0.300(Ft.)
Slope =    0.01500  s(%)=       1.50
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    2.334 min.
Rainfall intensity =      3.171(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.873
Subarea runoff =      0.028(CFS)
Total initial stream area =        0.010(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.095(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.082(Ft.), Average velocity =   1.244(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00              0.50
       2            30.00              0.00
       3            60.00              0.50
Manning's 'N' friction factor =   0.013
```

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----------------------------------------------------------------
Sub-Channel flow  =      0.500(CFS)
  '     '       flow top width =      9.825(Ft.)
  '     '    velocity=    1.244(Ft/s)
  '     '       area =      0.402(Sq.Ft)
  '     '       Froude number =     1.084

Upstream point elevation =  1050.700(Ft.)
Downstream point elevation =  1048.500(Ft.)
Flow length =   262.000(Ft.)
Travel time  =    3.51 min.
Time of concentration =    5.84 min.
Depth of flow =   0.082(Ft.)
Average velocity =   1.244(Ft/s)
Total irregular channel flow =     0.500(CFS)
Irregular channel normal depth above invert elev. =   0.082(Ft.)
Average velocity of channel(s) =   1.244(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Rainfall intensity =      1.828(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.853
Subarea runoff =      0.847(CFS) for    0.551(Ac.)
Total runoff =      0.875(CFS)
Effective area this stream =        0.56(Ac.)
Total Study Area (Main Stream No. 2) =        2.56(Ac.)
Area averaged Fm value =    0.095(In/Hr)
Depth of flow =   0.101(Ft.), Average velocity =   1.431(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1048.500(Ft.)
Downstream point/station elevation =  1048.000(Ft.)
Pipe length  =    16.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.875(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.875(CFS)
Normal flow depth in pipe =    4.38(In.)
Flow top width inside pipe =    5.33(In.)
Critical Depth =    5.48(In.)
Pipe flow velocity =      5.70(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     5.89 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.561(Ac.)
Runoff from this stream =      0.875(CFS)
Time of concentration =    5.89 min.
Rainfall intensity =     1.819(In/Hr)
Area averaged loss rate (Fm) =    0.0951(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min)  (In/Hr)     (In/Hr)
```

```
1      0.37     0.297      8.36    0.095      1.475
2      0.88     0.561      5.89    0.095      1.819
Qmax(1) =
          1.000 *    1.000 *     0.374) +
          0.800 *    1.000 *     0.875) + =       1.074
Qmax(2) =
          1.250 *    0.705 *     0.374) +
          1.000 *    1.000 *     0.875) + =       1.204

Total of 2 streams to confluence:
Flow rates before confluence point:
       0.374       0.875
Maximum flow rates at confluence using above data:
        1.074        1.204
Area of streams before confluence:
        0.297        0.561
Effective area values after confluence:
        0.858        0.770
Results of confluence:
Total flow rate =      1.204(CFS)
Time of concentration =     5.891 min.
Effective stream area after confluence =      0.770(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.095(In/Hr)
Study area total (this main stream) =      0.86(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Depth of flow =   0.068(Ft.), Average velocity =   2.614(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             50.00              0.00
       3            100.00              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      1.204(CFS)
  '     '       flow top width =     13.573(Ft.)
  '     '    velocity=    2.614(Ft/s)
  '     '       area =      0.461(Sq.Ft)
  '     '       Froude number =     2.501

Upstream point elevation =  1048.000(Ft.)
Downstream point elevation =  1047.000(Ft.)
Flow length =    21.000(Ft.)
Travel time  =    0.13 min.
Time of concentration =    6.02 min.
Depth of flow =   0.068(Ft.)
Average velocity =   2.614(Ft/s)
Total irregular channel flow =     1.204(CFS)
Irregular channel normal depth above invert elev. =   0.068(Ft.)
Average velocity of channel(s) =   2.614(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.770(Ac.)
Runoff from this stream =      1.204(CFS)
Time of concentration =    6.02 min.
Rainfall intensity =     1.795(In/Hr)
Area averaged loss rate (Fm) =    0.0951(In/Hr)
```

```
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min)  (In/Hr)      (In/Hr)


1      2.32     1.470      8.47    0.095      1.463
2      1.20     0.770      6.02    0.095      1.795
Qmax(1) =
          1.000 *    1.000 *     2.324) +
          0.805 *    1.000 *     1.204) + =       3.293
Qmax(2) =
          1.242 *    0.712 *     2.324) +
          1.000 *    1.000 *     1.204) + =       3.258

Total of 2 main streams to confluence:
Flow rates before confluence point:
       3.324       2.204
Maximum flow rates at confluence using above data:
        3.293        3.258
Area of streams before confluence:
        1.470        0.770
Effective area values after confluence:
        2.241        1.816


Results of confluence:
Total flow rate =       3.293(CFS)
Time of concentration =     8.468 min.
Effective stream area after confluence  =      2.241(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.095(In/Hr)
Study area total =       2.24(Ac.)
End of computations, Total Study Area =           2.56 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  56.0
```

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              San Bernardino County Rational Hydrology Program

                 (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2012 Version 7.2
       Rational Hydrology Study        Date: 07/25/22
------------------------------------------------------------------------
POST DEVELOPMENT - POC2 UNMIT
2 YEAR - RATIONAL METHOD
BY WARE MALCOMB
FILE: POC2Q2.RSB
------------------------------------------------------------------------


Program License Serial Number 6312

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is     2.0
Computed rainfall intensity:
Storm year =     2.00   1 hour rainfall =     0.452 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 1


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      210.000 to Point/Station      211.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Initial subarea data:
Initial area flow distance =    50.000(Ft.)
Top (of initial area) elevation =  1051.500(Ft.)
Bottom (of initial area) elevation =  1051.000(Ft.)
Difference in elevation =     0.500(Ft.)
Slope =    0.01000  s(%)=       1.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    3.651 min.
Rainfall intensity =      2.424(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.865
Subarea runoff =      0.025(CFS)
Total initial stream area =        0.012(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.095(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      211.000 to Point/Station      212.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.084(Ft.), Average velocity =   1.018(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00              0.50
       2            30.00              0.00
       3            60.00              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
```

```
Sub-Channel flow  =      0.429(CFS)
  '     '       flow top width =     10.062(Ft.)
  '     '    velocity=    1.018(Ft/s)
  '     '       area =      0.422(Sq.Ft)
  '     '       Froude number =     0.876

Upstream point elevation =  1051.000(Ft.)
Downstream point elevation =  1049.340(Ft.)
Flow length =   305.000(Ft.)
Travel time  =    5.00 min.
Time of concentration =    8.65 min.
Depth of flow =   0.084(Ft.)
Average velocity =   1.018(Ft/s)
Total irregular channel flow =     0.429(CFS)
Irregular channel normal depth above invert elev. =   0.084(Ft.)
Average velocity of channel(s) =   1.018(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Rainfall intensity =      1.445(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.841
Subarea runoff =      0.729(CFS) for    0.609(Ac.)
Total runoff =      0.755(CFS)
Effective area this stream =        0.62(Ac.)
Total Study Area (Main Stream No. 1) =        0.62(Ac.)
Area averaged Fm value =    0.095(In/Hr)
Depth of flow =   0.104(Ft.), Average velocity =   1.172(Ft/s)


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Process from Point/Station      212.000 to Point/Station      203.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Depth of flow =   0.148(Ft.), Average velocity =   1.378(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2              0.00              0.00
       3             20.00              0.40
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      0.755(CFS)
  '     '       flow top width =      7.400(Ft.)
  '     '    velocity=    1.378(Ft/s)
  '     '       area =      0.548(Sq.Ft)
  '     '       Froude number =     0.893

Upstream point elevation =  1049.340(Ft.)
Downstream point elevation =  1048.000(Ft.)
Flow length =   279.000(Ft.)
Travel time  =    3.37 min.
Time of concentration =   12.02 min.
Depth of flow =   0.148(Ft.)
Average velocity =   1.378(Ft/s)
Total irregular channel flow =     0.755(CFS)
Irregular channel normal depth above invert elev. =   0.148(Ft.)
Average velocity of channel(s) =   1.378(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** CONFLUENCE OF MAIN STREAMS ****
```

```
_____________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.621(Ac.)
Runoff from this stream =      0.755(CFS)
Time of concentration =   12.02 min.
Rainfall intensity =     1.186(In/Hr)
Area averaged loss rate (Fm) =    0.0951(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      201.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Initial subarea data:
Initial area flow distance =    50.000(Ft.)
Top (of initial area) elevation =  1051.500(Ft.)
Bottom (of initial area) elevation =  1051.000(Ft.)
Difference in elevation =     0.500(Ft.)
Slope =    0.01000  s(%)=       1.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    3.651 min.
Rainfall intensity =      2.424(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.865
Subarea runoff =      0.023(CFS)
Total initial stream area =        0.011(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.095(In/Hr)


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.082(Ft.), Average velocity =   1.096(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             30.00              0.00
       3             60.00              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      0.445(CFS)
  '     '       flow top width =      9.868(Ft.)
  '     '    velocity=    1.096(Ft/s)
  '     '       area =      0.406(Sq.Ft)
  '     '       Froude number =     0.952

Upstream point elevation =  1051.000(Ft.)
Downstream point elevation =  1049.160(Ft.)
Flow length =   284.000(Ft.)
Travel time  =    4.32 min.
Time of concentration =    7.97 min.
Depth of flow =   0.082(Ft.)
Average velocity =   1.096(Ft/s)
Total irregular channel flow =     0.445(CFS)
Irregular channel normal depth above invert elev. =   0.082(Ft.)
Average velocity of channel(s) =   1.096(Ft/s)
```

```
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Rainfall intensity =      1.518(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.844
Subarea runoff =      0.771(CFS) for    0.609(Ac.)
Total runoff =      0.794(CFS)
Effective area this stream =        0.62(Ac.)
Total Study Area (Main Stream No. 2) =        1.24(Ac.)
Area averaged Fm value =    0.095(In/Hr)
Depth of flow =   0.102(Ft.), Average velocity =   1.267(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      203.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Depth of flow =   0.052(Ft.), Average velocity =   2.899(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             50.00              0.00
       3            100.00              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      0.794(CFS)
  '     '       flow top width =     10.464(Ft.)
  '     '    velocity=    2.900(Ft/s)
  '     '       area =      0.274(Sq.Ft)
  '     '       Froude number =     3.159

Upstream point elevation =  1049.160(Ft.)
Downstream point elevation =  1048.000(Ft.)
Flow length =    14.000(Ft.)
Travel time  =    0.08 min.
Time of concentration =    8.05 min.
Depth of flow =   0.052(Ft.)
Average velocity =   2.899(Ft/s)
Total irregular channel flow =     0.794(CFS)
Irregular channel normal depth above invert elev. =   0.052(Ft.)
Average velocity of channel(s) =   2.899(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.620(Ac.)
Runoff from this stream =      0.794(CFS)
Time of concentration =    8.05 min.
Rainfall intensity =     1.508(In/Hr)
Area averaged loss rate (Fm) =    0.0951(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min)  (In/Hr)     (In/Hr)


1      0.75     0.621     12.02    0.095      1.186
```

```
2      0.79     0.620      8.05    0.095      1.508
Qmax(1) =
          1.000 *    1.000 *     0.755) +
          0.772 *    1.000 *     0.794) + =       1.367
Qmax(2) =
          1.296 *    0.670 *     0.755) +
          1.000 *    1.000 *     0.794) + =       1.448

Total of 2 main streams to confluence:
Flow rates before confluence point:
       1.755       1.794
Maximum flow rates at confluence using above data:
        1.367        1.448
Area of streams before confluence:
        0.621        0.620
Effective area values after confluence:
        1.241        1.036


Results of confluence:
Total flow rate =       1.448(CFS)
Time of concentration =     8.051 min.
Effective stream area after confluence  =      1.036(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.095(In/Hr)
Study area total =       1.24(Ac.)
End of computations, Total Study Area =           1.24 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  56.0
```

```
              San Bernardino County Rational Hydrology Program

                  (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2012 Version 7.2
       Rational Hydrology Study        Date: 07/25/22
------------------------------------------------------------------------
POST DEVELOPMENT - POC3 UNMIT
2 YEAR - RATIONAL METHOD
BY WARE MALCOMB
FILE: POC3Q2.RSB
------------------------------------------------------------------------


Program License Serial Number 6312

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is     2.0
Computed rainfall intensity:
Storm year =     2.00   1 hour rainfall =     0.452 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 1


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      308.000 to Point/Station      309.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Initial subarea data:
Initial area flow distance =    36.000(Ft.)
Top (of initial area) elevation =  1053.440(Ft.)
Bottom (of initial area) elevation =  1052.980(Ft.)
Difference in elevation =     0.460(Ft.)
Slope =    0.01278  s(%)=       1.28
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    3.049 min.
Rainfall intensity =      2.701(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.868
Subarea runoff =      0.049(CFS)
Total initial stream area =        0.021(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.095(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      309.000 to Point/Station      310.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.085(Ft.), Average velocity =   1.182(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             30.00              0.00
       3             60.00              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
```

```
Sub-Channel flow  =      0.512(CFS)
  '     '       flow top width =     10.197(Ft.)
  '     '    velocity=    1.182(Ft/s)
  '     '       area =      0.433(Sq.Ft)
  '     '       Froude number =     1.011

Upstream point elevation =  1052.980(Ft.)
Downstream point elevation =  1050.960(Ft.)
Flow length =   280.000(Ft.)
Travel time  =    3.95 min.
Time of concentration =    7.00 min.
Depth of flow =   0.085(Ft.)
Average velocity =   1.182(Ft/s)
Total irregular channel flow =     0.512(CFS)
Irregular channel normal depth above invert elev. =   0.085(Ft.)
Average velocity of channel(s) =   1.182(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Rainfall intensity =      1.641(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.848
Subarea runoff =      0.838(CFS) for    0.617(Ac.)
Total runoff =      0.888(CFS)
Effective area this stream =        0.64(Ac.)
Total Study Area (Main Stream No. 1) =        0.64(Ac.)
Area averaged Fm value =    0.095(In/Hr)
Depth of flow =   0.104(Ft.), Average velocity =   1.356(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      310.000 to Point/Station      306.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1050.960(Ft.)
Downstream point/station elevation =  1050.000(Ft.)
Pipe length  =   179.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.888(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     0.888(CFS)
Normal flow depth in pipe =    5.72(In.)
Flow top width inside pipe =    8.66(In.)
Critical Depth =    5.17(In.)
Pipe flow velocity =      2.99(Ft/s)
Travel time through pipe =    1.00 min.
Time of concentration (TC) =     7.99 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      306.000 to Point/Station      306.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.638(Ac.)
Runoff from this stream =      0.888(CFS)
Time of concentration =    7.99 min.
Rainfall intensity =     1.515(In/Hr)
Area averaged loss rate (Fm) =    0.0951(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


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Process from Point/Station      304.000 to Point/Station      305.000
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```
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Initial subarea data:
Initial area flow distance =    34.000(Ft.)
Top (of initial area) elevation =  1052.970(Ft.)
Bottom (of initial area) elevation =  1052.500(Ft.)
Difference in elevation =     0.470(Ft.)
Slope =    0.01382  s(%)=       1.38
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    2.933 min.
Rainfall intensity =      2.765(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.869
Subarea runoff =      0.048(CFS)
Total initial stream area =       0.020(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.095(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      305.000 to Point/Station      303.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.093(Ft.), Average velocity =   1.476(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00             0.50
       2            30.00             0.00
       3            60.00             0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      0.763(CFS)
  '     '       flow top width =     11.138(Ft.)
  '     '    velocity=    1.476(Ft/s)
  '     '       area =      0.517(Sq.Ft)
  '     '       Froude number =     1.207

Upstream point elevation =  1052.500(Ft.)
Downstream point elevation =  1050.380(Ft.)
Flow length =   212.000(Ft.)
Travel time  =    2.39 min.
Time of concentration =    5.33 min.
Depth of flow =   0.093(Ft.)
Average velocity =   1.476(Ft/s)
Total irregular channel flow =     0.763(CFS)
Irregular channel normal depth above invert elev. =   0.093(Ft.)
Average velocity of channel(s) =   1.476(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Rainfall intensity =      1.933(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.856
Subarea runoff =      1.341(CFS) for    0.820(Ac.)
Total runoff =      1.389(CFS)
```

```
Effective area this stream =        0.84(Ac.)
Total Study Area (Main Stream No. 2) =        1.48(Ac.)
Area averaged Fm value =    0.095(In/Hr)
Depth of flow =   0.116(Ft.), Average velocity =   1.715(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      303.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.840(Ac.)
Runoff from this stream =      1.389(CFS)
Time of concentration =    5.33 min.
Rainfall intensity =     1.933(In/Hr)
Area averaged loss rate (Fm) =    0.0951(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      301.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Initial subarea data:
Initial area flow distance =    30.000(Ft.)
Top (of initial area) elevation =  1052.940(Ft.)
Bottom (of initial area) elevation =  1052.500(Ft.)
Difference in elevation =     0.440(Ft.)
Slope =    0.01467  s(%)=       1.47
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    2.757 min.
Rainfall intensity =      2.869(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      0.050(CFS)
Total initial stream area =        0.020(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.095(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      302.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.092(Ft.), Average velocity =   1.077(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00              0.50
       2            30.00              0.00
       3            60.00              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      0.545(CFS)
  '     '       flow top width =     11.017(Ft.)
  '     '    velocity=    1.077(Ft/s)
  '     '       area =      0.506(Sq.Ft)
  '     '       Froude number =     0.886

Upstream point elevation =  1052.500(Ft.)
Downstream point elevation =  1051.360(Ft.)
Flow length =   211.000(Ft.)
```

```
Travel time  =    3.27 min.
Time of concentration =    6.02 min.
Depth of flow =   0.092(Ft.)
Average velocity =   1.077(Ft/s)
Total irregular channel flow =     0.545(CFS)
Irregular channel normal depth above invert elev. =   0.092(Ft.)
Average velocity of channel(s) =   1.077(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Rainfall intensity =      1.795(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.852
Subarea runoff =      0.903(CFS) for    0.603(Ac.)
Total runoff =      0.953(CFS)
Effective area this stream =        0.62(Ac.)
Total Study Area (Main Stream No. 2) =        2.10(Ac.)
Area averaged Fm value =    0.095(In/Hr)
Depth of flow =   0.113(Ft.), Average velocity =   1.239(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      303.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1051.360(Ft.)
Downstream point/station elevation =  1050.380(Ft.)
Pipe length  =   208.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.953(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     0.953(CFS)
Normal flow depth in pipe =    6.32(In.)
Flow top width inside pipe =    8.23(In.)
Critical Depth =    5.36(In.)
Pipe flow velocity =      2.88(Ft/s)
Travel time through pipe =    1.20 min.
Time of concentration (TC) =     7.23 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      303.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.623(Ac.)
Runoff from this stream =      0.953(CFS)
Time of concentration =    7.23 min.
Rainfall intensity =     1.609(In/Hr)
Area averaged loss rate (Fm) =    0.0951(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min)  (In/Hr)      (In/Hr)


1      1.39     0.840      5.33    0.095      1.933
2      0.95     0.623      7.23    0.095      1.609
Qmax(1) =
          1.000 *    1.000 *     1.389) +
          1.213 *    0.737 *     0.953) + =       2.242
Qmax(2) =
          0.824 *    1.000 *     1.389) +
          1.000 *    1.000 *     0.953) + =       2.098
```

```
Total of 2 streams to confluence:
Flow rates before confluence point:
       1.389       0.953
Maximum flow rates at confluence using above data:
        2.242        2.098
Area of streams before confluence:
        0.840        0.623
Effective area values after confluence:
        1.299        1.463
Results of confluence:
Total flow rate =      2.242(CFS)
Time of concentration =     5.327 min.
Effective stream area after confluence =      1.299(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.095(In/Hr)
Study area total (this main stream) =       1.46(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      306.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1050.380(Ft.)
Downstream point/station elevation =  1050.000(Ft.)
Pipe length  =    15.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.242(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     2.242(CFS)
Normal flow depth in pipe =    6.39(In.)
Flow top width inside pipe =    8.17(In.)
Critical Depth =    8.04(In.)
Pipe flow velocity =      6.69(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     5.36 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      306.000 to Point/Station      306.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.299(Ac.)
Runoff from this stream =      2.242(CFS)
Time of concentration =    5.36 min.
Rainfall intensity =     1.924(In/Hr)
Area averaged loss rate (Fm) =    0.0951(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min)  (In/Hr)      (In/Hr)


1      0.89     0.638      7.99    0.095      1.515
2      2.24     1.299      5.36    0.095      1.924
Qmax(1) =
          1.000 *    1.000 *     0.888) +
          0.776 *    1.000 *     2.242) + =       2.628
Qmax(2) =
          1.288 *    0.671 *     0.888) +
          1.000 *    1.000 *     2.242) + =       3.009

Total of 2 main streams to confluence:
Flow rates before confluence point:
       1.888       3.242
Maximum flow rates at confluence using above data:
        2.628        3.009
Area of streams before confluence:
        0.638        1.299
Effective area values after confluence:
```

```
        1.937        1.727


Results of confluence:
Total flow rate =      3.009(CFS)
Time of concentration =     5.365 min.
Effective stream area after confluence  =      1.727(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.095(In/Hr)
Study area total =       1.94(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      306.000 to Point/Station      307.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1050.000(Ft.)
Downstream point/station elevation =  1049.000(Ft.)
Pipe length  =    30.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.009(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     3.009(CFS)
Normal flow depth in pipe =    7.35(In.)
Flow top width inside pipe =    6.97(In.)
Critical depth could not be calculated.
Pipe flow velocity =      7.79(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =     5.43 min.
End of computations, Total Study Area =            2.10 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  56.0
```

POST-DEVELOPED CONDITIONS
MITIGATED 2-YEAR STORM RATIONAL METHOD

```
                San Bernardino County Rational Hydrology Program

                     (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2012 Version 7.2
       Rational Hydrology Study        Date: 07/26/22
------------------------------------------------------------------------
POST DEVELOPMENT - POC1 MIT
2 YEAR - RATIONAL METHOD
BY WARE MALCOMB
FILE: POC1Q2MIT.RSB
------------------------------------------------------------------------


Program License Serial Number 6312

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is     2.0
Computed rainfall intensity:
Storm year =     2.00   1 hour rainfall =     0.452 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 1


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      113.000 to Point/Station      113.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Rainfall intensity =      0.997(In/Hr) for a     2.0 year storm
User specified values are as follows:
TC =  16.06 min.  Rain intensity =       1.00(In/Hr)
Total area this stream =        1.70(Ac.)
Total Study Area (Main Stream No. 1) =       1.70(Ac.)
Total runoff =      0.35(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      113.000 to Point/Station      114.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1049.000(Ft.)
Downstream point/station elevation =  1048.000(Ft.)
Pipe length  =    31.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.353(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.353(CFS)
Normal flow depth in pipe =    2.45(In.)
Flow top width inside pipe =    5.90(In.)
Critical Depth =    3.61(In.)
Pipe flow velocity =      4.68(Ft/s)
Travel time through pipe =    0.11 min.
Time of concentration (TC) =    16.17 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      114.000 to Point/Station      104.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Depth of flow =   0.115(Ft.), Average velocity =   1.069(Ft/s)
```

```
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2              0.00              0.00
       3             20.00              0.40
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      0.353(CFS)
  '     '       flow top width =      5.747(Ft.)
  '     '    velocity=    1.069(Ft/s)
  '     '       area =      0.330(Sq.Ft)
  '     '       Froude number =     0.786

Upstream point elevation =  1048.000(Ft.)
Downstream point elevation =  1047.000(Ft.)
Flow length =   247.000(Ft.)
Travel time  =    3.85 min.
Time of concentration =   20.02 min.
Depth of flow =   0.115(Ft.)
Average velocity =   1.069(Ft/s)
Total irregular channel flow =     0.353(CFS)
Irregular channel normal depth above invert elev. =   0.115(Ft.)
Average velocity of channel(s) =   1.069(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.703(Ac.)
Runoff from this stream =      0.353(CFS)
Time of concentration =   20.02 min.
Rainfall intensity =     0.873(In/Hr)
Area averaged loss rate (Fm) =    0.0951(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      107.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Rainfall intensity =      1.122(In/Hr) for a     2.0 year storm
User specified values are as follows:
TC =  13.19 min.  Rain intensity =       1.12(In/Hr)
Total area this stream =         0.30(Ac.)
Total Study Area (Main Stream No. 2) =        2.00(Ac.)
Total runoff =      0.21(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1045.750(Ft.)
Downstream point/station elevation =  1045.000(Ft.)
Pipe length  =    39.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.214(CFS)
Nearest computed pipe diameter  =      6.00(In.)
```

```
Calculated individual pipe flow  =     0.214(CFS)
Normal flow depth in pipe =    2.15(In.)
Flow top width inside pipe =    5.75(In.)
Critical Depth =    2.78(In.)
Pipe flow velocity =      3.38(Ft/s)
Travel time through pipe =    0.19 min.
Time of concentration (TC) =    13.38 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.297(Ac.)
Runoff from this stream =      0.214(CFS)
Time of concentration =   13.38 min.
Rainfall intensity =     1.112(In/Hr)
Area averaged loss rate (Fm) =    0.0951(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      102.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 1 = 36.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Rainfall intensity =      1.262(In/Hr) for a     2.0 year storm
User specified values are as follows:
TC =  10.84 min.  Rain intensity =       1.26(In/Hr)
Total area this stream =         0.56(Ac.)
Total Study Area (Main Stream No. 2) =        2.56(Ac.)
Total runoff =      0.33(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1045.500(Ft.)
Downstream point/station elevation =  1045.000(Ft.)
Pipe length  =    16.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.327(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.327(CFS)
Normal flow depth in pipe =    2.37(In.)
Flow top width inside pipe =    5.87(In.)
Critical Depth =    3.47(In.)
Pipe flow velocity =      4.53(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =    10.90 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.561(Ac.)
Runoff from this stream =      0.327(CFS)
Time of concentration =   10.90 min.
Rainfall intensity =     1.258(In/Hr)
Area averaged loss rate (Fm) =    0.0951(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
```

```
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min)  (In/Hr)     (In/Hr)


1      0.21     0.297     13.38    0.095      1.112
2      0.33     0.561     10.90    0.095      1.258
Qmax(1) =
          1.000 *    1.000 *     0.214) +
          0.875 *    1.000 *     0.327) + =       0.500
Qmax(2) =
          1.143 *    0.814 *     0.214) +
          1.000 *    1.000 *     0.327) + =       0.526

Total of 2 streams to confluence:
Flow rates before confluence point:
       0.214       0.327
Maximum flow rates at confluence using above data:
        0.500       0.526
Area of streams before confluence:
        0.297       0.561
Effective area values after confluence:
        0.858       0.803
Results of confluence:
Total flow rate =      0.526(CFS)
Time of concentration =    10.899 min.
Effective stream area after confluence =      0.803(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.095(In/Hr)
Study area total (this main stream) =      0.86(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1049.230(Ft.)
Downstream point/station elevation =  1048.400(Ft.)
Pipe length  =    21.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.526(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.526(CFS)
Normal flow depth in pipe =    2.90(In.)
Flow top width inside pipe =    6.00(In.)
Critical Depth =    4.44(In.)
Pipe flow velocity =      5.60(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =    10.96 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.803(Ac.)
Runoff from this stream =      0.526(CFS)
Time of concentration =   10.96 min.
Rainfall intensity =     1.253(In/Hr)
Area averaged loss rate (Fm) =    0.0951(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min)  (In/Hr)     (In/Hr)


1      0.35     1.703     20.02    0.095      0.873
2      0.53     0.803     10.96    0.095      1.253
```

```
Qmax(1) =
          1.000 *    1.000 *     0.353) +
          0.672 *    1.000 *     0.526) + =       0.707
Qmax(2) =
          1.489 *    0.547 *     0.353) +
          1.000 *    1.000 *     0.526) + =       0.814

Total of 2 main streams to confluence:
Flow rates before confluence point:
       1.353       1.526
Maximum flow rates at confluence using above data:
        0.707        0.814
Area of streams before confluence:
        1.703        0.803
Effective area values after confluence:
        2.506        1.735


Results of confluence:
Total flow rate =       0.814(CFS)
Time of concentration =    10.961 min.
Effective stream area after confluence  =      1.735(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.095(In/Hr)
Study area total =       2.51(Ac.)
End of computations, Total Study Area =           2.56 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  56.0
```

```
               San Bernardino County Rational Hydrology Program

                    (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2012 Version 7.2
       Rational Hydrology Study        Date: 07/26/22
------------------------------------------------------------------------
POST DEVELOPMENT - POC2 MIT
2 YEAR - RATIONAL METHOD
BY WARE MALCOMB
FILE: POC2Q2MIT.RSB
------------------------------------------------------------------------


Program License Serial Number 6312

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.220 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      212.000 to Point/Station      212.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Rainfall intensity =      3.900(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =   8.65 min.  Rain intensity =       3.90(In/Hr)
Total area this stream =         0.62(Ac.)
Total Study Area (Main Stream No. 1) =        0.62(Ac.)
Total runoff =      0.64(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      212.000 to Point/Station      203.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Depth of flow =   0.139(Ft.), Average velocity =   1.320(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00              0.50
       2             0.00              0.00
       3            20.00              0.40
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      0.636(CFS)
  '     '       flow top width =      6.941(Ft.)
  '     '    velocity=    1.320(Ft/s)
  '     '       area =      0.482(Sq.Ft)
  '     '       Froude number =     0.883

Upstream point elevation =  1049.340(Ft.)
Downstream point elevation =  1048.000(Ft.)
Flow length =   279.000(Ft.)
```

```
Travel time  =    3.52 min.
Time of concentration =   12.17 min.
Depth of flow =   0.139(Ft.)
Average velocity =   1.320(Ft/s)
Total irregular channel flow =     0.636(CFS)
Irregular channel normal depth above invert elev. =   0.139(Ft.)
Average velocity of channel(s) =   1.320(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.621(Ac.)
Runoff from this stream =      0.636(CFS)
Time of concentration =   12.17 min.
Rainfall intensity =     3.177(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      202.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Rainfall intensity =      3.058(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  12.97 min.  Rain intensity =       3.06(In/Hr)
Total area this stream =         0.62(Ac.)
Total Study Area (Main Stream No. 2) =        1.24(Ac.)
Total runoff =      0.62(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1049.160(Ft.)
Downstream point/station elevation =  1049.000(Ft.)
Pipe length  =    14.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.624(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     0.624(CFS)
Normal flow depth in pipe =    3.69(In.)
Flow top width inside pipe =    8.85(In.)
Critical Depth =    4.30(In.)
Pipe flow velocity =      3.66(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =    13.03 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.620(Ac.)
Runoff from this stream =      0.624(CFS)
Time of concentration =   13.03 min.
```

```
Rainfall intensity =     3.049(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min)  (In/Hr)     (In/Hr)


1      0.64     0.621     12.17    0.044      3.177
2      0.62     0.620     13.03    0.044      3.049
Qmax(1) =
          1.000 *    1.000 *     0.636) +
          1.042 *    0.934 *     0.624) + =       1.244
Qmax(2) =
          0.959 *    1.000 *     0.636) +
          1.000 *    1.000 *     0.624) + =       1.234

Total of 2 main streams to confluence:
Flow rates before confluence point:
       1.636       1.624
Maximum flow rates at confluence using above data:
        1.244        1.234
Area of streams before confluence:
        0.621        0.620
Effective area values after confluence:
        1.200        1.241


Results of confluence:
Total flow rate =       1.244(CFS)
Time of concentration =    12.172 min.
Effective stream area after confluence  =      1.200(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.044(In/Hr)
Study area total =       1.24(Ac.)
End of computations, Total Study Area =           1.24 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  56.0
```

MITIGATED POC-3 HAS ONE (1) BMP AND DOES NOT REQUIRE CONFLUENCING. NO CIVILD IS REQUIRED FOR POC-3. MITIGATED RUNOFF FOR POC-3 IS THE FOLLOWING:

T_c = 30.37 MIN

Q = 0.35 CFS

REFER TO THE HYDRAFLOW HYDROGRAPH ANALYSIS IN APPENDIX D.

POST-DEVELOPED CONDITIONS
UNMITIGATED 100-YEAR STORM RATIONAL METHOD

```
                San Bernardino County Rational Hydrology Program

                    (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2012 Version 7.2
       Rational Hydrology Study        Date: 07/25/22
------------------------------------------------------------------------
POST DEVELOPMENT - POC1 UNMIT
100 YEAR - RATIONAL METHOD
BY WARE MALCOMB
FILE: POC1Q100.RSB
------------------------------------------------------------------------


Program License Serial Number 6312

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.220 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      115.000 to Point/Station      116.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Initial subarea data:
Initial area flow distance =    33.000(Ft.)
Top (of initial area) elevation =  1051.590(Ft.)
Bottom (of initial area) elevation =  1051.420(Ft.)
Difference in elevation =     0.170(Ft.)
Slope =    0.00515  s(%)=       0.52
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    3.531 min.
Rainfall intensity =      6.676(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.894
Subarea runoff =      0.107(CFS)
Total initial stream area =        0.018(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.044(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      116.000 to Point/Station      117.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.139(Ft.), Average velocity =   1.418(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             30.00              0.00
       3             60.00              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
```

```
Sub-Channel flow  =      1.641(CFS)
  '     '       flow top width =     16.665(Ft.)
  '     '    velocity=    1.418(Ft/s)
  '     '       area =      1.157(Sq.Ft)
  '     '       Froude number =     0.948

Upstream point elevation =  1051.420(Ft.)
Downstream point elevation =  1049.980(Ft.)
Flow length =   267.000(Ft.)
Travel time  =    3.14 min.
Time of concentration =    6.67 min.
Depth of flow =   0.139(Ft.)
Average velocity =   1.418(Ft/s)
Total irregular channel flow =     1.641(CFS)
Irregular channel normal depth above invert elev. =   0.139(Ft.)
Average velocity of channel(s) =   1.418(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Rainfall intensity =      4.558(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.891
Subarea runoff =      3.009(CFS) for    0.749(Ac.)
Total runoff =      3.116(CFS)
Effective area this stream =        0.77(Ac.)
Total Study Area (Main Stream No. 1) =        0.77(Ac.)
Area averaged Fm value =    0.044(In/Hr)
Depth of flow =   0.177(Ft.), Average velocity =   1.665(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      117.000 to Point/Station      112.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1049.980(Ft.)
Downstream point/station elevation =  1044.000(Ft.)
Pipe length  =   299.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.116(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     3.116(CFS)
Normal flow depth in pipe =    6.83(In.)
Flow top width inside pipe =   11.88(In.)
Critical Depth =    9.08(In.)
Pipe flow velocity =      6.75(Ft/s)
Travel time through pipe =    0.74 min.
Time of concentration (TC) =     7.41 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      112.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.767(Ac.)
Runoff from this stream =      3.116(CFS)
Time of concentration =    7.41 min.
Rainfall intensity =     4.280(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      111.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
```

```
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Initial subarea data:
Initial area flow distance =    19.000(Ft.)
Top (of initial area) elevation =  1051.130(Ft.)
Bottom (of initial area) elevation =  1050.750(Ft.)
Difference in elevation =     0.380(Ft.)
Slope =    0.02000  s(%)=       2.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    2.159 min.
Rainfall intensity =      8.969(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.896
Subarea runoff =      0.104(CFS)
Total initial stream area =        0.013(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.044(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      112.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.169(Ft.), Average velocity =   1.363(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00              0.50
       2            30.00              0.00
       3            60.00              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      2.335(CFS)
  '     '       flow top width =     20.272(Ft.)
  '     '    velocity=    1.363(Ft/s)
  '     '       area =      1.712(Sq.Ft)
  '     '       Froude number =     0.827

Upstream point elevation =  1050.750(Ft.)
Downstream point elevation =  1049.840(Ft.)
Flow length =   237.000(Ft.)
Travel time  =    2.90 min.
Time of concentration =    5.06 min.
Depth of flow =   0.169(Ft.)
Average velocity =   1.363(Ft/s)
Total irregular channel flow =     2.335(CFS)
Irregular channel normal depth above invert elev. =   0.169(Ft.)
Average velocity of channel(s) =   1.363(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Rainfall intensity =      5.382(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.893
Subarea runoff =      4.393(CFS) for    0.923(Ac.)
Total runoff =      4.497(CFS)
Effective area this stream =        0.94(Ac.)
Total Study Area (Main Stream No. 1) =        1.70(Ac.)
```

```
Area averaged Fm value =    0.044(In/Hr)
Depth of flow =   0.216(Ft.), Average velocity =   1.606(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      112.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.936(Ac.)
Runoff from this stream =      4.497(CFS)
Time of concentration =    5.06 min.
Rainfall intensity =     5.382(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min)  (In/Hr)      (In/Hr)


1      3.12     0.767      7.41    0.044      4.280
2      4.50     0.936      5.06    0.044      5.382
Qmax(1) =
          1.000 *    1.000 *     3.116) +
          0.794 *    1.000 *     4.497) + =       6.685
Qmax(2) =
          1.260 *    0.683 *     3.116) +
          1.000 *    1.000 *     4.497) + =       7.178

Total of 2 streams to confluence:
Flow rates before confluence point:
       3.116       4.497
Maximum flow rates at confluence using above data:
        6.685       7.178
Area of streams before confluence:
        0.767       0.936
Effective area values after confluence:
        1.703       1.460
Results of confluence:
Total flow rate =      7.178(CFS)
Time of concentration =     5.056 min.
Effective stream area after confluence =      1.460(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.044(In/Hr)
Study area total (this main stream) =       1.70(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      113.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1049.840(Ft.)
Downstream point/station elevation =  1049.000(Ft.)
Pipe length  =     5.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.178(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     7.178(CFS)
Normal flow depth in pipe =    5.94(In.)
Flow top width inside pipe =   12.00(In.)
Critical depth could not be calculated.
Pipe flow velocity =     18.52(Ft/s)
Travel time through pipe =    0.00 min.
Time of concentration (TC) =     5.06 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      113.000 to Point/Station      114.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1049.000(Ft.)
```

```
Downstream point/station elevation =  1048.000(Ft.)
Pipe length  =    31.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.178(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     7.178(CFS)
Normal flow depth in pipe =    8.53(In.)
Flow top width inside pipe =   14.86(In.)
Critical Depth =   12.86(In.)
Pipe flow velocity =      9.95(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     5.11 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      114.000 to Point/Station      104.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Depth of flow =   0.356(Ft.), Average velocity =   2.270(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00             0.50
       2             0.00             0.00
       3            20.00             0.40
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      7.178(CFS)
  '     '       flow top width =     17.784(Ft.)
  '     '    velocity=    2.270(Ft/s)
  '     '       area =      3.163(Sq.Ft)
  '     '       Froude number =     0.948

Upstream point elevation =  1048.000(Ft.)
Downstream point elevation =  1047.000(Ft.)
Flow length =   247.000(Ft.)
Travel time  =    1.81 min.
Time of concentration =    6.93 min.
Depth of flow =   0.356(Ft.)
Average velocity =   2.270(Ft/s)
Total irregular channel flow =     7.178(CFS)
Irregular channel normal depth above invert elev. =   0.356(Ft.)
Average velocity of channel(s) =   2.270(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.460(Ac.)
Runoff from this stream =      7.178(CFS)
Time of concentration =    6.93 min.
Rainfall intensity =     4.456(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


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Process from Point/Station      105.000 to Point/Station      106.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
```

```
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Initial subarea data:
Initial area flow distance =    31.000(Ft.)
Top (of initial area) elevation =  1051.000(Ft.)
Bottom (of initial area) elevation =  1050.700(Ft.)
Difference in elevation =     0.300(Ft.)
Slope =    0.00968  s(%)=       0.97
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    3.036 min.
Rainfall intensity =      7.310(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.895
Subarea runoff =      0.085(CFS)
Total initial stream area =        0.013(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.044(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      107.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.103(Ft.), Average velocity =   0.912(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              1.00
       2              3.00              0.00
       3             10.00              0.00
       4             13.00              1.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =      0.684(CFS)
  '     '       flow top width =      7.615(Ft.)
  '     '    velocity=    0.912(Ft/s)
  '     '       area =      0.750(Sq.Ft)
  '     '       Froude number =     0.512

Upstream point elevation =  1050.700(Ft.)
Downstream point elevation =  1048.750(Ft.)
Flow length =   191.000(Ft.)
Travel time  =    3.49 min.
Time of concentration =    6.53 min.
Depth of flow =   0.103(Ft.)
Average velocity =   0.912(Ft/s)
Total irregular channel flow =     0.684(CFS)
Irregular channel normal depth above invert elev. =   0.103(Ft.)
Average velocity of channel(s) =   0.912(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Rainfall intensity =      4.618(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.891
Subarea runoff =      1.138(CFS) for    0.284(Ac.)
Total runoff =      1.223(CFS)
Effective area this stream =        0.30(Ac.)
Total Study Area (Main Stream No. 2) =        2.00(Ac.)
Area averaged Fm value =    0.044(In/Hr)
Depth of flow =   0.145(Ft.), Average velocity =   1.135(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      103.000
```

```
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1048.750(Ft.)
Downstream point/station elevation =  1048.000(Ft.)
Pipe length  =    39.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.223(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.223(CFS)
Normal flow depth in pipe =    4.68(In.)
Flow top width inside pipe =    8.99(In.)
Critical Depth =    6.11(In.)
Pipe flow velocity =      5.28(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =     6.65 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.297(Ac.)
Runoff from this stream =      1.223(CFS)
Time of concentration =    6.65 min.
Rainfall intensity =     4.566(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      101.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Initial subarea data:
Initial area flow distance =    20.000(Ft.)
Top (of initial area) elevation =  1051.000(Ft.)
Bottom (of initial area) elevation =  1050.700(Ft.)
Difference in elevation =     0.300(Ft.)
Slope =    0.01500  s(%)=       1.50
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    2.334 min.
Rainfall intensity =      8.559(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.895
Subarea runoff =      0.077(CFS)
Total initial stream area =       0.010(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.044(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.121(Ft.), Average velocity =   1.615(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00             0.50
       2            30.00             0.00
       3            60.00             0.50
Manning's 'N' friction factor =   0.013
```

```
-----------------------------------------------------------------
Sub-Channel flow  =      1.422(CFS)
  '     '       flow top width =     14.534(Ft.)
  '     '    velocity=    1.615(Ft/s)
  '     '       area =      0.880(Sq.Ft)
  '     '       Froude number =     1.157

Upstream point elevation =  1050.700(Ft.)
Downstream point elevation =  1048.500(Ft.)
Flow length =   262.000(Ft.)
Travel time  =    2.70 min.
Time of concentration =    5.04 min.
Depth of flow =   0.121(Ft.)
Average velocity =   1.615(Ft/s)
Total irregular channel flow =     1.422(CFS)
Irregular channel normal depth above invert elev. =   0.121(Ft.)
Average velocity of channel(s) =   1.615(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Rainfall intensity =      5.394(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.893
Subarea runoff =      2.625(CFS) for    0.551(Ac.)
Total runoff =      2.701(CFS)
Effective area this stream =        0.56(Ac.)
Total Study Area (Main Stream No. 2) =        2.56(Ac.)
Area averaged Fm value =    0.044(In/Hr)
Depth of flow =   0.154(Ft.), Average velocity =   1.896(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1048.500(Ft.)
Downstream point/station elevation =  1048.000(Ft.)
Pipe length  =    16.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.701(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     2.701(CFS)
Normal flow depth in pipe =    6.82(In.)
Flow top width inside pipe =    7.71(In.)
Critical Depth =    8.47(In.)
Pipe flow velocity =      7.51(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     5.07 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.561(Ac.)
Runoff from this stream =      2.701(CFS)
Time of concentration =    5.07 min.
Rainfall intensity =     5.372(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min)  (In/Hr)     (In/Hr)
```

```
1      1.22     0.297      6.65    0.044      4.566
2      2.70     0.561      5.07    0.044      5.372
Qmax(1) =
          1.000 *    1.000 *     1.223) +
          0.849 *    1.000 *     2.701) + =       3.516
Qmax(2) =
          1.178 *    0.763 *     1.223) +
          1.000 *    1.000 *     2.701) + =       3.800

Total of 2 streams to confluence:
Flow rates before confluence point:
       1.223       2.701
Maximum flow rates at confluence using above data:
        3.516       3.800
Area of streams before confluence:
        0.297       0.561
Effective area values after confluence:
        0.858       0.788
Results of confluence:
Total flow rate =      3.800(CFS)
Time of concentration =     5.073 min.
Effective stream area after confluence =      0.788(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.044(In/Hr)
Study area total (this main stream) =      0.86(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Depth of flow =   0.104(Ft.), Average velocity =   3.485(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00             0.50
       2            50.00             0.00
       3           100.00             0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      3.800(CFS)
  '     '       flow top width =     20.886(Ft.)
  '     '    velocity=    3.485(Ft/s)
  '     '       area =      1.091(Sq.Ft)
  '     '       Froude number =     2.687

Upstream point elevation =  1048.000(Ft.)
Downstream point elevation =  1047.000(Ft.)
Flow length =    21.000(Ft.)
Travel time  =    0.10 min.
Time of concentration =    5.17 min.
Depth of flow =   0.104(Ft.)
Average velocity =   3.485(Ft/s)
Total irregular channel flow =     3.800(CFS)
Irregular channel normal depth above invert elev. =   0.104(Ft.)
Average velocity of channel(s) =   3.485(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.788(Ac.)
Runoff from this stream =      3.800(CFS)
Time of concentration =    5.17 min.
Rainfall intensity =     5.309(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
```

```
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min)  (In/Hr)      (In/Hr)


1      7.18     1.460      6.93    0.044      4.456
2      3.80     0.788      5.17    0.044      5.309
Qmax(1) =
          1.000 *    1.000 *     7.178) +
          0.838 *    1.000 *     3.800) + =      10.362
Qmax(2) =
          1.193 *    0.747 *     7.178) +
          1.000 *    1.000 *     3.800) + =      10.197

Total of 2 main streams to confluence:
Flow rates before confluence point:
       8.178       4.800
Maximum flow rates at confluence using above data:
       10.362       10.197
Area of streams before confluence:
        1.460        0.788
Effective area values after confluence:
        2.247        1.878


Results of confluence:
Total flow rate =      10.362(CFS)
Time of concentration =     6.926 min.
Effective stream area after confluence  =      2.247(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.044(In/Hr)
Study area total =       2.25(Ac.)
End of computations, Total Study Area =           2.56 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  56.0
```

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              San Bernardino County Rational Hydrology Program

                  (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2012 Version 7.2
       Rational Hydrology Study        Date: 07/25/22
------------------------------------------------------------------------
POST DEVELOPMENT - POC2 UNMIT
100 YEAR - RATIONAL METHOD
BY WARE MALCOMB
FILE: POC2Q100.RSB
------------------------------------------------------------------------


Program License Serial Number 6312

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.220 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      210.000 to Point/Station      211.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Initial subarea data:
Initial area flow distance =    50.000(Ft.)
Top (of initial area) elevation =  1051.500(Ft.)
Bottom (of initial area) elevation =  1051.000(Ft.)
Difference in elevation =     0.500(Ft.)
Slope =    0.01000  s(%)=       1.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    3.651 min.
Rainfall intensity =      6.543(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.894
Subarea runoff =      0.070(CFS)
Total initial stream area =        0.012(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.044(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      211.000 to Point/Station      212.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.126(Ft.), Average velocity =   1.332(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             30.00              0.00
       3             60.00              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
```

```
Sub-Channel flow  =      1.261(CFS)
  '     '       flow top width =     15.074(Ft.)
  '     '    velocity=    1.332(Ft/s)
  '     '       area =      0.947(Sq.Ft)
  '     '       Froude number =     0.937

Upstream point elevation =  1051.000(Ft.)
Downstream point elevation =  1049.340(Ft.)
Flow length =   305.000(Ft.)
Travel time  =    3.82 min.
Time of concentration =    7.47 min.
Depth of flow =   0.126(Ft.)
Average velocity =   1.332(Ft/s)
Total irregular channel flow =     1.261(CFS)
Irregular channel normal depth above invert elev. =   0.126(Ft.)
Average velocity of channel(s) =   1.332(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Rainfall intensity =      4.260(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.891
Subarea runoff =      2.286(CFS) for    0.609(Ac.)
Total runoff =      2.356(CFS)
Effective area this stream =        0.62(Ac.)
Total Study Area (Main Stream No. 1) =        0.62(Ac.)
Area averaged Fm value =    0.044(In/Hr)
Depth of flow =   0.159(Ft.), Average velocity =   1.558(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      212.000 to Point/Station      203.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Depth of flow =   0.227(Ft.), Average velocity =   1.832(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2              0.00              0.00
       3             20.00              0.40
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      2.356(CFS)
  '     '       flow top width =     11.342(Ft.)
  '     '    velocity=    1.832(Ft/s)
  '     '       area =      1.286(Sq.Ft)
  '     '       Froude number =     0.958

Upstream point elevation =  1049.340(Ft.)
Downstream point elevation =  1048.000(Ft.)
Flow length =   279.000(Ft.)
Travel time  =    2.54 min.
Time of concentration =   10.01 min.
Depth of flow =   0.227(Ft.)
Average velocity =   1.832(Ft/s)
Total irregular channel flow =     2.356(CFS)
Irregular channel normal depth above invert elev. =   0.227(Ft.)
Average velocity of channel(s) =   1.832(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** CONFLUENCE OF MAIN STREAMS ****
```

```
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.621(Ac.)
Runoff from this stream =      2.356(CFS)
Time of concentration =   10.01 min.
Rainfall intensity =     3.574(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      201.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Initial subarea data:
Initial area flow distance =    50.000(Ft.)
Top (of initial area) elevation =  1051.500(Ft.)
Bottom (of initial area) elevation =  1051.000(Ft.)
Difference in elevation =     0.500(Ft.)
Slope =    0.01000  s(%)=       1.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    3.651 min.
Rainfall intensity =      6.543(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.894
Subarea runoff =      0.064(CFS)
Total initial stream area =        0.011(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.044(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.123(Ft.), Average velocity =   1.434(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              0.50
      2             30.00              0.00
      3             60.00              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      1.304(CFS)
  '     '       flow top width =     14.773(Ft.)
  '     '    velocity=    1.434(Ft/s)
  '     '       area =      0.909(Sq.Ft)
  '     '       Froude number =     1.019

Upstream point elevation =  1051.000(Ft.)
Downstream point elevation =  1049.160(Ft.)
Flow length =   284.000(Ft.)
Travel time  =    3.30 min.
Time of concentration =    6.95 min.
Depth of flow =   0.123(Ft.)
Average velocity =   1.434(Ft/s)
Total irregular channel flow =     1.304(CFS)
Irregular channel normal depth above invert elev. =   0.123(Ft.)
Average velocity of channel(s) =   1.434(Ft/s)
```

```
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Rainfall intensity =      4.446(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.891
Subarea runoff =      2.392(CFS) for    0.609(Ac.)
Total runoff =      2.456(CFS)
Effective area this stream =        0.62(Ac.)
Total Study Area (Main Stream No. 2) =        1.24(Ac.)
Area averaged Fm value =    0.044(In/Hr)
Depth of flow =   0.156(Ft.), Average velocity =   1.680(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      203.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Depth of flow =   0.080(Ft.), Average velocity =   3.846(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00              0.50
       2            50.00              0.00
       3           100.00              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      2.456(CFS)
  '     '       flow top width =     15.984(Ft.)
  '     '    velocity=    3.846(Ft/s)
  '     '       area =      0.639(Sq.Ft)
  '     '       Froude number =     3.390

Upstream point elevation =  1049.160(Ft.)
Downstream point elevation =  1048.000(Ft.)
Flow length =    14.000(Ft.)
Travel time  =    0.06 min.
Time of concentration =    7.01 min.
Depth of flow =   0.080(Ft.)
Average velocity =   3.846(Ft/s)
Total irregular channel flow =     2.456(CFS)
Irregular channel normal depth above invert elev. =   0.080(Ft.)
Average velocity of channel(s) =   3.846(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.620(Ac.)
Runoff from this stream =      2.456(CFS)
Time of concentration =    7.01 min.
Rainfall intensity =     4.423(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min)  (In/Hr)      (In/Hr)


1      2.36     0.621     10.01    0.044      3.574
```

```
2      2.46     0.620      7.01    0.044      4.423
Qmax(1) =
          1.000 *    1.000 *     2.356) +
          0.806 *    1.000 *     2.456) + =       4.336
Qmax(2) =
          1.241 *    0.701 *     2.356) +
          1.000 *    1.000 *     2.456) + =       4.505

Total of 2 main streams to confluence:
Flow rates before confluence point:
       3.356       3.456
Maximum flow rates at confluence using above data:
        4.336        4.505
Area of streams before confluence:
        0.621        0.620
Effective area values after confluence:
        1.241        1.055


Results of confluence:
Total flow rate =       4.505(CFS)
Time of concentration =     7.012 min.
Effective stream area after confluence  =      1.055(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.044(In/Hr)
Study area total =       1.24(Ac.)
End of computations, Total Study Area =            1.24 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  56.0
```

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              San Bernardino County Rational Hydrology Program

                 (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2012 Version 7.2
       Rational Hydrology Study        Date: 07/25/22
------------------------------------------------------------------------
POST DEVELOPMENT - POC3 UNMIT
100 YEAR - RATIONAL METHOD
BY WARE MALCOMB
FILE: POC3Q100.RSB
------------------------------------------------------------------------


Program License Serial Number 6312

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.220 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      308.000 to Point/Station      309.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Initial subarea data:
Initial area flow distance =    36.000(Ft.)
Top (of initial area) elevation =  1053.440(Ft.)
Bottom (of initial area) elevation =  1052.980(Ft.)
Difference in elevation =     0.460(Ft.)
Slope =    0.01278  s(%)=       1.28
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    3.049 min.
Rainfall intensity =      7.291(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.895
Subarea runoff =      0.137(CFS)
Total initial stream area =        0.021(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.044(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      309.000 to Point/Station      310.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.126(Ft.), Average velocity =   1.538(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00              0.50
       2            30.00              0.00
       3            60.00              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
```

```
Sub-Channel flow  =      1.467(CFS)
  '     '       flow top width =     15.132(Ft.)
  '     '    velocity=    1.538(Ft/s)
  '     '       area =      0.954(Sq.Ft)
  '     '       Froude number =     1.079

Upstream point elevation =  1052.980(Ft.)
Downstream point elevation =  1050.960(Ft.)
Flow length =   280.000(Ft.)
Travel time  =    3.03 min.
Time of concentration =    6.08 min.
Depth of flow =   0.126(Ft.)
Average velocity =   1.538(Ft/s)
Total irregular channel flow =     1.467(CFS)
Irregular channel normal depth above invert elev. =   0.126(Ft.)
Average velocity of channel(s) =   1.538(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Rainfall intensity =      4.817(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.892
Subarea runoff =      2.604(CFS) for    0.617(Ac.)
Total runoff =      2.741(CFS)
Effective area this stream =        0.64(Ac.)
Total Study Area (Main Stream No. 1) =        0.64(Ac.)
Area averaged Fm value =    0.044(In/Hr)
Depth of flow =   0.159(Ft.), Average velocity =   1.798(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      310.000 to Point/Station      306.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1050.960(Ft.)
Downstream point/station elevation =  1050.000(Ft.)
Pipe length  =   179.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.741(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     2.741(CFS)
Normal flow depth in pipe =    8.19(In.)
Flow top width inside pipe =   14.94(In.)
Critical Depth =    7.98(In.)
Pipe flow velocity =      4.00(Ft/s)
Travel time through pipe =    0.75 min.
Time of concentration (TC) =     6.83 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      306.000 to Point/Station      306.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.638(Ac.)
Runoff from this stream =      2.741(CFS)
Time of concentration =    6.83 min.
Rainfall intensity =     4.494(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      304.000 to Point/Station      305.000
```

```
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Initial subarea data:
Initial area flow distance =    34.000(Ft.)
Top (of initial area) elevation =  1052.970(Ft.)
Bottom (of initial area) elevation =  1052.500(Ft.)
Difference in elevation =     0.470(Ft.)
Slope =    0.01382  s(%)=      1.38
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    2.933 min.
Rainfall intensity =      7.462(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.895
Subarea runoff =      0.134(CFS)
Total initial stream area =        0.020(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.044(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      305.000 to Point/Station      303.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.138(Ft.), Average velocity =   1.920(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             30.00              0.00
       3             60.00              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      2.183(CFS)
  '     '       flow top width =     16.521(Ft.)
  '     '    velocity=    1.920(Ft/s)
  '     '       area =      1.137(Sq.Ft)
  '     '       Froude number =     1.289

Upstream point elevation =  1052.500(Ft.)
Downstream point elevation =  1050.380(Ft.)
Flow length =   212.000(Ft.)
Travel time  =    1.84 min.
Time of concentration =    4.77 min.
Depth of flow =   0.138(Ft.)
Average velocity =   1.920(Ft/s)
Total irregular channel flow =     2.183(CFS)
Irregular channel normal depth above invert elev. =   0.138(Ft.)
Average velocity of channel(s) =   1.920(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Rainfall intensity =      5.571(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.893
Subarea runoff =      4.045(CFS) for    0.820(Ac.)
Total runoff =      4.178(CFS)
```

```
Effective area this stream =        0.84(Ac.)
Total Study Area (Main Stream No. 2) =        1.48(Ac.)
Area averaged Fm value =    0.044(In/Hr)
Depth of flow =   0.176(Ft.), Average velocity =   2.258(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      303.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.840(Ac.)
Runoff from this stream =      4.178(CFS)
Time of concentration =    4.77 min.
Rainfall intensity =     5.571(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      301.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Initial subarea data:
Initial area flow distance =    30.000(Ft.)
Top (of initial area) elevation =  1052.940(Ft.)
Bottom (of initial area) elevation =  1052.500(Ft.)
Difference in elevation =     0.440(Ft.)
Slope =    0.01467  s(%)=       1.47
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    2.757 min.
Rainfall intensity =      7.744(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.895
Subarea runoff =      0.139(CFS)
Total initial stream area =        0.020(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.044(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      302.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.136(Ft.), Average velocity =   1.400(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00              0.50
       2            30.00              0.00
       3            60.00              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      1.557(CFS)
  '     '       flow top width =     16.334(Ft.)
  '     '    velocity=    1.400(Ft/s)
  '     '       area =      1.112(Sq.Ft)
  '     '       Froude number =     0.946

Upstream point elevation =  1052.500(Ft.)
Downstream point elevation =  1051.360(Ft.)
Flow length =   211.000(Ft.)
```

```
Travel time  =    2.51 min.
Time of concentration =    5.27 min.
Depth of flow =   0.136(Ft.)
Average velocity =   1.400(Ft/s)
Total irregular channel flow =     1.557(CFS)
Irregular channel normal depth above invert elev. =   0.136(Ft.)
Average velocity of channel(s) =   1.400(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Rainfall intensity =      5.251(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.892
Subarea runoff =      2.781(CFS) for    0.603(Ac.)
Total runoff =      2.920(CFS)
Effective area this stream =        0.62(Ac.)
Total Study Area (Main Stream No. 2) =        2.10(Ac.)
Area averaged Fm value =    0.044(In/Hr)
Depth of flow =   0.172(Ft.), Average velocity =   1.639(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      303.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1051.360(Ft.)
Downstream point/station elevation =  1050.380(Ft.)
Pipe length  =   208.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.920(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     2.920(CFS)
Normal flow depth in pipe =    8.88(In.)
Flow top width inside pipe =   14.74(In.)
Critical Depth =    8.24(In.)
Pipe flow velocity =      3.86(Ft/s)
Travel time through pipe =    0.90 min.
Time of concentration (TC) =     6.17 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      303.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.623(Ac.)
Runoff from this stream =      2.920(CFS)
Time of concentration =    6.17 min.
Rainfall intensity =     4.778(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min)  (In/Hr)     (In/Hr)


1      4.18     0.840      4.77    0.044      5.571
2      2.92     0.623      6.17    0.044      4.778
Qmax(1) =
          1.000 *    1.000 *     4.178) +
          1.168 *    0.774 *     2.920) + =       6.817
Qmax(2) =
          0.856 *    1.000 *     4.178) +
          1.000 *    1.000 *     2.920) + =       6.498
```

```
Total of 2 streams to confluence:
Flow rates before confluence point:
       4.178       2.920
Maximum flow rates at confluence using above data:
        6.817       6.498
Area of streams before confluence:
        0.840       0.623
Effective area values after confluence:
        1.322       1.463
Results of confluence:
Total flow rate =      6.817(CFS)
Time of concentration =     4.774 min.
Effective stream area after confluence =      1.322(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.044(In/Hr)
Study area total (this main stream) =      1.46(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      306.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1050.380(Ft.)
Downstream point/station elevation =  1050.000(Ft.)
Pipe length  =    15.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.817(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     6.817(CFS)
Normal flow depth in pipe =    8.92(In.)
Flow top width inside pipe =   14.73(In.)
Critical Depth =   12.57(In.)
Pipe flow velocity =      8.96(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     4.80 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      306.000 to Point/Station      306.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.322(Ac.)
Runoff from this stream =      6.817(CFS)
Time of concentration =    4.80 min.
Rainfall intensity =     5.552(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min)  (In/Hr)     (In/Hr)


1      2.74     0.638      6.83    0.044      4.494
2      6.82     1.322      4.80    0.044      5.552
Qmax(1) =
          1.000 *    1.000 *     2.741) +
          0.808 *    1.000 *     6.817) + =       8.248
Qmax(2) =
          1.238 *    0.703 *     2.741) +
          1.000 *    1.000 *     6.817) + =       9.202

Total of 2 main streams to confluence:
Flow rates before confluence point:
       3.741       7.817
Maximum flow rates at confluence using above data:
        8.248       9.202
Area of streams before confluence:
        0.638       1.322
Effective area values after confluence:
```

```
        1.960        1.771


Results of confluence:
Total flow rate =      9.202(CFS)
Time of concentration =     4.802 min.
Effective stream area after confluence  =      1.771(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.044(In/Hr)
Study area total =       1.96(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      306.000 to Point/Station      307.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1050.000(Ft.)
Downstream point/station elevation =  1049.000(Ft.)
Pipe length  =    30.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.202(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     9.202(CFS)
Normal flow depth in pipe =    9.96(In.)
Flow top width inside pipe =   14.17(In.)
Critical Depth =   13.95(In.)
Pipe flow velocity =     10.63(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     4.85 min.
End of computations, Total Study Area =           2.10 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  56.0
```

POST-DEVELOPED CONDITIONS
MITIGATED 100-YEAR STORM RATIONAL METHOD

```
              San Bernardino County Rational Hydrology Program

                  (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2012 Version 7.2
       Rational Hydrology Study       Date: 07/26/22
------------------------------------------------------------------------
POST DEVELOPMENT - POC1 MIT
100 YEAR - RATIONAL METHOD
BY WARE MALCOMB
FILE: POC1Q100MIT.RSB
------------------------------------------------------------------------


Program License Serial Number 6312

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.220 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      113.000 to Point/Station      113.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Rainfall intensity =      1.684(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  35.06 min.  Rain intensity =       1.68(In/Hr)
Total area this stream =         1.70(Ac.)
Total Study Area (Main Stream No. 1) =       1.70(Ac.)
Total runoff =      0.69(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      113.000 to Point/Station      114.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1049.000(Ft.)
Downstream point/station elevation =  1048.000(Ft.)
Pipe length  =    31.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.689(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.689(CFS)
Normal flow depth in pipe =    3.64(In.)
Flow top width inside pipe =    5.86(In.)
Critical Depth =    5.03(In.)
Pipe flow velocity =      5.53(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =    35.15 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      114.000 to Point/Station      104.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Depth of flow =   0.148(Ft.), Average velocity =   1.263(Ft/s)
```

```
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2              0.00              0.00
       3             20.00              0.40
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      0.689(CFS)
  '     '       flow top width =      7.385(Ft.)
  '     '    velocity=    1.263(Ft/s)
  '     '       area =      0.545(Sq.Ft)
  '     '       Froude number =     0.819

Upstream point elevation =  1048.000(Ft.)
Downstream point elevation =  1047.000(Ft.)
Flow length =   247.000(Ft.)
Travel time  =    3.26 min.
Time of concentration =   38.41 min.
Depth of flow =   0.148(Ft.)
Average velocity =   1.263(Ft/s)
Total irregular channel flow =     0.689(CFS)
Irregular channel normal depth above invert elev. =   0.148(Ft.)
Average velocity of channel(s) =   1.263(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.703(Ac.)
Runoff from this stream =      0.689(CFS)
Time of concentration =   38.41 min.
Rainfall intensity =     1.594(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      107.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Rainfall intensity =      3.282(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  11.53 min.  Rain intensity =       3.28(In/Hr)
Total area this stream =         0.30(Ac.)
Total Study Area (Main Stream No. 2) =        2.00(Ac.)
Total runoff =      0.51(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1045.750(Ft.)
Downstream point/station elevation =  1045.000(Ft.)
Pipe length  =    39.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.510(CFS)
Nearest computed pipe diameter  =      6.00(In.)
```

```
Calculated individual pipe flow  =     0.510(CFS)
Normal flow depth in pipe =    3.54(In.)
Flow top width inside pipe =    5.90(In.)
Critical Depth =    4.37(In.)
Pipe flow velocity =      4.23(Ft/s)
Travel time through pipe =    0.15 min.
Time of concentration (TC) =    11.68 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.297(Ac.)
Runoff from this stream =      0.510(CFS)
Time of concentration =   11.68 min.
Rainfall intensity =     3.256(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      102.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Rainfall intensity =      3.566(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  10.04 min.  Rain intensity =       3.57(In/Hr)
Total area this stream =         0.56(Ac.)
Total Study Area (Main Stream No. 2) =        2.56(Ac.)
Total runoff =      0.65(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1045.500(Ft.)
Downstream point/station elevation =  1045.000(Ft.)
Pipe length  =    16.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.647(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.647(CFS)
Normal flow depth in pipe =    3.53(In.)
Flow top width inside pipe =    5.90(In.)
Critical Depth =    4.89(In.)
Pipe flow velocity =      5.38(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =    10.09 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.561(Ac.)
Runoff from this stream =      0.647(CFS)
Time of concentration =   10.09 min.
Rainfall intensity =     3.556(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
```

```
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min)  (In/Hr)     (In/Hr)


1      0.51     0.297     11.68    0.044      3.256
2      0.65     0.561     10.09    0.044      3.556
Qmax(1) =
          1.000 *    1.000 *     0.510) +
          0.915 *    1.000 *     0.647) + =       1.102
Qmax(2) =
          1.093 *    0.864 *     0.510) +
          1.000 *    1.000 *     0.647) + =       1.128

Total of 2 streams to confluence:
Flow rates before confluence point:
       0.510       0.647
Maximum flow rates at confluence using above data:
        1.102       1.128
Area of streams before confluence:
        0.297       0.561
Effective area values after confluence:
        0.858       0.817
Results of confluence:
Total flow rate =      1.128(CFS)
Time of concentration =    10.090 min.
Effective stream area after confluence =      0.817(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.044(In/Hr)
Study area total (this main stream) =       0.86(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1049.230(Ft.)
Downstream point/station elevation =  1048.400(Ft.)
Pipe length  =    21.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.128(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.128(CFS)
Normal flow depth in pipe =    3.64(In.)
Flow top width inside pipe =    8.83(In.)
Critical Depth =    5.86(In.)
Pipe flow velocity =      6.75(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =    10.14 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.817(Ac.)
Runoff from this stream =      1.128(CFS)
Time of concentration =   10.14 min.
Rainfall intensity =     3.545(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min)  (In/Hr)     (In/Hr)


1      0.69     1.703     38.41    0.044      1.594
2      1.13     0.817     10.14    0.044      3.545
```

```
Qmax(1) =
          1.000 *    1.000 *     0.689) +
          0.443 *    1.000 *     1.128) + =       1.189
Qmax(2) =
          2.258 *    0.264 *     0.689) +
          1.000 *    1.000 *     1.128) + =       1.539

Total of 2 main streams to confluence:
Flow rates before confluence point:
       1.689       2.128
Maximum flow rates at confluence using above data:
        1.189        1.539
Area of streams before confluence:
        1.703        0.817
Effective area values after confluence:
        2.520        1.267


Results of confluence:
Total flow rate =       1.539(CFS)
Time of concentration =    10.141 min.
Effective stream area after confluence  =      1.267(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.044(In/Hr)
Study area total =       2.52(Ac.)
End of computations, Total Study Area =           2.56 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  56.0
```

```
              San Bernardino County Rational Hydrology Program

                   (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2012 Version 7.2
       Rational Hydrology Study        Date: 07/26/22
------------------------------------------------------------------------
POST DEVELOPMENT - POC2 MIT
100 YEAR - RATIONAL METHOD
BY WARE MALCOMB
FILE: POC2Q100MIT.RSB
------------------------------------------------------------------------


Program License Serial Number 6312

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.220 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      212.000 to Point/Station      212.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Rainfall intensity =      3.131(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  12.47 min.  Rain intensity =       3.13(In/Hr)
Total area this stream =        0.62(Ac.)
Total Study Area (Main Stream No. 1) =       0.62(Ac.)
Total runoff =      1.54(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      212.000 to Point/Station      203.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Depth of flow =   0.193(Ft.), Average velocity =   1.647(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2              0.00              0.00
       3             20.00              0.40
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      1.541(CFS)
  '     '       flow top width =      9.672(Ft.)
  '     '    velocity=    1.647(Ft/s)
  '     '       area =      0.936(Sq.Ft)
  '     '       Froude number =     0.933

Upstream point elevation =  1049.340(Ft.)
Downstream point elevation =  1048.000(Ft.)
Flow length =   279.000(Ft.)
```

```
Travel time  =    2.82 min.
Time of concentration =   15.29 min.
Depth of flow =   0.193(Ft.)
Average velocity =   1.647(Ft/s)
Total irregular channel flow =     1.541(CFS)
Irregular channel normal depth above invert elev. =   0.193(Ft.)
Average velocity of channel(s) =   1.647(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.621(Ac.)
Runoff from this stream =      1.541(CFS)
Time of concentration =   15.29 min.
Rainfall intensity =     2.770(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      202.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.044(In/Hr)
Rainfall intensity =      3.212(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  11.95 min.  Rain intensity =       3.21(In/Hr)
Total area this stream =         0.62(Ac.)
Total Study Area (Main Stream No. 2) =        1.24(Ac.)
Total runoff =      1.50(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1049.160(Ft.)
Downstream point/station elevation =  1049.000(Ft.)
Pipe length  =    14.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.495(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.495(CFS)
Normal flow depth in pipe =    6.35(In.)
Flow top width inside pipe =    8.20(In.)
Critical Depth =    6.76(In.)
Pipe flow velocity =      4.49(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =    12.00 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.620(Ac.)
Runoff from this stream =      1.495(CFS)
Time of concentration =   12.00 min.
```

```
Rainfall intensity =     3.204(In/Hr)
Area averaged loss rate (Fm) =    0.0440(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min)  (In/Hr)     (In/Hr)


1      1.54     0.621     15.29    0.044      2.770
2      1.50     0.620     12.00    0.044      3.204
Qmax(1) =
          1.000 *    1.000 *     1.541) +
          0.863 *    1.000 *     1.495) + =       2.831
Qmax(2) =
          1.159 *    0.785 *     1.541) +
          1.000 *    1.000 *     1.495) + =       2.897

Total of 2 main streams to confluence:
Flow rates before confluence point:
       2.541       2.495
Maximum flow rates at confluence using above data:
        2.831        2.897
Area of streams before confluence:
        0.621        0.620
Effective area values after confluence:
        1.241        1.107


Results of confluence:
Total flow rate =       2.897(CFS)
Time of concentration =    12.002 min.
Effective stream area after confluence  =      1.107(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.044(In/Hr)
Study area total =       1.24(Ac.)
End of computations, Total Study Area =           1.24 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  56.0
```

MITIGATED POC-3 HAS ONE (1) BMP AND DOES NOT REQUIRE CONFLUENCING. NO CIVILD IS REQUIRED FOR POC-3. MITIGATED RUNOFF FOR POC-3 IS THE FOLLOWING:

Tc = 44.80 MIN

Q = 0.676 CFS

REFER TO THE HYDRAFLOW HYDROGRAPH ANALYSIS IN APPENDIX D.

4.3 Project Conformance Analysis

Complete the following forms for each project site DA to document that the proposed LID BMPs conform to the project DCV developed to meet performance criteria specified in the MS4 Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the MS4 Permit (see Section 5.3.1 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

- Site Design and Hydrologic Source Controls (Form 4.3-2)
- Retention and Infiltration (Form 4.3-3)
- Harvested and Use (Form 4.3-4) or
- Biotreatment (Form 4.3-5).

At the end of each form, additional fields facilitate the determination of the extent of mitigation provided by the specific BMP category, allowing for use of the next category of BMP in the hierarchy, if necessary.

The first step in the analysis, using Section 5.3.2.1 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is "Yes," provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Forms 4.3-2 and 4.3-4 to determine the feasibility of applicable HSC and harvest and use BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

If no site constraints exist that would limit the type of BMP to be implemented in a DA, evaluate the use of combinations of LID BMPs, including all applicable HSC BMPs to maximize on-site retention of the DCV. If no combination of BMP can mitigate the entire DCV, implement the single BMP type, or combination of BMP types, that maximizes on-site retention of the DCV within the minimum effective area.

If the combination of LID HSC, retention and infiltration, and harvest and use BMPs are unable to mitigate the entire DCV, then biotreatment BMPs may be implemented by the project proponent. If biotreatment BMPs are used, then they must be sized to provide sufficient capacity for effective treatment of the remainder of the volume-based performance criteria that cannot be achieved with LID BMPs (TGD for WQMP Section 5.4.4.2). **Under no circumstances shall any portion of the DCV be released from the site without effective mitigation and/or treatment**.

Form 4.3-1 Infiltration BMP Feasibility (DA 1)

Form 4.3-1 Infiltration BMP Feasibility (DA 1)
Feasibility Criterion – Complete evaluation for each DA on the Project Site
1 Would infiltration BMP pose significant risk for groundwater related concerns? Yes ☐ No ☒ *Refer to Section 5.3.2.1 of the TGD for WQMP*
If Yes, Provide basis: (attach)
2 Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes ☐ No ☒ (Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert): • The location is less than 50 feet away from slopes steeper than 15 percent • The location is less than eight feet from building foundations or an alternative setback. • A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards.
If Yes, Provide basis: (attach)
3 Would infiltration of runoff on a Project site violate downstream water rights? Yes ☐ No ☒
If Yes, Provide basis: (attach)
4 Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils? Yes ☐ No ☒
If Yes, Provide basis: (attach)
5 Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)? Yes ☐ No ☒
If Yes, Provide basis: (attach)
6 Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? Yes ☐ No ☒ *See Section 3.5 of the TGD for WQMP and WAP*
If Yes, Provide basis: (attach)
7 Any answer from Item 1 through Item 3 is "Yes": Yes ☐ No ☒ *If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 8 below.* 8 Any answer from Item 4 through Item 6 is "Yes": Yes ☒ No ☐ *If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Hydrologic Source Control BMP.* *If no, then proceed to Item 9, below.* 9 All answers to Item 1 through Item 6 are "No": *Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP.* *Proceed to Form 4.3-2, Hydrologic Source Control BMP.*

4.3.1 Site Design Hydrologic Source Control BMP

Section XI.E. of the Permit emphasizes the use of LID preventative measures; and the use of LID HSC BMPs reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable HSC shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of HSC, if a project cannot feasibly meet BMP sizing requirements or cannot fully address HCOCs, feasibility of all applicable HSC must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design HSC BMP. Refer to Section 5.4.1 in the TGD for more detailed guidance.

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 1)			
1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3): *$V_{retention}$ =Sum of Item 4 for all BMPs*			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) *$V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3): *$V_{retention}$ =Sum of Item 12 for all BMPs*			

Form 4.3-2 cont. Site Design Hydrologic Source Control BMPs (DA 1)

14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes ☐ No ☒ *If yes, complete Items 15-20. If no, proceed to Item 21*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Rooftop area planned for ET BMP (ft^2)			
16 Average wet season ET demand (in/day) *Use local values, typical ~ 0.1*			
17 Daily ET demand (ft^3/day) *Item 15 * (Item 16 / 12)*			
18 Drawdown time (hrs) *Copy Item 6 in Form 4.2-1*			
19 Retention Volume (ft^3) *$V_{retention}$ = Item 17 * (Item 18 / 24)*			
20 Runoff volume retention from evapotranspiration BMPs (ft^3): *$V_{retention}$ =Sum of Item 19 for all BMPs*			
21 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 22-25. If no, proceed to Item 26*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
22 Number of Street Trees			
23 Average canopy cover over impervious area (ft^2)			
24 Runoff volume retention from street trees (ft^3) *$V_{retention}$ = Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches*			
25 Runoff volume retention from street tree BMPs (ft^3): *$V_{retention}$ = Sum of Item 24 for all BMPs*			
26 Implementation of residential rain barrel/cisterns: Yes☐ No ☒ *If yes, complete Items 27-29; If no, proceed to Item 30*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
27 Number of rain barrels/cisterns			
28 Runoff volume retention from rain barrels/cisterns (ft^3) *$V_{retention}$ = Item 27 * 3*			
29 Runoff volume retention from residential rain barrels/Cisterns (ft3): *$V_{retention}$ =Sum of Item 28 for all BMPs*			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: 0 *Sum of Items 5, 13, 20, 25 and 29*			

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 2)			
1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3): 118 $V_{retention}$ *=Sum of Item 4 for all BMPs*			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) *$V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3): $V_{retention}$ *=Sum of Item 12 for all BMPs*			

Form 4.3-2 cont. Site Design Hydrologic Source Control BMPs (DA 2)

14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes ☐ No ☒ *If yes, complete Items 15-20. If no, proceed to Item 21*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Rooftop area planned for ET BMP (ft^2)			
16 Average wet season ET demand (in/day) *Use local values, typical ~ 0.1*			
17 Daily ET demand (ft^3/day) *Item 15 * (Item 16 / 12)*			
18 Drawdown time (hrs) *Copy Item 6 in Form 4.2-1*			
19 Retention Volume (ft^3) *$V_{retention}$ = Item 17 * (Item 18 / 24)*			
20 Runoff volume retention from evapotranspiration BMPs (ft^3): *$V_{retention}$ =Sum of Item 19 for all BMPs*			
21 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 22-25. If no, proceed to Item 26*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
22 Number of Street Trees			
23 Average canopy cover over impervious area (ft^2)			
24 Runoff volume retention from street trees (ft^3) *$V_{retention}$ = Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches*			
25 Runoff volume retention from street tree BMPs (ft^3): *$V_{retention}$ = Sum of Item 24 for all BMPs*			
26 Implementation of residential rain barrel/cisterns: Yes ☐ No ☒ *If yes, complete Items 27-29; If no, proceed to Item 30*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
27 Number of rain barrels/cisterns			
28 Runoff volume retention from rain barrels/cisterns (ft^3) *$V_{retention}$ = Item 27 * 3*			
29 Runoff volume retention from residential rain barrels/Cisterns (ft3): *$V_{retention}$ =Sum of Item 28 for all BMPs*			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: 0 *Sum of Items 5, 13, 20, 25 and 29*			

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 3)

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3):	$V_{retention}$ *=Sum of Item 4 for all BMPs*		
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) *$V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3):	$V_{retention}$ *=Sum of Item 12 for all BMPs*		

Form 4.3-2 cont. Site Design Hydrologic Source Control BMPs (DA 3)

14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes ☐ No ☒ *If yes, complete Items 15-20. If no, proceed to Item 21*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Rooftop area planned for ET BMP (ft^2)			
16 Average wet season ET demand (in/day) *Use local values, typical ~ 0.1*			
17 Daily ET demand (ft^3/day) *Item 15 * (Item 16 / 12)*			
18 Drawdown time (hrs) *Copy Item 6 in Form 4.2-1*			
19 Retention Volume (ft^3) *$V_{retention}$ = Item 17 * (Item 18 / 24)*			
20 Runoff volume retention from evapotranspiration BMPs (ft^3): *$V_{retention}$ =Sum of Item 19 for all BMPs*			
21 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 22-25. If no, proceed to Item 26*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
22 Number of Street Trees			
23 Average canopy cover over impervious area (ft^2)			
24 Runoff volume retention from street trees (ft^3) *$V_{retention}$ = Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches*			
25 Runoff volume retention from street tree BMPs (ft^3): *$V_{retention}$ = Sum of Item 24 for all BMPs*			
26 Implementation of residential rain barrel/cisterns: Yes ☐ No ☒ *If yes, complete Items 27-29; If no, proceed to Item 30*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
27 Number of rain barrels/cisterns			
28 Runoff volume retention from rain barrels/cisterns (ft^3) *$V_{retention}$ = Item 27 * 3*			
29 Runoff volume retention from residential rain barrels/Cisterns (ft3): *$V_{retention}$ =Sum of Item 28 for all BMPs*			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: 0 *Sum of Items 5, 13, 20, 25 and 29*			

4.3.2 Infiltration BMPs

Use Form 4.3-3 to compute on-site retention of runoff from proposed retention and infiltration BMPs. Volume retention estimates are sensitive to the percolation rate used, which determines the amount of runoff that can be infiltrated within the specified drawdown time. The infiltration safety factor reduces field measured percolation to account for potential inaccuracy associated with field measurements, declining BMP performance over time, and compaction during construction. Appendix D of the TGD for WQMP provides guidance on estimating an appropriate safety factor to use in Form 4.3-3.

If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5.1 of the TGD for WQMP)

If implementation of infiltrations BMPs is feasible as determined using Form 4.3-1, then LID infiltration BMPs shall be implemented to the MEP (section 4.1 of the TGD for WQMP).

Form 4.3-2 Infiltration LID BMP - including underground BMPs (DA 2)

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 2,924 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 2 DMA 2A BMP Type Retention Basin	DA 2 DMA 2B BMP Type Permeable Concrete	DA 2 DMA 2C BMP Type Retention Basin	DA 2 DMA 2D BMP Type Permeable Concrete
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	2.60	1.40	2.10	1.40
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2.00	2.00	2.00	2.00
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	1.30	0.70	1.05	0.70
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48.00	48.00	48.00	48.00
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	0.50	0.00	0.50	0.50
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	0.50	0.50	0.50	0.50
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	395	3,135	281	2,072
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	1.5	0.00	1.5	0.00
10 Amended soil porosity	0.30	0.30	0.30	0.30
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	1.5	1.0	1.5	1.0
12 Gravel porosity	0.40	0.40	0.40	0.40
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3.00	3.00	3.00	3.00
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	737	3,480	503	2,300
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	0	0	0	0

16 Total Retention Volume from LID Infiltration BMPs: 7,020 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 240% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐

If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

4.3.3 Biotreatment BMP

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration, and harvest and use BMPs. A key consideration when using biotreatment BMP is the effectiveness of the proposed BMP in addressing the pollutants of concern for the project (see Table 5-5 of the TGD for WQMP).

Use Form 4.3-5 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV w. Biotreatment computations are included as follows:

- Use Form 4.3-6 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-7 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-8 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-3 Selection and Evaluation of Biotreatment BMP (DA 1)

1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft^3): 6,690 *Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9*	List pollutants of concern *Copy from Form 2.3-1.* Pathogens, Nutrients - Phosphorus, Nitrogen, Noxious Aquatic Plants, Sediment, Metals, Oil and Grease, Trash/Debris, Pesticides/Herbicides, Organic Compounds	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-6 and 4.3-7 to compute treated volume* ☒ Bioretention with underdrain ☐ Planter box with underdrain ☒ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume* ☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): 9,563 *Form 4.3-6 Item 15 + Form 4.3-7 Item 13*	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): 0 *Item 1 – Item 3*	5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 0% *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

Form 4.3-3 Selection and Evaluation of Biotreatment BMP (DA 3)

1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft^3): 5,906 *Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9*	List pollutants of concern *Copy from Form 2.3-1.* Pathogens, Nutrients - Phosphorus, Nitrogen, Noxious Aquatic Plants, Sediment, Metals, Oil and Grease, Trash/Debris, Pesticides/Herbicides, Organic Compounds

2 Biotreatment BMP Selected	Volume-based biotreatment *Use Forms 4.3-6 and 4.3-7 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume*
(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)	☐ Bioretention with underdrain ☐ Planter box with underdrain ☒ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment

3 Volume biotreated in volume based biotreatment BMP (ft^3): 13,388 *Form 4.3-6 Item 15 + Form 4.3-7 Item 13*	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): 0 *Item 1 – Item 3*	5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 0% *Item 4 / Item 1*

6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*

7 Metrics for MEP determination:

- Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*

Form 4.3-6 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains

Biotreatment BMP Type *(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)*	DA 1 DMA 1A BMP Type Biofiltration Basin	DA 1 DMA 1B BMP Type Biofiltration Basin	DA DMA BMP Type
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*	All	All	
2 Amended soil infiltration rate *Typical ~ 5.0*	5.00	5.00	
3 Amended soil infiltration safety factor *Typical ~ 2.0*	2.00	2.00	
4 Amended soil design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	2.50	2.50	
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*	48.00	48.00	
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	0.50	0.50	
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12 * Item 4 * Item 5) or Item 6*	0.50	0.50	
8 Amended soil surface area (ft^2)	1,139	799	
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	1.5	1.50	
10 Amended soil porosity, *n*	0.30	0.30	
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	1.50	1.50	
12 Gravel porosity, *n*	0.40	0.40	
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3.00	3.00	
14 Biotreated Volume (ft^3) *$V_{biotreated}$ = Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	2,193	1,538	
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: 3,731 *Sum of Item 14 for all volume-based BMPs included in this form*			

Form 4.3-7 Volume Based Biotreatment (DA 1) – Constructed Wetlands and Extended Detention

Biotreatment BMP Type *Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (e.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.*	DA 1 DMA 1C BMP Type MWS w/ UrbanPond		DA DMA BMP Type	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*	N/A	All		
2 Bottom width (ft)	30	8		
3 Bottom length (ft)	100	16		
4 Bottom area (ft²) A_{bottom} *= Item 2 * Item 3*	3,000	128		
5 Side slope (ft/ft)	0	0		
6 Depth of storage (ft)	3	0		
7 Water surface area (ft²) $A_{surface}$ *=(Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))*	3,000	128		
8 Storage volume (ft³) *For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details* V *=Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^0.5]*	9,000	0		
9 Drawdown Time (hrs) *Copy Item 6 from Form 2.1*	48			
10 Outflow rate (cfs) Q_{BMP} *= (Item* $8_{forebay}$ *+ Item* 8_{basin}*) / (Item 9 * 3600)*	0.052			
11 Duration of design storm event (hrs)	3			
12 Biotreated Volume (ft³) $V_{biotreated}$ *= (Item* $8_{forebay}$ *+ Item* 8_{basin}*) +(Item 10 * Item 11 * 3600)*	9,563			
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : 9,563 *(Sum of Item 12 for all BMP included in plan)*				

Form 4.3-7 Volume Based Biotreatment (DA 3) – Constructed Wetlands and Extended Detention

Biotreatment BMP Type *Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (e.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.*	DA 3 DMA 3A BMP Type MWS w/ UrbanPond		DA DMA BMP Type	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*	N/A	All		
2 Bottom width (ft)	30	8		
3 Bottom length (ft)	140	16		
4 Bottom area (ft^2) *A_{bottom} = Item 2 * Item 3*	4,200	128		
5 Side slope (ft/ft)	0	0		
6 Depth of storage (ft)	3	0		
7 Water surface area (ft^2) $A_{surface}$ *=(Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))*	4,200	128		
8 Storage volume (ft^3) *For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details* V *=Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^0.5]*	12,600	0		
9 Drawdown Time (hrs) *Copy Item 6 from Form 2.1*	48			
10 Outflow rate (cfs) *Q_{BMP} = (Item $8_{forebay}$ + Item 8_{basin}) / (Item 9 * 3600)*	0.073			
11 Duration of design storm event (hrs)	3			
12 Biotreated Volume (ft^3) *$V_{biotreated}$ = (Item $8_{forebay}$ + Item 8_{basin}) +(Item 10 * Item 11 * 3600)*	13,388			

13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : 13,388
(Sum of Item 12 for all BMP included in plan)

4.3.5 Conformance Summary

Complete Form 4.3-9 to demonstrate how on-site LID DCV is met with proposed site design hydrologic source control, infiltration, harvest and use, and/or biotreatment BMP. The bottom line of the form is used to describe the basis for infeasibility determination for on-site LID BMP to achieve full LID DCV, and provides methods for computing remaining volume to be addressed in an alternative compliance plan. If the project has more than one outlet, then complete additional versions of this form for each outlet.

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)

1 Total LID DCV for the Project DA-1 (ft^3): 6,690 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 0 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 13,294 *Copy Item 3 in Form 4.3-5*

6 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-5*

7 LID BMP performance criteria are achieved if answer to any of the following is “Yes”:

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☐ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☒
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes ☒ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

8 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 2)

1 Total LID DCV for the Project DA-1 (ft^3): 2,924 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 7,020 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-5*

6 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-5*

7 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☒
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☒
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

8 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  *Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 3)

1 Total LID DCV for the Project DA-1 (ft^3): 5,906 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 0 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 13,388 *Copy Item 3 in Form 4.3-5*

6 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-5*

7 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☐ No ☒
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☒
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes ☒ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

8 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

4.3.6 Hydromodification Control BMP

Use Form 4.3-10 to compute the remaining runoff volume retention, after LID BMP are implemented, needed to address HCOC, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential HCOC. Describe hydromodification control BMP that address HCOC, which may include off-site BMP and/or in-stream controls. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

<table>
<tr><th colspan="2">Form 4.3-10 Hydromodification Control BMPs (DA 1)</th></tr>
<tr><td>1 Volume reduction needed for HCOC performance criteria (ft^3): 6,690
(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1</td><td>2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): 0 Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction</td></tr>
<tr><td>3 Remaining volume for HCOC volume capture (ft^3): 6,690 Item 1 – Item 2</td><td>4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): 13,294 Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)</td></tr>
<tr><td colspan="2">5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification ☐ Attach in-stream control BMP selection and evaluation to this WQMP</td></tr>
<tr><td colspan="2">6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☐ No ☒
If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:
Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP ☒
BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐
Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐</td></tr>
<tr><td colspan="2">7 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☐ No ☒
If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:
Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs ☒
BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)
Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐</td></tr>
</table>

Form 4.3-10 Hydromodification Control BMPs (DA 2)

1 Volume reduction needed for HCOC performance criteria (ft^3): 2,924 *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): 0 *Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction*
3 Remaining volume for HCOC volume capture (ft^3): 2,924 *Item 1 – Item 2*	4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): 7,020 *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification ☐ *Attach in-stream control BMP selection and evaluation to this WQMP*

6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☐ No ☒

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP ☒
  BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

7 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☐ No ☒

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs ☒
  BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

Form 4.3-10 Hydromodification Control BMPs (DA 3)

1 Volume reduction needed for HCOC performance criteria (ft^3): 5,906 *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): 0 *Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction*
3 Remaining volume for HCOC volume capture (ft^3): 5,906 *Item 1 – Item 2*	4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): 13,388 *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification ☐ *Attach in-stream control BMP selection and evaluation to this WQMP*

6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☐ No ☒

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP ☒
  BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

7 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☐ No ☒

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs ☒
  BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

4.4 Alternative Compliance Plan (if applicable)

Describe an alternative compliance plan (if applicable) for projects not fully able to infiltrate, harvest and use, or biotreat the DCV via on-site LID practices. A project proponent must develop an alternative compliance plan to address the remainder of the LID DCV. Depending on project type some projects may qualify for water quality credits that can be applied to reduce the DCV that must be treated prior to development of an alternative compliance plan (see Form 2.4-1, Water Quality Credits). Form 4.3-9 Item 8 includes instructions on how to apply water quality credits when computing the DCV that must be met through alternative compliance. Alternative compliance plans may include one or more of the following elements:

- On-site structural treatment control BMP - All treatment control BMP should be located as close to possible to the pollutant sources and should not be located within receiving waters;
- Off-site structural treatment control BMP - Pollutant removal should occur prior to discharge of runoff to receiving waters;
- Urban runoff fund or In-lieu program, if available

Depending upon the proposed alternative compliance plan, approval by the executive officer may or may not be required (see Section 6 of the TGD for WQMP).

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMP included as part of the project WQMP are required to be maintained through regular scheduled inspection and maintenance (refer to Section 8, Post Construction BMP Requirements, in the TGD for WQMP). Fully complete Form 5-1 summarizing all BMP included in the WQMP. Attach additional forms as needed. The WQMP shall also include a detailed Operation and Maintenance Plan for all BMP and may require a Maintenance Agreement (consult the jurisdiction's LIP). If a Maintenance Agreement is required, it must also be attached to the WQMP.

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)			
BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
1	Owner		
2	Owner		
3	Owner		
4	Owner		
5	Owner		
6	Owner		
7	Owner		
8	Owner		

- Erosion due to concentrated storm water runoff flow that is not readily corrected by adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.

Other Special Considerations

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

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

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

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

References

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

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PR-1
Biofiltration with Partial Retention

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

Property / Development Name:	Responsible Party Name and Phone Number:
Property Address of BMP:	Responsible Party Address:

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

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

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

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

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

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

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

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

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

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

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

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

INF-3

Permeable Pavement as Structural BMP

BMP MAINTENANCE FACT SHEET
FOR
STRUCTURAL BMP INF-3 PERMEABLE PAVEMENT AS STRUCTURAL BMP

Permeable pavement is pavement that allows for percolation through void spaces in the pavement surface into subsurface layers. The subsurface layers are designed to provide storage of storm water runoff so that outflows, primarily via infiltration into subgrade soils or release to the downstream conveyance system, can be at controlled rates. Permeable pavement as structural BMP usually receives runoff from a larger tributary area than permeable pavement as site design BMP (see SD-6B for permeable pavement as site design BMP). Pollutant control is provided via infiltration (retention). Flow control is provided by infiltration and/or an outlet control structure. Typical permeable pavement components include:

- Permeable surface layer
- Bedding layer for permeable surface
- Aggregate storage layer with optional underdrain(s)
- Optional final filter course layer over uncompacted existing subgrade
- Uncompacted native soils at the bottom of the facility
- Optional subsurface check dams at regular intervals when pavement is sloped (more closely spaced on steeper slopes)
- Optional outflow control structure for runoff released via underdrain(s)

Normal Expected Maintenance

Routine maintenance of permeable pavement includes: removal of materials such as trash and debris accumulated on the paving surface; vacuuming of the paving surface to prevent clogging; and flushing paving and subsurface gravel to remove fine sediment. If the BMP includes underdrains and/or an outflow control structure, check and clear these features. A summary table of standard inspection and maintenance indicators is provided within this Fact Sheet.

Non-Standard Maintenance or BMP Failure

If the permeable pavement area is not drained between storm events, or if runoff sheet flows across the permeable pavement area and flows off the permeable pavement area during storm events, the BMP is not performing as intended to protect downstream waterways from pollution and/or erosion. During storm events up to the 85th percentile storm event (approximately 0.5 to 1 inch of rainfall in San Diego County), runoff should not flow off the permeable pavement area. The permeable pavement area is expected to have adequate hydraulic conductivity and storage such that rainfall landing on the permeable pavement and runoff from the surrounding drainage area will go directly into the pavement without ponding or overflow (in properly designed systems, the surrounding drainage area is not more than half as large as the permeable pavement area). Following the storm event, there should be no standing water (puddles) on the permeable pavement area.

If storm water is flowing off the permeable pavement during a storm event, or if there is standing water on the permeable pavement surface following a storm event, this is an indicator of clogging somewhere within the system. Poor drainage can result from clogging of the permeable surface layer, any of the subsurface components, or the subgrade soils. The specific cause of the drainage issue must be determined and corrected. Surface or subsurface ponding longer than approximately 96 hours following a storm event poses a risk of vector (mosquito) breeding. Corrective maintenance, increased inspection and maintenance, BMP replacement, or a different BMP type will be required. If poor drainage persists after flushing of the paving, subsurface gravel, and/or underdrain(s) when applicable, or if it is determined that the underlying soils do not have the infiltration capacity expected, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.

Other Special Considerations

The runoff storage and infiltration surface area in this BMP are not readily accessible because they are subsurface. This means that clogging and poor drainage are not easily corrected. If the tributary area draining to the BMP includes unpaved areas, the sediment load from the tributary drainage area can be too high, reducing BMP function or clogging the BMP. All unpaved areas within the tributary drainage area should be stabilized with vegetation. Other pretreatment components to prevent transport of sediment to the paving surface, such as grass buffer strips, will extend the life of the subsurface components and infiltration surface. Along with proper stabilization measures and pretreatment within the tributary area, **<u>routine maintenance, including preventive vacuum/regenerative air street sweeping, is key to preventing clogging</u>**.

SUMMARY OF STANDARD INSPECTION AND MAINTENANCE FOR INF-3 PERMEABLE PAVEMENT AS STRUCTURAL BMP		
The property owner is responsible to ensure inspection, operation and maintenance of permanent BMPs on their property unless responsibility has been formally transferred to an agency, community facilities district, homeowners association, property owners association, or other special district. Maintenance frequencies listed in this table are average/typical frequencies. Actual maintenance needs are site-specific, and maintenance may be required more frequently. Maintenance must be performed whenever needed, based on maintenance indicators presented in this table. The BMP owner is responsible for conducting regular inspections to see when maintenance is needed based on the maintenance indicators. During the first year of operation of a structural BMP, inspection is recommended at least once prior to August 31 and then monthly from September through May. Inspection during a storm event is also recommended. After the initial period of frequent inspections, the minimum inspection and maintenance frequency can be determined based on the results of the first year inspections.		
Threshold/Indicator	**Maintenance Action**	**Typical Maintenance Frequency**
Preventive vacuum/regenerative air street sweeping	Pavement should be swept with a vacuum power or regenerative air street sweeper to maintain infiltration through paving surface	• Schedule/perform this preventive action at least twice per year.
Accumulation of sediment, litter, or debris on permeable pavement surface	Remove and properly dispose of accumulated materials. Inspect tributary area for exposed soil or other sources of sediment and apply stabilization measures to sediment source areas. Apply source control measures as applicable to sources of litter or debris.	• Inspect monthly and after every 0.5-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Weeds growing on/through the permeable pavement surface	Remove weeds and add features as necessary to prevent weed intrusion. Use non-chemical methods (e.g., instead of pesticides, control weeds using mechanical removal, physical barriers, and/or physical changes in the surrounding area adjacent to pavement that will preclude weed intrusion into the pavement).	• Inspect monthly. • Remove any weeds found at each inspection.
Standing water in permeable paving area or subsurface infiltration gallery for longer than 24-96 hours following a storm event	This condition requires investigation of why infiltration is not occurring. If feasible, corrective action shall be taken to restore infiltration (e.g., pavement should be swept with a vacuum power or regenerative air street sweeper to restore infiltration rates, clear underdrains if underdrains are present). BMP may require retrofit if infiltration cannot be restored. The [City Engineer] shall be contacted prior to any repairs or reconstruction.	• Inspect monthly and after every 0.5-inch or larger storm event. If standing water is observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed.

SUMMARY OF STANDARD INSPECTION AND MAINTENANCE FOR INF-3 PERMEABLE PAVEMENT AS STRUCTURAL BMP (Continued from previous page)		
Threshold/Indicator	**Maintenance Action**	**Typical Maintenance Frequency**
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology	If mosquitos/larvae are observed: first, immediately remove any standing water by dispersing to nearby landscaping; second, make corrective measures as applicable to restore BMP drainage to prevent standing water. If mosquitos persist following corrective measures to remove standing water, or if the BMP design does not meet the 96-hour drawdown criteria because the underlying native soils have been compacted or do not have the infiltration capacity expected, the [City Engineer] shall be contacted to determine a solution. A different BMP type, or a Vector Management Plan prepared with concurrence from the County of San Diego Department of Environmental Health, may be required.	• Inspect monthly and after every 0.5-inch or larger storm event. If mosquitos are observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed.
Obstructed underdrain or outlet structure (when the BMP includes outflow control structure for runoff released from subsurface storage via underdrain(s))	Clear blockage.	• Inspect if standing water is observed for longer than 24-96 hours following a storm event. • Maintenance when needed.
Damage to structural components of subsurface infiltration gallery such as weirs or outlet structures	Repair or replace as applicable.	• Inspect annually. • Maintenance when needed.
Damage to permeable paving surface (e.g., cracks, settlement, misaligned paver blocks, void spaces between paver blocks need fill materials replenished)	Repair or replace damaged surface as appropriate.	• Inspect annually. • Maintenance when needed.

References

American Mosquito Control Association.
http://www.mosquito.org/

California Storm Water Quality Association (CASQA). 2003. Municipal BMP Handbook.
https://www.casqa.org/resources/bmp-handbooks/municipal-bmp-handbook

County of San Diego. 2014. Low Impact Development Handbook.
http://www.sandiegocounty.gov/content/sdc/dpw/watersheds/susmp/lid.html

San Diego County Copermittees. 2016. Model BMP Design Manual, Appendix E, Fact Sheet INF-3.
http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=250&Itemid=220

INF-3

Permeable Pavement as Structural BMP

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

Property / Development Name:	Responsible Party Name and Phone Number:
Property Address of BMP:	Responsible Party Address:

INSPECTION AND MAINTENANCE CHECKLIST FOR INF-3 PERMEABLE PAVEMENT AS STRUCTURAL BMP PAGE 1 of 4

Threshold/Indicator	Maintenance Recommendation	Date	Description of Maintenance Conducted
Accumulation of sediment, litter, or debris on permeable pavement surface Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove and properly dispose of accumulated materials ☐ Inspect tributary area for exposed soil or other sources of sediment and apply stabilization measures to sediment source areas. Apply source control measures as applicable to sources of litter or debris ☐ Other / Comments:		
Weeds growing on/through the permeable pavement surface Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove weeds and add features as necessary to prevent weed intrusion ☐ Use non-chemical methods (e.g., instead of pesticides, control weeds using mechanical removal, physical barriers, and/or physical changes in the surrounding area adjacent to pavement that will preclude weed intrusion into the pavement). ☐ Other / Comments:		

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

INSPECTION AND MAINTENANCE CHECKLIST FOR INF-3 PERMEABLE PAVEMENT AS STRUCTURAL BMP PAGE 2 of 4			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Standing water in permeable paving area or subsurface infiltration gallery for longer than 24-96 hours following a storm event* Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ If feasible, take corrective action to restore infiltration (e.g., sweep pavement with a vacuum power or regenerative air street sweeper to restore infiltration rates, clear underdrains if underdrains are present). BMP may require retrofit if infiltration cannot be restored. The [City Engineer] shall be contacted prior to any repairs or reconstruction. ☐ Other / Comments:		
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Apply corrective measures to remove standing water in BMP when standing water occurs for longer than 24-96 hours following a storm event.** ☐ Other / Comments:		

*Surface or subsurface ponding longer than approximately 96 hours following a storm event poses a risk of vector (mosquito) breeding. Poor drainage can result from clogging of the permeable surface layer, any of the subsurface components, or the underlying native soils. The specific cause of the drainage issue must be determined and corrected. If poor drainage persists after flushing of the paving, subsurface gravel, and/or underdrain(s) when applicable, or if it is determined that the underlying native soils have been compacted or do not have the infiltration capacity expected, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.

**If mosquitos persist following corrective measures to remove standing water, or if the BMP design does not meet the 96-hour drawdown criteria because the underlying native soils have been compacted or do not have the infiltration capacity expected, the [City Engineer] shall be contacted to determine a solution. A different BMP type, or a Vector Management Plan prepared with concurrence from the County of San Diego Department of Environmental Health, may be required.

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

INSPECTION AND MAINTENANCE CHECKLIST FOR INF-3 PERMEABLE PAVEMENT AS STRUCTURAL BMP PAGE 3 of 4			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Obstructed underdrain or outlet structure (when the BMP includes outflow control structure for runoff released from subsurface storage via underdrain(s)) Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Clear blockage ☐ Other / Comments:		
Damage to structural components of subsurface infiltration gallery such as weirs or outlet structures Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair or replace as applicable ☐ Other / Comments:		
Damage to permeable paving surface (e.g., cracks, settlement, misaligned paver blocks, void spaces between paver blocks need fill materials replenished) Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair or replace damaged surface as appropriate ☐ Other / Comments:		

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

INSPECTION AND MAINTENANCE CHECKLIST FOR INF-3 PERMEABLE PAVEMENT AS STRUCTURAL BMP PAGE 4 of 4			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Preventive vacuum/regenerative air street sweeping Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Pavement should be swept with a vacuum power or regenerative air street sweeper to maintain infiltration through paving surface. ☐ Schedule/perform this preventive action at least twice per year. ☐ Other / Comments:		

BF-1
Biofiltration

BMP MAINTENANCE FACT SHEET
FOR
STRUCTURAL BMP BF-1 BIOFILTRATION

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

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

Normal Expected Maintenance

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

Non-Standard Maintenance or BMP Failure

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

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

Other Special Considerations

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

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

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

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

References

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Bio Clean

A Forterra Company

Modular Wetlands® Linear

A Stormwater Biofiltration Solution

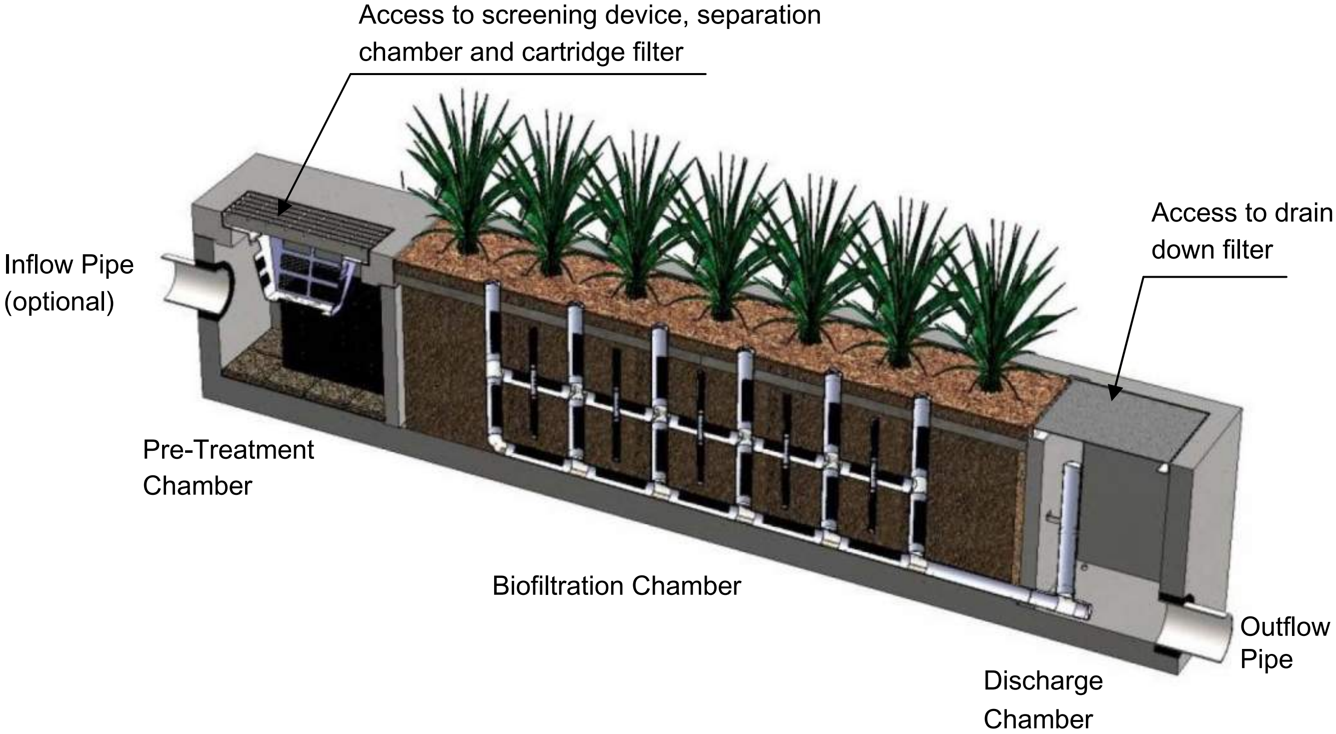
OPERATION & MAINTENANCE MANUAL

Maintenance Guidelines for Modular Wetlands 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 Report
Modular Wetlands Linear

Bio Clean
A Forterra Company

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

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 ____________________

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: ____________________

Bio Clean
A Forterra Company

Cleaning and Maintenance Report
Modular Wetlands Linear

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:

UrbanPond™

A Stormwater Storage Solution

INSPECTION & MAINTENANCE MANUAL

5796 Armada Drive Suite 250 | Carlsbad, CA 92008 | 855.566.3938
stormwater@forterrabp.com | biocleanenvironmental.com

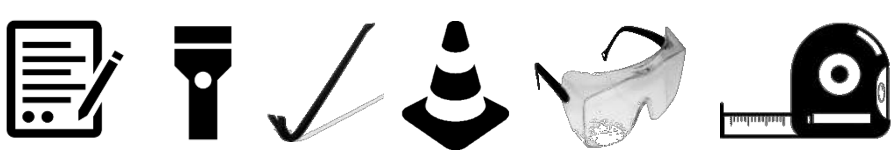
URBAN POND INSPECTION & MAINTENANCE

Inspection and maintenance of the Urban Pond 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 all 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 quarterly 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:

- Bio Clean Environmental 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 Urban Pond 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 Urban Pond 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 Urban Pond underground detention, retention, or infiltration system:

- Bio Clean Environmental 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.

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.

For Maintenance Services please contact Bio Clean at 760-433-7640, or email info@biocleanenvironmental.com.

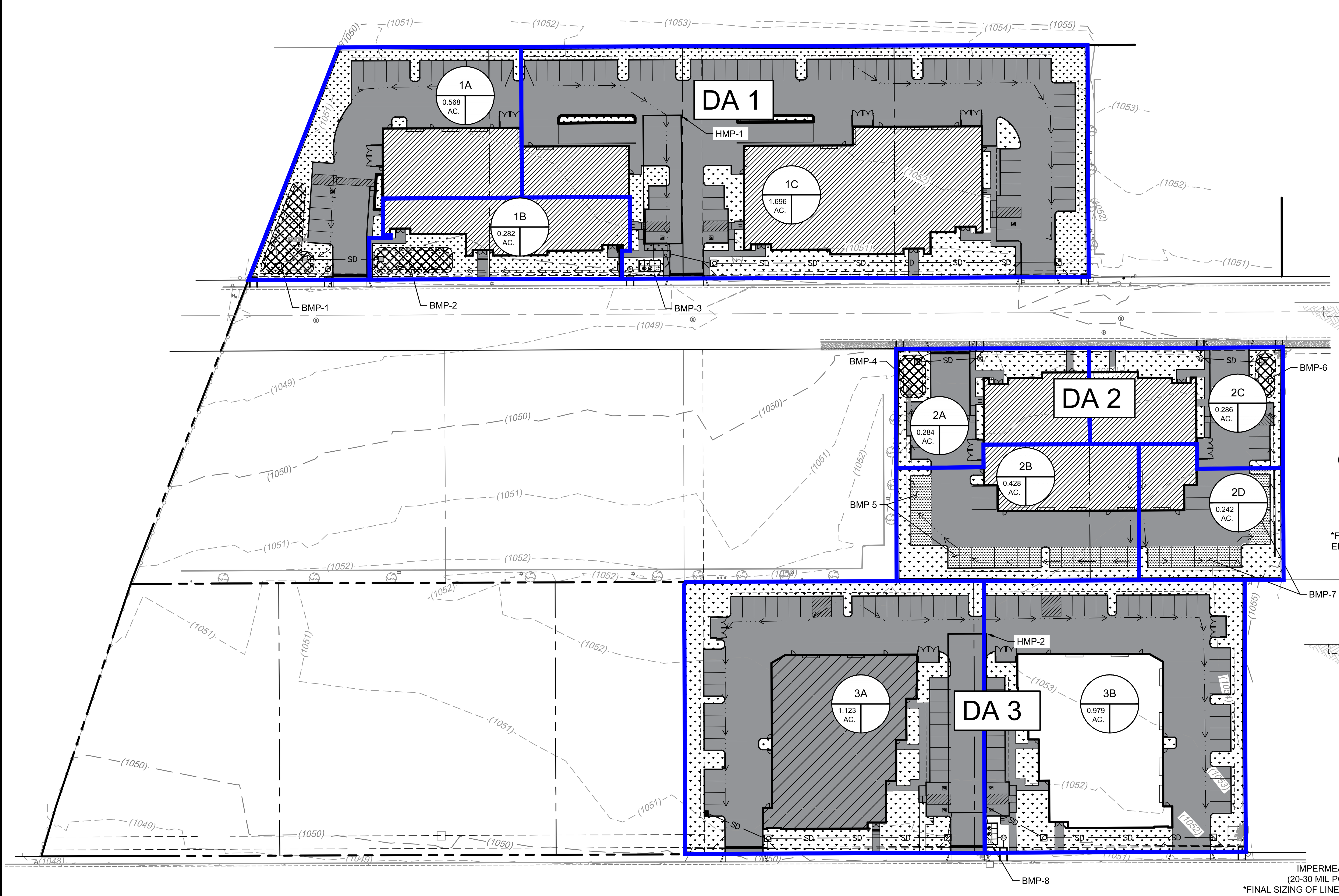
Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

Include a site plan and drainage plan sheet set containing the following minimum information:

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural Source Control BMP locations
- Site Design Hydrologic Source Control BMP locations
- LID BMP details
- Drainage delineations and flow information
- Drainage connections

CAUTION: IF THIS SHEET IS NOT 24"x36" IT IS A REDUCED PRINT

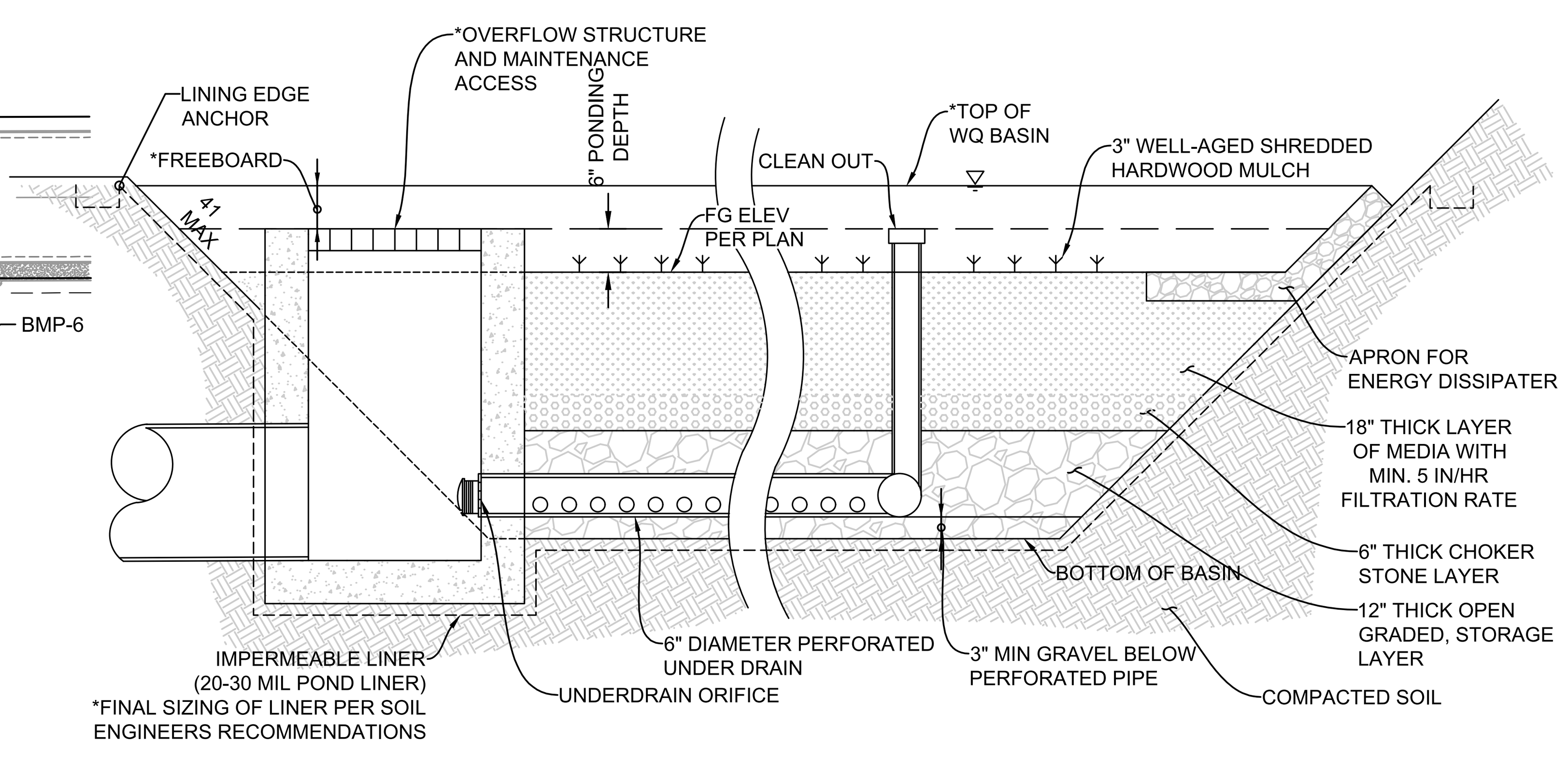


LEGEND

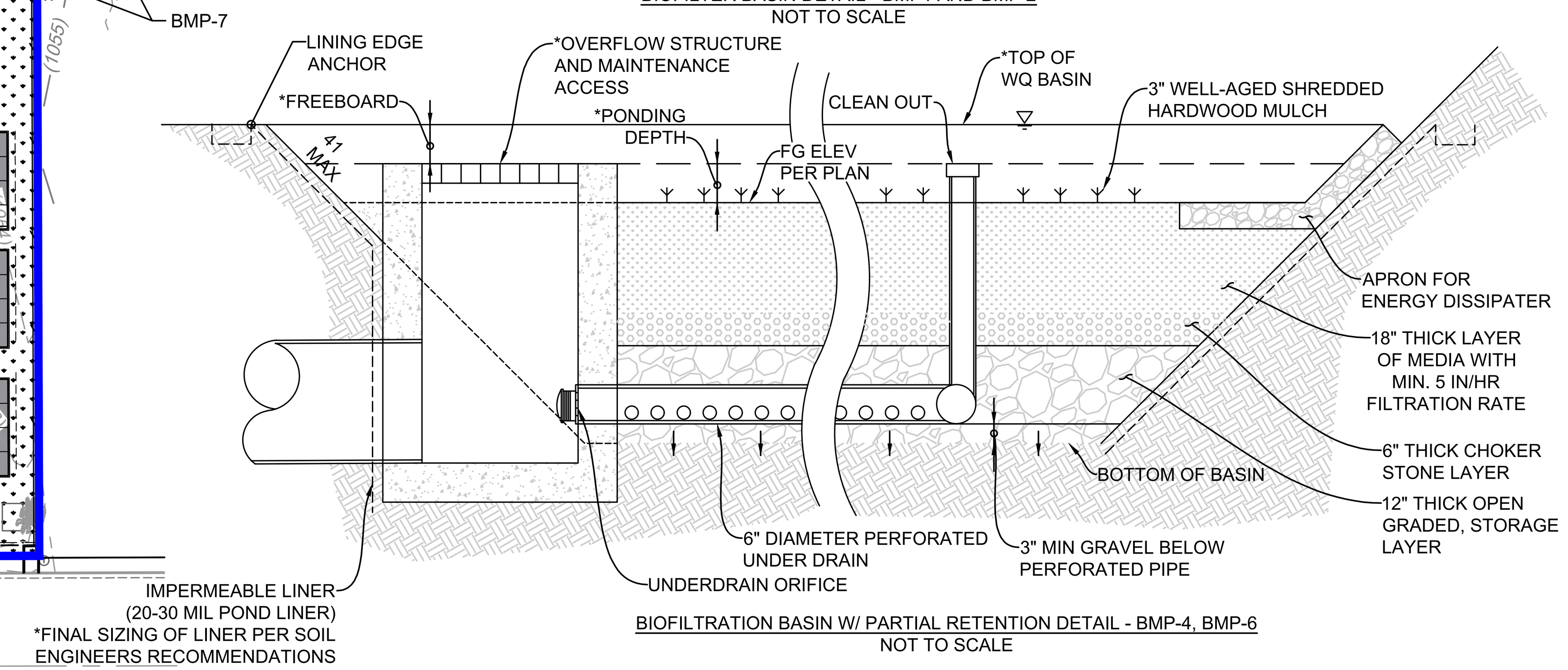
- IMPERVIOUS
- ROOF
- LANDSCAPE
- PERMEABLE CONCRETE
- BIO BASIN
- DMA BOUNDARY
- FLOW PATH

FEATURES TO MINIMIZE IMPERVIOUSNESS:
PAVEMENT WIDTHS ARE KEPT TO MINIMUM DESIGN STANDARDS
RUNOFF IS TREATED BY BIOFILTRATION

DMA EXHIBIT
SOIL GROUPS:
THE SITE IS UNDERLAIN BY SOIL GROUP "B".
NO EXISTING NATURAL HYDROLOGIC FEATURES
NO CRITICAL COURSE SEDIMENT AREAS TO BE PROTECTED
DEPTH TO GROUNDWATER EXPECTED TO BE OVER 20FT*

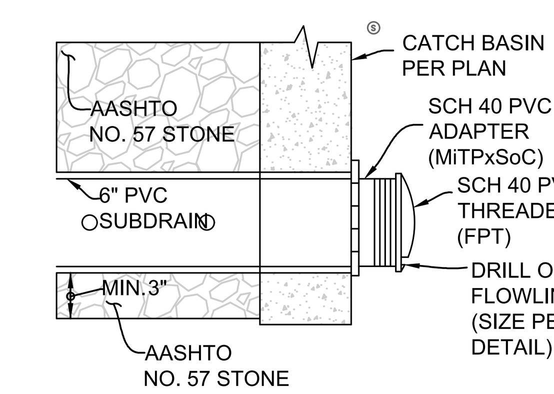


BIOFILTER BASIN DETAIL - BMP1 AND BMP 2
NOT TO SCALE



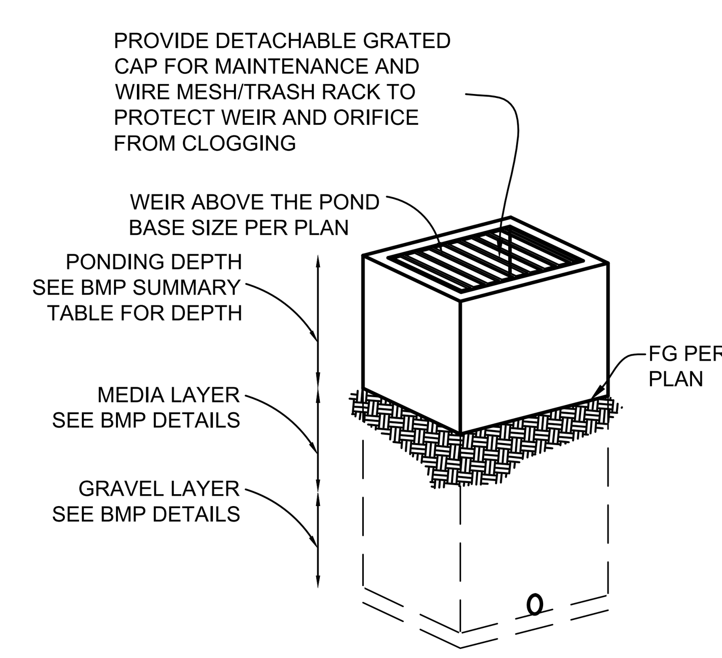
BIOFILTRATION BASIN W/ PARTIAL RETENTION DETAIL - BMP-4, BMP-6
NOT TO SCALE

DMA SUMMARY TABLE														
DMA ID	AREA (ACRES)	AREA (SF)	IMPERVIOUS AREAS (SF)	PERVIOUS AREAS (SF)	IMPERVIOUS PERCENTAGE (%)	METHOD OF TREATMENT	BMP ID	DRAINS TO	SOIL TYPE	BASIN AREA PROVIDED (SF)	MWS TREATMENT VOLUME PROVIDED (CF)	PERMEABLE AREA PROVIDED (SF)	VAULT ID	VAULT VOLUME PROVIDED (CF)
1A	0.568	24,733	17,760	6,973	71.8%	BIOFILTRATION	BMP-1	POC-1	B	1,486	-	-	-	-
1B	0.282	12,277	7,650	4,627	62.3%	BIOFILTRATION	BMP-2	POC-1	B	621	-	-	-	-
1C	1.696	73,869	53,972	19,897	73.1%	MODULAR WETLAND(MWS) AND UNDERGROUND VAULT	BMP-3	POC-1	B	-	6,875	-	HMP-1	9,563
2A	0.284	12,373	8,790	3,583	71.0%	BIOFILTRATION W/ PARTIAL RETENTION	BMP-4	POC-2	B	395	-	-	-	-
2B	0.428	18,652	11,975	6,677	64.2%	PERMEABLE CONCRETE	BMP-5	POC-2	B	-	-	3,135	-	-
2C	0.286	12,469	8,693	3,776	69.7%	BIOFILTRATION W/ PARTIAL RETENTION	BMP-6	POC-2	B	281	-	-	-	-
2D	0.242	10,547	6,009	4,538	57.0%	PERMEABLE CONCRETE	BMP-7	POC-2	B	-	-	2,072	-	-
3A	1.123	48,921	36,604	12,317	74.8%	MODULAR WETLAND(MWS) AND UNDERGROUND VAULT	BMP-8	POC-3	B	-	8,859	-	HMP-2	13,388
3B	0.979	42,638	32,141	10,497	75.4%									
TOTAL	5.888	256,479	183,594	72,885	71.6%									

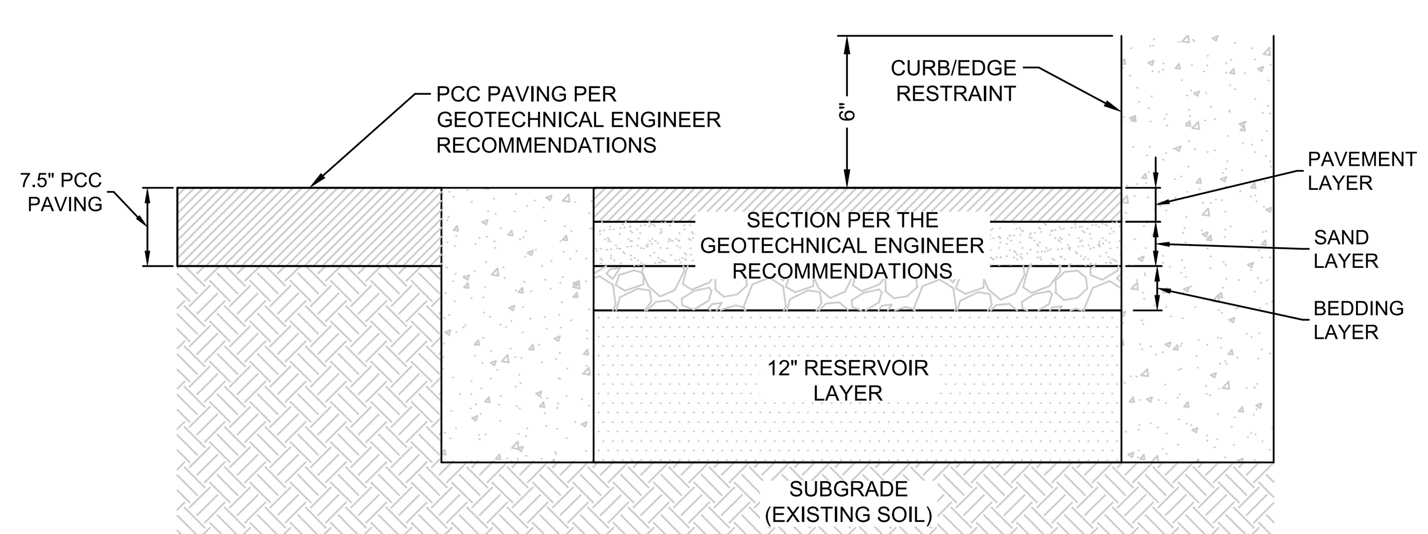


UNDERDRAIN ORIFICE DETAIL
NOT TO SCALE

UNDERDRAIN ORIFICE DETAIL
NOT TO SCALE



CATCH BASIN DETAIL
NOT TO SCALE



PERMEABLE PAVEMENT SECTION
NOT TO SCALE

0 25 50 100
SCALE: 1" = 50'

WARE MALCOMB
LEADING DESIGN FOR COMMERCIAL REAL ESTATE
3911 sorrento valley blvd.
suite 120
san diego, ca 92121
p 858.638.7277
waremalcomb.com

FOR AND ON BEHALF OF WARE MALCOMB

DMA AND HMP EXHIBIT
HARDT ST & BRIER DR
San Bernardino, CA 92408

REVISIONS

NO	DATE	REMARKS
##	##	##
##	##	##
##	##	##
##	##	##
##	##	##
##	##	##
##	##	##

JOB NO.:	SDG20-0108
PA / PM:	SMB
DRAWN BY:	ALU
DATE:	10/1/21
PLOT DATE:	

SHEET
1
Sheet 1 of 1

NOT FOR CONSTRUCTION

6.2 Electronic Data Submittal

Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their local Local Implementation Plan), this section will describe the contents (e.g., layering, nomenclature, geo-referencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

6.3 Post Construction

Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

RECORDING REQUESTED BY:
County of San Bernardino
Department of Public Works

AND WHEN RECORDED MAIL TO:
County of San Bernardino
Department of Public Works
825 E. Third Street, Room 117
San Bernardino, CA 92415-0835

SPACE ABOVE THIS LINE FOR RECORDER'S USE

COVENANT AND AGREEMENT REGARDING WATER QUALITY MANAGEMENT PLAN AND STORMWATER BEST MANAGEMENT PRACTICES TRANSFER, ACCESS AND MAINTENANCE

THIS PAGE ADDED TO PROVIDE ADEQUATE SPACE FOR RECORDING INFORMATION

Covenant and Agreement Regarding Water Quality Management Plan and Stormwater Best Management Practices Transfer, Access and Maintenance

OWNER NAME: ____

PROPERTY ADDRESS: ____

____

APN: ____

THIS AGREEMENT is made and entered into in

____________________________________ ,California, this _________ day of

____________________________________ , by and between

____ , hereinafter

referred to as Owner, and the COUNTY OF SAN BERNARDINO, a political subdivision of the State of California, hereinafter referred to as "the County";

WHEREAS, the Owner owns real property ("Property") in the County of San Bernardino, State of California, more specifically described in Exhibit "A" and depicted in Exhibit "B", each of which exhibits is attached hereto and incorporated herein by this reference; and

WHEREAS, at the time of initial approval of development project known as

______________________________________ within the Property described herein, the County required the project to employ Best Management Practices, hereinafter referred to as "BMPs," to minimize pollutants in urban runoff; and

WHEREAS, the Owner has chosen to install and/or implement BMPs as described in the Water Quality Management Plan, dated ________________________, on file with the County and incorporated herein by this reference, hereinafter referred to as "WQMP", to minimize pollutants in urban runoff and to minimize other adverse impacts of urban runoff; and

WHEREAS, said WQMP has been certified by the Owner and reviewed and approved by the County; and

WHEREAS, the Owner is aware that periodic and continuous maintenance, including, but not necessarily limited to, filter material replacement and sediment removal, is required to assure peak performance of all BMPs in the WQMP and that, furthermore, such maintenance activity will require compliance with all Local, State, or Federal laws and regulations, including those pertaining to confined space and waste disposal methods, in effect at the time such maintenance occurs.

NOW THEREFORE, it is mutually stipulated and agreed as follows:

1. Owner shall comply with the WQMP.

2. All maintenance or replacement of BMPs proposed as part of the WQMP are the sole responsibility of the Owner in accordance with the terms of this Agreement.

3. Owner hereby provides the County's designee complete access, of any duration, to the BMPs and their immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by the County Director of Public Works, no advance notice, for the purpose of inspection, sampling, testing of the BMPs, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 5 below. The County shall make every effort at all times to minimize or avoid interference with Owner's use of the Property. Denial of access to any premises or facility that contains WQMP features is a breach of this Agreement and may also be a violation of the County's Pollutant Discharge Elimination System regulations, which on the effective date of this Agreement are found in County Code Sections 35.0101 et seq. If there is reasonable cause to believe that an illicit discharge or breach of this Agreement is occurring on the premises then the authorized enforcement agency may seek issuance of a search warrant from any court of competent jurisdiction in addition to other enforcement actions. Owner recognizes that the County may perform routine and regular inspections, as well as emergency inspections, of the BMPs. Owner or Owner's successors or assigns shall pay County for all costs incurred by County in the inspection, sampling, testing of the BMPs within thirty (30) calendar days of County invoice.

4. Owner shall use its best efforts diligently to maintain all BMPs in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Owner and Owner's representative or contractor in the removal and extraction of any material(s) from the BMPs and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested from time to time by the County, the Owner shall provide the County with documentation identifying the material(s) removed, the quantity, and disposal destination), testing construction or reconstruction.

5. In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) business days of being given written notice by the County , the County is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense against the Property and/or to the Owner or Owner's successors or assigns, including administrative costs, attorneys fees and interest thereon at the maximum rate authorized by the County Code from the date of the notice of expense until paid in full. Owner or Owner's successors or assigns shall pay County within thirty (30) calendar days of County invoice.

6. The County may require the owner to post security in form and for a time period satisfactory to the County to guarantee the performance of the obligations stated herein. Should the Owner fail to perform the obligations under the Agreement, the County may, in the case of a cash bond, act for the Owner using the proceeds from it, or in the case of a surety bond, require the surety(ies) to perform the obligations of this Agreement.

7. The County agrees, from time to time, within ten (10) business days after request of Owner, to execute and deliver to Owner, or Owner's designee, an estoppel certificate requested by Owner, stating that this Agreement is in full force and effect, and that Owner is not in default hereunder with regard to any maintenance or payment obligations (or specifying in detail the nature of Owner's default). Owner shall pay all costs and expenses incurred by the County in its investigation of whether to issue an estoppel certificate within thirty (30) calendar days after receipt of a County invoice and prior to the County's issuance of such certificate. Where the County cannot issue an estoppel certificate, Owner shall pay the County within thirty (30) calendar days of receipt of a County invoice.

8. Owner shall not change any BMPs identified in the WQMP without an amendment to this Agreement approved by authorized representatives of both the County and the Owner.

9. County and Owner shall comply with all applicable laws, ordinances, rules, regulations, court orders and government agency orders now or hereinafter in effect in carrying out the terms of this Agreement. If a provision of this Agreement is terminated or held to be invalid, illegal or unenforceable, the validity, legality and enforceability of the remaining provisions shall remain in full effect.

10. In addition to any remedy available to County under this Agreement, if Owner violates any term of this Agreement and does not cure the violation within the time already provided in this Agreement, or, if not provided, within thirty (30) calendar days, or within such time authorized by the County if said cure reasonably requires more than the subject time, the County may bring an action at law or in equity in a court of competent jurisdiction to enforce compliance by the Owner with the terms of this Agreement. In such action, the County may recover any damages to which the County may be entitled for the violation, enjoin the violation by temporary or permanent injunction without the necessity of proving actual damages or the inadequacy of otherwise available legal remedies, or obtain other equitable relief, including, but not limited to, the restoration of the Property and/or the BMPs identified in the WQMP to the condition in which it/they existed prior to any such violation or injury.

11. This Agreement shall be recorded in the Office of the Recorder of San Bernardino County, California, at the expense of the Owner and shall constitute notice to all successors and assigns of the title to said Property of the obligation herein set forth, and also a lien in such amount as will fully reimburse the County, including interest as herein above set forth, subject to foreclosure in event of default in payment.

12. In event of legal action occasioned by any default or action of the Owner, or its successors or assigns, then the Owner and its successors or assigns agree(s) to hold the County harmless and pay all costs incurred by the County in enforcing the terms of this Agreement, including reasonable attorney's fees and costs, and that the same shall become a part of the lien against said Property.

13. It is the intent of the parties hereto that burdens and benefits herein undertaken shall constitute covenants that run with said Property and constitute a lien there against.

14. The obligations herein undertaken shall be binding upon the heirs, successors, executors, administrators and assigns of the parties hereto. The term "Owner" shall include not only the present Owner, but also its heirs, successors, executors, administrators, and assigns. Owner shall notify any successor to title of all or part of the Property about the existence of this Agreement. Owner shall provide such notice prior to such successor obtaining an

interest in all or part of the Property. Owner shall provide a copy of such notice to the County at the same time such notice is provided to the successor.

15. Time is of the essence in the performance of this Agreement.

16. Any notice to a party required or called for in this Agreement shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two (72) hours after deposit in the U.S. Mail, whichever is earlier. A party may change a notice address only by providing written notice thereof to the other party.

17. Owner agrees to indemnify, defend (with counsel reasonably approved by the County) and hold harmless the County and its authorized officers, employees, agents and volunteers from any and all claims, actions, losses, damages, and/or liability arising out of this Agreement from any cause whatsoever, including the acts, errors or omissions of any person and for any costs or expenses incurred by the County on account of any claim except where such indemnification is prohibited by law. This indemnification provision shall apply regardless of the existence or degree of fault of indemnitees. The Owner's indemnification obligation applies to the County's "active" as well as "passive" negligence but does not apply to the County's "sole negligence" or "willful misconduct" within the meaning of Civil Code Section 2782, or to any claims, actions, losses, damages, and/or liabilities, to the extent caused by the acts or omissions of any third party contractors undertaking any work (other than field inspections) or other maintenance on the Property on behalf of the County under this Agreement..

[REMAINDER OF THIS PAGE INTENTIONALLY LEFT BLANK]

IF TO COUNTY :	**IF TO OWNER:**
Director of Public Works	______________________________
825 E. Third Street, Room 117	______________________________
San Bernardino, CA 92415-0835	______________________________

IN WITNESS THEREOF, the parties hereto have affixed their signatures as of the date first written above.

OWNER:

Company/Trust:_________________________

Signature: ___________________________

Name: ______________________________

Title: ______________________________

Date: ______________________________

OWNER:

Company/Trust:_________________________

Signature: ___________________________

Name: ______________________________

Title: ______________________________

Date: ______________________________

FOR: Maintenance Agreement, dated ________________________, for the project known as ________________________________ ________________________________ (APN)____________________________, As described in the WQMP dated ________________________________.

NOTARIES ON FOLLOWING PAGE

A notary acknowledgement is required for recordation.

ACCEPTED BY:

____

BRENDON BIGGS, M.S., P.E., Director of Public Works

Date: ________________________________

Attachment: Notary Acknowledgement

ATTACHMENT 1
Notary Acknowledgement)

EXHIBIT A

(Legal Description)

EXHIBIT B
(Map/illustration)

REPORT OF GEOTECHNICAL INVESTIGATION
PROPOSED INDUSTRIAL BUILDINGS
HARDT STREET & BRIER STREET
SAN BERNARDINO, CALIFORNIA

PREPARED FOR:

OAK PROPERTIES
ATTENTION: MR. MIKE GAY
9747 BUSINESS PARK AVENUE
SAN DIEGO, CALIFORNIA 92131

PREPARED BY:

CONSTRUCTION TESTING & ENGINEERING, SOUTH, INC.
14538 MERIDIAN PARKWAY, SUITE A
RIVERSIDE, CA 92518

CTE JOB NO. 40-3959G **JUNE 24, 2021**

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APPENDIX B LABORATORY METHODS AND RESULTS
APPENDIX C SEISMIC SETTLEMENT ANALYSES
APPENDIX D STANDARD SPECIFICATIONS FOR GRADING & TRENCH BACKFILL

1.0 EXECUTIVE SUMMARY

Construction Testing & Engineering, Inc. (CTE) has performed a geotechnical investigation to provide site-specific geotechnical information for the proposed industrial development in San Bernardino, California. The proposed development will consist of five buildings with a total footprint area of approximately 108,000 square feet. The buildings will be concrete tilt-up construction founded on conventional shallow footings with slab-on-grade floors. The development will include pavements, hardscapes, utilities, bioinfiltration basins, and landscaping.

Based on our investigation and review of geologic maps, the site is underlain by younger (Holocene-age) alluvium. Groundwater was not encountered during our investigation. Groundwater is not expected to impact the proposed development, although grading or construction could be adversely affected if performed during or following periods of wet weather.

Based on our investigation and geologic literature review, the site is not located in a State of California Alquist-Priolo Earthquake Fault Zone. Based on the depth to groundwater, the potential for liquefaction of site soils is considered very low.

Based on our investigation, the proposed development at the site is considered feasible from a geotechnical standpoint, provided the recommendations herein are implemented during project design and construction.

2.0 INTRODUCTION AND SCOPE OF SERVICES

2.1 Introduction

CTE has prepared this report for Oak Properties. Presented herein are the results of the subsurface investigation performed as well as recommendations regarding the geotechnical engineering and dynamic loading criteria for the proposed construction.

2.2 Scope of Services

Our scope of services included:

- Review of readily available geologic and geotechnical literature pertinent to the site.
- Explorations to determine subsurface soil, rock and groundwater conditions to the depths influenced by the proposed development.
- Percolation testing for use in onsite storm water BMP design.
- Laboratory testing of representative soil samples to provide data to evaluate the geotechnical design characteristics of the site foundation soils.
- Definition of the general geology and evaluation of potential geologic hazards at the site.
- Preparation of this report detailing the investigation performed and providing conclusions and geotechnical engineering recommendations for design and construction. Included in the report are site geology and hazards, seismic effects and design parameters, earthwork recommendations, foundation design parameters including lateral resistance, retaining wall design parameters, and pavement structure section recommendations.

3.0 SITE AND PROPOSED CONSTRUCTION

The site consists of ten vacant, undeveloped parcels located off Hardt and Brier Streets, west of Tippecanoe Avenue in the city of San Bernardino, California. Four parcels are located north, and two parcels located south of Hardt Street; and four parcels are located north of Brier Street.

Figure 1 shows the location of the site. The site is relatively flat. The ground surface is exposed soil with sparse vegetation. The site has recently been disced. A drainage channel, traversing east-west, borders the site to the north, and a water district easement borders the site to the west. Developed parcels also border the site.

The proposed development will consist of five buildings with a total footprint area of approximately 108,000 square feet. The buildings will be concrete tilt-up construction founded on conventional shallow footings with slab-on-grade floors. The development will include pavements, hardscapes, utilities, bioinfiltration basins, and landscaping.

4.0 FIELD AND LABORATORY INVESTIGATION

4.1 Field Investigation

Our field investigation was performed on April 29-30 and May 3-6, 2021, and included 14 exploratory borings (identified as B-1 through B-14), six cone penetration test (CPT) soundings (identified as CPT-1 thru CPT-6), and 14 percolation test borings (identified as P-1A thru P-5C). The explorations were conducted at the proposed building, pavement, and BMP locations. The exploration and test locations are shown on Figure 2.

The exploratory borings were excavated to investigate and obtain samples of the subsurface soils. The borings were excavated using a truck-mounted, eight-inch diameter, hollow-stem auger drill rig to a maximum explored depth of approximately 51½ feet below ground surface (bgs). CPT soundings were advanced using a Vertek integrated electronic cone system, and advanced by a 30-ton truck to the maximum explored depth of 50 feet. At location CPT-3, shear wave measurements were obtained at approximately 5-foot intervals.

Soils encountered within the explorations were classified in the field in accordance with the Unified Soil Classification System. The field descriptions were later modified (as appropriate) based on the results of our laboratory testing program. In general, soil samples were obtained at 5-foot intervals with standard split spoon (SPT and California Modified) samplers. Specifics of the soils encountered can be found on the Exploration Logs, which are presented in Appendix A.

4.2 Laboratory Tests

Laboratory tests were conducted on representative soil samples to evaluate their physical properties and engineering characteristics. Specific laboratory tests included: direct shear, consolidation/swell, maximum dry density and optimum moisture content, in-place moisture and dry density, "R" value, Atterberg limits, expansion index, gradation, and chemical analyses. These tests were conducted to determine the engineering properties and corrosivity of the on-site soils. Test method descriptions and laboratory results are presented in Appendix B and on the Exploration Logs.

5.0 GEOLOGY

5.1 General Physiographic Setting

The subject site is situated within the Transverse Ranges Geomorphic Province, which is a complex series of mountain ranges and valleys distinguished by a dominant east-west trend. This geomorphic province is approximately 10 to 50 miles wide (north-south) and 300 miles long (east-west). The east-west structure of the province is the result of major crustal rotation.

5.2 Site Geologic Conditions

Based on our investigation and review of geologic mapping (Morton, 1978), the site is underlain by younger alluvium. Below is a brief description of the materials encountered during the investigation. More detailed descriptions are provided in the Exploration Logs in Appendix A.

5.2.1 Quaternary Younger Alluvium (Qya)

Younger (Holocene-age) alluvium was encountered in the explorations from the surface to the maximum explored depth of 51½ feet bgs. The deposits consisted of interbedded layers of loose to dense silty sand, clayey sand and poorly-graded sand, and medium stiff to very stiff clay, silty clay, and silt. The deposits were in damp to very moist condition.

5.3 Groundwater Conditions

Groundwater was not encountered in the explorations. Review of online water data library (DWR) shows historical high groundwater in the vicinity of the site to be greater than 50 feet bgs. Groundwater levels will likely fluctuate during periods of high precipitation. Groundwater is not expected to impact the proposed development, although grading or construction could be adversely affected if performed during or following periods of wet weather.

5.4 Geologic Hazards

From our investigation, it appears that geologic hazards at the site are limited primarily to those caused by strong shaking from earthquake-generated ground motions. Presented herein are the geologic hazards that are considered for potential impacts to site development.

5.4.1 Surface Fault Rupture

In accordance with the Alquist-Priolo Earthquake Fault Zoning Act, (ACT), the State of California established Earthquake Fault Zones around known active faults. The purpose of the ACT is to regulate the development of structures intended for human occupancy near active fault traces in order to mitigate hazards associated with surface fault rupture. According to the California Geological Survey (Special Publication 42, Revised 2018), a fault that has had surface displacement within the last 11,700 years is defined as a Holocene-active fault and is either already zoned or pending zonation in accordance with the ACT. There are several other definitions of fault activity that are used to regulate dams, power plants, and other critical facilities, and some agencies designate faults that are documented as older than Holocene (last 11,700 years) and younger than late Quaternary (1.6 million years) as potentially active faults that are subject to local jurisdictional regulations. The site is not located in or adjacent to an Alquist-Priolo Earthquake Fault Zone.

Based on our site reconnaissance and review of the referenced literature, no known active fault traces underlie the site. Based on our investigation, the potential for surface rupture from displacement or fault movement beneath the improvements is considered low.

5.4.2 Local and Regional Faulting

The United States Geological Survey (USGS), with support of State Geological Surveys, and reviewed published work by various researchers, have developed a Quaternary Fault and Fold Database of faults and associated folds that are believed to be sources of earthquakes with magnitudes greater than 6.0 that have occurred during the Quaternary (the past 1.6 million years). The faults and folds within the database have been categorized into four Classes (Class A-D) based on the level of evidence confirming that a Quaternary fault is of tectonic origin and whether the structure is exposed for mapping or inferred from fault related deformational features. Class A faults have been mapped and categorized based on age of documented activity ranging from Historical faults (activity within last 150 years), Latest Quaternary faults (activity within last 15,000 years), Late Quaternary (activity within last 130,000 years), to Middle to late Quaternary (activity within last 1.6 million years). The Class A faults are considered to have the highest potential to generate earthquakes and/or surface rupture, and the earthquake and surface rupture potential generally increases from oldest to youngest. The evidence for Quaternary deformation and/or tectonic activity progressively decreases for Class B and Class C faults. When geologic evidence indicates that a fault is not of tectonic origin it is considered to be a Class D structure. Such evidence includes joints, fractures, landslides, or erosional and fluvial scarps that resemble fault features, but demonstrate a non-tectonic origin.

The nearest Class A fault to the site is San Jacinto fault zone, which is approximately 1.4 miles from the site. A regional fault activity map is presented on Figure 3.

5.4.3 Liquefaction and Seismic Settlement Evaluation

Liquefaction occurs when saturated fine sands, silts or low plasticity clays lose their physical strength during earthquake-induced shaking and behave as a liquid. This is due to loss of point-to-point grain contact and transfer of normal stress to the pore water. Liquefaction potential varies with groundwater level, soil type, material gradation, relative density, and the intensity and duration of ground shaking.

Based on the depth to groundwater, the potential for liquefaction of site soils is considered very low.

Seismic settlement (dynamic densification) occurs when loose to medium dense granular soils densify during seismic events. The program LiquefyPro was used for a quantitative liquefaction/seismic settlement analysis. The soil profiles from explorations CPT-3 and CPT-6 were used for the analysis. An earthquake magnitude of 7.5, determined using USGS Unified Hazard Tool (USGS, online), and an assumed high groundwater depth of 50 feet bgs were used in the analysis. The analysis estimates total settlement at the site due to post-earthquake settlement of granular soils to be 2.94 inches. Differential dynamic settlement is estimated to be 1 inch or less over a horizontal distance of 40 feet or more. These settlements should be anticipated in the event of a major magnitude earthquake in the immediate vicinity of the site and should be incorporated into the design of the project, as necessary. Results of the seismic settlement analyses are presented in Appendix C.

5.4.4 Tsunami and Seiche Evaluation

Due to site elevation and distance from the Pacific Ocean, the site is not considered to be subject to damage from tsunamis. Based on the absence of large bodies of water in the area, seiche (oscillatory waves in standing bodies of water) damage is also not expected.

5.4.5 Landsliding

No features typically associated with landsliding were noted during the site investigation. In the reference review, no evidence of landsliding was found to have occurred within the area of the site. Therefore, the potential for landsliding to affect the site is considered very low.

5.4.6 Compressible and Expansive Soils

Based on our investigation and laboratory testing, the upper 10-feet of site soil is expected to be compressible relative to the post-construction overburden; mitigation of the compressible soils are recommended through removal and recompaction as recommended in Section 6.2 below. Based on the results of expansion index testing, site soils are anticipated to have low expansion potential.

5.4.7 Flood Zones

Based on Federal Emergency Management Agency flood zone map (FEMA, 2016), the site is located in Zone X, which is identified as an "area determined to be outside the 0.2% chance flood plain." The northern portion of the site is adjacent to an earthen drainage channel, which is located in Zone A, identified as an "area with no base flood elevations determined."

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 General

Based on our investigation, the proposed construction on the site is feasible from a geotechnical standpoint, provided the recommendations in this report are incorporated into design and construction of the project. Preliminary recommendations for the design and construction of the proposed development are included in the subsequent sections of this report. Additional recommendations could be required based on the actual conditions encountered during earthwork and/or improvement construction.

6.2 Site Preparation

6.2.1 General

Prior to grading, the site should be cleared of existing vegetation, debris, and other deleterious materials. In areas to receive structures or distress-sensitive improvements, surficial eroded, desiccated, burrowed, or otherwise loose or disturbed soils should be removed to the depth of competent material as recommended below in Section 6.2.2. Organic and other deleterious materials not suitable for use as structural backfill should be disposed of offsite at a legal disposal site.

6.2.2 Remedial Grading and Excavations

Due to soft/loose and compressible soils encountered in the upper 10-feet of the site soil profile, and in order to provide uniform structural support, remedial grading will be required. The building pads should be excavated to a depth of 10-feet below existing grade or five feet below footing bottoms, whichever is greater. The excavations should extend laterally 10-feet beyond foundation footprint limits. The soils exposed at the base of the excavations should be observed by a geotechnical representative of this office to determine their suitability prior to fill placement. Deeper removals (to depth of competent material) may be needed, based on field conditions exposed during excavations. Over-excavation for new pavement areas may be limited to 2-feet below existing or finish grade, whichever is greater.

Temporary, unsurcharged excavations up to three feet deep may be cut vertically. Deeper excavations should be sloped back or shored. Temporary sloped excavations should be cut at a slope of 1:1 (horizontal:vertical) or flatter. Vehicles and storage loads should not be placed within 10 feet of the top of the excavation. Berms are recommended along the tops of slopes to divert runoff water from entering the excavation and eroding the slope faces. Excavations should be stabilized within 30 days of initial excavation. Final slopes should be no steeper than 2:1 (horizontal:vertical). Safety provisions of Cal OSHA and other related statutory agencies should be followed, especially as related to support of adjacent structures.

6.2.3 Preparation of Areas to Receive Fill

Exposed excavation bottoms and subgrade surfaces to receive fill should be scarified to a minimum depth of 8 inches, brought to within +/- 2 percent of optimum moisture content and compacted to at least 90 percent of the maximum dry density as determined by ASTM D 1557.

6.2.4 Fill Placement and Compaction

Structural fill and backfill should be compacted to at least 90 percent of the maximum dry density (as determined by ASTM D 1557) at moisture content within +/- 2 percent of optimum. The top 12-inches of pavement subgrade should be compacted to at least 95 percent. Compaction equipment should be appropriate for the materials being compacted. The optimum lift thickness for fill soils will be dependent on the type of compaction equipment being utilized. Fill should be placed in uniform horizontal lifts not exceeding 8 inches in loose thickness. Placement and compaction of fill should be performed in general conformance with geotechnical recommendations and local ordinances.

Soils generated from on-site excavations are anticipated to be suitable for use as structural fill, provided they are free from debris and deleterious material, and are dried to moisture content near optimum. Rocks or other soil fragments greater than four inches in size should not be used in the fills. Proposed import material should be evaluated by the project geotechnical engineer prior to being placed at the site. Import materials should consist of non-corrosive, granular material with an expansion index less than 20.

6.2.5 Utility Trenches

Utility trenches should be excavated in accordance with the recommendations presented in Section 6.2.2. Backfill should be placed in loose lifts no greater than eight inches and mechanically compacted to a relative compaction of at least 90 percent of the maximum dry density (per ASTM D 1557) at moisture content within +/- 2 percent of optimum.

6.2.6 Earthwork Shrinkage Factor

Estimates of shrinkage are based on comparison of the soil material in its existing condition, as encountered in the explorations, to its compacted state. Based on the in situ densities in the borings from the top 10 feet of site soil, and our experience with similar soils, shrinkage is estimated to be up to 10 percent for soil compacted to at least 90 percent of the maximum dry density. This estimate is provided for preliminary quantity estimates only. Variations in actual shrinkage/bulking factors should be expected.

6.3 Foundations and Slab Recommendations

6.3.1 General

Foundations and slabs for the proposed structures should be designed in accordance with structural considerations and the following minimum preliminary geotechnical recommendations. Foundations are expected to be supported in properly compacted fill. These recommendations assume that the foundation soils will have low potential for expansion, as anticipated.

6.3.2 Shallow Foundations

It is our opinion that the use of isolated and continuous footings will be geotechnically suitable for this project. We recommend that continuous footings be constructed a minimum of 18 inches wide and be founded at least 24 inches below the lowest adjacent rough grade elevation. Dimensions for isolated footings should be a minimum of 24 inches square and founded at least 24 inches below top of slab elevation.

Foundation dimensions should be based on an allowable bearing pressure of 1,500 pounds per square foot (psf) for minimum footing dimensions of one foot in width and one foot in depth. The values may be increased by 20 percent for each additional 12-inches of width or depth to a maximum value of 3,000 psf. The allowable bearing value may be increased by one-third for short-duration loading which includes the effects of wind or seismic forces.

Footing reinforcement within continuous footings should consist of a minimum of four number 4 bars, two located at the top of the footing and two located at the bottom. This minimum reinforcement is due to geotechnical conditions and is not to be used in lieu of that needed for structural considerations. Reinforcement for isolated footings should be determined by the structural engineer.

Resistance to lateral loading may be provided by friction acting at the base of foundations and by passive earth pressure within the natural soils or compacted fill. An allowable coefficient of friction of 0.30 may be used with the dead load forces.

For spread footings in compacted or natural soils the allowable passive earth pressure may be computed as an equivalent fluid having a density of 150 pounds per cubic foot with a maximum earth pressure of 1,500 pounds per square foot. When combining the passive and friction values for calculating the lateral resistance, the passive component shall be reduced by one third.

6.3.3 Settlement of Foundations

We have analyzed settlement potential during construction and for long-term performance. Construction settlement is expected to occur as loads are applied and structures are brought to their operational weight. Long-term settlement is expected to occur over time as a result of compression of wetted or partially saturated soil.

It is anticipated that shallow foundations designed and constructed as recommended will experience total settlement of less than 1 inch and differential static settlement of less than 1/2 inch over a distance of 30 feet or more.

6.3.4 Concrete Slabs-On-Grade

Concrete slabs-on-grade should be designed for the anticipated loading. Lightly-loaded concrete slabs should measure a minimum of 5 inches thick and be reinforced with a minimum of number 3 reinforcing bars placed on 18-inch centers, each way at mid-slab height. Floor slabs should be underlain by 4 inches of coarse clean sand or crushed stone. An uncorrected modulus of subgrade reaction of 100 pci may be used for elastic design. Concrete slabs subjected to heavier loads may require thicker slab sections and/or increased reinforcement as per the project structural engineer. The correct placement of the reinforcement in the slab is vital for satisfactory performance under normal conditions.

In areas to receive moisture-sensitive floor coverings or used to store moisture-sensitive materials, a polyethylene or visqueen moisture vapor retarder (15-mil or thicker) should be placed beneath the slab. A two-inch layer of coarse clean sand or crushed stone should underlie the moisture vapor retarder.

It is recommended that a water-cement ratio of 0.5 or less be used for concrete, and that the slab be moist-cured for at least five days in accordance with methods recommended by the American Concrete Institute. On-site quality control should be used to confirm the design conditions.

6.3.5 Pipe Bedding and Thrust Blocks

We recommend that pipes be supported on a minimum of 6 inches of sand, gravel, or crushed rock. The pipe bedding material should be placed around the pipe, without voids, and to an elevation of at least 12 inches above the top of the pipe. The pipe bedding material should be compacted in accordance with the recommendations in the earthwork section of this report.

Thrust forces may be resisted by thrust blocks and the adjacent soil. Thrust blocks may be designed using a passive resistance in engineered fill equal to the pressure developed by a fluid with a density of 250 pounds per cubic foot (pcf). A friction value of 0.25 may be used between the pipe and adjacent soil.

6.4 Seismic Design Criteria

The seismic ground motion values listed in Table 1 below were derived in accordance with the ASCE 7-16 Standard that is incorporated into the California Building Code, 2019 (effective January 1, 2020). This was accomplished by establishing the Site Class based on the soil properties at the site, and then calculating the site coefficients and parameters using the United States Geological Survey Seismic Design Maps application for the 2019 CBC values. These values are intended for the design of structures to resist the effects of earthquake ground motions. The site coordinates used in the application were 34.07218°N and 117.26344°W. Site Class D was used for the analysis.

TABLE 1
SEISMIC GROUND MOTION VALUES

PARAMETER	VALUE
Site Class	D
Mapped Spectral Response Acceleration Parameter, S_S	2.265g
Mapped Spectral Response Acceleration Parameter, S_1	0.905g
Seismic Coefficient, F_a	1.000
Seismic Coefficient, F_v	Null (refer to ACSE 7-16 Section11.4.8)
MCE Spectral Response Acceleration Parameter, S_{MS}	2.265g
MCE Spectral Response Acceleration Parameter, S_{M1}	Null (refer to ACSE 7-16 Section11.4.8)
Design Spectral Response Acceleration Parameter, S_{DS}	1.510g
Design Spectral Response Acceleration Parameter, S_{D1}	Null (refer to ACSE 7-16 Section11.4.8)
Mapped MCE Geometric Peak Ground Acceleration, PGA_m	1.05g
Seismic Design Category	Null (refer to ACSE 7-16 Section11.4.8)

A site-specific ground motion analysis was not in the current scope of services. Should an analysis be needed, this office may provide upon request.

6.5 Vehicular Pavements

Pavement sections were evaluated using a design 'R' value of 10, correlating to a modulus of subgrade reaction of approximately 100 pci for site subgrade soil. The laboratory determined 'R' values for site soil were 14 and 18. The pavement section recommendations are based on the assumption that the subgrade soil (the top 12-inches minimum) will be compacted to a minimum of 95 percent of the maximum dry density (per ASTM D 1557).

If concrete pavement is used, it should have a minimum modulus of rupture (flexural strength) of 600 psi. We estimate that a 4,500 psi 28-day compressive strength concrete would generally provide the minimum required flexural strength; however, other mix designs could also meet the requirements. As such, we recommend that the contractor submit the proposed mix design with necessary documentation to offer a proper level of confidence in the proposed concrete materials. Recommended concrete pavement sections are presented below in Table 2.

TABLE 2

PORTLAND CEMENT CONCRETE (PCC) PAVEMENT SECTION

Traffic Area	Assumed Traffic Index	Design Modulus of Subgrade Reaction (pci)	PCC Thickness (inches)
Auto Parking Areas	5.0	100	7.0
Truck Drive Lanes	6.0	100	8.0

An unreinforced pavement with the minimum thickness indicated above should generally be constructed with maximum joint spacing of 24 times the pavement thickness, in both directions, and in nearly square patterns. As an alternative, the concrete pavement could be constructed with typical minimal reinforcement consisting of #4 bars at 18 inches, on-center, both ways, at or above mid-slab height and with proper concrete cover.

Recommended asphalt concrete pavement sections are presented below in Table 3.

TABLE 3

ASPHALT CONCRETE (AC) PAVEMENT SECTIONS

Traffic Area	Assumed Traffic Index	Design 'R' Value	AC Thickness (inches)	Aggregate Base Thickness* (inches)
Auto Parking Areas	5.0	10	3.0	9.0
Truck Drive Lanes	6.0	10	3.5	11.5

* Minimum R Value of 78.

In addition, it is recommended that pavement areas conform to the following criteria:

- Placement and construction of the recommended pavement section should be performed in accordance with the Standard Specifications for Public Works Construction (Greenbook, latest edition).

- Aggregate base should conform to the specification for Caltrans Class 2 Aggregate Base (Caltrans, 2015) or Greenbook Crushed Aggregate Base.

- Pavement sections are prepared assuming that periodic maintenance will be done, including sealing of cracks and other measures.

6.6 Retaining Walls

For the design of walls where the surface of the backfill is level, it may be assumed that the on-site soils will exert an active lateral pressure equal to that developed by a fluid with a density of 45 pounds per cubic foot (pcf). The active pressure should be used for walls free to yield at the top at least 0.2 percent of the wall height. For walls restrained at the top so that such movement is not permitted, a pressure corresponding to an equivalent fluid density of 65 pcf should be used, based on at-rest soil conditions. These pressures should be increased by 20 pcf for walls retaining soils inclined at 2:1 (horizontal:vertical).

Retaining walls over six feet high should be designed for earthquake forces. Lateral pressures on cantilever retaining walls (yielding walls) due to earthquake motions may be calculated based on work by Seed and Whitman (1970). The total lateral thrust against a properly drained and backfilled cantilever retaining wall above the groundwater level can be expressed as:

$$P_{AE} = P_A + \Delta P_{AE}$$

For non-yielding (or "restrained') walls, the total lateral thrust may be similarly calculated based on work by Wood (1973):

$$P_{KE} = P_K + \Delta P_{KE}$$

Where:

P_A = Static Active Thrust

P_K = Static Restrained Wall Thrust

ΔP_{AE} = Dynamic Active Thrust Increment = $(3/8)\ k_h\ \gamma H^2$

ΔP_{KE} = Dynamic Restrained Thrust Increment = $k_h\ \gamma H^2$

k_h = 2/3 Peak Ground Acceleration =2/3 (PGA_M) = 0.70g

H = Total Height of the Wall

γ = Total Unit Weight of Soil ≈ 135 pounds per cubic foot

The increment of dynamic thrust in both cases should be distributed as an inverted triangle, with a resultant located at 0.6H above the bottom of the wall. Recommendations for waterproofing the walls to reduce moisture infiltration should be provided by the project architect or structural engineer.

We recommend that walls be backfilled with soil having an expansion index of 20 or less with less than 30 percent passing the #200 sieve. The backfill area should include the zone defined by a 1:1 sloping plane, extended back from the base of the wall footing. Wall backfill should be compacted to at least 90 percent relative compaction, based on ASTM D 1557. Backfill should not be placed until walls have achieved adequate structural strength. Heavy compaction equipment, which could cause distress to walls, should not be used. The recommended lateral earth pressures presented herein assume that drainage will be provided behind the walls to prevent the accumulation of hydrostatic pressures. A backdrain system (similar to that shown on Figure 4) should be provided to reduce the potential for the accumulation of hydrostatic pressures.

6.7 Corrosive Soils

Sulfate-containing solutions or soil can have a deleterious effect on the in-service performance of concrete. In order to evaluate the foundation environment, a representative sample of site soil was laboratory tested for pH, resistivity, soluble sulfate and chloride. The results of the tests are summarized in Table 4.

TABLE 4 SUMMARY OF CHEMICAL ANALYSES				
Sample Location	pH	Resistivity (ohm-cm)	Sulfate (mg/kg)	Chloride (mg/kg)
B-4 @ 1-4 ft.	9.1	640	504	62
B-11 @ 1-3 ft.	8.6	20,400	5.7	4.9
B-12 @ 5-9 ft.	8.6	1,160	358	53

Based on ACI 318-14 Building Code and Commentary, the onsite soil tested is a sulfate exposure class of S0, which is considered low and injurious sulfate attack is not a concern. We recommend concrete containing Type II cement be used. A three-inch concrete cover over reinforcing steel is recommended for concrete in contact with the soil.

Based on the results of the resistivity tests, site soil appears to be *severely corrosive to corrosive* to ferrous metals. We recommend plastic pipes be used. CTE does not practice in the field of corrosion engineering. Therefore, a corrosion engineer could be consulted to determine the appropriate protection for metallic improvements in contact with site soils.

6.8 Exterior Flatwork

Exterior concrete flatwork should have a minimum thickness of four inches (unless otherwise specified by the project architect) and be underlain by four inches of compacted aggregate base. To reduce the potential for distress to exterior flatwork caused by minor settlement of foundation soils, we recommend that such flatwork be installed with crack-control joints at appropriate spacing as recommended by the structural engineer. Flatwork, such as sidewalks, and architectural features, should be installed with crack control joints. The upper six inches of subgrade should be prepared in accordance with the earthwork recommendations provided herein. Positive drainage should be established and maintained adjacent to flatwork as per the recommendations of the project civil engineer of record.

6.9 Drainage

Positive drainage at a slope of 2 percent or more should be established for a minimum distance of five feet away from structures and improvements, and as recommended by the project civil engineer of record. To facilitate this, the proper use of construction elements such as roof drains, downspouts, earthen and/or concrete swales, sloped external slabs-on-grade, and subdrains may be employed. The project civil engineer should thoroughly evaluate the on-site drainage and make provisions as necessary to keep surface water from entering structural areas.

Slabs and planted areas immediately adjacent to the appurtenant structures should slope away from the structures to mitigate pooling of water and should drain to a safe point of collection. Planter boxes adjacent to buildings should have concrete bottoms and drainage away from the buildings. Joints in slabs and swales should be maintained sealed with an appropriate joint compound. Drainage devices shall be provided as specified by the Building Code and grading ordinances.

6.10 Percolation Test Results

Percolation tests were conducted for use in on-site storm water low impact development BMP design, using bore-hole methods. Tests were conducted in proposed infiltration areas at locations and depths indicated by the civil designer. Testing was conducted in accordance with local BMP guidelines (CDM Smith, 2013). Stabilized percolation rates were converted to infiltration rates using the Porchet method. Percolation test results are presented in Table 5.

TABLE 5
PERCOLATION TEST RESULTS

Test No.	Depth of Test (feet bgs)	Soil Description	Tested Infiltration Rate (in/hr)
P-1A	5	Silty Clay	0.10
P-1B	5	Clay	0.03
P-1C	5	Silty Clay	0.09
P-2A	5	Clay	0.04
P-2B	5	Clay	0.03
P-3A	5	Fine Silty Sand	2.6
P-3B	5	Fine Silty Sand to Sandy Silt	2.1
P-3C	5	Sandy Silt	1.4
P-4A	5	Sand with Silt	3.9
P-4B	5	Fine Silty Sand	2.5
P-4C	5	Sand with Silt	3.1
P-5A	5	Silty Clay	0.07
P-5B	5	Clay	0.02
P-5C	5	Clay	0.03

Infiltration rates can be affected by such factors as build-up of silt, debris, degree of soil saturation, and compaction of soil from grading. Accordingly, an appropriate factor of safety should be applied to the slowest tested rate from each BMP area to accommodate such factors as subsurface inconsistencies, potential compaction from grading, and potential silting of the soils. In accordance with the referenced BMP guidelines, a minimum factor of safety of 2 shall be applied to the tested infiltration rates to produce a design infiltration rate.

Due to the variation in infiltration rates across the site, additional testing may be necessary if proposed BMP locations change from the locations tested.

6.11 Plan Review

CTE should be authorized to review project grading and foundation plans and the project specifications before the start of earthwork to identify potential conflicts with the recommendations contained in this report.

6.12 On-Site Construction Reviews

On-site construction reviews of grading, drainage and foundation work should be performed by a field representative of this office to ascertain compliance with the recommendations of this report. Final grading and/or construction should be observed and a written observation form or report issued by this office stating that the work meets the recommendations of this report. As a minimum, on-site construction reviews are to be performed at the following stages of work:

1. Observation of exposed temporary cut slope surface before excavation is more than five feet deep, and again after final excavation before workman enter or placement of any steel.

2. As called for in Section 6.2 and Appendix D herein, for on-site construction reviews and testing of grading work and of compacted earth backfilling behind retaining walls.

3. Observation of footing excavations prior to placement of form boards or reinforcing steel.

4. During proof rolling of subgrade before placement of base material or reinforcing steel, and again following the placement of base material prior to placing reinforcing steel.

5. Observation following installation of sub-drain perforated pipes before covering with gravel or filter material, and again after placing the filter material over perforated pipes before covering with backfill.

6. Following installation of drainage structures and completion of all work.

This office should be given a minimum 48 hours prior notice for any required on-site observations.

7.0 LIMITATIONS

The recommendations provided in this report are based on the anticipated construction and the subsurface conditions found in our explorations. The interpolated subsurface conditions should be checked in the field during construction to document that conditions are as anticipated.

Recommendations provided in this report are based on the understanding and assumption that CTE will provide the observation and testing services for the project. Earthwork should be observed and tested to document that grading activity has been performed according to the recommendations contained within this report. The project geotechnical engineer should evaluate footing excavations prior to placement of reinforcing steel.

The field evaluation, laboratory testing and geotechnical analysis presented in this report have been conducted according to current engineering practice and the standard of care exercised by reputable geotechnical consultants performing similar tasks in this area. No other warranty, expressed or implied, is made regarding the conclusions, recommendations and opinions expressed in this report. Variations may exist and conditions not observed or described in this report may be encountered during construction.

This report is applicable to the site for a period of three years after the issue date provided the project remains as described herein. Modifications to the standard of practice and regulatory requirements may necessitate an update to this report prior to the three years from issue.

Our conclusions and recommendations are based on an analysis of the observed conditions. If conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if required, will be provided upon request. CTE should review project specifications for earthwork, foundation, and shoring-related activities prior to the solicitation of construction bids.

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

Respectfully submitted,
CONSTRUCTION TESTING & ENGINEERING, INC.

Dharmesh Amin, MS, PE, GE
Principal Engineer

Vincent J. Patula, CEG
Senior Engineering Geologist

Robert L. Ellerbusch
Project Geologist

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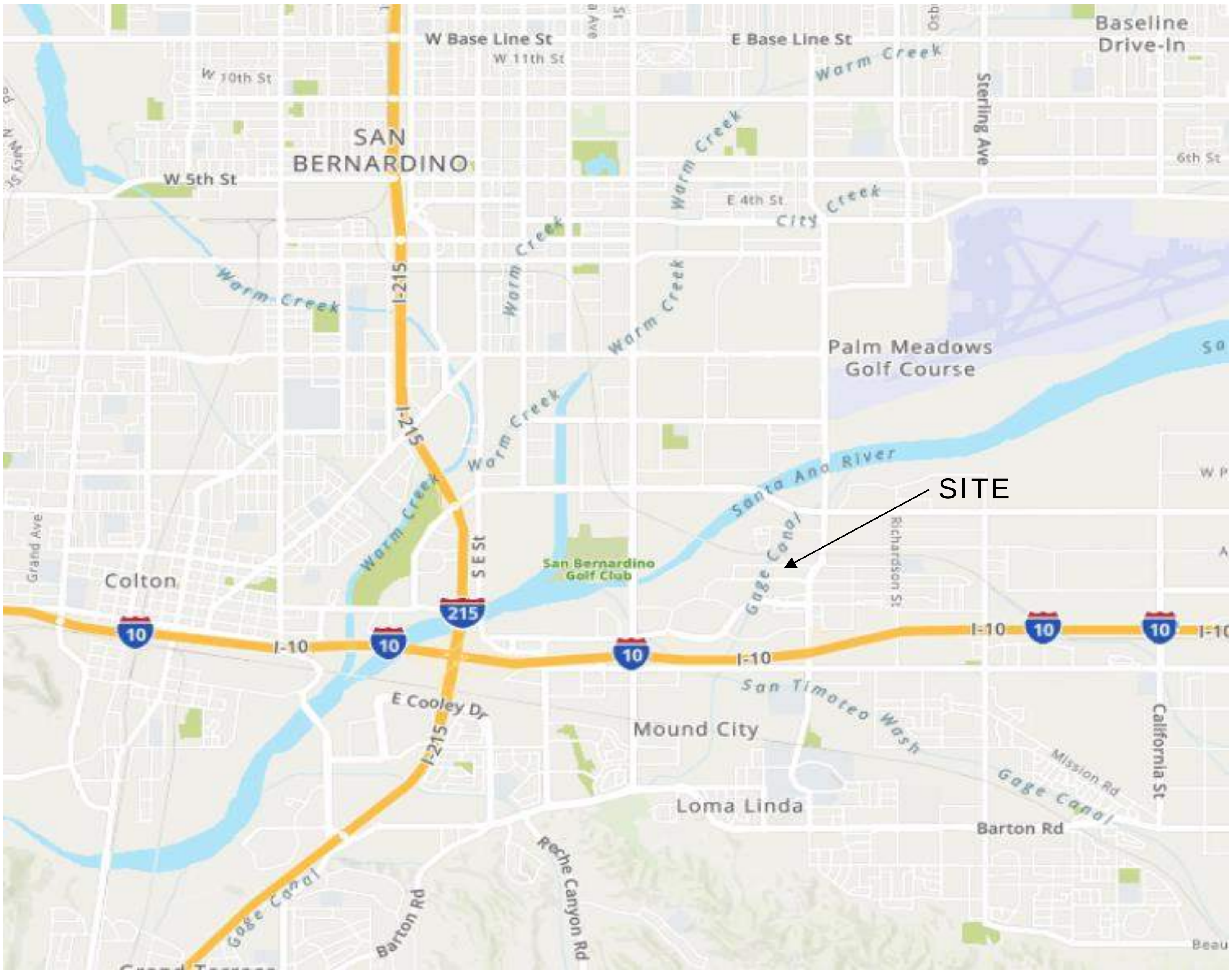

NO SCALE

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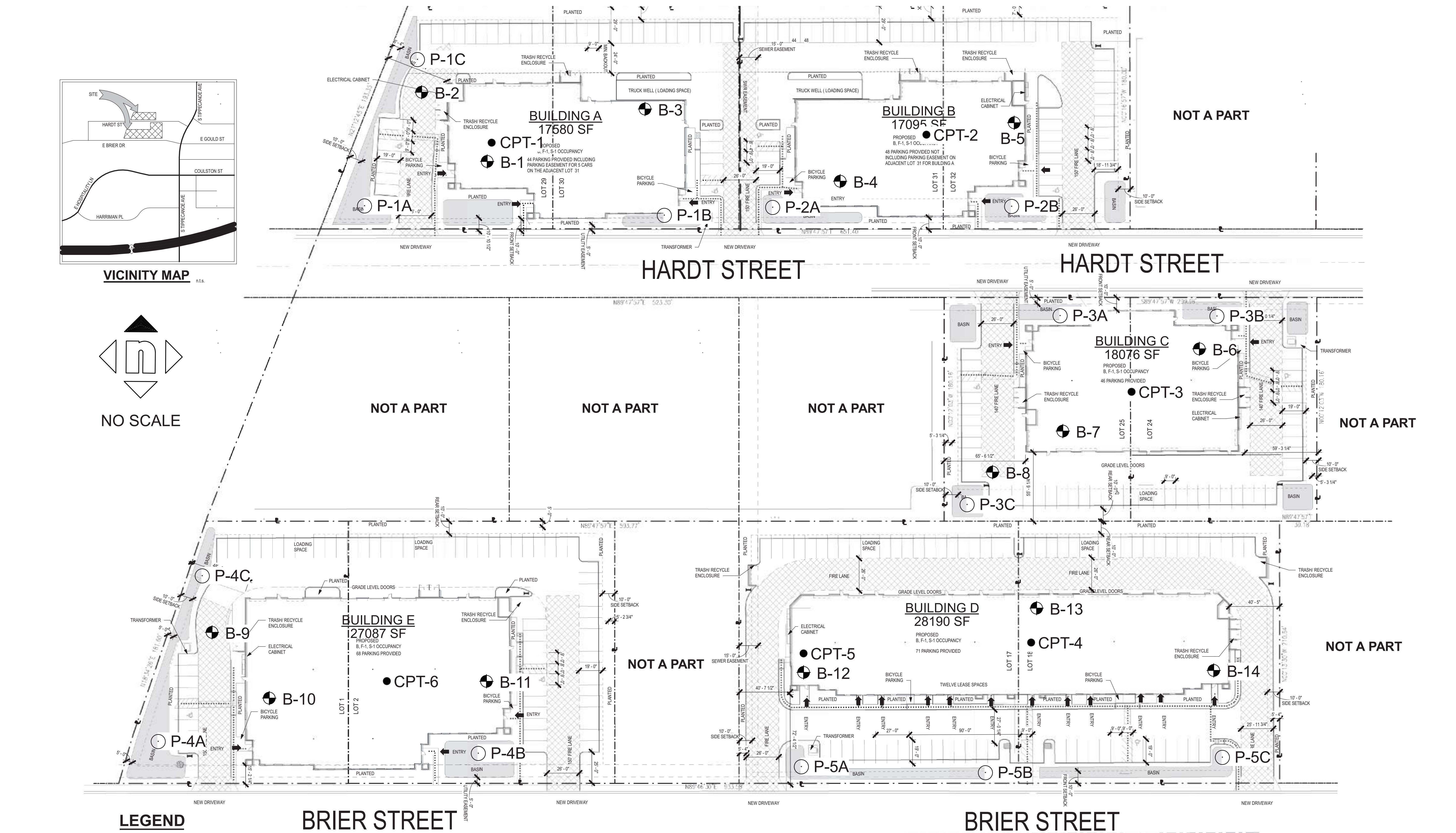
SITE LOCATION MAP

INDUSTRIAL BUILDINGS - HARDT & BRIER STREETS

SAN BERNARDINO, CALIFORNIA

Job No.	Date	Figure
40-3959G	JUNE 2021	1



LEGEND

B-1	APPROXIMATE BORING LOCATION
CPT-1	APPROXIMATE CPT LOCATION
P-1A	APPROXIMATE PERCOLATION TEST LOCATION

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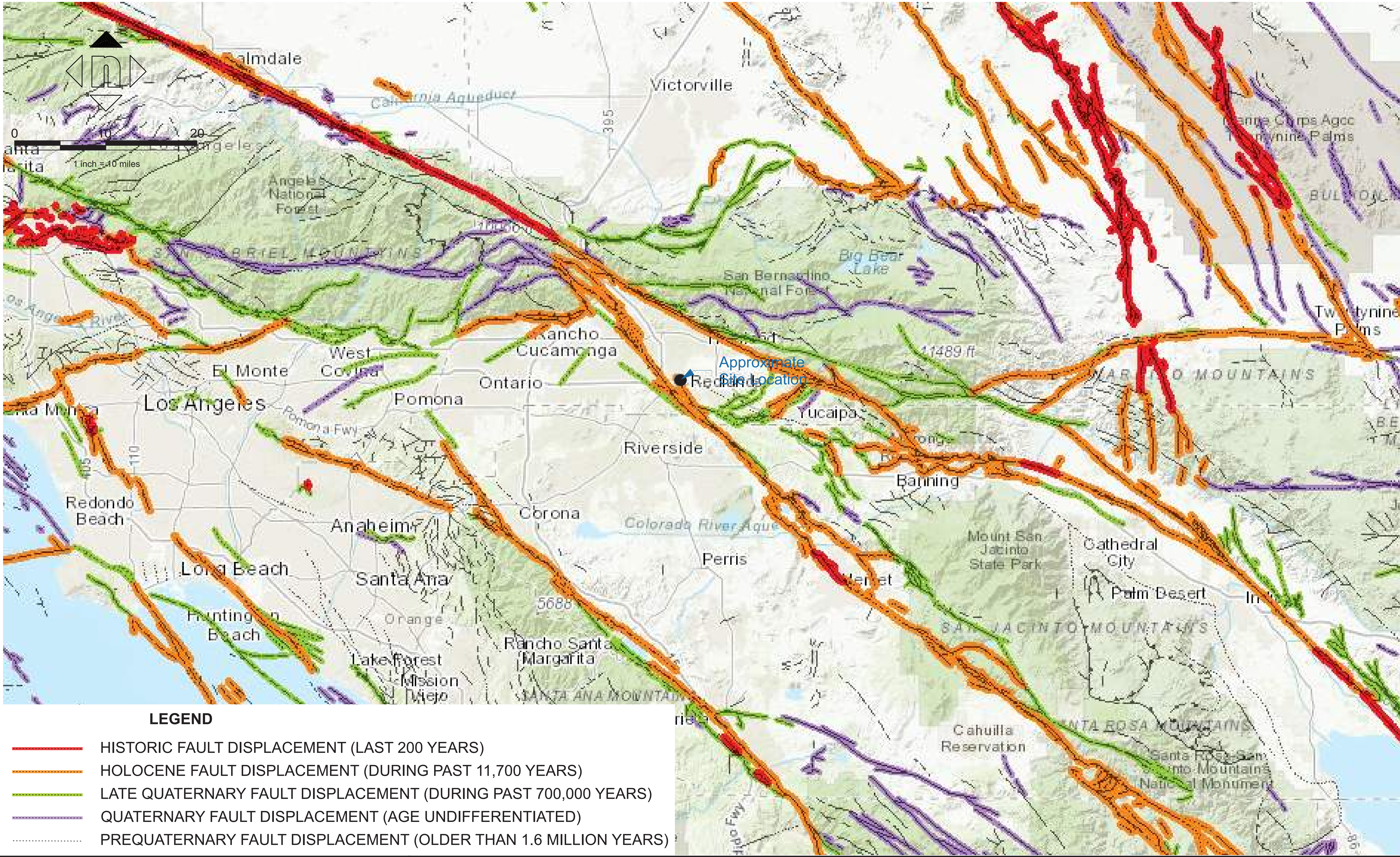
EXPLORATION AND TEST LOCATION MAP

Industrial Buildings
Hardt & Brier Streets
San Bernardino, California

CTE JOB NO: 40-3959G

DATE: Jun 2021

FIGURE: 2



LEGEND

- HISTORIC FAULT DISPLACEMENT (LAST 200 YEARS)
- HOLOCENE FAULT DISPLACEMENT (DURING PAST 11,700 YEARS)
- LATE QUATERNARY FAULT DISPLACEMENT (DURING PAST 700,000 YEARS)
- QUATERNARY FAULT DISPLACEMENT (AGE UNDIFFERENTIATED)
- PREQUATERNARY FAULT DISPLACEMENT (OLDER THAN 1.6 MILLION YEARS)

NOTES: CALIFORNIA GEOLOGICAL SURVEY, ONLINE FAULT ACTIVITY MAP, https://maps.conservation.ca.gov/cgs/fam/.

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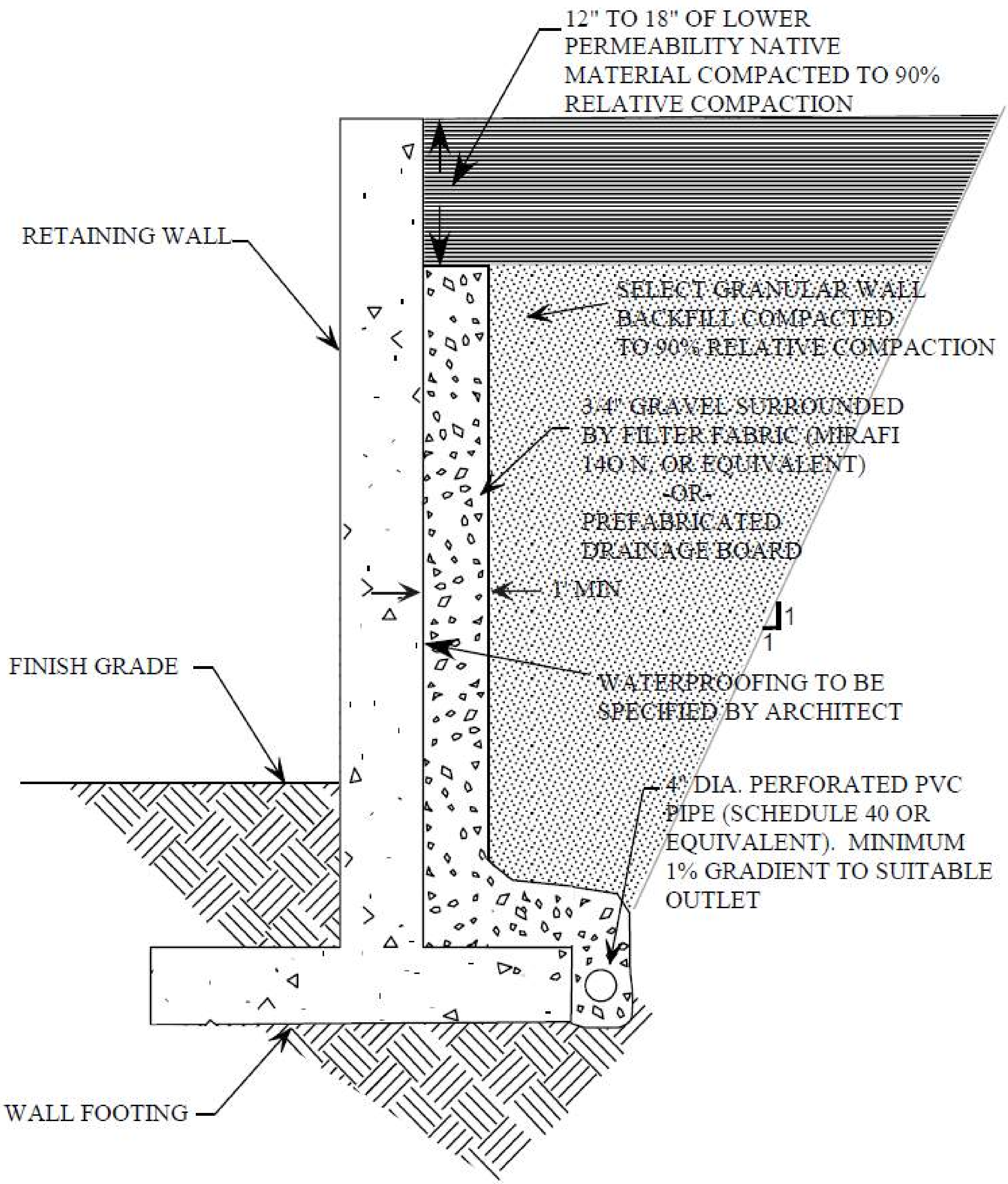
REGIONAL FAULT ACTIVITY MAP

PROPOSED INDUSTRIAL BUILDINGS
HARDT STREET & BRIER STREET
SAN BERNARDINO, CALIFORNIA

CTE JOB NO:	40-3959G
SCALE:	1 inch = 10 miles
DATE: Jun 2021	FIGURE: 3



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RETAINING WALL DRAIN DETAIL

INDUSTRIAL BUILDINGS - HARDT & BRIER STREETS

SAN BERNARDINO, CALIFORNIA

Job No.	Date	Figure
40-3959G	June 2021	4

APPENDIX A

FIELD EXPLORATION METHODS AND EXPLORATION LOGS

APPENDIX A

FIELD EXPLORATION METHODS AND EXPLORATION LOGS

Soil Boring Methods

Relatively “Undisturbed” Soil Samples

Relatively “undisturbed” soil samples were collected using a modified California-drive sampler (2.4-inch inside diameter, 3-inch outside diameter) lined with sample rings. Drive sampling was conducted in general accordance with ASTM D-3550. The steel sampler was driven into the bottom of the borehole with successive drops of a 140-pound weight falling 30-inches. Blow counts (N) required for sampler penetration are shown on the boring logs in the column “Blows/Foot.” The soil was retained in brass rings (2.4 inches in diameter, 1.0 inch in height) and sealed in waterproof plastic containers for shipment to the CTE, South, Inc. geotechnical laboratory.

Disturbed Soil Sampling

Bulk soil samples were collected for laboratory analysis using two methods. Standard Penetration Tests (SPT) were performed according to ASTM D-1586 at selected depths in the borings using a standard (1.4-inches inside diameter, 2-inches outside diameter) split-barrel sampler. The steel sampler was driven into the bottom of the borehole with successive drops of a 140-pound weight falling 30-inches. Blow counts (N) required for sampler penetration are shown on the boring logs in the column “Blows/Foot.” Samples collected in this manner were placed in sealed plastic bags. Bulk soil samples of the drill cuttings were also collected in large plastic bags. The disturbed soil samples were returned to the CTE, South, Inc. geotechnical laboratory for analysis.

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DEFINITION OF TERMS

PRIMARY DIVISIONS			SYMBOLS	SECONDARY DIVISIONS
COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	**GRAVELS** MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS < 5% FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES LITTLE OR NO FINES
			GP	POORLY GRADED GRAVELS OR GRAVEL SAND MIXTURES, LITTLE OF NO FINES
		GRAVELS WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, NON-PLASTIC FINES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS < 5% FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	**SILTS AND CLAYS** LIQUID LIMIT IS LESS THAN 50		ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, SLIGHTLY PLASTIC CLAYEY SILTS
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY, SANDY, SILTS OR LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTY CLAYS
HIGHLY ORGANIC SOILS			PT	PEAT AND OTHER HIGHLY ORGANIC SOILS

GRAIN SIZES

BOULDERS	COBBLES	GRAVEL		SAND			SILTS AND CLAYS
		COARSE	FINE	COARSE	MEDIUM	FINE	

12" 3" 3/4" 4 10 40 200

CLEAR SQUARE SIEVE OPENING — U.S. STANDARD SIEVE SIZE

ADDITIONAL TESTS

(OTHER THAN TEST PIT AND BORING LOG COLUMN HEADINGS)

MAX- Maximum Dry Density
GS- Grain Size Distribution
SE- Sand Equivalent
EI- Expansion Index
CHM- Sulfate and Chloride Content , pH, Resistivity
COR - Corrosivity
SD- Sample Disturbed

PM- Permeability
SG- Specific Gravity
HA- Hydrometer Analysis
AL- Atterberg Limits
RV- R-Value
CN- Consolidation
CP- Collapse Potential
HC- Hydrocollapse
REM- Remolded

PP- Pocket Penetrometer
WA- Wash Analysis
DS- Direct Shear
UC- Unconfined Compression
MD- Moisture/Density
M- Moisture
SC- Swell Compression
OI- Organic Impurities

FIGURE:	BL1

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PROJECT:	DRILLER:	SHEET: of
CTE JOB NO:	DRILL METHOD:	DRILLING DATE:
LOGGED BY:	SAMPLE METHOD:	ELEVATION:

Depth (Feet) | Bulk Sample | Driven Type | Blows/Foot | Dry Density (pcf) | Moisture (%) | U.S.C.S. Symbol | Graphic Log

BORING LEGEND

DESCRIPTION

Laboratory Tests

0 5 10 15 20 25

Block or Chunk Sample

Bulk Sample

Standard Penetration Test

Modified Split-Barrel Drive Sampler (Cal Sampler)

Groundwater Table

Soil Type or Classification Change

? ——— ? ——— ? ——— ? ——— ? ——— ? ——— ? —

Formation Change [(Approximate boundaries queried (?)]

"SM"

Quotes are placed around classifications where the soils exist in situ as bedrock

FIGURE: BL2

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	1 of 2
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/30/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-1

Depth (Feet)	Bulk Sample	Driven Sample Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						ML		**Quaternary Younger Alluvium (Qya)**	
								Sandy SILT, moist, dark brown.	
5			4 8 10	112.7	13.4			Sandy SILT, stiff, moist, dark brown.	MD
10			4 5 7		18.6			Sandy SILT, stiff, very moist, dark olive brown.	M
15			7 13 18	108.8	18.5	CL-ML		Sandy Silty CLAY, very stiff, very moist, brown.	DS, MD
20			2 2 4		31.6			Silty CLAY with Sand, medium stiff, very moist, dark olive brown.	M
25									

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	2 of 2
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/30/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-1 Cont'd.

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
25		▯	2 3 5		33.2	CL-ML		Silty CLAY with Sand, medium stiff, very moist, dark olive brown.	M
								Total Depth 26.5 feet bgs. Groundwater not encountered.	
30									
35									
40									
45									
50									

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/30/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-2

Depth (Feet)	Sample: Bulk	Sample: Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						ML		**Quaternary Younger Alluvium (Qya)**	
1–5	X							Sandy SILT, moist, dark brown.	RV
5–6.5		X	4 4 5		10.1			Samdy SILT, stiff, moist, dark brown.	WA (60% fines) M
								Total Depth 6.5 feet bgs. Groundwater not encountered.	

Depth scale: 0, 5, 10, 15, 20, 25

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/30/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-3

Depth (Feet)	Sample: Bulk	Sample: Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	DESCRIPTION	Laboratory Tests
0						CL	**Quaternary Younger Alluvium (Qya)**	
1–5	X						Sandy Lean CLAY, moist, dark olive brown.	MAX, EI AL (LL=28, PI=9) GS (64% fines)
5		Ring	1 2 3		14.4		Sandy Lean CLAY, medium stiff, moist dark olive brown.	M
10		SPT	3 11 15	108.8	9.3	SC-SM	Silty Clayey SAND, medium dense, moist, gray brown.	MD
15		Ring	2 5 6		18.8	ML	Sandy SILT, very moist, dark olive brown.	WA (50% fines) M
20		SPT	4 6 10	96.7	26.9	CL	Lean CLAY with Sand, stiff, very moist, dark grayish brown.	MD
							Total Depth 21.5 feet bgs. Groundwater not encountered.	
25								

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/30/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-4

Depth (Feet)	Sample: Bulk	Sample: Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						CL		**Quaternary Younger Alluvium (Qya)**	
	X							Sandy Lean CLAY, moist, dark brown.	CHM
5		X	8 11 11	121.2	12.1	SC-SM		Silty Clayey SAND, fine, medium dense, moist, dark brown.	MD
10		X	4 4 6		26.5	ML		SILT with Sand, stiff, very moist, olive.	M
15						CL		Lean CLAY, very moist, gray	
		X	10 8 10	98.1	11.9	SM		Silty SAND, medium dense, moist, grayish brown. grades to	MD
20		X	4 6 11		14.1	SP-SM		Poorly-graded SAND with Silt, medium dense, moist, gray.	M
								Total Depth 21.5 feet bgs. Groundwater not encountered.	
25									

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	1 of 2
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/30/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-5

Depth (Feet)	Sample: Bulk	Sample: Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						CL-ML		**Quaternary Younger Alluvium (Qya)**	
	X							Sandy Silty CLAY, moist, dark brown.	GS (69% fines) AL (LL=25, PI=6)
5		X	4 7 9		10.9			Sandy Silty CLAY, stiff, moist, olive brown, slightly porous.	M
10		X	3 3 4		11.7			Sandy Silty CLAY, medium stiff, moist, olive brown.	WA (51% fines) M
15		X	3 4 8		23.8	CL		Sandy Lean CLAY, stiff, very moist, gray, lens of fine sand.	WA (63% fines) M
20		X	3 3 4		32.0			Sandy Lean CLAY, medium stiff, very moist, gray.	AL (LL=47, PI=17) M
25									

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	2 of 2
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/30/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-5 Cont'd.

Depth (Feet)	Sample Bulk	Sample Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
25		▯	3 3 9			CL		Sandy Lean CLAY	
					16.7	SC		Clayey SAND, medium dense, moist, dark grayish brown.	M
						CL			
30		▯	8 8 8		30.3			Lean CLAY with Sand, stiff, very moist, gray, lenses of silt.	WA (79% fines) M
35		▯	4 4 8		30.7			Lean CLAY with Sand, stiff, very moist, gray, lenses of fine sand.	M
40		▯	6 6 10		28.1			Lean CLAY with Sand, stiff, very moist, dark gray.	M
								Total Depth 41.5 feet bgs. Groundwater not encountered.	
45									
50									

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/30/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-6

Depth (Feet)	Sample: Bulk	Sample: Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	DESCRIPTION	Laboratory Tests
0						CL-ML	**Quaternary Younger Alluvium (Qya)** Sandy Silty CLAY, moist, dark brown	GS (62% fines) EI
5			4 10 16	99.3	15.6	ML	Sandy SILT, very stiff, moist, dark olive brown.	MD
10			3 3 6		30.4	CL	Lean CLAY with Sand, stiff, very moist, dark olive brown.	M
15			4 19 38	112.3	3.8	SP-SM	Poorly-graded SAND with Silt, very dense, damp, gray.	MD
20			6 10 13		1.9		Poorly-graded SAND, medium dense, damp, gray.	M
							Total Depth 21.5 feet bgs. Groundwater not encountered.	
25								

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/30/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-7

Depth (Feet)	Bulk Sample	Driven Sample Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM		**Quaternary Younger Alluvium (Qya)** Silty SAND, fine, moist, dark brown.	
5			3 6 7		11.4			Silty SAND, fine, medium dense, moist, dark olive brown.	M
10			5 8 10	86.2	21.6	ML		Sandy SILT, stiff, very moist, olive brown, clay lenses.	DS, MD
15			8 10 12		2.7	SP-SM		Poorly-graded SAND with Silt, medium dense, damp, grayish brown.	M
20			19 38 50	111.8	4.1			Poorly-graded SAND with Silt, very dense, damp, gray.	MD
								Total Depth 21.5 feet bgs. Groundwater not encountered.	
25									

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	4/30/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-8

Depth (Feet)	Bulk Sample	Driven Sample Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	DESCRIPTION	Laboratory Tests
0						SM	**Quaternary Younger Alluvium (Qya)** Silty SAND, fine, moist, dark brown.	
5		X	4 5 7		17.4	ML	Sandy SILT, stiff, moist, dark brown.	WA (69% fines) M
							Total Depth 6.5 feet bgs. Groundwater not encountered.	
10								
15								
20								
25								

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	5/3/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-9

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM		**Quaternary Younger Alluvium (Qya)** Silty SAND, damp, brown, scattered gravel and cobbles.	
5			10 6 5			SP-SM		Poorly-graded SAND with Silt, medium dense, damp, brown.	
								Total Depth 6.5 feet bgs. Groundwater not encountered.	
10									
15									
20									
25									

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	5/3/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-10

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM		**Quaternary Younger Alluvium (Qya)** Silty SAND, damp, brown, scattered gravel and cobbles.	
						SP-SM		Poorly-graded SAND with Silt, damp, brown.	
5			4 5 5	92.9	28.2	CL		Lean CLAY with Sand, medium stiff, very moist, dark grayish brown.	MD
10			3 4 4		19.0			Sandy CLAY, medium stiff, very moist, dark olive-brown.	WA (52% fines) M
15			5 11 17	108.9	14.7	SC		Clayey SAND, medium dense, moist, olive brown.	MD
20			5 4 7		13.1			Clayey SAND, medium dense, moist, olive brown.	M
25						CL-ML			

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	2 of 2
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	5/3/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-10 Cont'd.

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
25			7 12 13	106.7	17.1	CL-ML		Silty CLAY with Sand, stiff, moist, grayish brown.	MD
								Total Depth 26.5 feet bgs. Groundwater not encountered.	
30									
35									
40									
45									
50									

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	1 of 3
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	5/3/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-11

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM		**Quaternary Younger Alluvium (Qya)** Silty SAND, damp, brown, scattered gravel.	CHM
						SP-SM		Sand with Silt, damp, olive brown.	
5			2 3 4		17.4	CL		Sandy Lean CLAY, medium stiff, moist, dark olive brown.	WA (65% fines) M
10			7 16 20	119.4	11.4	SC		Clayey SAND, fine, dense, moist, dark olive brown.	MD
15			3 4 7		13.0	CL		Sandy Silty CLAY, stiff, moist, grayish brown.	WA (50% fines) M
20			8 17 15			SC-SM		Silty Clayey SAND, medium dense, moist, olive brown.	
25						CL			

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	2 of 3
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	5/3/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-11 Cont'd.

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
25			3 4 6		29.6	CL		Lean CLAY with Sand, stiff, very moist, grayish brown.	WA (80% fines) M
30			7 19 14			SC		grades to Clayey SAND, medium dense, moist, dark olive brown.	
35			9 12 15		15.4	SP-SC		Poorly-graded SAND with Clay, medium dense, moist, olive brown.	WA (12% fines) M
40			4 7 16		22.0	ML		Sandy SILT, stiff, very moist, dark gray. (sand in sampler tip)	M
						SP		Poorly-graded SAND, damp, gray.	
45			4 6 12		25.4	CL		Lean CLAY with Sand, very stiff, very moist, gray, interbedded 3" layer of sand.	M
50						SC			

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	3 of 3
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	5/3/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-11 Cont'd.

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
50			15			SC-SM		Silty Clayey SAND, medium dense, very moist, grayish brown.	
			12			SP		SAND, moist, light gray	
			13		22.7	SC-SM		Silty Clayey SAND, medium dense, very moist, grayish brown.	M
								Total Depth 51.5 feet bgs. Groundwater not encountered.	
55									
60									
65									
70									
75									

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	5/3/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-12

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	DESCRIPTION	Laboratory Tests
0						SM	**Quaternary Younger Alluvium (Qya)** Silty SAND, moist, olive brown	
						SC		
5	X	X	11 17 21	100.0	15.5		Clayey SAND, dense, moist, dark olive brown.	CHM MD
10		X	4 4 5		30.5	ML	SILT with Sand, stiff, very moist, olive brown.	WA (77% fines) M
15		X	11 15 20	112.6	14.9	SC-SM	Silty Clayey SAND, dense, moist, olive brown.	MD
20		X	3 6 11		6.3	SP-SM	Poorly-graded SAND with Silt, medium dense, moist, grayish brown.	M
25						CL		

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	2 of 2
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	5/3/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-12 Cont'd.

Depth (Feet)	Bulk Sample	Driven Sample Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
25			5 7 8		25.9	CL		Sandy Lean CLAY, stiff, very moist, grayish brown.	M
								Total Depth 26.5 feet bgs. Groundwater not encountered.	
30									
35									
40									
45									
50									

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	5/3/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-13

Depth (Feet)	Sample Bulk	Sample Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM		**Quaternary Younger Alluvium (Qya)** Silty SAND, damp, dark brown, trace gravel and cobbles.	
						CL-ML			
5		Driven	4 7 8		17.3			Silty CLAY with Sand, stiff, very moist, olive brown.	WA (75% fines) M
10		Driven	6 16 18	115.5	5.4	SM		Silty SAND, dense, moist, dark brown.	MD
15		Driven	4 5 7		32.6	CL-ML		Silty CLAY with Sand, stiff, very moist, dark olive brown.	M
20		Driven	6 12 21	106.8	19.8	CL SC		Lean CLAY, stiff, very moist, gray. Clayey SAND, fine, dense, very moist.	MD
25						CL			

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	2 of 2
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	5/3/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-13 Cont'd.

Depth (Feet)	Bulk Sample	Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
25			2 4 8		24.3	CL		Lean CLAY with Sand, stiff, very moist, grayish brown.	M
								Total Depth 26.5 feet bgs. Groundwater not encountered.	
30									
35									
40									
45									
50									

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PROJECT:	Industrial Buildings - Hardt & Brier Streets	DRILLER:	2R Drilling CME 75	SHEET:	1 of 1
CTE JOB NO:	40-3959G	DRILL METHOD:	8" Hollow Stem Auger	DRILLING DATE:	5/3/2021
LOGGED BY:	RE	SAMPLE METHOD:	140 lb/30" Autohammer	ELEVATION:	~

BORING: B-14

Depth (Feet)	Sample: Bulk	Sample: Driven Type	Blows/6-inches	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						CL		**Quaternary Younger Alluvium (Qya)** Lean CLAY with Sand, moist, dark olive brown.	RV GS (70% fines) AL (LL=27, PI=8)
5			9 14 15	107.2	11.1	SC-SM		Silty Clayey SAND, medium dense, moist, dark brown.	MD
10			2 3 6		16.4	CL-ML		Sandy Silty CLAY, stiff, moist, dark grayish brown.	M
15			9 23 24	113.7	14.4	SC		Clayey SAND, fine, dense, moist, dary grayish brown.	MD
20			4 7 8		5.6	ML SM		SILT with Sand Silty SAND, medium dense, moist, dark grayish brown.	M
								Total Depth 21.5 feet bgs. Groundwater not encountered.	
25									

SUMMARY

OF

CONE PENETRATION TEST DATA

Project:

Industrial Building at Hardt & Brier
San Bernardino, CA
April 29, 2021

Prepared for:

Mr. Rob Ellerbusch
CTE (Construction Testing & Eng.)
14538 Meridian Parkway, Ste A
Riverside, CA 92518
Office (951) 571-4081 / Fax (951) 571-4188

Prepared by:

KEHOE TESTING & ENGINEERING
5415 Industrial Drive
Huntington Beach, CA 92649-1518
Office (714) 901-7270 / Fax (714) 901-7289
www.kehoetesting.com

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3. **FIELD EQUIPMENT & PROCEDURES**

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- CPT Classification/Soil Behavior Chart
- Summary of Shear Wave Velocities
- Pore Pressure Dissipation Graphs
- CPT Data Files (sent via email)

SUMMARY

OF

CONE PENETRATION TEST DATA

1. INTRODUCTION

This report presents the results of a Cone Penetration Test (CPT) program carried out for the Industrial Buildings at Hardt & Brier project located in San Bernardino, California. The work was performed by Kehoe Testing & Engineering (KTE) on April 29, 2021. The scope of work was performed as directed by CTE (Construction Testing & Eng.) personnel.

2. SUMMARY OF FIELD WORK

The fieldwork consisted of performing CPT soundings at six locations to determine the soil lithology. A summary is provided in **TABLE 2.1**.

LOCATION	DEPTH OF CPT (ft)	COMMENTS/NOTES:
CPT-1	50	
CPT-2	50	
CPT-3	50	
CPT-4	50	
CPT-5	50	
CPT-6	50	

TABLE 2.1 - Summary of CPT Soundings

3. FIELD EQUIPMENT & PROCEDURES

The CPT soundings were carried out by **KTE** using an integrated electronic cone system manufactured by Vertek. The CPT soundings were performed in accordance with ASTM standards (D5778). The cone penetrometers were pushed using a 30-ton CPT rig. The cone used during the program was a 15 cm^2 cone and recorded the following parameters at approximately 2.5 cm depth intervals:

- Cone Resistance (qc)
- Sleeve Friction (fs)
- Dynamic Pore Pressure (u)
- Inclination
- Penetration Speed
- Pore Pressure Dissipation (at selected depths)

At location CPT-3, shear wave measurements were obtained at approximately 5-foot intervals. The shear wave is generated using an air-actuated hammer, which is located inside the front jack of the CPT rig. The cone has a triaxial geophone, which recorded the shear wave signal generated by the air hammer.

The above parameters were recorded and viewed in real time using a laptop computer. Data is stored at the KTE office for up to 2 years for future analysis and reference. A complete set of baseline readings was taken prior to each sounding to determine temperature shifts and any zero load offsets. Monitoring base line readings ensures that the cone electronics are operating properly.

4. CONE PENETRATION TEST DATA & INTERPRETATION

The Cone Penetration Test data is presented in graphical form in the attached Appendix. These plots were generated using the CPeT-IT program. Penetration depths are referenced to ground surface. The soil behavior type on the CPT plots is derived from the attached CPT SBT plot (Robertson, "Interpretation of Cone Penetration Test…", 2009) and presents major soil lithologic changes. The stratigraphic interpretation is based on relationships between cone resistance (qc), sleeve friction (fs), and penetration pore pressure (u). The friction ratio (Rf), which is sleeve friction divided by cone resistance, is a calculated parameter that is used along with cone resistance to infer soil behavior type. Generally, cohesive soils (clays) have high friction ratios, low cone resistance and generate excess pore water pressures. Cohesionless soils (sands) have lower friction ratios, high cone bearing and generate little (or negative) excess pore water pressures.

The CPT data files have also been provided. These files can be imported in CPeT-IT (software by GeoLogismiki) and other programs to calculate various geotechnical parameters.

It should be noted that it is not always possible to clearly identify a soil type based on qc, fs and u. In these situations, experience, judgement and an assessment of the pore pressure data should be used to infer the soil behavior type.

If you have any questions regarding this information, please do not hesitate to call our office at (714) 901-7270.

Sincerely,

KEHOE TESTING & ENGINEERING

Steven P. Kehoe
President

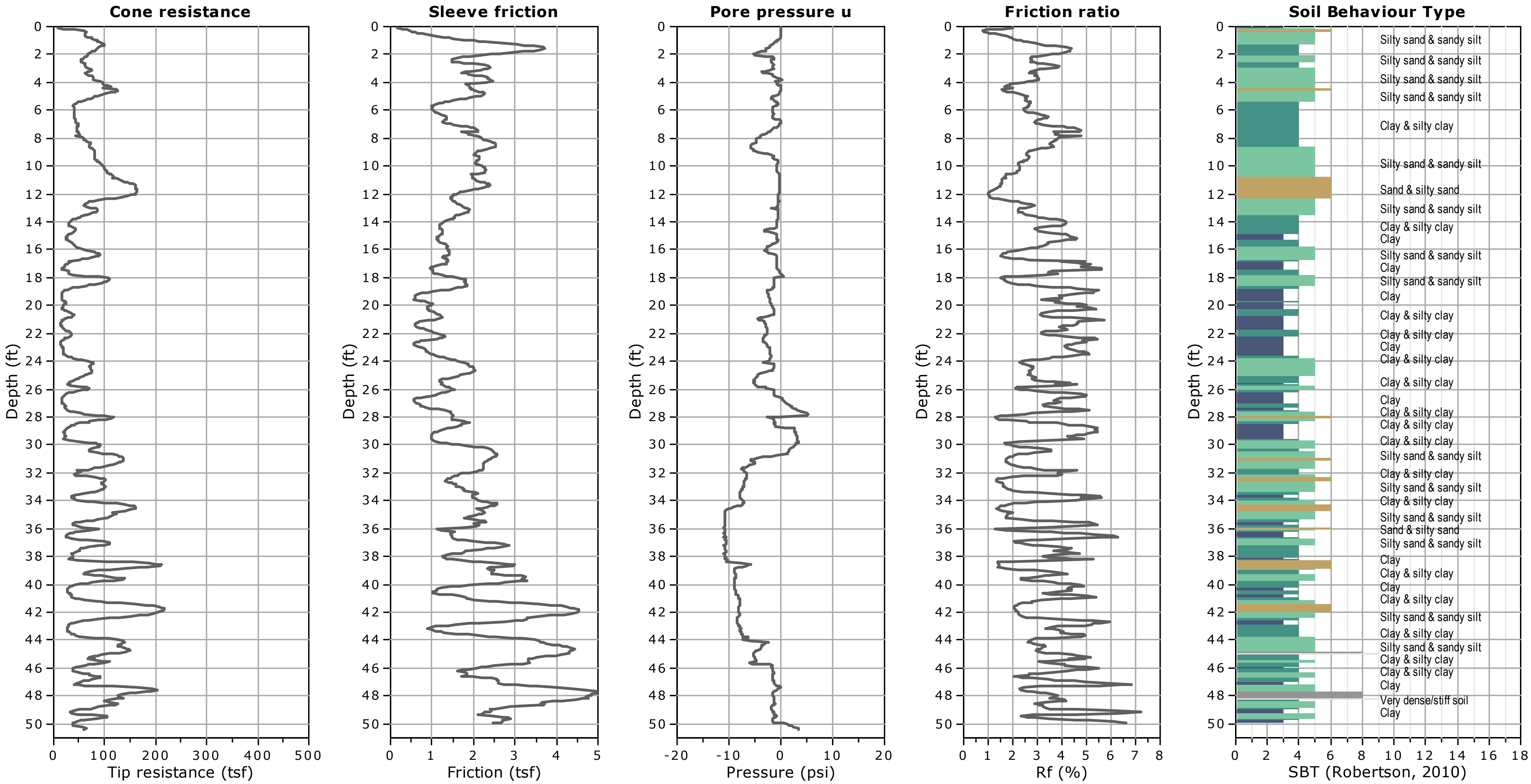
05/03/21-hh-2855

APPENDIX

Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: CTE / Industrial Buildings at Hardt & Brier
Location: San Bernadino, CA

CPT-1
Total depth: 50.37 ft, Date: 4/29/2021



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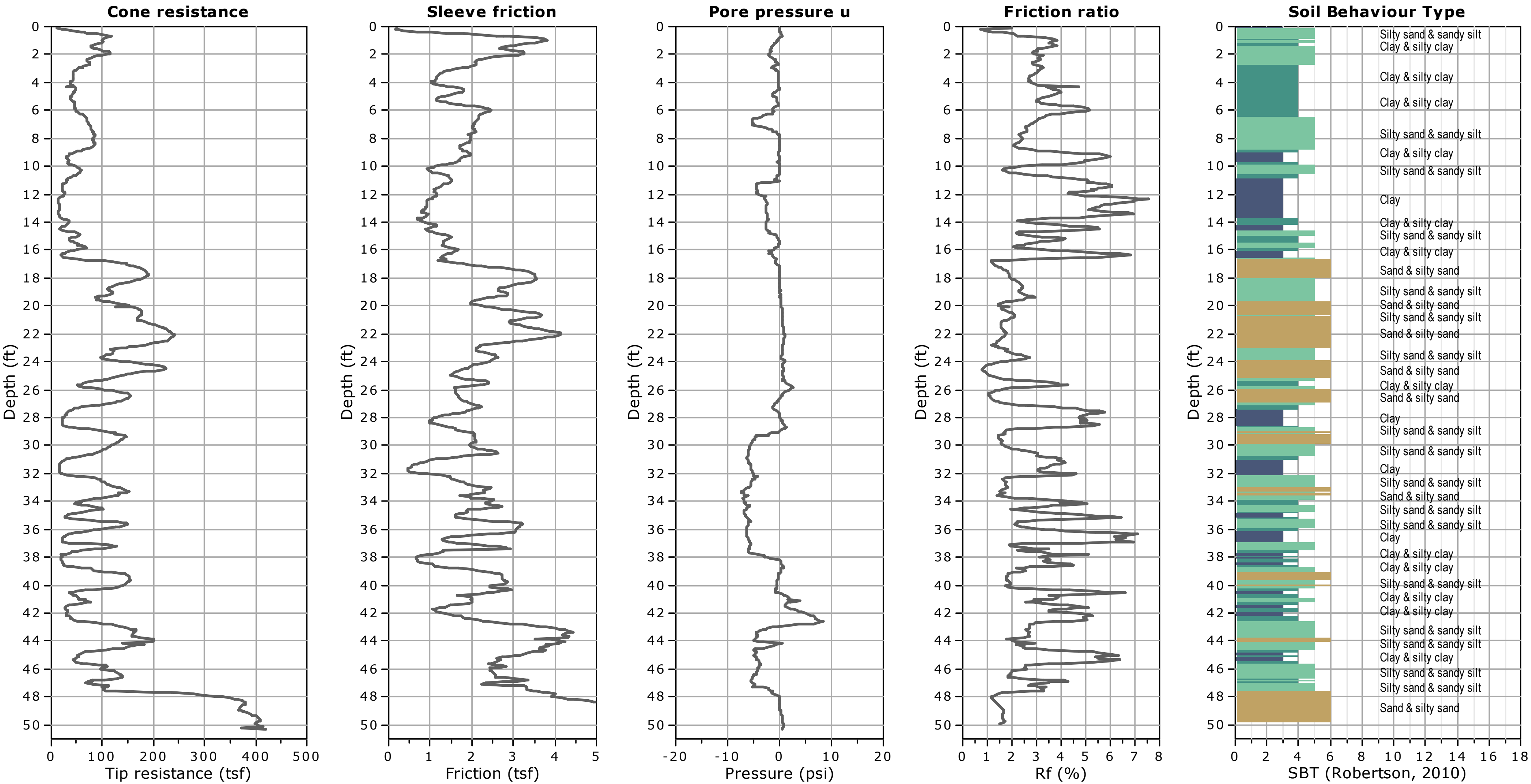
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: CTE / Industrial Buildings at Hardt & Brier

Location: San Bernadino, CA

CPT-2

Total depth: 50.30 ft, Date: 4/29/2021



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steve@kehoetesting.com
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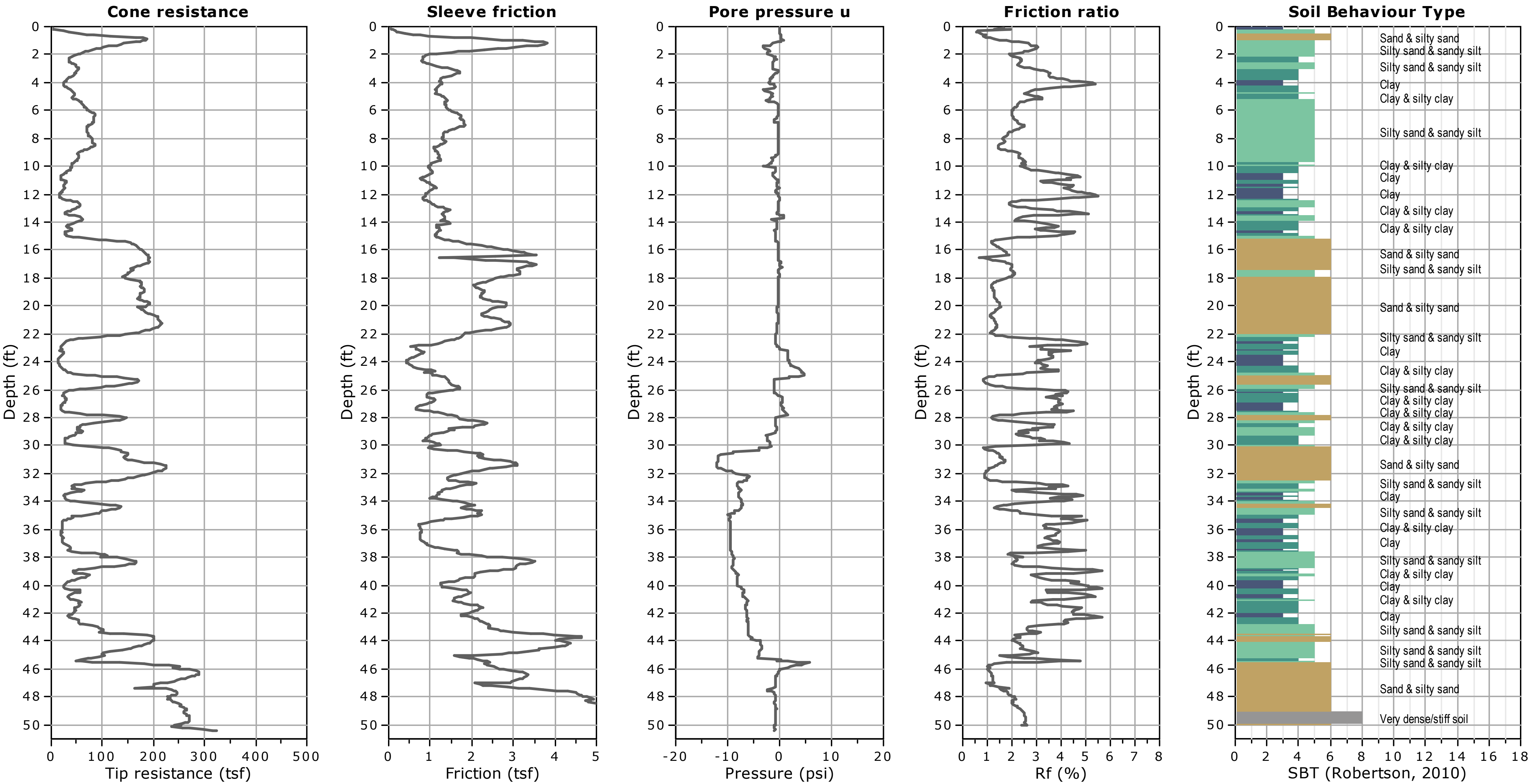
Project: CTE / Industrial Buildings at Hardt & Brier
Location: San Bernadino, CA

CPT-3
Total depth: 50.44 ft, Date: 4/29/2021



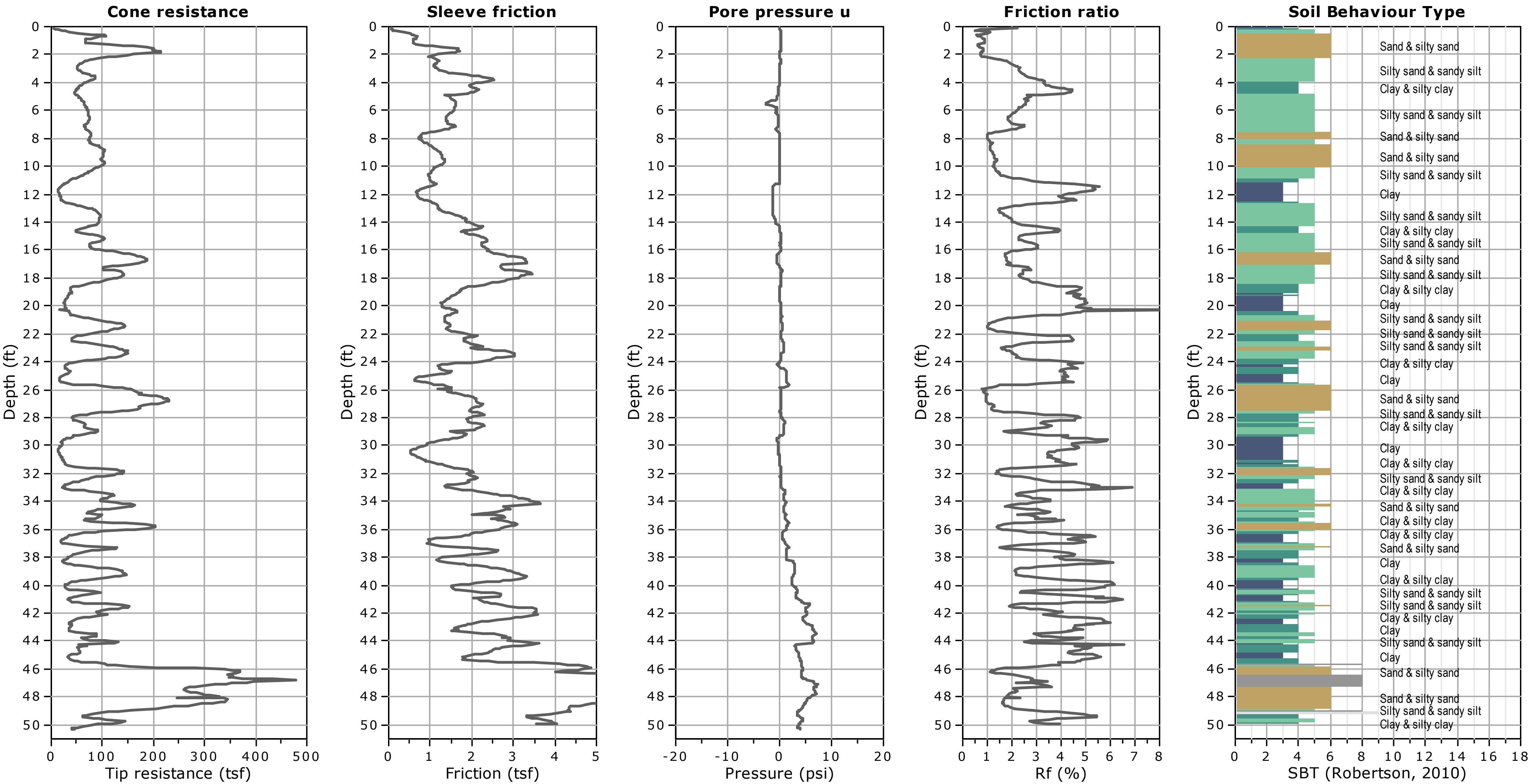
Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: **CTE / Industrial Buildings at Hardt & Brier**

Location: **San Bernadino, CA**

CPT-4

Total depth: 50.33 ft, Date: 4/29/2021



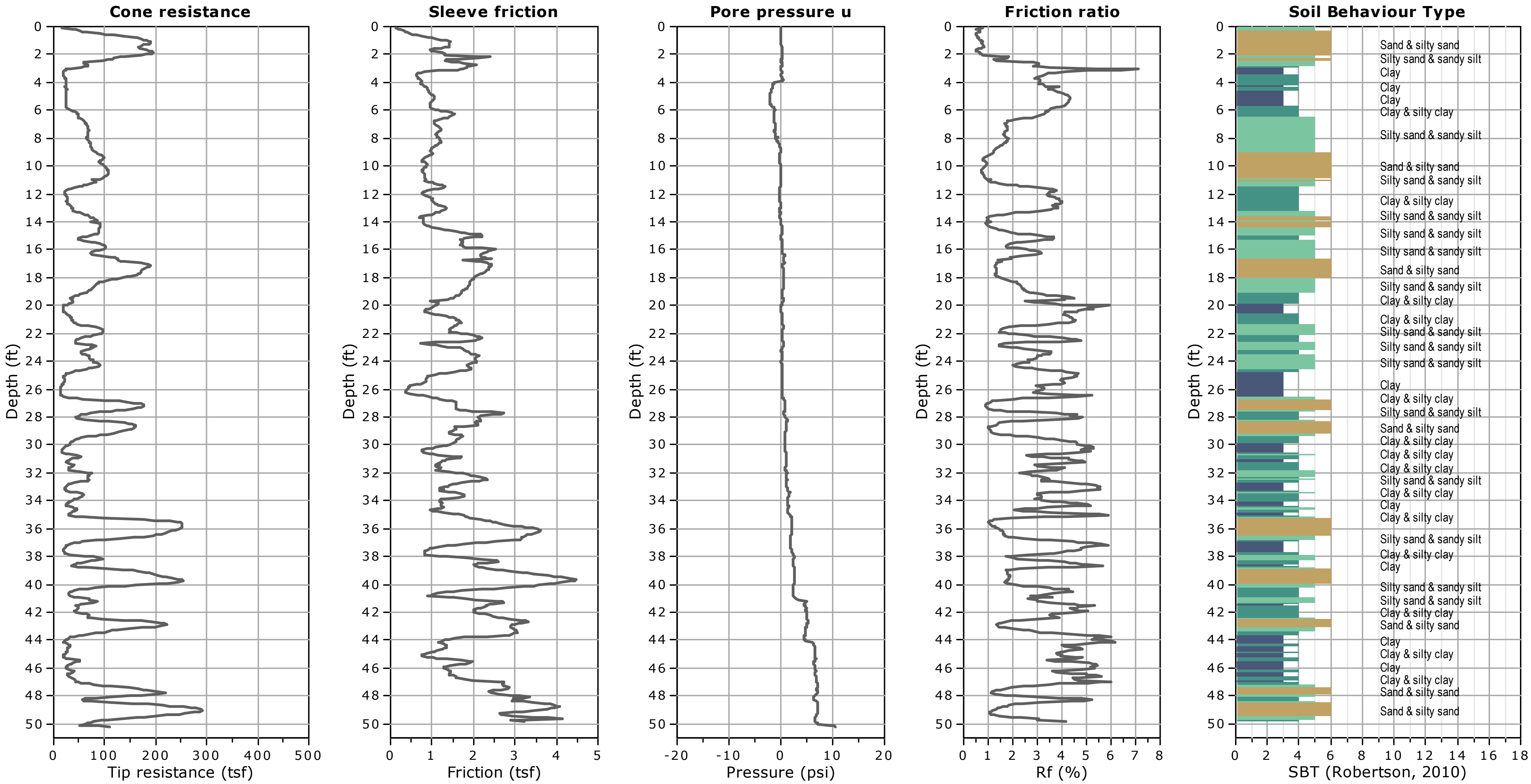
Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: CTE / Industrial Buildings at Hardt & Brier

Location: San Bernadino, CA

CPT-5

Total depth: 50.22 ft, Date: 4/29/2021



Kehoe Testing and Engineering
714-901-7270
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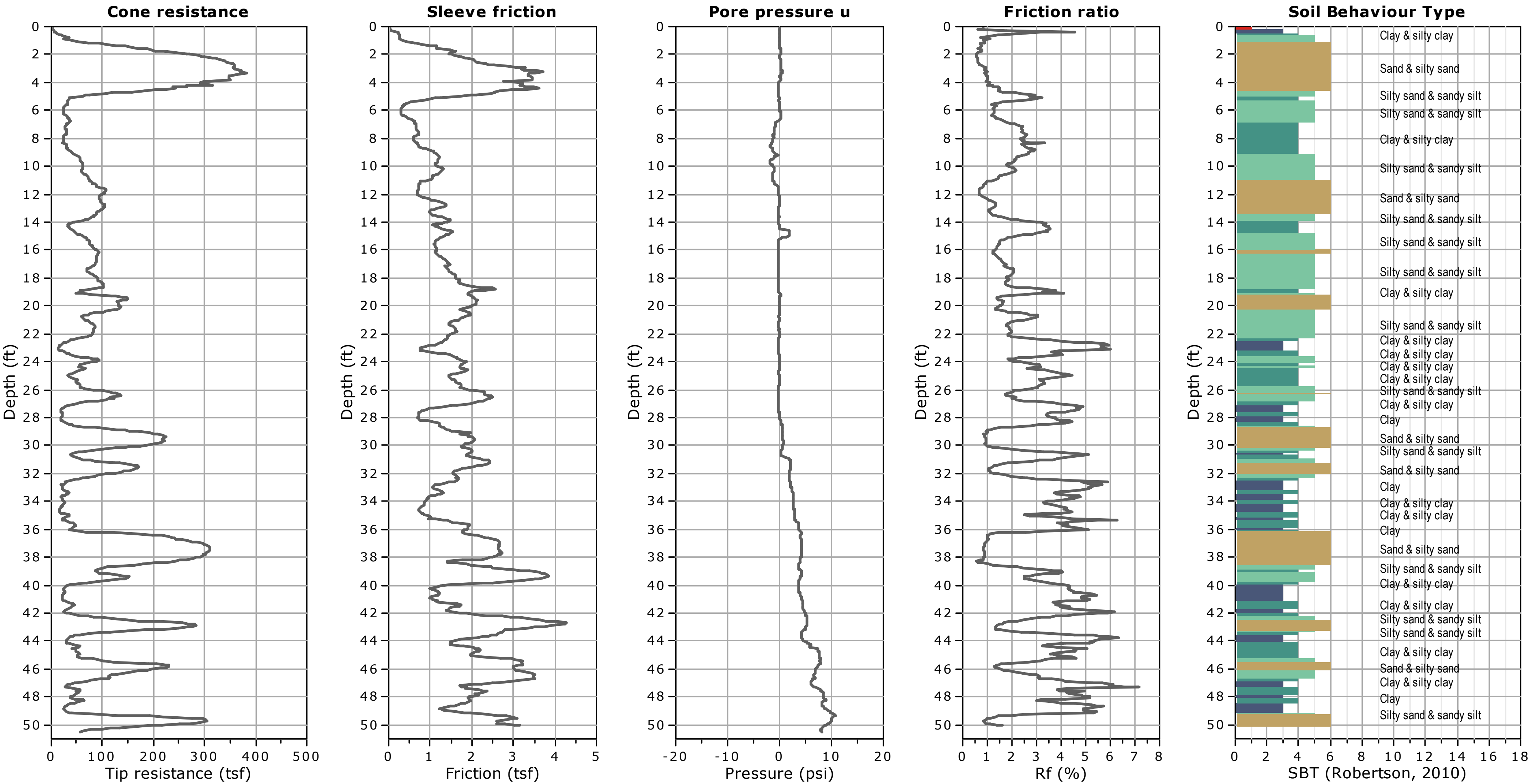
Project: **CTE / Industrial Buildings at Hardt & Brier** **CPT-6**

Location: **San Bernadino, CA** Total depth: 50.48 ft, Date: 4/29/2021



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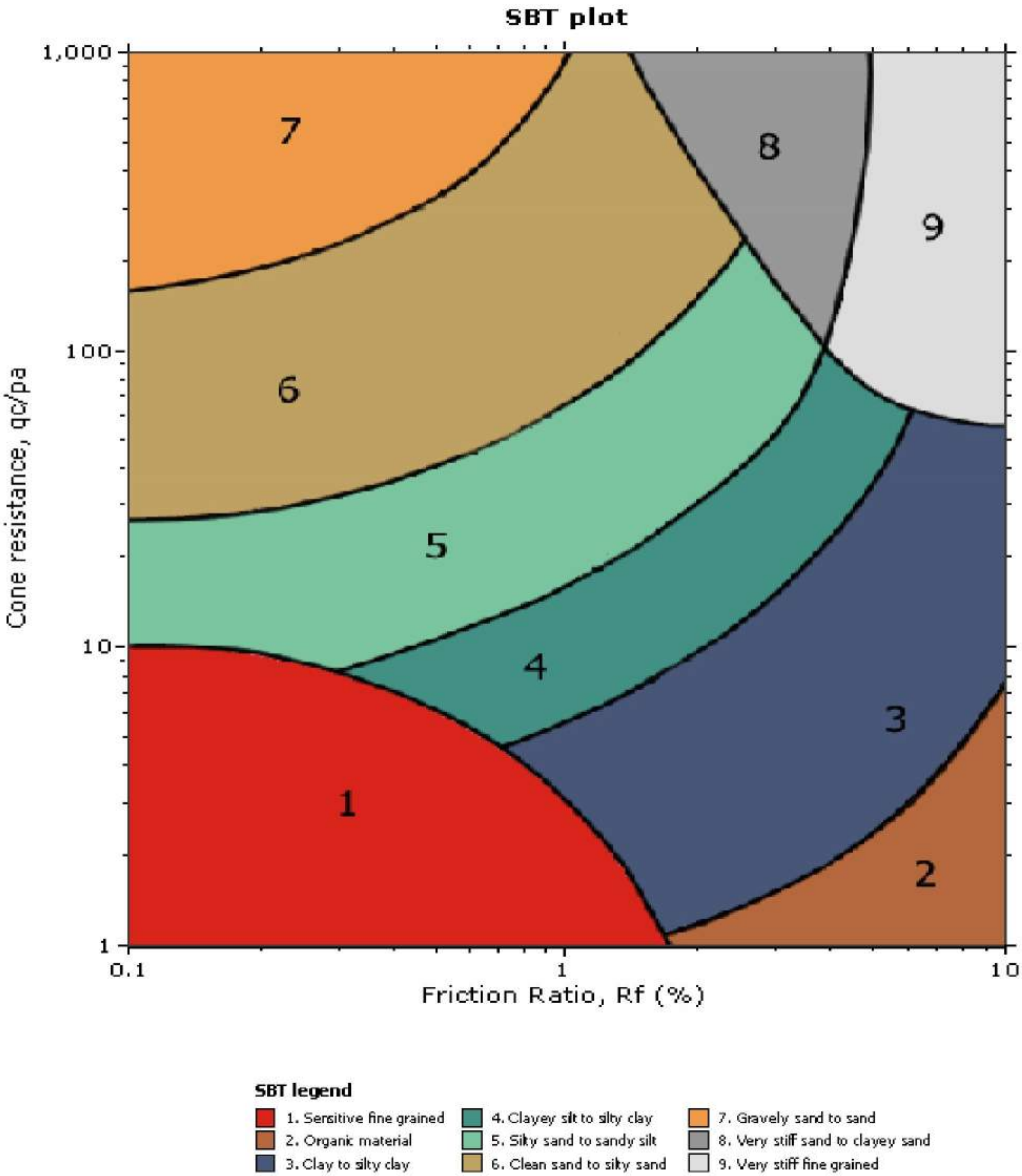


CTE
Industrial Buildings at Hardt & Brier
San Bernadino, CA

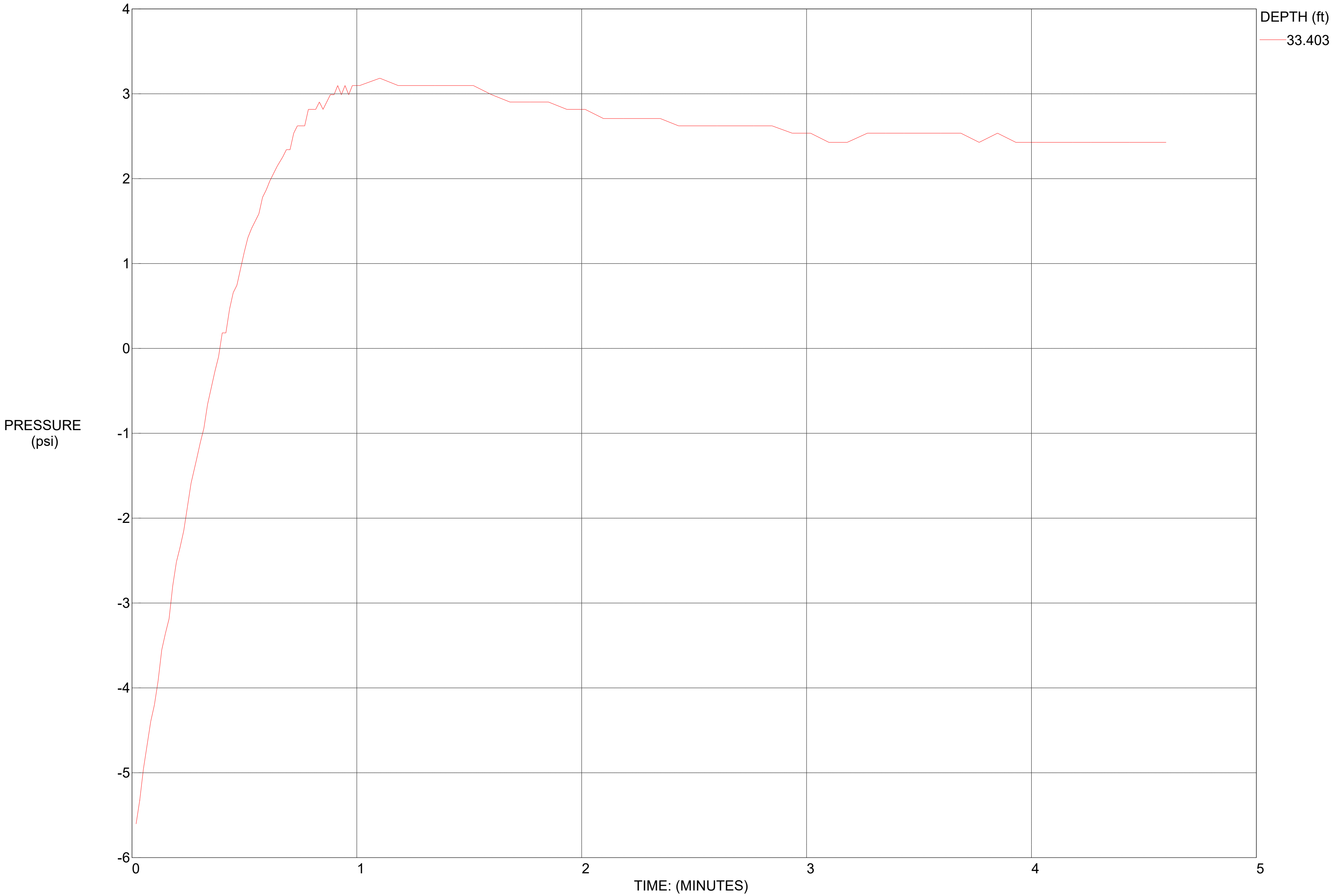
CPT Shear Wave Measurements

Location	Tip Depth (ft)	Geophone Depth (ft)	Travel Distance (ft)	S-Wave Arrival (msec)	S-Wave Velocity from Surface (ft/sec)	Interval S-Wave Velocity (ft/sec)
CPT-3	5.05	4.05	4.52	6.72	672	
	10.07	9.07	9.29	12.72	730	795
	15.06	14.06	14.20	19.04	746	777
	20.08	19.08	19.18	25.06	766	828
	25.00	24.00	24.08	30.82	781	850
	30.35	29.35	29.42	39.16	751	640
	35.01	34.01	34.07	45.16	754	775
	40.12	39.12	39.17	51.80	756	768
	45.21	44.21	44.26	57.92	764	831
	50.43	49.43	49.47	62.20	795	1219

Shear Wave Source Offset - 2 ft

S-Wave Velocity from Surface = Travel Distance/S-Wave Arrival
Interval S-Wave Velocity = (Travel Dist2-Travel Dist1)/(Time2-Time1)

TEST ID: CPT-2


DEPTH (ft)
33.403
PRESSURE
(psi)
4
3
2
1
0
-1
-2
-3
-4
-5
-6
0
1
2
3
4
5
TIME: (MINUTES)

APPENDIX B

LABORATORY METHODS AND RESULTS

APPENDIX B

LABORATORY METHODS AND RESULTS

Laboratory tests were performed on selected soil samples to evaluate their engineering properties. Tests were performed following test methods of the American Society for Testing and Materials (ASTM), or other accepted standards. The following presents a brief description of the various test methods used. Laboratory results are presented in the following section of this Appendix.

Atterberg Limits

The liquid limit and plasticity index were determined on selected soil samples in accordance with ASTM D4318.

Chemical Analysis

Soil materials were collected and tested for Sulfate and Chloride content, pH, and Resistivity in accordance with Caltrans test methods.

Classification

Soils were classified visually according to the Unified Soil Classification System. Visual classifications were supplemented by laboratory testing of selected samples according to ASTM D 2487.

Consolidation/Swell

To assess their compressibility and volume change behavior when loaded and wetted, relatively undisturbed samples of representative samples were subject to consolidation/swell tests in accordance with ASTM D 2435.

Direct Shear

Direct shear tests were performed on relatively undisturbed samples. Direct shear testing was performed in accordance with ASTM D 3080. The samples were inundated during shearing to represent adverse field conditions.

Expansion Index

Expansion Index testing was performed on selected samples of the on-site soil according to ASTM D 4829.

In-Place Moisture/Density

The in-place moisture content and dry unit weight of selected relatively undisturbed samples in accordance with ASTM D 2216 and D 2937, respectively.

Moisture-Density Relations (Modified Proctor)

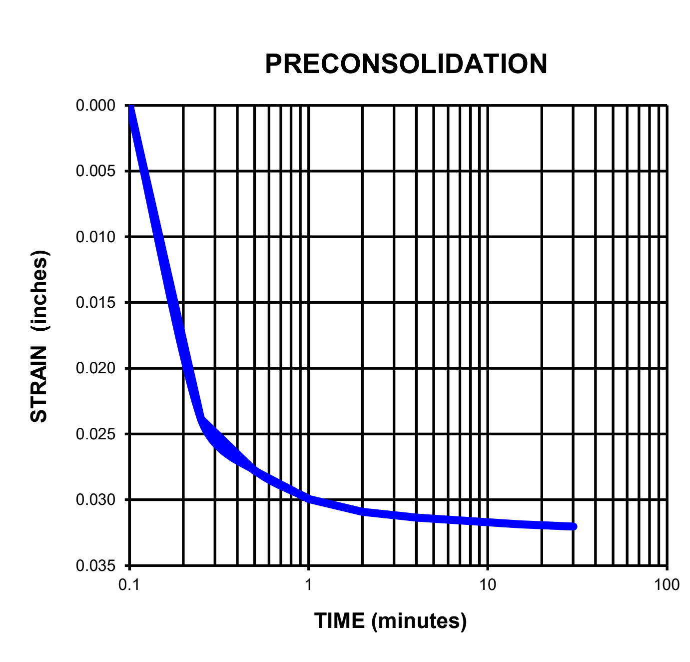
Laboratory maximum dry density and optimum moisture content were evaluated according to ASTM D 1557.

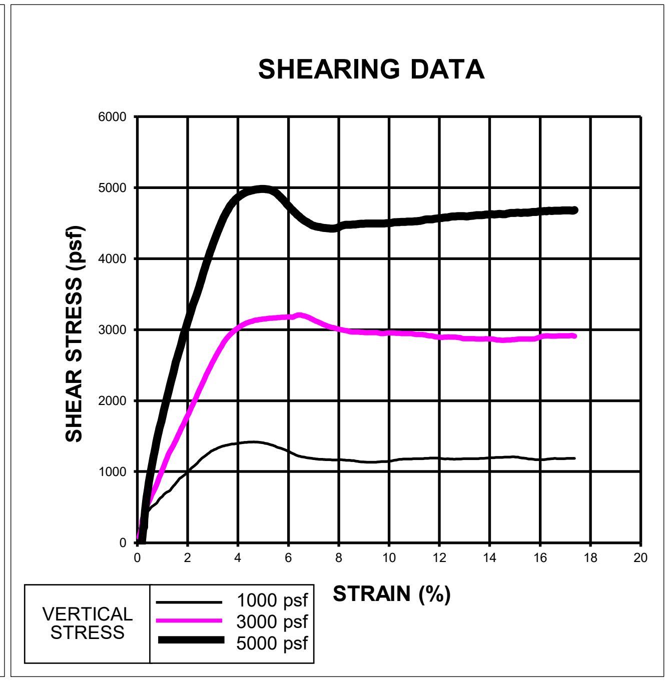
Resistance "R" Value

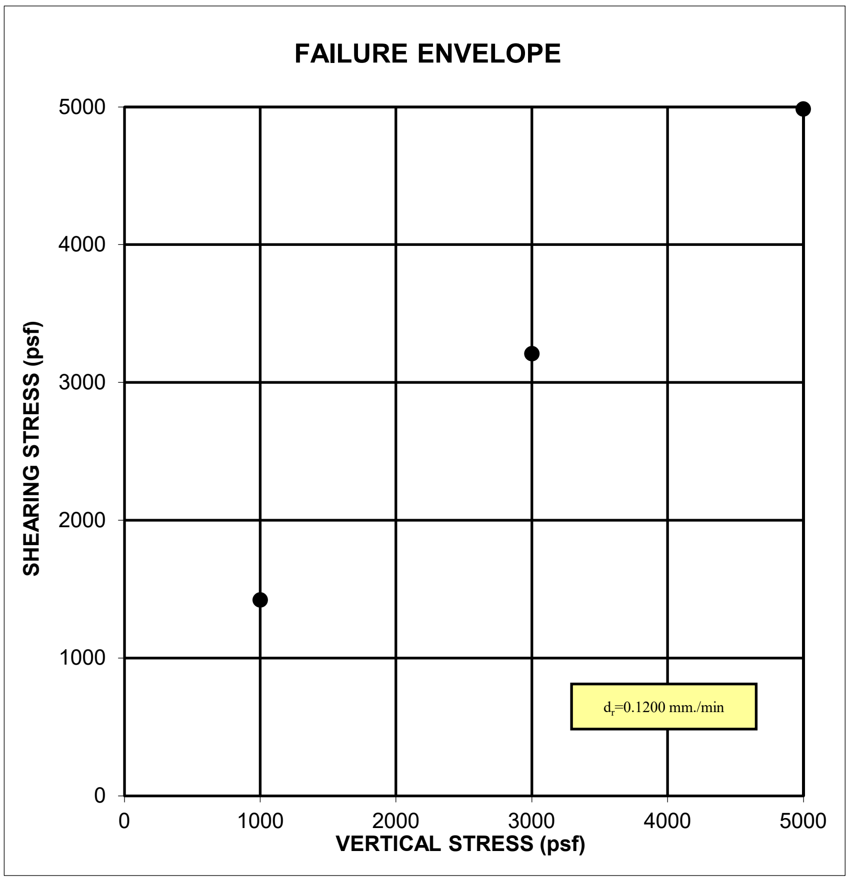
The resistance "R"-value was measured by the CTM 301. The graphically determined "R" value at an exudation pressure of 300 pounds per square inch is the value used for pavement section calculation.

Sieve Analysis (Gradation)

Sieve analyses and 200 washes were performed on selected representative samples according to ASTM C 136 and D 1140 to determine grain-size distribution.

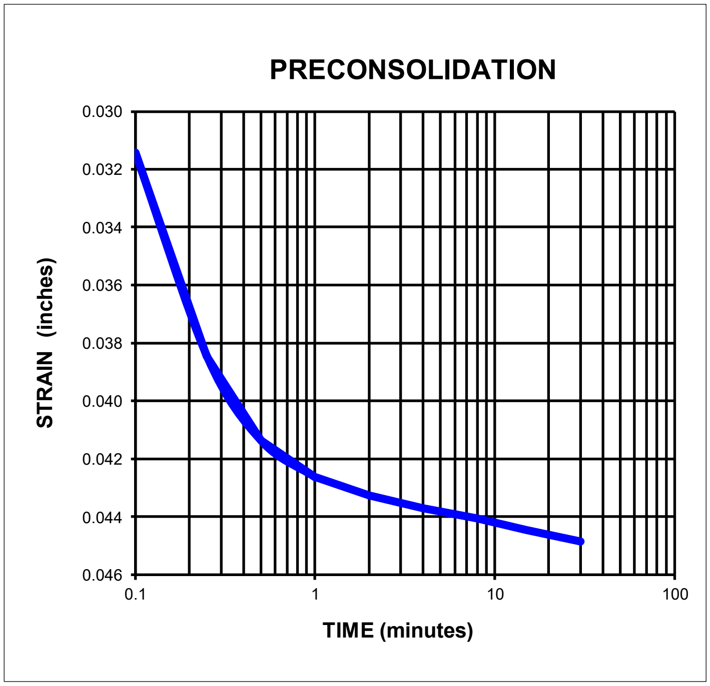


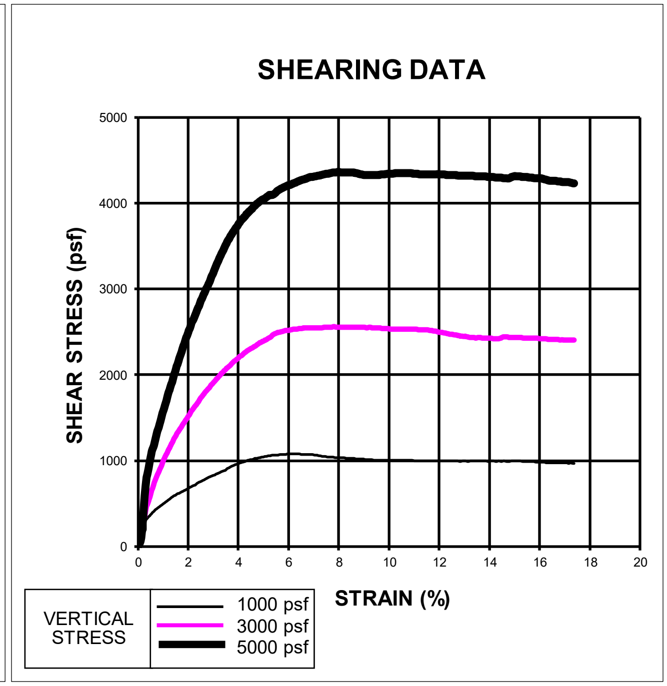


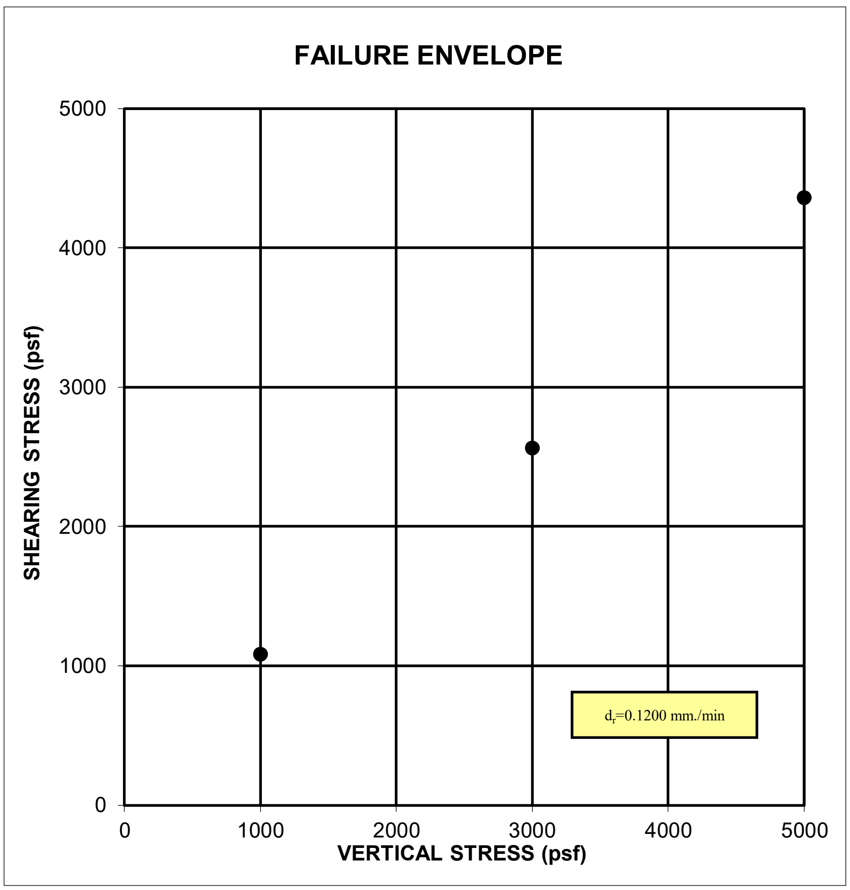


SHEAR STRENGTH TEST - ASTM D3080

Job Name:	Industial Buildings - Hardt & Brier			Initial Dry Density (pcf):	108.8
Project Number:	40-3959G	Sample Date:	5/3/2021	Initial Moisture (%):	18.5
Lab Number:	32166	Test Date:	5/24/2021	Final Moisture (%):	20.2
Sample Location:	B-1 @ 15'	Tested by:	JH	Cohesion:	530 psf
Sample Description:	Grayish Brown CL-ML			Angle Of Friction:	41.7







SHEAR STRENGTH TEST - ASTM D3080

Job Name: Industrial Buildings - Hardt & Brier

Initial Dry Density (pcf): 99.3

Project Number: 40-3959G

Sample Date: 5/3/2021

Initial Moisture (%): 15.6

Lab Number: 32166

Test Date: 5/25/2021

Final Moisture (%): 26.6

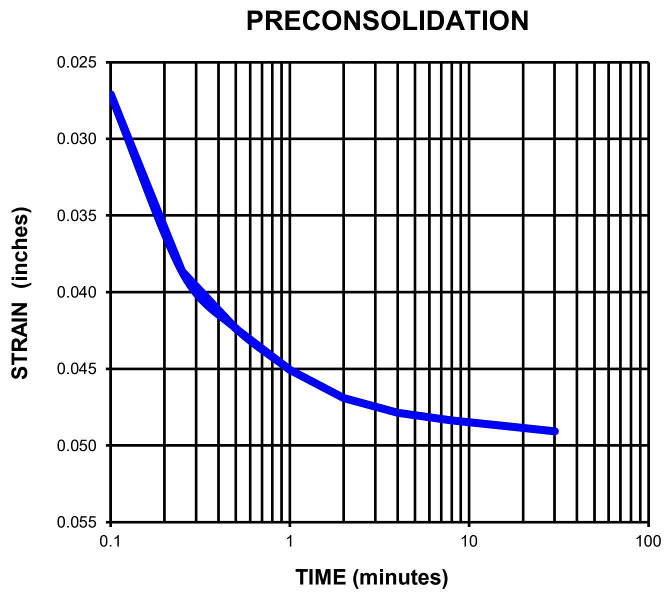
Sample Location: B-6 @ 5'

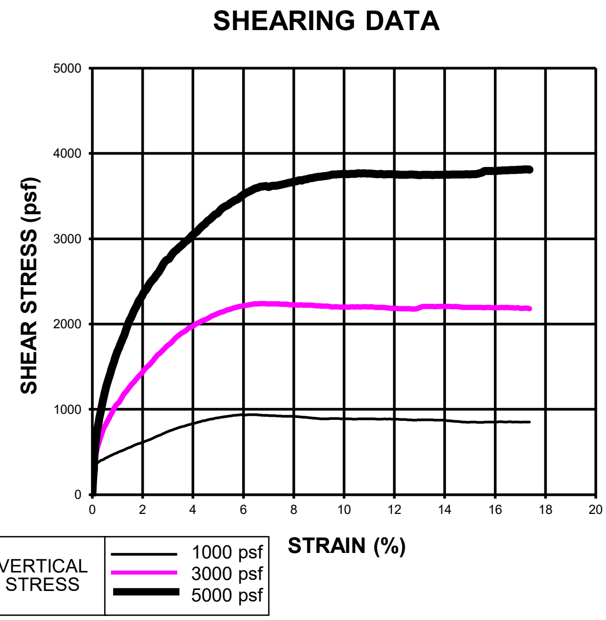
Tested by: JH

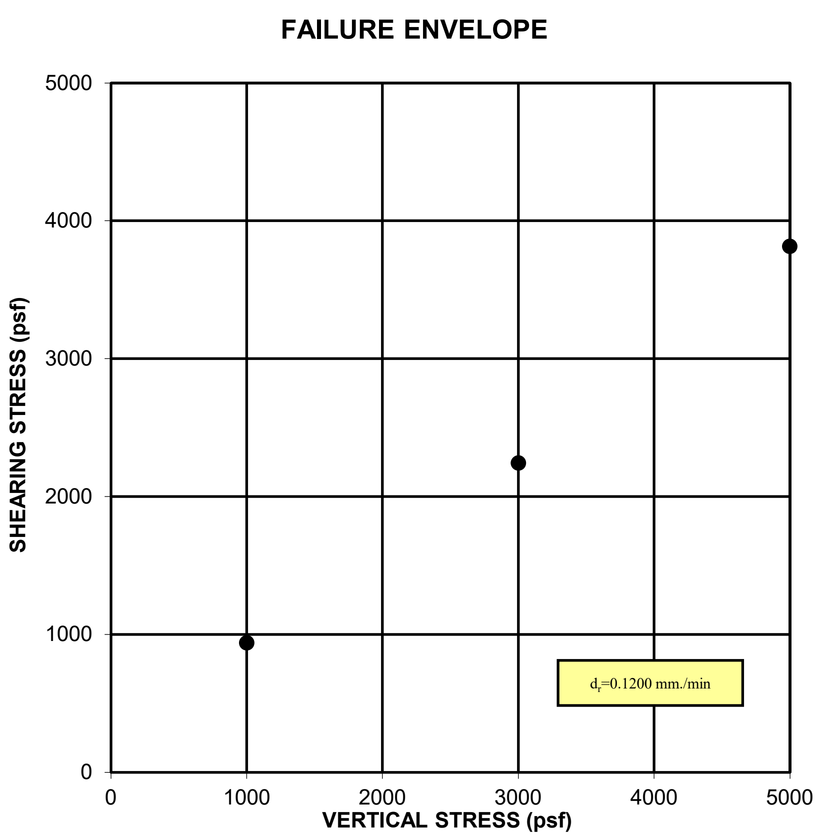
Cohesion: 200 psf

Sample Description: Gray ML

Angle Of Friction: 39.4

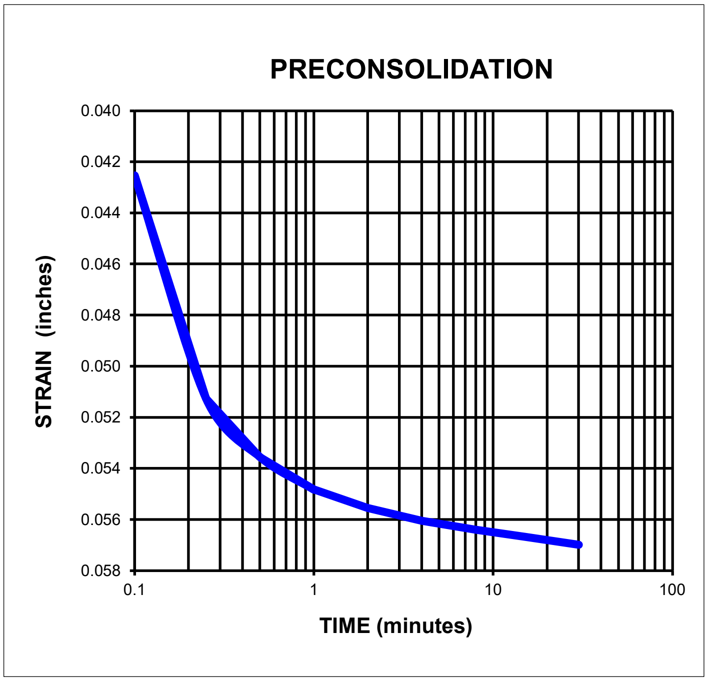


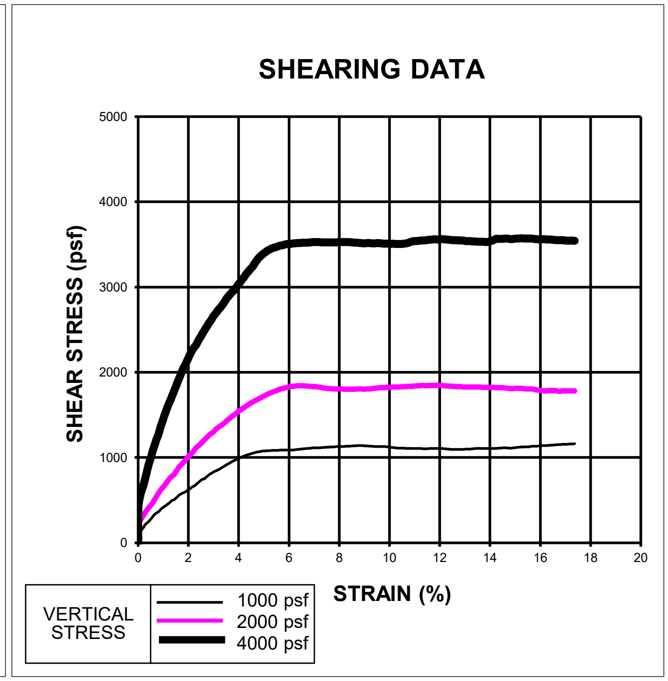


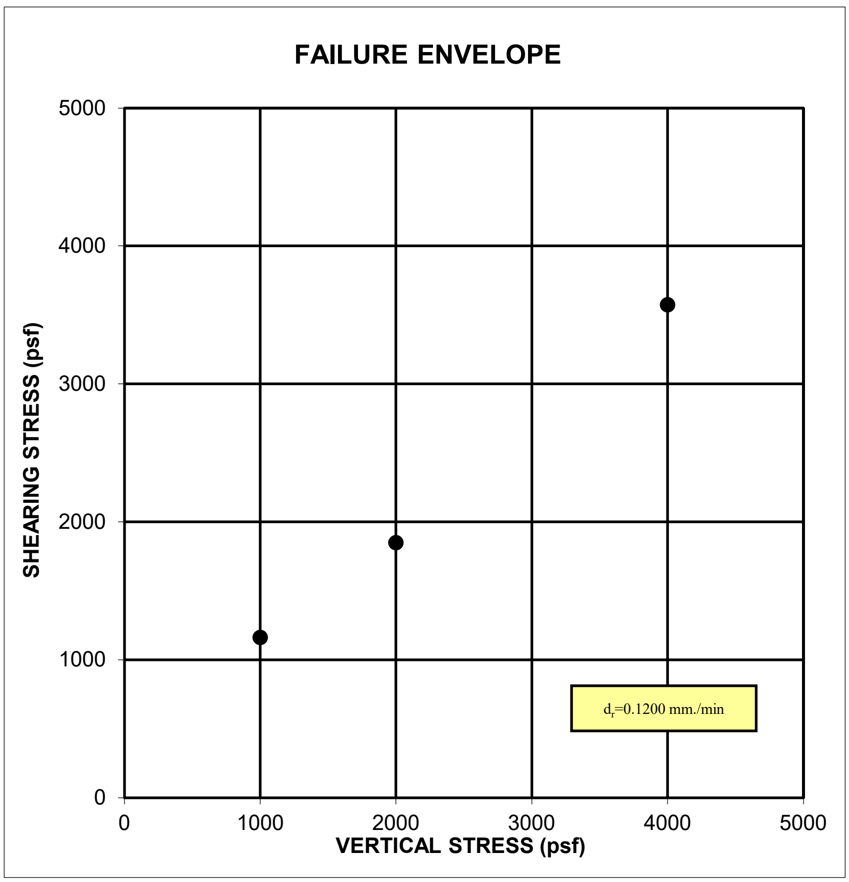


SHEAR STRENGTH TEST - ASTM D3080

Job Name:	Industrial Buildings - Hardt & Brier			Initial Dry Density (pcf):	86.2
Project Number:	40-3959G	Sample Date:	5/3/2021	Initial Moisture (%):	21.6
Lab Number:	32166	Test Date:	5/26/2021	Final Moisture (%):	39.8
Sample Location:	B-7 @ 10'	Tested by:	JH	Cohesion:	170 psf
Sample Description:	Light Gray (ML)			Angle Of Friction:	35.7

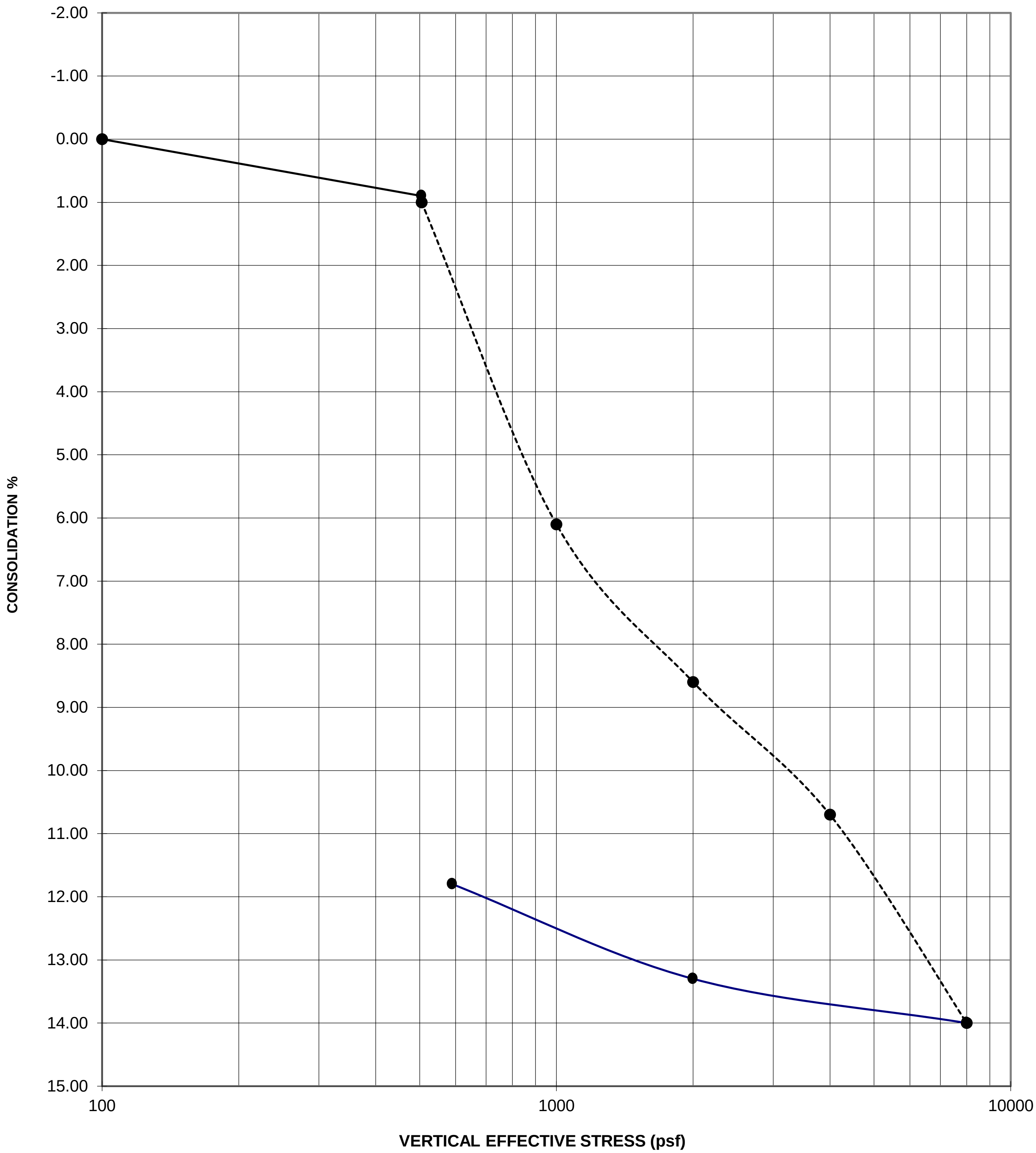






SHEAR STRENGTH TEST - ASTM D3080

Job Name:	Industrial Buildings - Hardt & Brier			Initial Dry Density (pcf):	107.2
Project Number:	40-3959G	Sample Date:	5/3/2021	Initial Moisture (%):	11.1
Lab Number:	32166	Test Date:	5/27/2021	Final Moisture (%):	19.7
Sample Location:	B-14 @ 5'	Tested by:	JH	Cohesion:	290 psf
Sample Description:	Brownish Gray (SC)			Angle Of Friction:	39.1



SWELL/CONSOLIDATION TEST			
Sample Designation	Depth (ft)	Symbol	Legend
B-10	5	●	FIELD MOISTURE
Initial Dry Density, pcf 92.9	Initial Moisture Content, % 28.2	Sample saturated at 500 psf	SAMPLE SATURATED REBOUND

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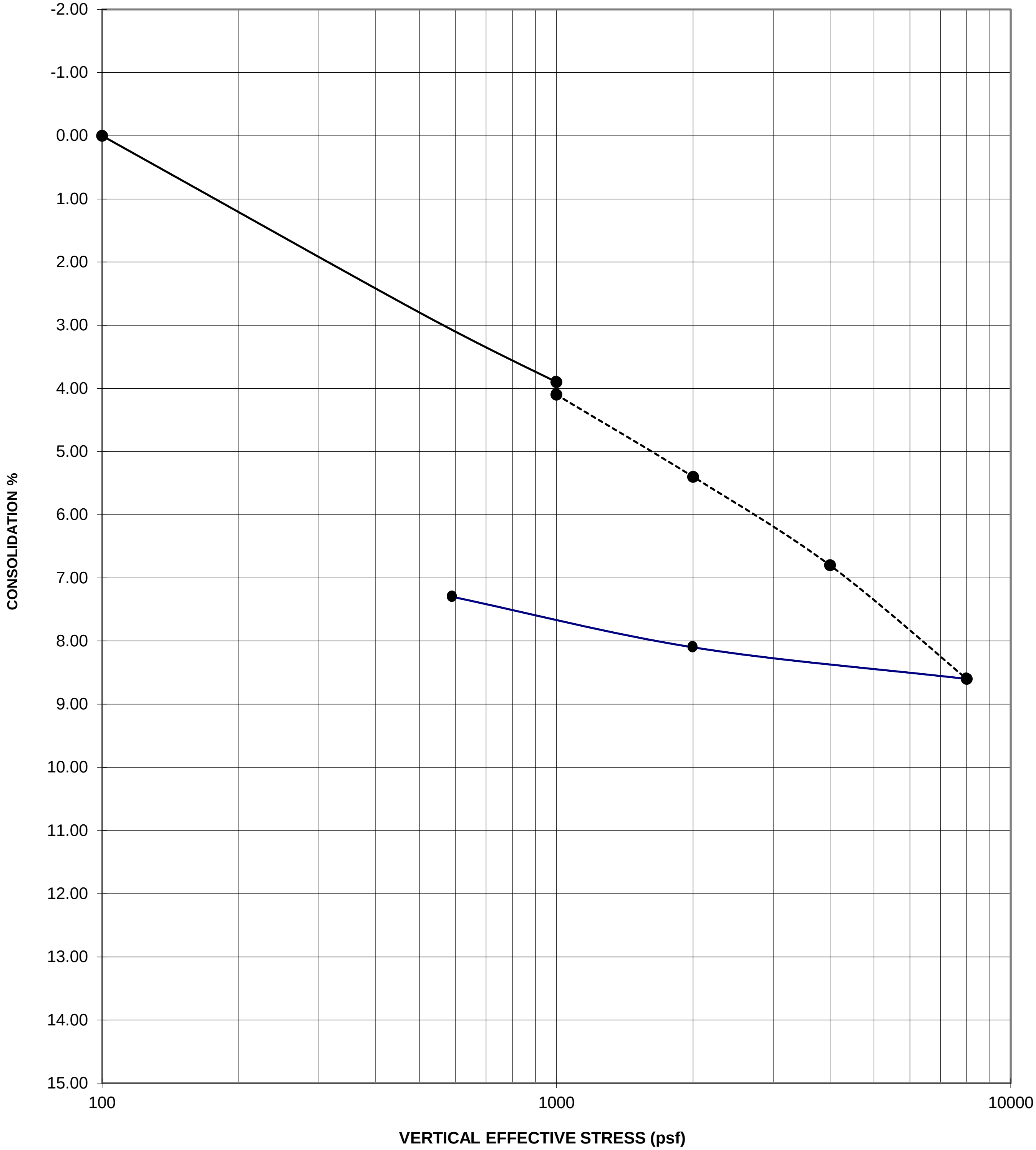
CTE JOB NO: 40-3959

Industrial Bldgs - Hardt & Brier



SWELL/CONSOLIDATION TEST			
Sample Designation	Depth (ft)	Symbol	Legend
B-11	10	●	FIELD MOISTURE
Initial Dry Density, pcf 119.4	Initial Moisture Content, % 11.4	Sample saturated at 1000 psf	SAMPLE SATURATED REBOUND

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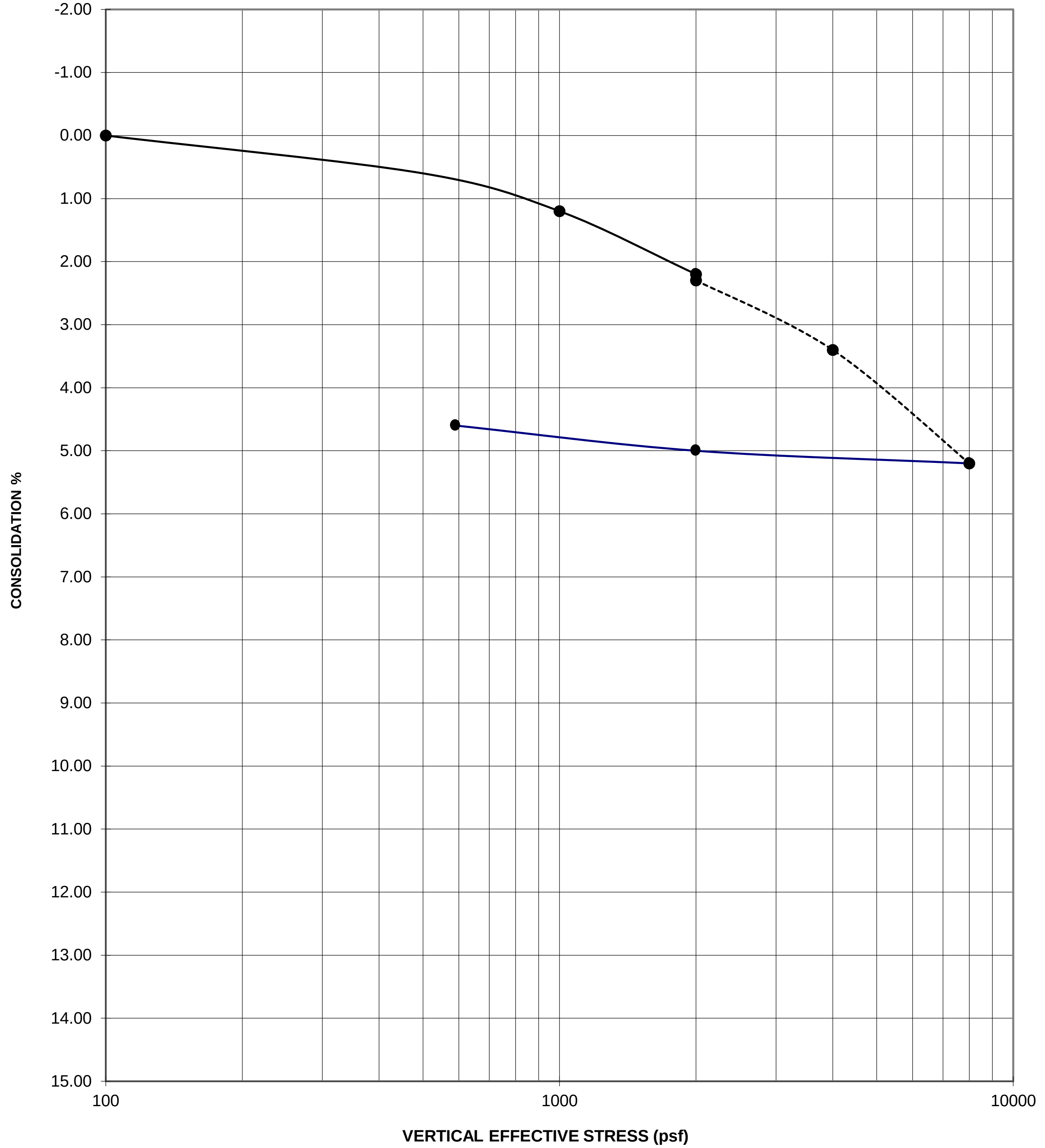
Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

CTE JOB NO: 40-3959

Industrial Bldgs - Hardt & Brier



SWELL/CONSOLIDATION TEST			
Sample Designation	Depth (ft)	Symbol	Legend
B-13	20	●	FIELD MOISTURE
Initial Dry Density, pcf 106.8	Initial Moisture Content, % 19.8	Sample saturated at 2000 psf	SAMPLE SATURATED REBOUND

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Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

CTE JOB NO: 40-3959

Industrial Bldgs - Hardt & Brier

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REPORT OF RESISTANCE 'R' VALUE-EXPANSION PRESSURE

Project Name: Industrial Buildings Hardt- Brier
Project No.: 40-3959G
Sample Location: B-2 @ 1-5'
Soil Description: Moderate Brown ML
Test Procedure: Cal 301

Lab No.: 32166
Sampled By: R.E. **Date:** 4/30-5/3/21
Submitted By: R.E. **Date:** 4/30-5/3/21
Tested By: Larry Sachs **Date:** 5/13/2021
Reviewed By: Erik Campbell **Date:** 5/14/2021

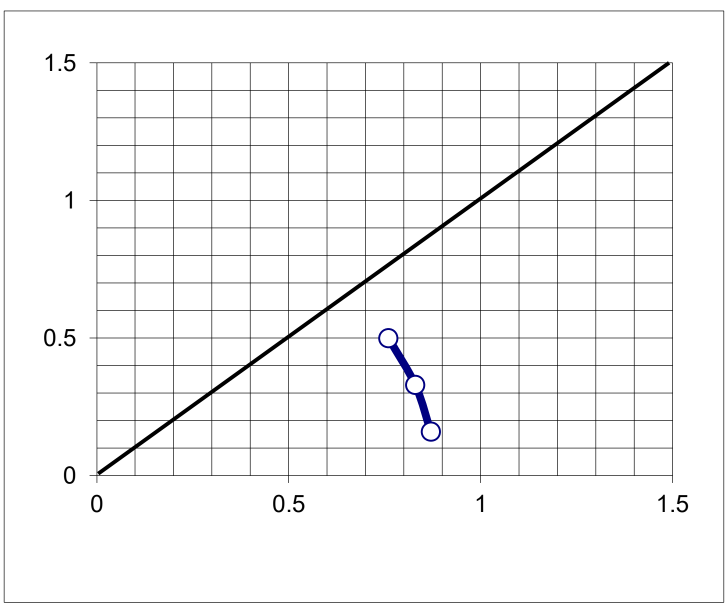
Specimen/ Mold No.	1	2	3	
Compactor Air Pressure, ft.lbs.	120	180	250	
Initial Moisture, %	4.5	4.5	4.5	
Wet Weight / Tare (g)	1901.2	1901.2	1901.2	
Dry Weight / Tare (g)	1850.0	1850.0	1850.0	
Tare (g)	701.4	701.4	701.4	
Water Added, ml	140	130	120	
Moisture at Compaction, %	16.6	15.8	14.9	
Wt. Of Briquette and Mold, g	3217	3181	3213	
Wt. Of Mold, g	2109	2095	2094	
Wt. Of Briquitte,g	1108	1086	1119	
Height of Briquette, in	2.54	2.52	2.57	
Dry Density, pcf	113.4	112.8	114.9	
Stabilometer PH @ 1000 lbs	59	55	51	
Stabilometer PH @ 2000 lbs	131	125	115	
Displacement	5.20	4.40	3.89	
R' Value	9	13	20	
Corrected 'R' Value	9	13	20	
Exudation Pressure, lbs	2700	3500	4900	
Exudation Pressure, psi	216	280	392	
Stabilometer Thickness - ft	0.87	0.83	0.76	
Expansion Pressure	0.0005	0.0010	0.0015	
Expansion Press, Thick-ft	0.16	0.33	0.50	

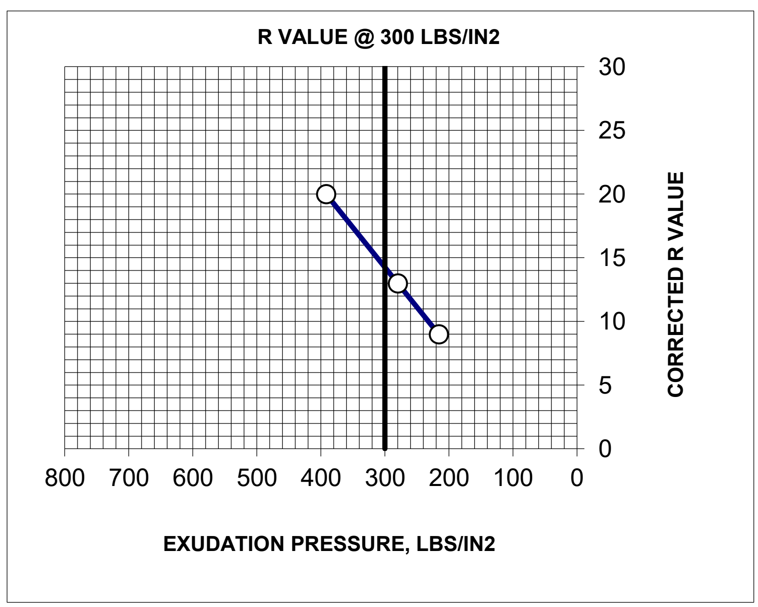
Exudation 14

Expansion 18

R-value **14**

TI	4.5
Expansion	18





Cover Thickness by Expansion Pressure-Feet

Expansion From Graph:	0.79

Erik Campbell
Laboratory Manager

Construction Testing & Engineering, Inc.

Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

REPORT OF RESISTANCE 'R' VALUE-EXPANSION PRESSURE

Project Name: Industrial Buildings Hardt- Brier
Lab No.: 32166
Project No.: 40-3959G
Sampled By: R.E. **Date:** 4/30/5/3/21
Sample Location: B-14 @ 1-5'
Submitted By: R.E. **Date:** 4/30-5/3/21
Soil Description: Moderate Brown CL
Tested By: Larry Sachs **Date:** 5/13/2021
Test Procedure: Cal 301
Reviewed By: Erik Campbell **Date:** 5/14/2021

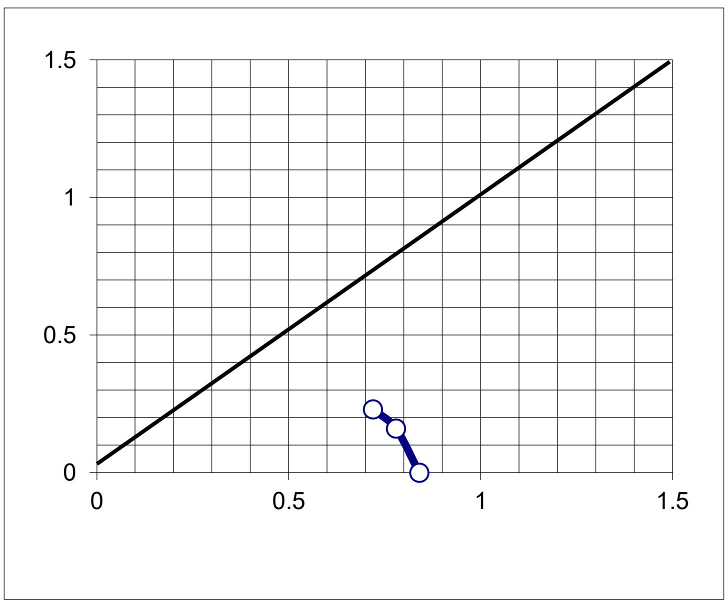
Specimen/ Mold No.	7	8	9	
Compactor Air Pressure, ft.lbs.	100	200	350	
Initial Moisture, %	3.3	3.3	3.3	
Wet Weight / Tare (g)	1891.2	1891.2	1891.2	
Dry Weight / Tare (g)	1852.9	1852.9	1852.9	
Tare (g)	691.8	691.8	691.8	
Water Added, ml	150	130	115	
Moisture at Compaction, %	16.2	14.5	13.2	
Wt. Of Briquette and Mold, g	3131	3139	3195	
Wt. Of Mold, g	2064	2064	2065	
Wt. Of Briquitte,g	1067	1075	1130	
Height of Briquette, in	2.42	2.49	2.55	
Dry Density, pcf	115.0	114.3	118.7	
Stabilometer PH @ 1000 lbs	56	48	41	
Stabilometer PH @ 2000 lbs	128	113	110	
Displacement	4.55	4.50	3.50	
R' Value	12	18	24	
Corrected 'R' Value	12	18	24	
Exudation Pressure, lbs	2000	3800	5900	
Exudation Pressure, psi	160	304	472	
Stabilometer Thickness - ft	0.84	0.78	0.72	
Expansion Pressure	0.0000	0.0005	0.0007	
Expansion Press, Thick-ft	0.00	0.16	0.23	

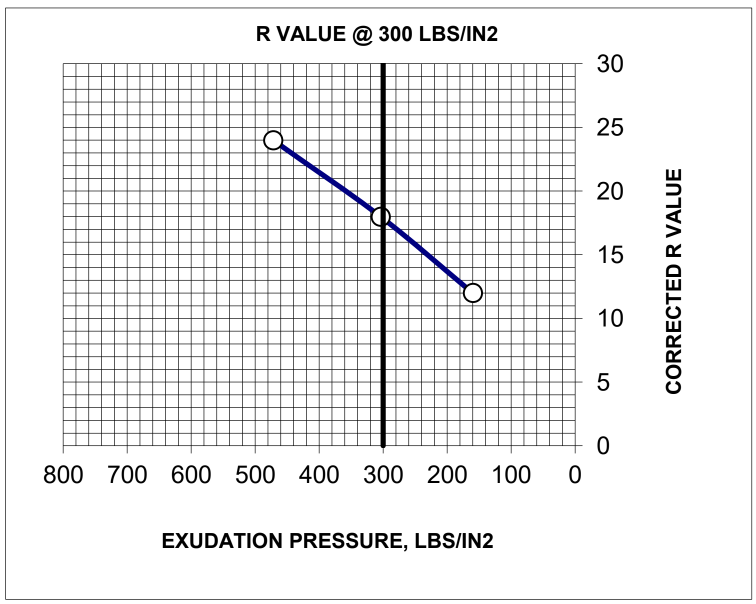
Exudation 18

Expansion 28

R-value **18**

TI	4.5
Expansion	28





Cover Thickness by Expansion Pressure-Feet

Expansion From Graph:	0.69

Erik Campbell
Laboratory Manager

LABORATORY COMPACTION OF SOIL (MODIFIED PROCTOR)

ASTM D 1557

Project Name:	Industrial Bldgs-Hardt and Brier	**Sampled By:**	RE	**Date:**	
CTE Project No.:	40-3959	**Tested By:**	SP	**Date:**	6-2-21
Lab No.:	9428	**Reviewed By:**	RE	**Date:**	6-2-21
Sample ID:	B-3 @ 1-5 feet				
Sample Description:	Dark Brown Sandy Lean Clay				

TEST NO.	1	2	3	4	
Wt. Comp. Soil + Mold (lbs)	13.570	13.688	13.600	13.311	
Wt. of Mold (lbs)	9.108	9.108	9.108	9.108	
Net Wt. of Soil (lbs)	4.462	4.580	4.492	4.203	
Wet Wt. of Soil + Cont. (g)	1336.0	1322.0	1325.3	1388.5	
Dry Wt. of Soil + Cont. (g)	1279.5	1260.3	1258.8	1347.8	
Wt. of Container (g)	499.4	655.5	742.4	497.3	
Moisture Content (%)	7.2	10.2	12.9	4.8	
Wet Density (pcf)	134.8	138.4	135.7	127.0	
Dry Density (pcf)	125.7	125.6	120.2	121.2	

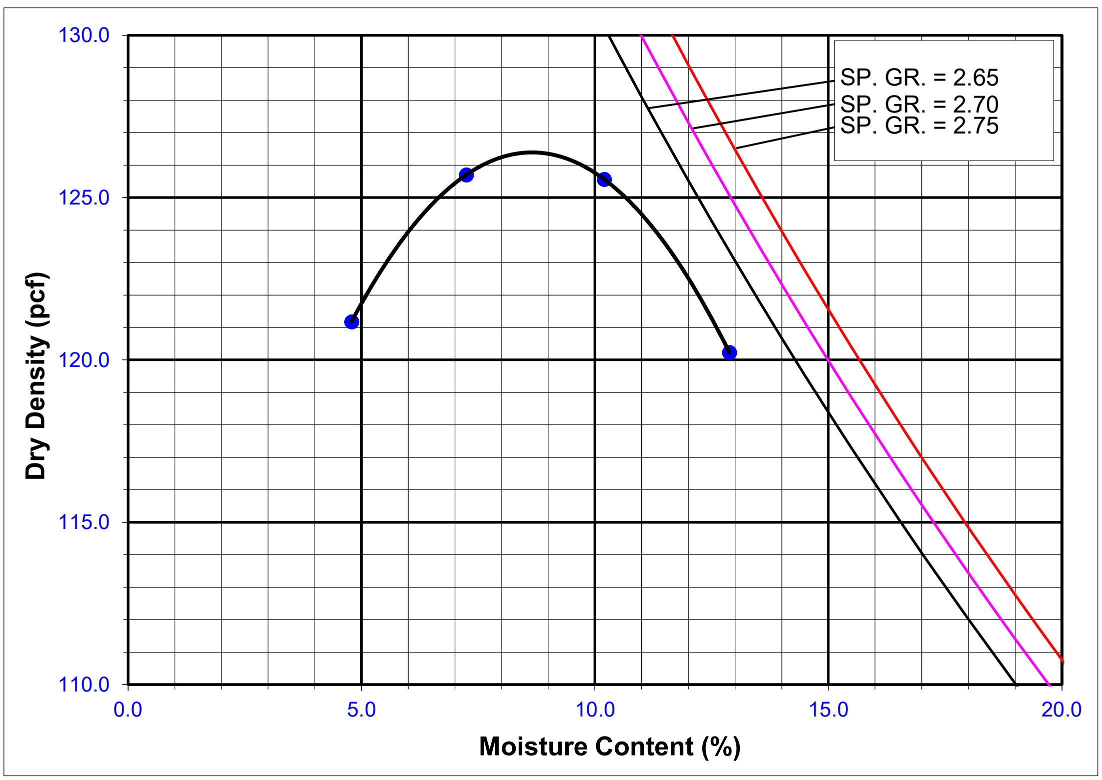
Preparation Method:	**Dry**	
	Moist	X
	Mechanical Rammer	
	Manual Rammer	X
Hammer Weight:	**10.0 lb.**	
Drop:	**18 in.**	
Mold Volume ($ft.^3$):	**0.03310**	

METHOD USED

X **Method A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if No.4 retained =/< 25%

Method B
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if 3/8" retained =/< 25%

Method C
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
May be used if 3/4" retained =/< 30%



OVERSIZE FRACTION

Total Sample Weight (g): 7203.9

Weight Retained (g)		Percent Retained
	Plus 3/4"	0.0
	Plus 3/8"	0.0
65.5	Plus #4	0.9

Maximum Dry Density (pcf)	**126.4**
Optimum Moisture Content (%)	**8.7**

Rock Correction Applied per ASTM D 4718

Maximum Dry Density (pcf)	**NA**
Optimum Moisture Content (%)	**NA**

14538 Meridian Pkwy, Riverside, CA 92518 (951)571-4081 www.ctesouth.com

LABORATORY COMPACTION OF SOIL (MODIFIED PROCTOR)

ASTM D 1557

Project Name: Industrial Bldgs-Hardt and Brier
CTE Project No.: 40-3959
Lab No.: 9428
Sample ID: B-6 @ 1-5 feet
Sample Description: Dark Brown Sandy Silty Clay

Sampled By: RE **Date:**
Tested By: SP **Date:** 6-2-21
Reviewed By: RE **Date:** 6-2-21

TEST NO.	1	2	3	4	
Wt. Comp. Soil + Mold (lbs)	13.407	13.627	13.601	13.480	
Wt. of Mold (lbs)	9.108	9.108	9.108	9.108	
Net Wt. of Soil (lbs)	4.299	4.519	4.493	4.372	
Wet Wt. of Soil + Cont. (g)	1334.8	1312.5	1313.7	1352.7	
Dry Wt. of Soil + Cont. (g)	1277.2	1235.3	1217.0	1258.5	
Wt. of Container (g)	497.2	498.6	496.3	650.3	
Moisture Content (%)	7.4	10.5	13.4	15.5	
Wet Density (pcf)	129.9	136.5	135.7	132.1	
Dry Density (pcf)	120.9	123.6	119.7	114.4	

Preparation Method: Dry [ ] Moist [X]

Mechanical Rammer [ ]
Manual Rammer [X]

Hammer Weight: 10.0 lb.

Drop: 18 in.

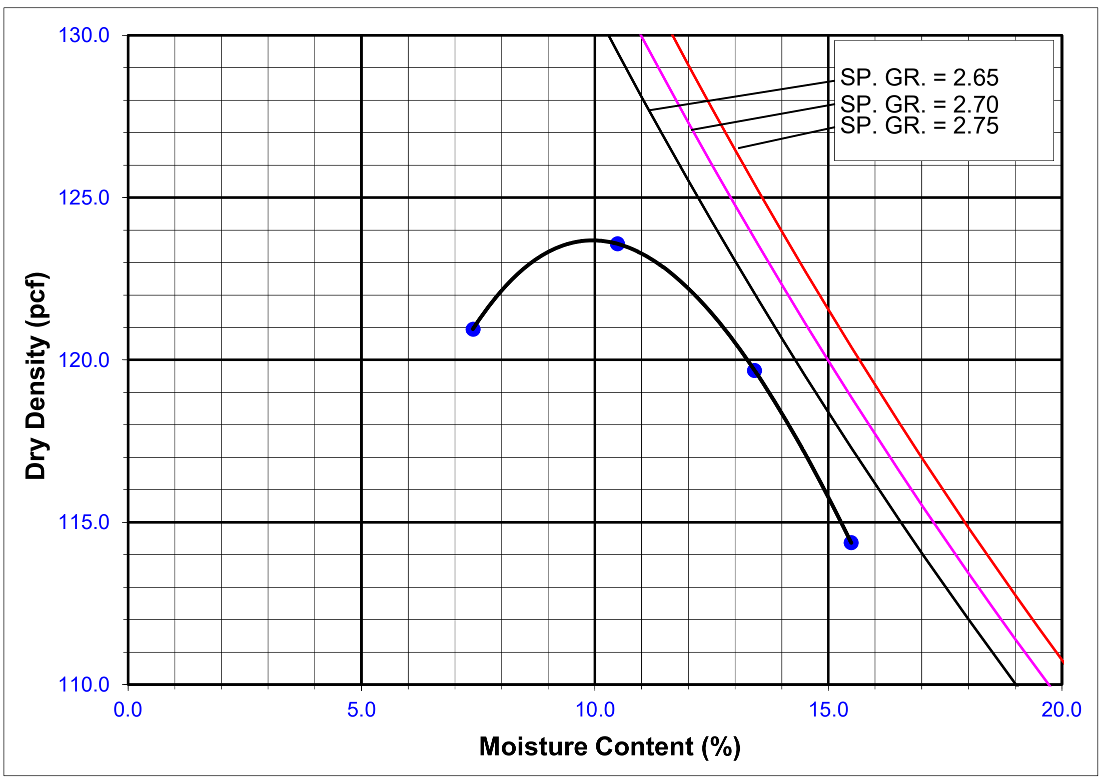
Mold Volume (ft.^{3}): 0.03310

METHOD USED

[X] **Method A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if No.4 retained =/< 25%

[ ] **Method B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if 3/8" retained =/< 25%

[ ] **Method C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
May be used if 3/4" retained =/< 30%



OVERSIZE FRACTION

Total Sample Weight (g): 13915.4

Weight Retained (g)		Percent Retained
	Plus 3/4"	0.0
	Plus 3/8"	0.0
649	Plus #4	4.7

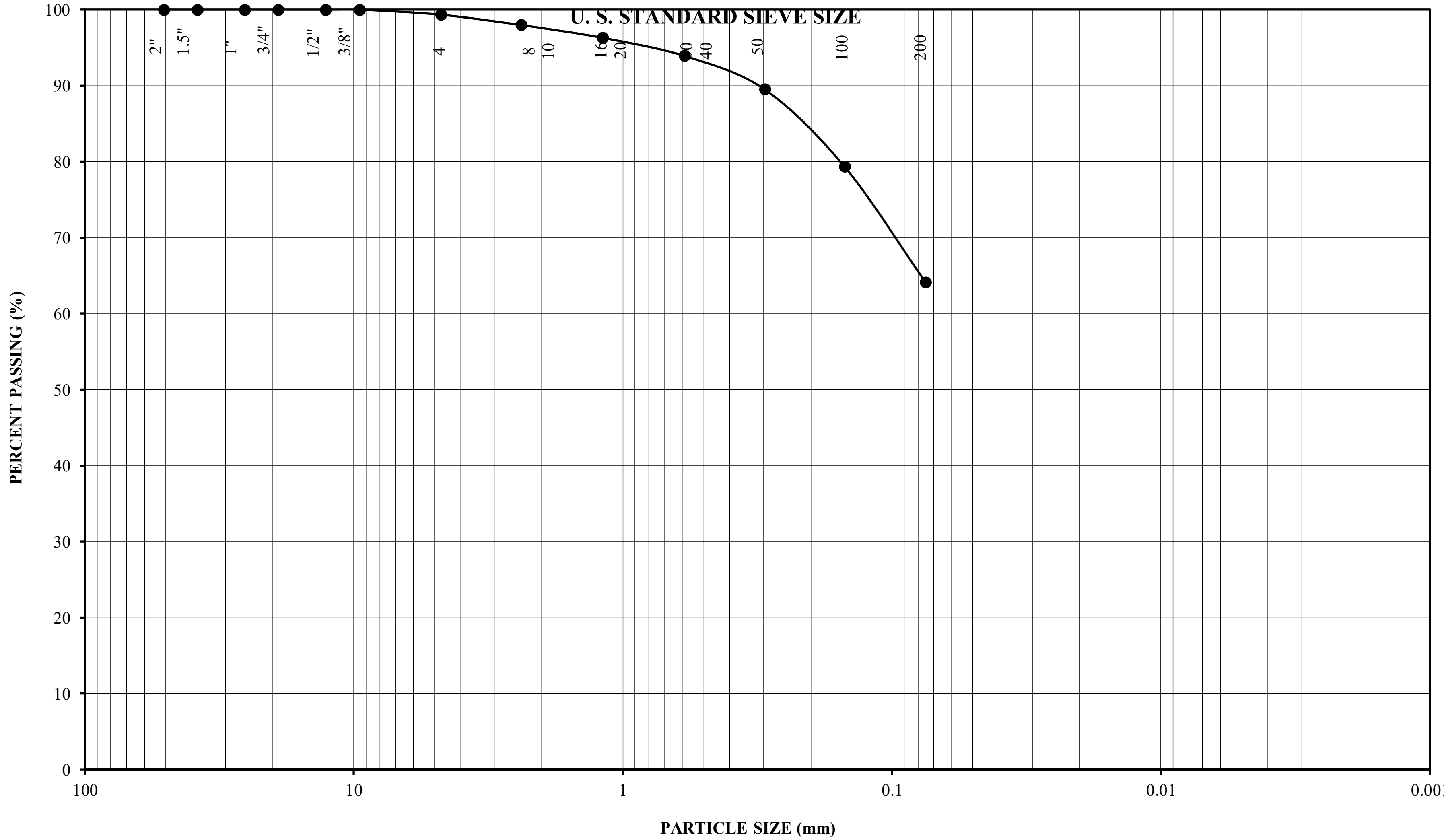
Maximum Dry Density (pcf) 123.7

Optimum Moisture Content (%) 10.0

Rock Correction Applied per ASTM D 4718

Maximum Dry Density (pcf) N/A

Optimum Moisture Content (%) N/A



PARTICLE SIZE ANALYSIS

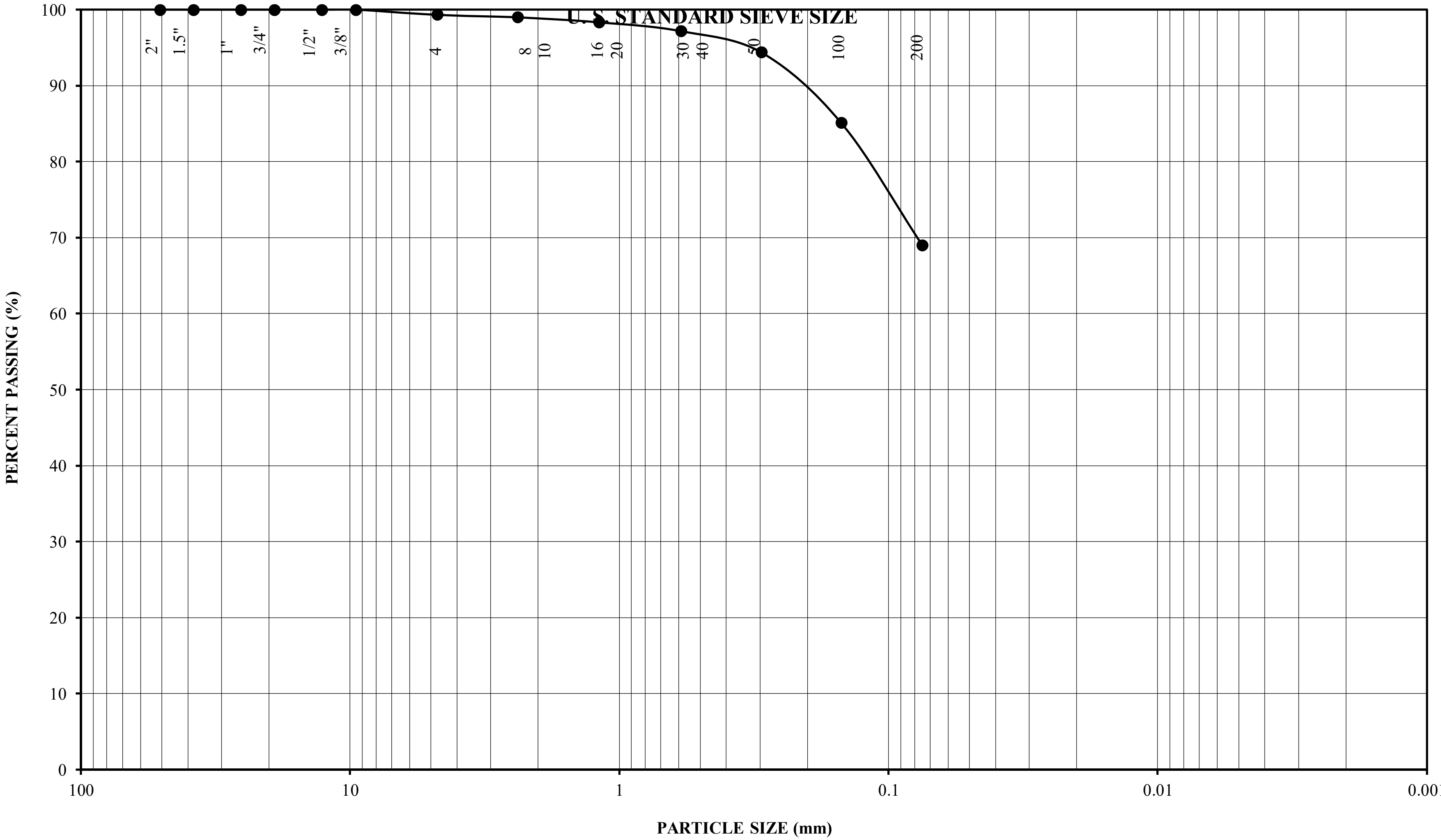
CTE SOUTH Construction Testing & Engineering, South, Inc.

Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

Sample Designation	Sample Depth (feet)	Symbol	Liquid Limit (%)	Plasticity Index	Classification
B-3	1-5	●	28	9	CL
		■			

CTE JOB NUMBER: 40-3959G

Hardt & Brier Indust Bldgs



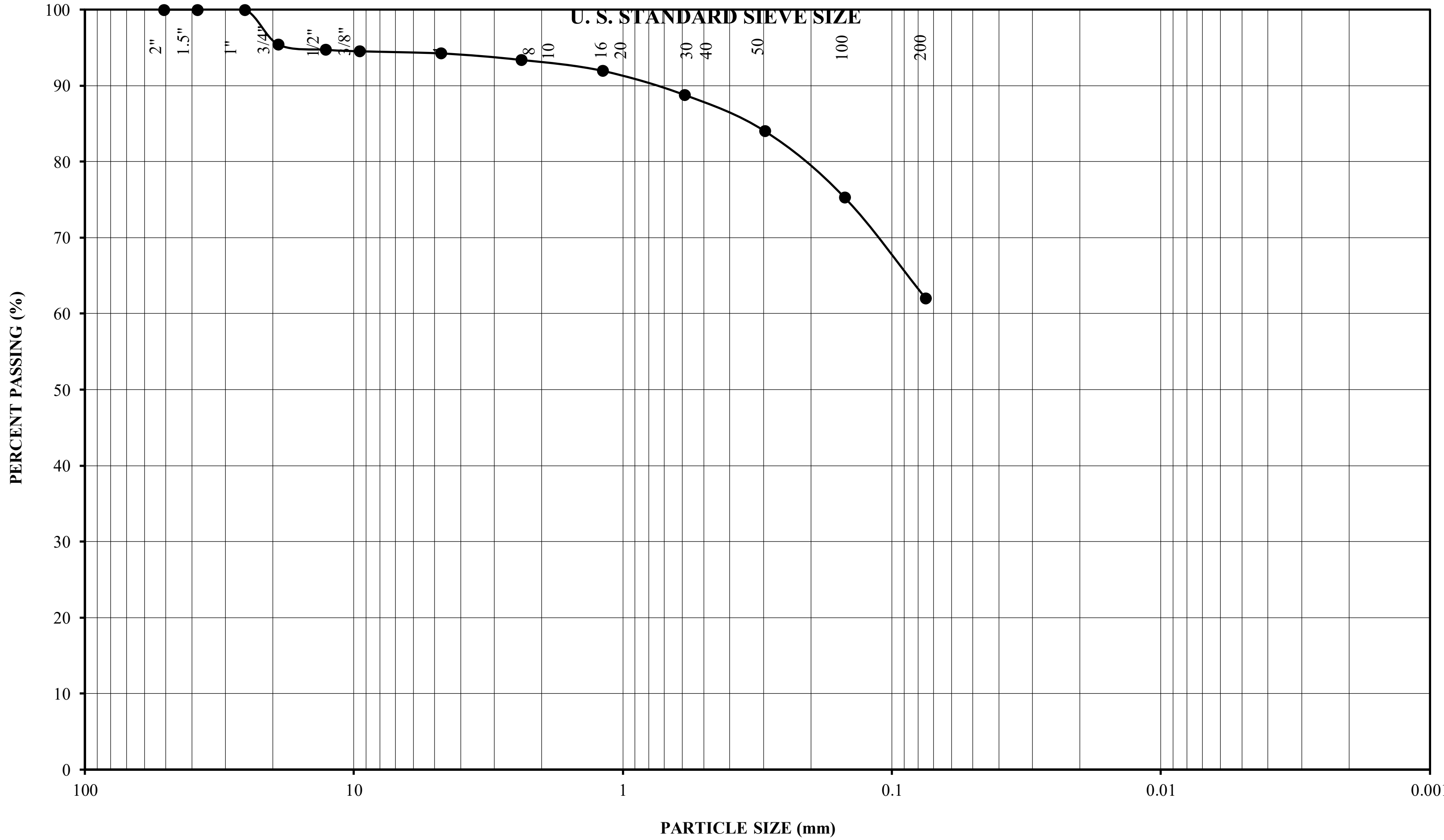
PARTICLE SIZE ANALYSIS

CTE SOUTH Construction Testing & Engineering, South, Inc.
Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

Sample Designation	Sample Depth (feet)	Symbol	Liquid Limit (%)	Plasticity Index	Classification
B-5	1-5	●	25	6	CL-ML
		■			

CTE JOB NUMBER: 40-3959G

Hardt & Brier Indust Bldgs



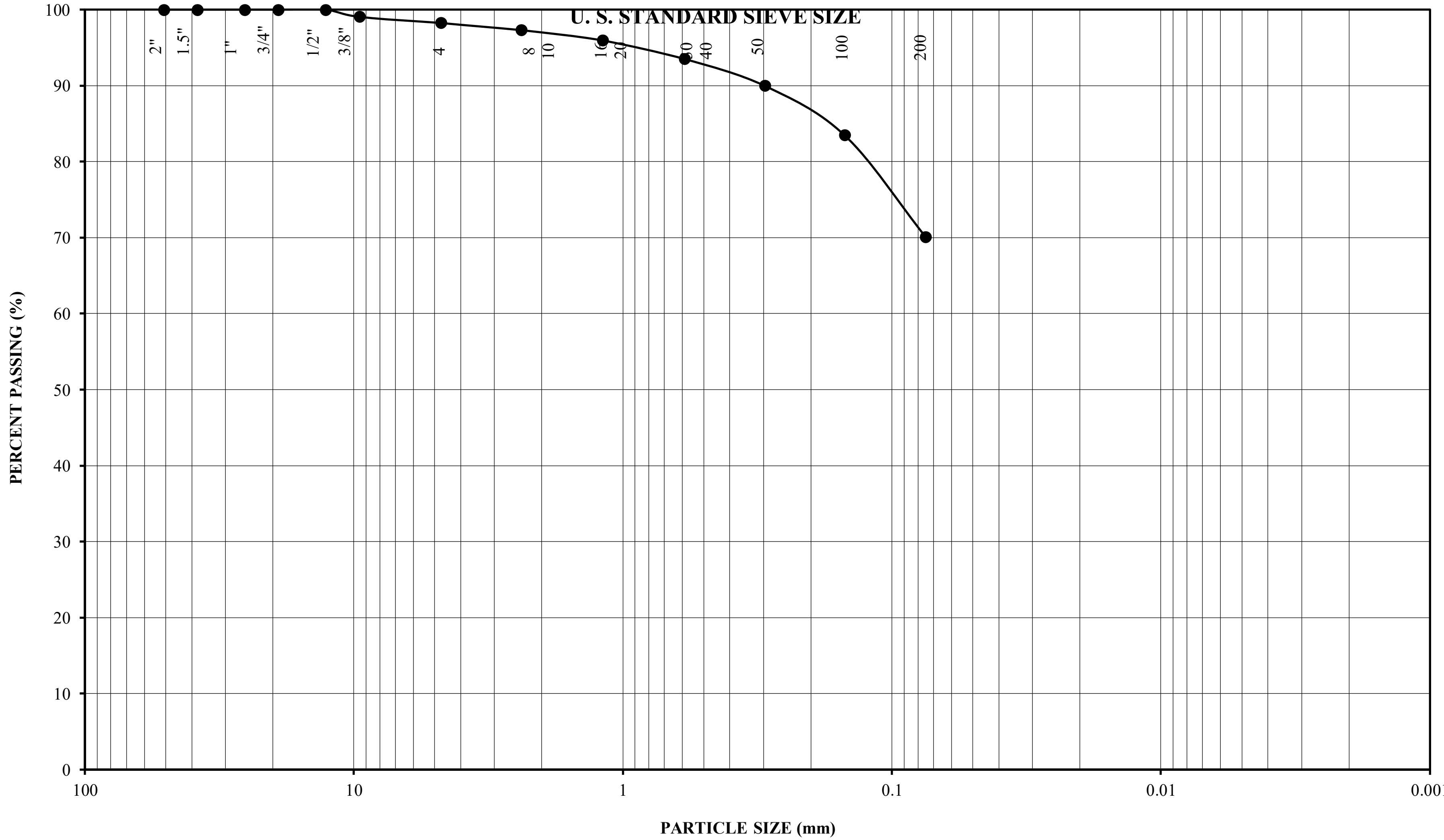
PARTICLE SIZE ANALYSIS

CTE SOUTH Construction Testing & Engineering, South, Inc.
Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

Sample Designation	Sample Depth (feet)	Symbol	Liquid Limit (%)	Plasticity Index	Classification
B-6	1-5	●			CL-ML
		■			

CTE JOB NUMBER: 40-3959G

Hardt & Brier Indust Bldgs



PARTICLE SIZE ANALYSIS

CTE SOUTH Construction Testing & Engineering, South, Inc.
Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

Sample Designation	Sample Depth (feet)	Symbol	Liquid Limit (%)	Plasticity Index	Classification
B-14	1-5	●	27	8	CL
		■			

CTE JOB NUMBER: 40-3959G

Hardt & Brier Indust Bldgs

EXPANSION INDEX TEST

ASTM D 4829

CTE Project Number: **40-3959G**

Project Name: **Industrial Buildings – Hardt & Brier**

Sample ID: B-3 @ 1-5 ft.
Sample Description: Sandy Lean CLAY
Lab No: 9428

Test Start Date:	Time:	Initial Reading:
6-2-2021	2:30 pm	0.0015
Test Finish Date:	Time:	Final Reading:
6-3-2021	2:30 pm	0.0283

Specimen Moisture Content, %: 8.5
Specimen Dry Density, pcf: 113.6
Specimen Saturation, %: 51.1

Expansion (inches): 0.0268

Expansion Index: 27

Expansion Potential: Low

EXPANSION INDEX TEST

ASTM D 4829

CTE Project Number: **40-3959G**

Project Name: **Industrial Buildings – Hardt & Brier**

Sample ID: B-6 @ 1-5 ft.
Sample Description: Sandy Silty CLAY
Lab No: 9428

Test Start Date:	Time:	Initial Reading:
6-7-2021	3:00 pm	0.0055
Test Finish Date:	**Time:**	**Final Reading:**
6-8-2021	3:00 pm	0.0437

Specimen Moisture Content, %: 9.5
Specimen Dry Density, pcf: 109.7
Specimen Saturation, %: 51.2

Expansion (inches): 0.0382

Expansion Index: 38

Expansion Potential: Low

TRANSMITTAL LETTER

DATE: May 14, 2021

ATTENTION: **Robert Ellerbusch**

TO: CTE South, Inc.
14538 Meridian Pkwy, Suite A
Riverside, CA 92518

SUBJECT: Laboratory Test Data
Industrial Buildings
Your #40-3959G, HDR Lab #21-0405LAB

COMMENTS: Enclosed are the results for the subject project.

James T. Keegan, MD
Corrosion and Lab Services Section Manager

Table 1 - Laboratory Tests on Soil Samples

CTE South, Inc.
Industrial Buildings
Your #40-3959G, HDR Lab #21-0405LAB
14-May-21

Sample ID

			B-4 @ 1-4'	B-11 @ 1-3'	B-12 @ 5-9'
Resistivity		**Units**			
as-received		ohm-cm	2,320	148,000	5,200
minimum		ohm-cm	640	20,400	1,160
pH			9.1	8.6	8.6
Electrical Conductivity		mS/cm	0.80	0.06	0.37
Chemical Analyses					
Cations					
calcium	Ca^{2+}	mg/kg	137	33	46
magnesium	Mg^{2+}	mg/kg	37	1.5	1.5
sodium	Na^{1+}	mg/kg	1,050	25	395
potassium	K^{1+}	mg/kg	40	2.8	5.6
ammonium	NH_4^{1+}	mg/kg	ND	ND	ND
Anions					
carbonate	CO_3^{2-}	mg/kg	308	87	101
bicarbonate	HCO_3^{1-}	mg/kg	671	ND	159
fluoride	F^{1-}	mg/kg	52	2.4	25
chloride	Cl^{1-}	mg/kg	62	4.9	53
sulfate	SO_4^{2-}	mg/kg	504	5.7	358
nitrate	NO_3^{1-}	mg/kg	221	2.9	42
phosphate	PO_4^{3-}	mg/kg	ND	ND	ND
Other Tests					
sulfide	S^{2-}	qual	na	na	na
Redox		mV	na	na	na

Minimum resistivity and pH per CTM 643, Chloride per CTM 422, Sulfate per CTM 417

Electrical conductivity in millisiemens/cm and chemical analyses were made on a 1:5 soil-to-water extract.

mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

APPENDIX C

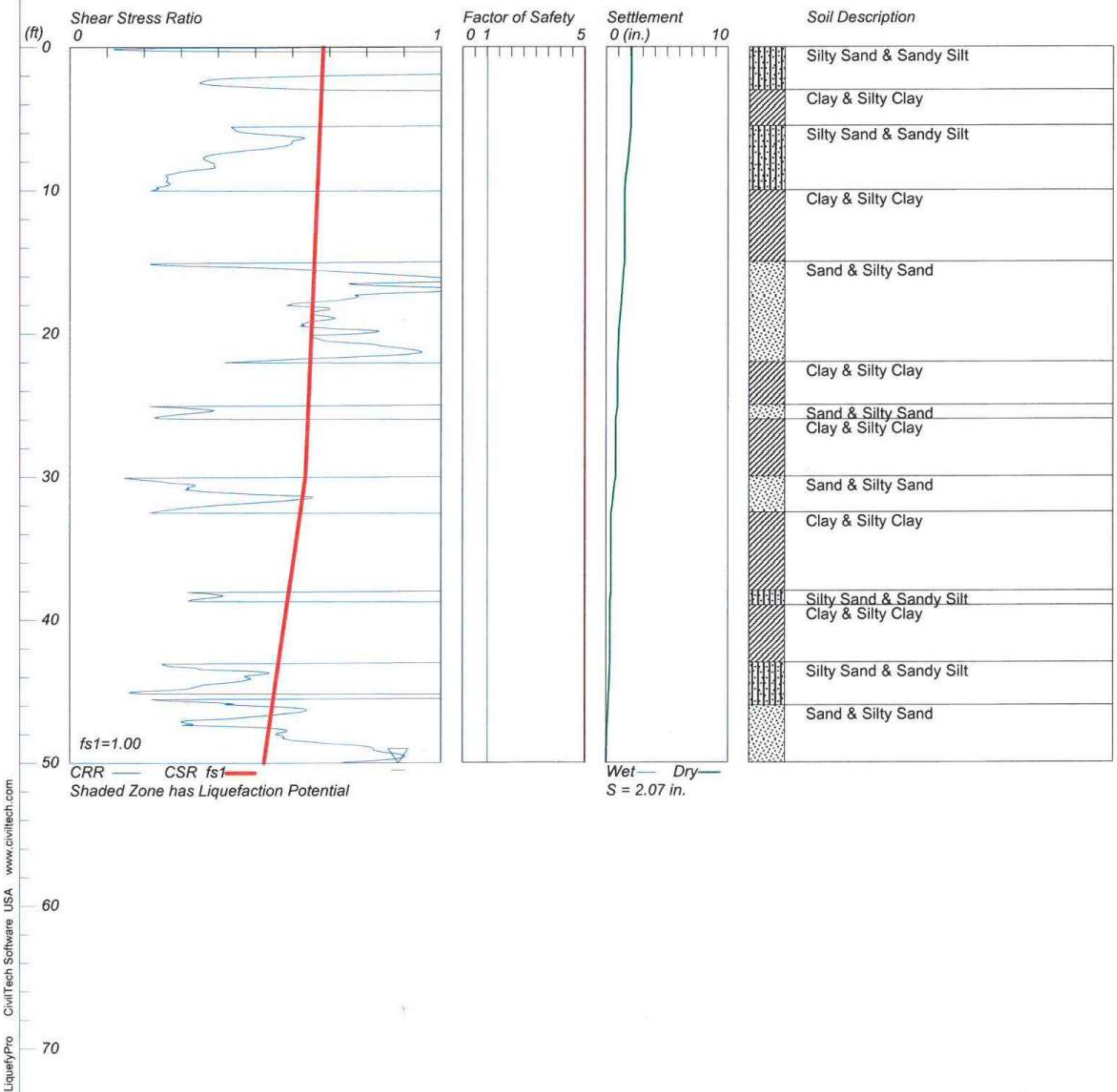
SEISMIC SETTLEMENT ANALYSES

LIQUEFACTION ANALYSIS

Industrial Bldgs - Hardt & Brier Streets

Hole No.=CPT-3 Water Depth=50 ft

Magnitude=7.5
Acceleration=1.05g



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LIQUEFACTION ANALYSIS CALCULATION SHEET

www.civiltech.com
(425) 453-6488 Fax (425) 453-5848

****
****

Licensed to ,   6/17/2021   10:29:55 AM

Input File Name: R:\Projects\40-3959G Geo. Inv. Multi-Building Development\seismic settlement analyses\CPT-3.liq
Title: Industrial Bldgs - Hardt & Brier Streets
Subtitle: 40-3959G

Surface Elev.=
Hole No.=CPT-3
Depth of Hole= 50.0 ft
Water Table during Earthquake= 50.0 ft
Water Table during In-Situ Testing= 50.0 ft
Max. Acceleration= 1.05 g
Earthquake Magnitude= 7.5

Input Data:
Surface Elev.=
Hole No.=CPT-3
Depth of Hole=50.0 ft
Water Table during Earthquake= 50.0 ft
Water Table during In-Situ Testing= 50.0 ft
Max. Acceleration=1.05 g
Earthquake Magnitude=7.5

1. CPT Calulation Method: Modified Robertson*
2. Settlement Analysis Method: Ishihara / Yoshimine*
3. Fines Correction for Liquefaction: Idriss/Seed (SPT only)
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio,   Ce = 1
7. Borehole Diameter,   Cb= 1
8. Sampling Method,   Cs= 1
9. User request factor of safety (apply to CSR) ,   User= 1
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	qc tsf	fs tsf	gamma pcf	Fines %	D50 mm
0.0	-0.1	0.0	120.0	50.0	0.1
0.1	2.0	0.0	120.0	50.0	0.1
0.2	4.0	0.1	120.0	50.0	0.1
0.2	5.5	0.1	120.0	50.0	0.1
0.3	24.8	0.1	120.0	50.0	0.1
0.4	33.7	0.2	120.0	50.0	0.1
0.4	35.8	0.2	120.0	50.0	0.1
0.5	52.2	0.4	120.0	50.0	0.1
0.6	70.4	0.6	120.0	50.0	0.1
0.6	82.1	0.8	120.0	50.0	0.1
0.7	115.5	1.0	120.0	50.0	0.1
0.8	166.0	1.6	120.0	50.0	0.1
0.8	178.6	2.0	120.0	50.0	0.1
0.9	186.5	2.4	120.0	50.0	0.1
0.9	184.8	2.7	120.0	50.0	0.1
1.0	179.7	3.2	120.0	50.0	0.1
1.1	174.7	3.5	120.0	50.0	0.1
1.1	164.5	3.7	120.0	50.0	0.1
1.2	142.9	3.8	120.0	50.0	0.1
1.3	136.6	3.7	120.0	50.0	0.1
1.3	129.4	3.6	120.0	50.0	0.1
1.4	111.2	3.3	120.0	50.0	0.1
1.5	100.5	3.1	120.0	50.0	0.1
1.5	96.3	2.8	120.0	50.0	0.1
1.6	87.7	2.6	120.0	50.0	0.1
1.7	80.4	2.3	120.0	50.0	0.1
1.7	72.6	1.9	120.0	50.0	0.1
1.8	66.4	1.7	120.0	50.0	0.1
1.8	61.2	1.5	120.0	50.0	0.1
1.9	55.7	1.1	120.0	50.0	0.1
2.0	53.2	1.0	120.0	50.0	0.1
2.1	45.9	0.9	120.0	50.0	0.1
2.1	41.4	0.9	120.0	50.0	0.1
2.2	39.5	0.8	120.0	50.0	0.1
2.2	35.0	0.8	120.0	50.0	0.1
2.3	33.7	0.8	120.0	50.0	0.1
2.4	35.1	0.8	120.0	50.0	0.1
2.5	33.9	0.8	120.0	50.0	0.1
2.5	35.1	0.8	120.0	50.0	0.1
2.6	36.2	0.8	120.0	50.0	0.1
2.7	40.3	0.9	120.0	50.0	0.1
2.7	41.7	0.9	120.0	50.0	0.1
2.8	46.8	1.1	120.0	50.0	0.1
2.8	49.0	1.1	120.0	50.0	0.1
2.9	51.4	1.3	120.0	50.0	0.1
3.0	52.7	1.4	120.0	50.0	0.1
3.0	52.7	1.5	115.0	NoLiq	0.0

3.1	51.3	1.6	115.0	NoLiq	0.0
3.2	50.4	1.6	115.0	NoLiq	0.0
3.2	49.1	1.7	115.0	NoLiq	0.0
3.3	48.6	1.7	115.0	NoLiq	0.0
3.4	46.7	1.7	115.0	NoLiq	0.0
3.4	44.7	1.6	115.0	NoLiq	0.0
3.5	43.1	1.5	115.0	NoLiq	0.0
3.6	37.7	1.3	115.0	NoLiq	0.0
3.6	35.8	1.3	115.0	NoLiq	0.0
3.7	32.6	1.3	115.0	NoLiq	0.0
3.7	30.8	1.2	115.0	NoLiq	0.0
3.8	28.7	1.2	115.0	NoLiq	0.0
3.9	28.1	1.2	115.0	NoLiq	0.0
3.9	26.4	1.2	115.0	NoLiq	0.0
4.0	24.0	1.3	115.0	NoLiq	0.0
4.1	23.6	1.3	115.0	NoLiq	0.0
4.1	23.3	1.3	115.0	NoLiq	0.0
4.2	25.0	1.2	115.0	NoLiq	0.0
4.3	27.3	1.2	115.0	NoLiq	0.0
4.3	28.8	1.2	115.0	NoLiq	0.0
4.4	32.7	1.2	115.0	NoLiq	0.0
4.5	36.8	1.1	115.0	NoLiq	0.0
4.5	38.3	1.1	115.0	NoLiq	0.0
4.6	41.2	1.1	115.0	NoLiq	0.0
4.7	42.7	1.1	115.0	NoLiq	0.0
4.8	44.1	1.1	115.0	NoLiq	0.0
4.8	44.7	1.1	115.0	NoLiq	0.0
4.9	45.2	1.2	115.0	NoLiq	0.0
5.0	44.0	1.3	115.0	NoLiq	0.0
5.0	43.0	1.3	115.0	NoLiq	0.0
5.1	41.4	1.3	115.0	NoLiq	0.0
5.1	42.6	1.4	115.0	NoLiq	0.0
5.2	48.6	1.4	115.0	NoLiq	0.0
5.3	53.5	1.4	115.0	NoLiq	0.0
5.3	55.7	1.4	115.0	NoLiq	0.0
5.4	58.9	1.4	115.0	NoLiq	0.0
5.5	60.0	1.4	115.0	NoLiq	0.0
5.5	61.8	1.4	120.0	50.0	0.1
5.6	62.3	1.4	120.0	50.0	0.1
5.7	63.5	1.4	120.0	50.0	0.1
5.8	64.9	1.4	120.0	50.0	0.1
5.8	65.7	1.4	120.0	50.0	0.1
5.9	68.4	1.4	120.0	50.0	0.1
5.9	69.5	1.4	120.0	50.0	0.1
6.0	73.3	1.5	120.0	50.0	0.1
6.1	75.4	1.5	120.0	50.0	0.1
6.1	79.6	1.6	120.0	50.0	0.1
6.2	81.7	1.6	120.0	50.0	0.1
6.3	85.4	1.7	120.0	50.0	0.1
6.4	86.0	1.7	120.0	50.0	0.1

6.4	85.5	1.7	120.0	50.0	0.1
6.5	84.2	1.7	120.0	50.0	0.1
6.5	83.7	1.7	120.0	50.0	0.1
6.6	83.3	1.8	120.0	50.0	0.1
6.6	83.1	1.8	120.0	50.0	0.1
6.7	82.1	1.8	120.0	50.0	0.1
6.8	81.8	1.8	120.0	50.0	0.1
6.9	81.4	1.8	120.0	50.0	0.1
6.9	80.4	1.8	120.0	50.0	0.1
7.0	74.8	1.8	120.0	50.0	0.1
7.1	73.1	1.8	120.0	50.0	0.1
7.1	71.8	1.8	120.0	50.0	0.1
7.2	69.3	1.7	120.0	50.0	0.1
7.3	69.3	1.6	120.0	50.0	0.1
7.3	69.3	1.6	120.0	50.0	0.1
7.4	69.3	1.5	120.0	50.0	0.1
7.5	69.4	1.4	120.0	50.0	0.1
7.5	70.1	1.4	120.0	50.0	0.1
7.6	70.4	1.3	120.0	50.0	0.1
7.7	71.2	1.3	120.0	50.0	0.1
7.7	71.4	1.3	120.0	50.0	0.1
7.8	73.0	1.3	120.0	50.0	0.1
7.8	74.0	1.3	120.0	50.0	0.1
7.9	76.8	1.3	120.0	50.0	0.1
8.0	78.2	1.3	120.0	50.0	0.1
8.0	79.5	1.3	120.0	50.0	0.1
8.1	80.8	1.3	120.0	50.0	0.1
8.2	79.6	1.4	120.0	50.0	0.1
8.2	79.2	1.4	120.0	50.0	0.1
8.3	81.3	1.4	120.0	50.0	0.1
8.4	85.6	1.3	120.0	50.0	0.1
8.4	85.4	1.3	120.0	50.0	0.1
8.5	84.5	1.2	120.0	50.0	0.1
8.6	80.5	1.1	120.0	50.0	0.1
8.6	76.9	1.1	120.0	50.0	0.1
8.7	74.9	1.1	120.0	50.0	0.1
8.8	70.3	1.1	120.0	50.0	0.1
8.9	64.5	1.1	120.0	50.0	0.1
8.9	61.2	1.1	120.0	50.0	0.1
8.9	58.1	1.1	120.0	50.0	0.1
9.0	53.5	1.2	120.0	50.0	0.1
9.1	52.0	1.2	120.0	50.0	0.1
9.2	52.5	1.2	120.0	50.0	0.1
9.2	52.4	1.2	120.0	50.0	0.1
9.3	52.6	1.2	120.0	50.0	0.1
9.4	52.8	1.2	120.0	50.0	0.1
9.4	52.5	1.2	120.0	50.0	0.1
9.5	51.6	1.2	120.0	50.0	0.1
9.6	50.3	1.2	120.0	50.0	0.1
9.6	48.8	1.2	120.0	50.0	0.1

9.7	44.7	1.1	120.0	50.0	0.1
9.8	43.0	1.0	120.0	50.0	0.1
9.8	40.9	1.0	120.0	50.0	0.1
9.9	39.3	1.0	120.0	50.0	0.1
10.0	39.8	1.0	120.0	50.0	0.1
10.0	40.5	0.9	115.0	NoLiq	0.0
10.1	37.5	1.0	115.0	NoLiq	0.0
10.1	39.0	1.0	115.0	NoLiq	0.0
10.2	37.8	1.0	115.0	NoLiq	0.0
10.3	36.4	1.0	115.0	NoLiq	0.0
10.3	33.5	1.0	115.0	NoLiq	0.0
10.4	30.4	1.0	115.0	NoLiq	0.0
10.5	28.2	1.1	115.0	NoLiq	0.0
10.5	27.4	1.1	115.0	NoLiq	0.0
10.6	23.4	1.0	115.0	NoLiq	0.0
10.7	19.9	0.9	115.0	NoLiq	0.0
10.7	18.2	0.9	115.0	NoLiq	0.0
10.8	18.0	0.8	115.0	NoLiq	0.0
10.9	18.0	0.8	115.0	NoLiq	0.0
10.9	17.9	0.8	115.0	NoLiq	0.0
11.0	21.0	0.8	115.0	NoLiq	0.0
11.1	28.4	0.9	115.0	NoLiq	0.0
11.1	28.6	0.9	115.0	NoLiq	0.0
11.2	27.1	1.0	115.0	NoLiq	0.0
11.3	25.7	1.0	115.0	NoLiq	0.0
11.3	24.3	1.0	115.0	NoLiq	0.0
11.4	23.7	1.1	115.0	NoLiq	0.0
11.4	24.9	1.1	115.0	NoLiq	0.0
11.5	27.1	1.1	115.0	NoLiq	0.0
11.6	26.8	1.1	115.0	NoLiq	0.0
11.6	24.1	1.0	115.0	NoLiq	0.0
11.7	22.4	1.0	115.0	NoLiq	0.0
11.8	20.6	1.0	115.0	NoLiq	0.0
11.8	19.4	0.9	115.0	NoLiq	0.0
11.9	18.0	0.9	115.0	NoLiq	0.0
12.0	17.1	0.9	115.0	NoLiq	0.0
12.1	16.4	0.9	115.0	NoLiq	0.0
12.1	15.9	0.9	115.0	NoLiq	0.0
12.2	17.4	0.8	115.0	NoLiq	0.0
12.3	18.3	0.8	115.0	NoLiq	0.0
12.3	21.8	0.8	115.0	NoLiq	0.0
12.4	29.1	0.9	115.0	NoLiq	0.0
12.5	38.5	0.9	115.0	NoLiq	0.0
12.5	43.3	1.0	115.0	NoLiq	0.0
12.6	49.5	1.0	115.0	NoLiq	0.0
12.6	53.7	1.0	115.0	NoLiq	0.0
12.7	56.1	1.0	115.0	NoLiq	0.0
12.8	56.5	1.1	115.0	NoLiq	0.0
12.8	56.0	1.1	115.0	NoLiq	0.0
12.9	53.9	1.2	115.0	NoLiq	0.0

13.0	50.9	1.3	115.0	NoLiq	0.0
13.0	48.9	1.4	115.0	NoLiq	0.0
13.1	40.4	1.5	115.0	NoLiq	0.0
13.2	37.2	1.4	115.0	NoLiq	0.0
13.2	32.0	1.4	115.0	NoLiq	0.0
13.3	28.0	1.3	115.0	NoLiq	0.0
13.4	25.5	1.3	115.0	NoLiq	0.0
13.4	28.4	1.3	115.0	NoLiq	0.0
13.5	33.7	1.3	115.0	NoLiq	0.0
13.5	46.0	1.3	115.0	NoLiq	0.0
13.6	55.4	1.3	115.0	NoLiq	0.0
13.7	59.5	1.4	115.0	NoLiq	0.0
13.8	62.5	1.3	115.0	NoLiq	0.0
13.8	61.6	1.3	115.0	NoLiq	0.0
13.9	58.9	1.3	115.0	NoLiq	0.0
13.9	54.9	1.4	115.0	NoLiq	0.0
14.0	48.0	1.4	115.0	NoLiq	0.0
14.1	44.1	1.5	115.0	NoLiq	0.0
14.2	34.3	1.2	115.0	NoLiq	0.0
14.2	32.5	1.2	115.0	NoLiq	0.0
14.3	29.4	1.1	115.0	NoLiq	0.0
14.3	31.3	1.2	115.0	NoLiq	0.0
14.4	35.6	1.2	115.0	NoLiq	0.0
14.5	41.3	1.2	115.0	NoLiq	0.0
14.6	39.1	1.2	115.0	NoLiq	0.0
14.6	36.3	1.2	115.0	NoLiq	0.0
14.7	30.4	1.2	115.0	NoLiq	0.0
14.7	26.1	1.2	115.0	NoLiq	0.0
14.8	25.9	1.2	115.0	NoLiq	0.0
14.9	27.7	1.1	115.0	NoLiq	0.0
14.9	28.1	1.1	115.0	NoLiq	0.0
15.0	29.4	1.1	115.0	20.0	0.3
15.1	42.6	1.2	115.0	20.0	0.3
15.1	53.5	1.2	115.0	20.0	0.3
15.2	94.6	1.3	115.0	20.0	0.3
15.3	107.5	1.4	115.0	20.0	0.3
15.3	128.7	1.5	115.0	20.0	0.3
15.4	143.5	1.7	115.0	20.0	0.3
15.5	153.8	1.8	115.0	20.0	0.3
15.5	157.2	1.9	115.0	20.0	0.3
15.6	161.7	2.0	115.0	20.0	0.3
15.7	164.5	2.2	115.0	20.0	0.3
15.7	167.5	2.4	115.0	20.0	0.3
15.8	169.3	2.5	115.0	20.0	0.3
15.8	172.3	2.6	115.0	20.0	0.3
15.9	174.8	2.8	115.0	20.0	0.3
16.0	176.8	2.9	115.0	20.0	0.3
16.0	177.9	3.0	115.0	20.0	0.3
16.1	180.9	3.2	115.0	20.0	0.3
16.2	182.3	3.3	115.0	20.0	0.3

16.2	185.4	3.3	115.0	20.0	0.3
16.3	187.8	3.5	115.0	20.0	0.3
16.4	189.1	3.6	115.0	20.0	0.3
16.4	189.5	2.6	115.0	20.0	0.3
16.5	190.0	1.2	115.0	20.0	0.3
16.6	191.3	1.6	115.0	20.0	0.3
16.6	191.0	2.0	115.0	20.0	0.3
16.7	190.7	2.3	115.0	20.0	0.3
16.7	189.9	2.6	115.0	20.0	0.3
16.9	191.9	3.3	115.0	20.0	0.3
16.9	189.6	3.4	115.0	20.0	0.3
16.9	187.1	3.4	115.0	20.0	0.3
17.0	178.2	3.6	115.0	20.0	0.3
17.1	174.7	3.5	115.0	20.0	0.3
17.2	168.0	3.3	115.0	20.0	0.3
17.2	162.1	3.2	115.0	20.0	0.3
17.3	156.3	3.1	115.0	20.0	0.3
17.4	159.4	3.1	115.0	20.0	0.3
17.4	159.3	3.1	115.0	20.0	0.3
17.5	155.5	3.2	115.0	20.0	0.3
17.6	153.6	3.2	115.0	20.0	0.3
17.6	151.0	3.2	115.0	20.0	0.3
17.7	148.7	3.1	115.0	20.0	0.3
17.8	145.5	3.0	115.0	20.0	0.3
17.8	143.6	2.9	115.0	20.0	0.3
17.9	140.2	2.8	115.0	20.0	0.3
17.9	144.1	2.7	115.0	20.0	0.3
18.0	144.4	2.6	115.0	20.0	0.3
18.1	155.5	2.5	115.0	20.0	0.3
18.2	169.9	2.4	115.0	20.0	0.3
18.2	172.5	2.4	115.0	20.0	0.3
18.3	174.3	2.3	115.0	20.0	0.3
18.3	176.5	2.3	115.0	20.0	0.3
18.4	176.5	2.1	115.0	20.0	0.3
18.5	175.8	2.1	115.0	20.0	0.3
18.5	176.5	2.0	115.0	20.0	0.3
18.6	175.1	2.1	115.0	20.0	0.3
18.7	176.5	2.1	115.0	20.0	0.3
18.7	179.0	2.1	115.0	20.0	0.3
18.8	181.4	2.2	115.0	20.0	0.3
18.9	182.6	2.3	115.0	20.0	0.3
18.9	182.6	2.3	115.0	20.0	0.3
19.0	180.6	2.3	115.0	20.0	0.3
19.1	176.7	2.3	115.0	20.0	0.3
19.1	175.0	2.2	115.0	20.0	0.3
19.2	173.6	2.2	115.0	20.0	0.3
19.3	173.2	2.2	115.0	20.0	0.3
19.3	172.0	2.2	115.0	20.0	0.3
19.4	173.5	2.2	115.0	20.0	0.3
19.4	169.6	2.3	115.0	20.0	0.3

19.6	173.8	2.4	115.0	20.0	0.3
19.6	176.7	2.4	115.0	20.0	0.3
19.7	180.6	2.5	115.0	20.0	0.3
19.7	186.6	2.6	115.0	20.0	0.3
19.8	191.8	2.8	115.0	20.0	0.3
19.9	192.0	2.8	115.0	20.0	0.3
19.9	190.1	2.8	115.0	20.0	0.3
20.0	186.5	2.8	115.0	20.0	0.3
20.0	184.6	2.8	115.0	20.0	0.3
20.1	168.2	2.6	115.0	20.0	0.3
20.2	174.5	2.5	115.0	20.0	0.3
20.3	177.2	2.4	115.0	20.0	0.3
20.3	178.1	2.4	115.0	20.0	0.3
20.4	181.0	2.4	115.0	20.0	0.3
20.4	184.6	2.3	115.0	20.0	0.3
20.5	189.6	2.2	115.0	20.0	0.3
20.6	193.1	2.2	115.0	20.0	0.3
20.6	200.9	2.2	115.0	20.0	0.3
20.7	206.6	2.3	115.0	20.0	0.3
20.8	208.3	2.4	115.0	20.0	0.3
20.8	207.6	2.5	115.0	20.0	0.3
20.9	208.5	2.5	115.0	20.0	0.3
21.0	208.6	2.7	115.0	20.0	0.3
21.0	211.8	2.7	115.0	20.0	0.3
21.1	213.2	2.8	115.0	20.0	0.3
21.2	213.7	2.9	115.0	20.0	0.3
21.2	214.1	2.9	115.0	20.0	0.3
21.3	215.6	2.9	115.0	20.0	0.3
21.4	214.7	2.9	115.0	20.0	0.3
21.4	212.2	2.9	115.0	20.0	0.3
21.5	207.5	2.8	115.0	20.0	0.3
21.5	204.8	2.8	115.0	20.0	0.3
21.6	197.1	2.6	115.0	20.0	0.3
21.7	192.4	2.5	115.0	20.0	0.3
21.7	183.7	2.3	115.0	20.0	0.3
21.8	177.1	2.1	115.0	20.0	0.3
21.9	170.4	1.9	115.0	20.0	0.3
21.9	165.3	1.9	115.0	20.0	0.3
22.0	143.1	1.8	115.0	NoLiq	0.0
22.1	132.4	1.8	115.0	NoLiq	0.0
22.2	108.6	1.8	115.0	NoLiq	0.0
22.2	95.6	1.8	115.0	NoLiq	0.0
22.3	62.6	1.7	115.0	NoLiq	0.0
22.3	53.8	1.6	115.0	NoLiq	0.0
22.4	41.7	1.6	115.0	NoLiq	0.0
22.5	37.1	1.5	115.0	NoLiq	0.0
22.6	30.3	1.3	115.0	NoLiq	0.0
22.6	26.0	1.3	115.0	NoLiq	0.0
22.7	23.2	1.2	115.0	NoLiq	0.0
22.8	21.9	1.0	115.0	NoLiq	0.0

22.8	21.6	0.7	115.0	NoLiq	0.0
22.9	20.0	0.5	115.0	NoLiq	0.0
22.9	20.0	0.6	115.0	NoLiq	0.0
23.0	19.9	0.6	115.0	NoLiq	0.0
23.1	20.0	0.6	115.0	NoLiq	0.0
23.1	22.0	0.7	115.0	NoLiq	0.0
23.2	17.4	0.8	115.0	NoLiq	0.0
23.3	23.4	0.8	115.0	NoLiq	0.0
23.3	23.5	0.9	115.0	NoLiq	0.0
23.4	22.9	0.8	115.0	NoLiq	0.0
23.4	22.8	0.8	115.0	NoLiq	0.0
23.5	20.6	0.7	115.0	NoLiq	0.0
23.6	17.8	0.7	115.0	NoLiq	0.0
23.7	15.9	0.6	115.0	NoLiq	0.0
23.7	14.9	0.5	115.0	NoLiq	0.0
23.8	14.0	0.5	115.0	NoLiq	0.0
23.9	14.0	0.4	115.0	NoLiq	0.0
23.9	14.0	0.4	115.0	NoLiq	0.0
24.0	14.0	0.4	115.0	NoLiq	0.0
24.0	14.2	0.4	115.0	NoLiq	0.0
24.1	14.5	0.5	115.0	NoLiq	0.0
24.2	15.2	0.5	115.0	NoLiq	0.0
24.3	15.9	0.6	115.0	NoLiq	0.0
24.3	16.5	0.6	115.0	NoLiq	0.0
24.4	18.5	0.6	115.0	NoLiq	0.0
24.4	22.0	0.7	115.0	NoLiq	0.0
24.5	24.8	0.9	115.0	NoLiq	0.0
24.6	26.4	1.0	115.0	NoLiq	0.0
24.6	29.1	1.1	115.0	NoLiq	0.0
24.7	32.3	0.9	115.0	NoLiq	0.0
24.8	38.5	1.0	115.0	NoLiq	0.0
24.8	43.2	1.1	115.0	NoLiq	0.0
24.9	70.3	1.1	115.0	NoLiq	0.0
25.0	85.3	1.2	115.0	NoLiq	0.0
25.0	99.1	1.3	115.0	20.0	0.3
25.1	129.0	1.3	115.0	20.0	0.3
25.1	142.1	1.4	115.0	20.0	0.3
25.3	164.2	1.4	115.0	20.0	0.3
25.3	168.8	1.4	115.0	20.0	0.3
25.4	171.5	1.4	115.0	20.0	0.3
25.4	167.2	1.5	115.0	20.0	0.3
25.5	157.9	1.5	115.0	20.0	0.3
25.5	151.5	1.5	115.0	20.0	0.3
25.6	137.8	1.5	115.0	20.0	0.3
25.7	122.9	1.6	115.0	20.0	0.3
25.8	105.7	1.7	115.0	20.0	0.3
25.8	95.4	1.7	115.0	20.0	0.3
25.9	66.0	1.7	115.0	20.0	0.3
26.0	56.3	1.7	115.0	20.0	0.3
26.0	41.5	1.6	115.0	NoLiq	0.0

26.1	35.9	1.5	115.0	NoLiq	0.0
26.1	28.9	1.2	115.0	NoLiq	0.0
26.2	24.7	1.0	115.0	NoLiq	0.0
26.3	23.1	1.0	115.0	NoLiq	0.0
26.4	24.6	0.9	115.0	NoLiq	0.0
26.4	22.6	0.9	115.0	NoLiq	0.0
26.5	24.5	0.9	115.0	NoLiq	0.0
26.5	27.1	0.9	115.0	NoLiq	0.0
26.6	28.0	1.1	115.0	NoLiq	0.0
26.7	28.1	1.1	115.0	NoLiq	0.0
26.7	28.5	1.1	115.0	NoLiq	0.0
26.8	28.0	1.1	115.0	NoLiq	0.0
26.9	26.2	1.0	115.0	NoLiq	0.0
26.9	25.1	1.0	115.0	NoLiq	0.0
27.0	22.6	0.9	115.0	NoLiq	0.0
27.1	20.4	0.8	115.0	NoLiq	0.0
27.1	19.4	0.7	115.0	NoLiq	0.0
27.2	18.3	0.7	115.0	NoLiq	0.0
27.3	17.5	0.7	115.0	NoLiq	0.0
27.3	17.6	0.7	115.0	NoLiq	0.0
27.4	18.0	0.6	115.0	NoLiq	0.0
27.5	20.5	0.8	115.0	NoLiq	0.0
27.5	21.8	1.0	115.0	NoLiq	0.0
27.6	25.9	1.1	115.0	NoLiq	0.0
27.7	35.0	1.2	115.0	NoLiq	0.0
27.7	55.2	1.3	115.0	NoLiq	0.0
27.8	68.5	1.4	115.0	NoLiq	0.0
27.8	102.4	1.5	115.0	NoLiq	0.0
27.9	133.5	1.6	115.0	NoLiq	0.0
28.0	145.5	1.7	115.0	NoLiq	0.0
28.0	146.5	1.7	115.0	NoLiq	0.0
28.1	142.7	1.7	115.0	NoLiq	0.0
28.2	133.2	1.9	115.0	NoLiq	0.0
28.2	125.1	2.0	115.0	NoLiq	0.0
28.3	105.0	2.3	115.0	NoLiq	0.0
28.4	83.3	2.4	115.0	NoLiq	0.0
28.5	66.3	2.3	115.0	NoLiq	0.0
28.5	60.5	2.2	115.0	NoLiq	0.0
28.6	56.8	2.1	115.0	NoLiq	0.0
28.6	55.0	2.0	115.0	NoLiq	0.0
28.7	51.6	1.8	115.0	NoLiq	0.0
28.8	50.7	1.4	115.0	NoLiq	0.0
28.8	51.1	1.6	115.0	NoLiq	0.0
28.9	56.5	1.5	115.0	NoLiq	0.0
29.0	61.2	1.4	115.0	NoLiq	0.0
29.1	57.8	1.3	115.0	NoLiq	0.0
29.1	48.2	1.3	115.0	NoLiq	0.0
29.2	49.4	1.1	115.0	NoLiq	0.0
29.2	45.3	1.0	115.0	NoLiq	0.0
29.3	42.8	1.0	115.0	NoLiq	0.0

29.4	35.2	1.0	115.0	NoLiq	0.0
29.4	32.4	0.9	115.0	NoLiq	0.0
29.5	28.0	0.9	115.0	NoLiq	0.0
29.5	26.5	0.9	115.0	NoLiq	0.0
29.6	26.5	0.8	115.0	NoLiq	0.0
29.7	26.5	1.0	115.0	NoLiq	0.0
29.8	26.4	1.1	115.0	NoLiq	0.0
29.8	27.0	1.2	115.0	NoLiq	0.0
29.9	29.4	1.2	115.0	NoLiq	0.0
30.0	44.0	1.3	115.0	NoLiq	0.0
30.0	72.9	1.0	115.0	20.0	0.3
30.1	101.1	1.0	115.0	20.0	0.3
30.1	111.5	0.9	115.0	20.0	0.3
30.2	126.0	1.1	115.0	20.0	0.3
30.3	135.1	1.4	115.0	20.0	0.3
30.4	135.1	1.6	115.0	20.0	0.3
30.4	135.1	1.8	115.0	20.0	0.3
30.5	150.6	2.1	115.0	20.0	0.3
30.5	150.8	2.2	115.0	20.0	0.3
30.6	150.4	2.3	115.0	20.0	0.3
30.7	146.3	2.2	115.0	20.0	0.3
30.7	144.3	2.2	115.0	20.0	0.3
30.8	141.9	2.3	115.0	20.0	0.3
30.9	141.8	2.2	115.0	20.0	0.3
30.9	143.4	2.3	115.0	20.0	0.3
31.0	148.8	2.5	115.0	20.0	0.3
31.1	158.4	2.7	115.0	20.0	0.3
31.2	172.4	2.9	115.0	20.0	0.3
31.2	181.2	3.0	115.0	20.0	0.3
31.3	199.3	3.0	115.0	20.0	0.3
31.3	214.3	3.1	115.0	20.0	0.3
31.4	222.0	3.1	115.0	20.0	0.3
31.5	223.6	3.0	115.0	20.0	0.3
31.5	225.1	2.8	115.0	20.0	0.3
31.6	225.0	2.5	115.0	20.0	0.3
31.7	223.7	2.4	115.0	20.0	0.3
31.7	219.0	2.3	115.0	20.0	0.3
31.8	215.9	2.2	115.0	20.0	0.3
31.8	208.8	2.0	115.0	20.0	0.3
31.9	200.7	1.9	115.0	20.0	0.3
32.0	191.7	1.7	115.0	20.0	0.3
32.1	182.6	1.6	115.0	20.0	0.3
32.1	178.4	1.6	115.0	20.0	0.3
32.2	169.3	1.5	115.0	20.0	0.3
32.3	160.0	1.4	115.0	20.0	0.3
32.3	150.2	1.4	115.0	20.0	0.3
32.4	144.4	1.4	115.0	20.0	0.3
32.5	131.9	1.4	115.0	20.0	0.3
32.5	117.0	1.6	115.0	NoLiq	0.0
32.6	107.5	1.7	115.0	NoLiq	0.0

32.6	87.8	1.9	115.0	NoLiq	0.0
32.7	67.8	2.1	115.0	NoLiq	0.0
32.8	59.2	2.0	115.0	NoLiq	0.0
32.8	46.7	1.9	115.0	NoLiq	0.0
32.9	39.8	1.7	115.0	NoLiq	0.0
33.0	46.4	1.6	115.0	NoLiq	0.0
33.0	39.0	1.5	115.0	NoLiq	0.0
33.1	46.1	1.4	115.0	NoLiq	0.0
33.2	65.0	1.3	115.0	NoLiq	0.0
33.2	59.8	1.3	115.0	NoLiq	0.0
33.3	51.9	1.3	115.0	NoLiq	0.0
33.4	36.8	1.2	115.0	NoLiq	0.0
33.5	29.5	1.2	115.0	NoLiq	0.0
33.5	25.8	1.2	115.0	NoLiq	0.0
33.5	23.9	1.2	115.0	NoLiq	0.0
33.7	26.5	1.2	115.0	NoLiq	0.0
33.7	27.3	1.1	115.0	NoLiq	0.0
33.8	27.5	1.0	115.0	NoLiq	0.0
33.8	26.8	1.1	115.0	NoLiq	0.0
33.9	29.5	1.3	115.0	NoLiq	0.0
34.0	37.7	1.5	115.0	NoLiq	0.0
34.0	44.3	1.6	115.0	NoLiq	0.0
34.1	64.2	1.8	115.0	NoLiq	0.0
34.2	89.9	1.9	115.0	NoLiq	0.0
34.3	115.3	2.1	115.0	NoLiq	0.0
34.3	126.4	2.1	115.0	NoLiq	0.0
34.4	135.9	1.9	115.0	NoLiq	0.0
34.4	133.7	1.7	115.0	NoLiq	0.0
34.5	124.5	1.9	115.0	NoLiq	0.0
34.6	117.9	2.0	115.0	NoLiq	0.0
34.6	106.6	2.1	115.0	NoLiq	0.0
34.7	100.0	2.2	115.0	NoLiq	0.0
34.7	95.4	2.2	115.0	NoLiq	0.0
34.8	94.2	2.2	115.0	NoLiq	0.0
34.9	88.9	2.1	115.0	NoLiq	0.0
34.9	74.8	2.2	115.0	NoLiq	0.0
35.0	59.3	2.1	115.0	NoLiq	0.0
35.1	41.4	2.0	115.0	NoLiq	0.0
35.1	43.3	1.8	115.0	NoLiq	0.0
35.2	37.9	1.5	115.0	NoLiq	0.0
35.3	31.8	1.4	115.0	NoLiq	0.0
35.3	28.9	1.3	115.0	NoLiq	0.0
35.4	24.6	1.2	115.0	NoLiq	0.0
35.5	21.4	1.0	115.0	NoLiq	0.0
35.5	20.8	0.9	115.0	NoLiq	0.0
35.6	20.6	0.8	115.0	NoLiq	0.0
35.7	21.0	0.7	115.0	NoLiq	0.0
35.7	22.1	0.7	115.0	NoLiq	0.0
35.8	22.3	0.7	115.0	NoLiq	0.0
35.9	22.6	0.7	115.0	NoLiq	0.0

35.9	22.0	0.8	115.0	NoLiq	0.0
36.0	20.9	0.8	115.0	NoLiq	0.0
36.1	20.5	0.8	115.0	NoLiq	0.0
36.1	20.0	0.8	115.0	NoLiq	0.0
36.2	20.4	0.8	115.0	NoLiq	0.0
36.2	20.0	0.8	115.0	NoLiq	0.0
36.3	20.0	0.8	115.0	NoLiq	0.0
36.4	20.0	0.8	115.0	NoLiq	0.0
36.4	20.0	0.8	115.0	NoLiq	0.0
36.5	22.1	0.8	115.0	NoLiq	0.0
36.6	22.9	0.8	115.0	NoLiq	0.0
36.6	22.5	0.8	115.0	NoLiq	0.0
36.7	21.6	0.8	115.0	NoLiq	0.0
36.8	21.5	0.8	115.0	NoLiq	0.0
36.8	20.9	0.8	115.0	NoLiq	0.0
36.9	21.3	0.8	115.0	NoLiq	0.0
37.0	23.3	0.9	115.0	NoLiq	0.0
37.0	24.8	0.9	115.0	NoLiq	0.0
37.1	28.3	0.9	115.0	NoLiq	0.0
37.2	33.8	1.0	115.0	NoLiq	0.0
37.3	36.7	1.1	115.0	NoLiq	0.0
37.3	37.1	1.2	115.0	NoLiq	0.0
37.4	36.4	1.4	115.0	NoLiq	0.0
37.5	33.1	1.6	115.0	NoLiq	0.0
37.5	32.7	1.6	115.0	NoLiq	0.0
37.6	39.2	1.7	115.0	NoLiq	0.0
37.7	58.7	1.7	115.0	NoLiq	0.0
37.7	85.1	1.7	115.0	NoLiq	0.0
37.8	95.2	1.7	115.0	NoLiq	0.0
37.8	103.8	1.9	115.0	NoLiq	0.0
37.9	109.2	2.2	115.0	NoLiq	0.0
37.9	96.6	2.4	115.0	NoLiq	0.0
38.0	129.2	2.7	120.0	50.0	0.1
38.1	142.6	3.1	120.0	50.0	0.1
38.2	152.8	3.4	120.0	50.0	0.1
38.2	162.5	3.5	120.0	50.0	0.1
38.3	165.6	3.5	120.0	50.0	0.1
38.3	166.8	3.5	120.0	50.0	0.1
38.4	162.1	3.3	120.0	50.0	0.1
38.5	152.7	3.2	120.0	50.0	0.1
38.5	144.7	3.1	120.0	50.0	0.1
38.6	124.1	3.1	120.0	50.0	0.1
38.7	98.7	3.1	120.0	50.0	0.1
38.7	85.6	3.1	120.0	50.0	0.1
38.8	65.3	3.0	120.0	50.0	0.1
38.9	52.3	2.8	120.0	50.0	0.1
38.9	47.4	2.6	120.0	50.0	0.1
39.0	42.7	2.4	115.0	NoLiq	0.0
39.1	42.7	2.2	115.0	NoLiq	0.0
39.1	46.4	2.1	115.0	NoLiq	0.0

39.2	60.9	2.1	115.0	NoLiq	0.0
39.3	75.2	2.1	115.0	NoLiq	0.0
39.4	70.6	2.1	115.0	NoLiq	0.0
39.4	66.2	2.0	115.0	NoLiq	0.0
39.5	59.0	1.8	115.0	NoLiq	0.0
39.5	50.8	1.7	115.0	NoLiq	0.0
39.6	46.7	1.7	115.0	NoLiq	0.0
39.7	40.1	1.7	115.0	NoLiq	0.0
39.8	33.5	1.6	115.0	NoLiq	0.0
39.8	31.3	1.4	115.0	NoLiq	0.0
39.9	28.4	1.2	115.0	NoLiq	0.0
39.9	26.4	1.2	115.0	NoLiq	0.0
40.0	25.2	1.3	115.0	NoLiq	0.0
40.1	25.2	1.3	115.0	NoLiq	0.0
40.1	25.2	1.3	115.0	NoLiq	0.0
40.2	24.8	1.3	115.0	NoLiq	0.0
40.3	27.6	1.6	115.0	NoLiq	0.0
40.3	37.8	1.8	115.0	NoLiq	0.0
40.4	56.0	1.9	115.0	NoLiq	0.0
40.5	57.0	2.0	115.0	NoLiq	0.0
40.5	51.1	2.0	115.0	NoLiq	0.0
40.6	45.9	2.0	115.0	NoLiq	0.0
40.6	38.9	1.9	115.0	NoLiq	0.0
40.7	34.6	1.8	115.0	NoLiq	0.0
40.8	32.2	1.7	115.0	NoLiq	0.0
40.8	32.4	1.7	115.0	NoLiq	0.0
40.9	33.5	1.6	115.0	NoLiq	0.0
41.0	38.3	1.6	115.0	NoLiq	0.0
41.0	43.5	1.6	115.0	NoLiq	0.0
41.1	54.8	1.6	115.0	NoLiq	0.0
41.2	59.4	1.7	115.0	NoLiq	0.0
41.2	54.6	1.7	115.0	NoLiq	0.0
41.3	54.7	1.8	115.0	NoLiq	0.0
41.4	57.2	2.0	115.0	NoLiq	0.0
41.4	55.4	2.1	115.0	NoLiq	0.0
41.5	54.0	2.2	115.0	NoLiq	0.0
41.6	47.9	2.3	115.0	NoLiq	0.0
41.6	46.0	2.2	115.0	NoLiq	0.0
41.7	45.7	2.2	115.0	NoLiq	0.0
41.8	47.2	2.1	115.0	NoLiq	0.0
41.8	46.4	2.1	115.0	NoLiq	0.0
41.9	45.3	2.0	115.0	NoLiq	0.0
42.0	43.2	1.9	115.0	NoLiq	0.0
42.0	38.9	1.7	115.0	NoLiq	0.0
42.1	35.0	1.7	115.0	NoLiq	0.0
42.2	33.3	1.8	115.0	NoLiq	0.0
42.2	35.2	1.9	115.0	NoLiq	0.0
42.3	35.4	2.0	115.0	NoLiq	0.0
42.4	42.1	2.1	115.0	NoLiq	0.0
42.4	46.4	2.1	115.0	NoLiq	0.0

42.5	52.2	2.2	115.0	NoLiq	0.0
42.6	54.3	2.2	115.0	NoLiq	0.0
42.6	53.3	2.2	115.0	NoLiq	0.0
42.7	53.6	2.3	115.0	NoLiq	0.0
42.8	57.3	2.4	115.0	NoLiq	0.0
42.8	61.5	2.4	115.0	NoLiq	0.0
42.9	79.0	2.4	115.0	NoLiq	0.0
43.0	90.3	2.4	115.0	NoLiq	0.0
43.0	90.1	2.4	120.0	50.0	0.1
43.1	93.1	2.4	120.0	50.0	0.1
43.2	100.9	2.6	120.0	50.0	0.1
43.2	100.8	2.7	120.0	50.0	0.1
43.3	98.2	2.8	120.0	50.0	0.1
43.3	94.3	3.0	120.0	50.0	0.1
43.4	114.8	3.4	120.0	50.0	0.1
43.5	140.7	3.7	120.0	50.0	0.1
43.5	188.4	4.0	120.0	50.0	0.1
43.6	201.8	4.5	120.0	50.0	0.1
43.7	197.4	4.6	120.0	50.0	0.1
43.7	201.1	4.6	120.0	50.0	0.1
43.8	199.3	4.5	120.0	50.0	0.1
43.9	200.3	4.1	120.0	50.0	0.1
43.9	200.0	4.0	120.0	50.0	0.1
44.0	198.2	4.1	120.0	50.0	0.1
44.0	194.7	4.2	120.0	50.0	0.1
44.1	193.3	4.4	120.0	50.0	0.1
44.2	188.8	4.4	120.0	50.0	0.1
44.3	182.8	4.3	120.0	50.0	0.1
44.3	175.9	4.3	120.0	50.0	0.1
44.4	170.4	4.2	120.0	50.0	0.1
44.4	161.3	4.0	120.0	50.0	0.1
44.5	155.6	3.7	120.0	50.0	0.1
44.6	152.2	3.6	120.0	50.0	0.1
44.6	138.3	3.6	120.0	50.0	0.1
44.7	115.9	3.4	120.0	50.0	0.1
44.8	102.4	3.1	120.0	50.0	0.1
44.8	100.8	2.9	120.0	50.0	0.1
44.9	100.1	2.7	120.0	50.0	0.1
45.0	104.6	2.0	120.0	50.0	0.1
45.0	105.3	1.6	120.0	50.0	0.1
45.1	92.8	1.7	120.0	50.0	0.1
45.2	77.9	1.9	120.0	50.0	0.1
45.2	71.2	2.1	120.0	50.0	0.1
45.3	58.0	2.1	120.0	50.0	0.1
45.4	47.6	2.3	120.0	50.0	0.1
45.5	59.9	2.4	120.0	50.0	0.1
45.5	79.2	2.4	120.0	50.0	0.1
45.6	133.2	2.4	120.0	50.0	0.1
45.7	180.8	2.3	120.0	50.0	0.1
45.7	200.9	2.4	120.0	50.0	0.1

45.8	229.6	2.4	120.0	50.0	0.1
45.8	250.4	2.5	120.0	50.0	0.1
45.9	237.5	2.6	120.0	50.0	0.1
46.0	252.0	2.7	120.0	50.0	0.1
46.0	270.5	2.7	115.0	20.0	0.3
46.1	282.6	2.9	115.0	20.0	0.3
46.2	288.2	3.2	115.0	20.0	0.3
46.2	289.6	3.2	115.0	20.0	0.3
46.3	290.0	3.3	115.0	20.0	0.3
46.4	287.8	3.4	115.0	20.0	0.3
46.4	283.4	3.3	115.0	20.0	0.3
46.5	280.5	3.3	115.0	20.0	0.3
46.5	274.5	3.3	115.0	20.0	0.3
46.6	267.3	3.3	115.0	20.0	0.3
46.7	263.0	3.2	115.0	20.0	0.3
46.7	254.9	3.2	115.0	20.0	0.3
46.8	246.1	3.1	115.0	20.0	0.3
46.9	240.0	3.0	115.0	20.0	0.3
46.9	227.2	2.9	115.0	20.0	0.3
47.0	213.1	2.1	115.0	20.0	0.3
47.1	200.7	2.2	115.0	20.0	0.3
47.1	201.1	2.3	115.0	20.0	0.3
47.2	201.1	2.5	115.0	20.0	0.3
47.3	201.6	2.9	115.0	20.0	0.3
47.4	164.4	3.1	115.0	20.0	0.3
47.4	223.3	3.4	115.0	20.0	0.3
47.5	236.4	3.7	115.0	20.0	0.3
47.5	240.1	4.0	115.0	20.0	0.3
47.6	244.6	4.3	115.0	20.0	0.3
47.7	246.1	4.5	115.0	20.0	0.3
47.7	245.3	4.5	115.0	20.0	0.3
47.8	242.1	4.6	115.0	20.0	0.3
47.9	235.4	4.6	115.0	20.0	0.3
47.9	231.6	4.7	115.0	20.0	0.3
48.0	226.6	4.8	115.0	20.0	0.3
48.1	231.5	4.9	115.0	20.0	0.3
48.1	228.0	4.9	115.0	20.0	0.3
48.2	231.5	4.9	115.0	20.0	0.3
48.3	235.4	4.7	115.0	20.0	0.3
48.3	237.7	4.9	115.0	20.0	0.3
48.4	240.1	4.8	115.0	20.0	0.3
48.5	249.4	5.0	115.0	20.0	0.3
48.5	253.2	5.2	115.0	20.0	0.3
48.6	250.3	5.4	115.0	20.0	0.3
48.6	251.2	5.6	115.0	20.0	0.3
48.7	259.6	5.8	115.0	20.0	0.3
48.8	262.9	6.1	115.0	20.0	0.3
48.9	264.1	6.2	115.0	20.0	0.3
48.9	263.7	6.3	115.0	20.0	0.3
49.0	262.8	6.4	115.0	20.0	0.3

49.1	260.4	6.4	115.0	20.0	0.3
49.1	259.5	6.5	115.0	20.0	0.3
49.2	260.3	6.5	115.0	20.0	0.3
49.3	264.0	6.6	115.0	20.0	0.3
49.3	266.0	6.7	115.0	20.0	0.3
49.4	269.2	6.8	115.0	20.0	0.3
49.5	270.8	6.9	115.0	20.0	0.3
49.5	270.8	6.9	115.0	20.0	0.3
49.6	270.3	6.9	115.0	20.0	0.3
49.6	269.9	6.9	115.0	20.0	0.3
49.7	269.1	6.8	115.0	20.0	0.3
49.8	267.5	6.7	115.0	20.0	0.3
49.8	261.3	6.6	115.0	20.0	0.3
49.9	254.9	6.5	115.0	20.0	0.3
50.0	241.2	6.2	115.0	20.0	0.3

Output Results:

Settlement of saturated sands=0.00 in.
Settlement of dry sands=2.07 in.
Total settlement of saturated and dry sands=2.07 in.
Differential Settlement=1.034 to 1.365 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.68	5.00	0.00	2.07	2.07
0.05	0.26	0.68	5.00	0.00	2.07	2.07
0.10	0.12	0.68	5.00	0.00	2.07	2.07
0.15	0.12	0.68	5.00	0.00	2.07	2.07
0.20	0.17	0.68	5.00	0.00	2.07	2.07
0.25	0.28	0.68	5.00	0.00	2.07	2.07
0.30	0.58	0.68	5.00	0.00	2.07	2.07
0.35	1.17	0.68	5.00	0.00	2.07	2.07
0.40	1.21	0.68	5.00	0.00	2.07	2.07
0.45	1.76	0.68	5.00	0.00	2.07	2.07
0.50	2.08	0.68	5.00	0.00	2.07	2.07
0.55	2.08	0.68	5.00	0.00	2.07	2.07
0.60	2.08	0.68	5.00	0.00	2.07	2.07
0.65	2.08	0.68	5.00	0.00	2.07	2.07
0.70	2.08	0.68	5.00	0.00	2.07	2.07
0.75	2.08	0.68	5.00	0.00	2.07	2.07
0.80	2.08	0.68	5.00	0.00	2.07	2.07
0.85	2.08	0.68	5.00	0.00	2.07	2.07
0.90	2.08	0.68	5.00	0.00	2.07	2.07
0.95	2.08	0.68	5.00	0.00	2.07	2.07
1.00	2.08	0.68	5.00	0.00	2.07	2.07
1.05	2.08	0.68	5.00	0.00	2.07	2.07
1.10	2.08	0.68	5.00	0.00	2.07	2.07
1.15	2.08	0.68	5.00	0.00	2.07	2.07

1.20	2.08	0.68	5.00	0.00	2.07	2.07
1.25	2.08	0.68	5.00	0.00	2.07	2.07
1.30	2.08	0.68	5.00	0.00	2.07	2.07
1.35	2.08	0.68	5.00	0.00	2.07	2.07
1.40	2.08	0.68	5.00	0.00	2.07	2.07
1.45	2.08	0.68	5.00	0.00	2.07	2.07
1.50	2.08	0.68	5.00	0.00	2.07	2.07
1.55	2.08	0.68	5.00	0.00	2.07	2.07
1.60	2.08	0.68	5.00	0.00	2.07	2.07
1.65	2.08	0.68	5.00	0.00	2.07	2.07
1.70	2.08	0.68	5.00	0.00	2.07	2.07
1.75	1.94	0.68	5.00	0.00	2.07	2.07
1.80	1.54	0.68	5.00	0.00	2.07	2.07
1.85	1.25	0.68	5.00	0.00	2.07	2.07
1.90	1.01	0.68	5.00	0.00	2.07	2.07
1.95	0.81	0.68	5.00	0.00	2.06	2.06
2.00	0.68	0.68	5.00	0.00	2.06	2.06
2.05	0.58	0.68	5.00	0.00	2.06	2.06
2.10	0.50	0.68	5.00	0.00	2.06	2.06
2.15	0.45	0.68	5.00	0.00	2.06	2.06
2.20	0.41	0.68	5.00	0.00	2.06	2.06
2.25	0.38	0.68	5.00	0.00	2.06	2.06
2.30	0.37	0.68	5.00	0.00	2.06	2.06
2.35	0.37	0.68	5.00	0.00	2.06	2.06
2.40	0.36	0.68	5.00	0.00	2.06	2.06
2.45	0.35	0.68	5.00	0.00	2.06	2.06
2.50	0.35	0.68	5.00	0.00	2.05	2.05
2.55	0.36	0.68	5.00	0.00	2.05	2.05
2.60	0.37	0.68	5.00	0.00	2.05	2.05
2.65	0.40	0.68	5.00	0.00	2.04	2.04
2.70	0.43	0.68	5.00	0.00	2.04	2.04
2.75	0.47	0.68	5.00	0.00	2.03	2.03
2.80	0.51	0.68	5.00	0.00	2.03	2.03
2.85	0.56	0.68	5.00	0.00	2.03	2.03
2.90	0.61	0.68	5.00	0.00	2.02	2.02
2.95	0.65	0.68	5.00	0.00	2.02	2.02
3.00	0.70	0.68	5.00	0.00	2.02	2.02
3.05	2.00	0.68	5.00	0.00	2.02	2.02
3.10	2.00	0.68	5.00	0.00	2.02	2.02
3.15	2.00	0.68	5.00	0.00	2.02	2.02
3.20	2.00	0.68	5.00	0.00	2.02	2.02
3.25	2.00	0.68	5.00	0.00	2.02	2.02
3.30	2.00	0.68	5.00	0.00	2.02	2.02
3.35	2.00	0.68	5.00	0.00	2.02	2.02
3.40	2.00	0.68	5.00	0.00	2.02	2.02
3.45	2.00	0.68	5.00	0.00	2.02	2.02
3.50	2.00	0.68	5.00	0.00	2.02	2.02
3.55	2.00	0.68	5.00	0.00	2.02	2.02
3.60	2.00	0.68	5.00	0.00	2.02	2.02
3.65	2.00	0.68	5.00	0.00	2.02	2.02

3.70	2.00	0.68	5.00	0.00	2.02	2.02
3.75	2.00	0.68	5.00	0.00	2.02	2.02
3.80	2.00	0.68	5.00	0.00	2.02	2.02
3.85	2.00	0.68	5.00	0.00	2.02	2.02
3.90	2.00	0.68	5.00	0.00	2.02	2.02
3.95	2.00	0.68	5.00	0.00	2.02	2.02
4.00	2.00	0.68	5.00	0.00	2.02	2.02
4.05	2.00	0.68	5.00	0.00	2.02	2.02
4.10	2.00	0.68	5.00	0.00	2.02	2.02
4.15	2.00	0.68	5.00	0.00	2.02	2.02
4.20	2.00	0.68	5.00	0.00	2.02	2.02
4.25	2.00	0.68	5.00	0.00	2.02	2.02
4.30	2.00	0.68	5.00	0.00	2.02	2.02
4.35	2.00	0.68	5.00	0.00	2.02	2.02
4.40	2.00	0.68	5.00	0.00	2.02	2.02
4.45	2.00	0.68	5.00	0.00	2.02	2.02
4.50	2.00	0.68	5.00	0.00	2.02	2.02
4.55	2.00	0.68	5.00	0.00	2.02	2.02
4.60	2.00	0.68	5.00	0.00	2.02	2.02
4.65	2.00	0.68	5.00	0.00	2.02	2.02
4.70	2.00	0.68	5.00	0.00	2.02	2.02
4.75	2.00	0.67	5.00	0.00	2.02	2.02
4.80	2.00	0.67	5.00	0.00	2.02	2.02
4.85	2.00	0.67	5.00	0.00	2.02	2.02
4.90	2.00	0.67	5.00	0.00	2.02	2.02
4.95	2.00	0.67	5.00	0.00	2.02	2.02
5.00	2.00	0.67	5.00	0.00	2.02	2.02
5.05	2.00	0.67	5.00	0.00	2.02	2.02
5.10	2.00	0.67	5.00	0.00	2.02	2.02
5.15	2.00	0.67	5.00	0.00	2.02	2.02
5.20	2.00	0.67	5.00	0.00	2.02	2.02
5.25	2.00	0.67	5.00	0.00	2.02	2.02
5.30	2.00	0.67	5.00	0.00	2.02	2.02
5.35	2.00	0.67	5.00	0.00	2.02	2.02
5.40	2.00	0.67	5.00	0.00	2.02	2.02
5.45	2.00	0.67	5.00	0.00	2.02	2.02
5.50	2.00	0.67	5.00	0.00	2.02	2.02
5.55	0.44	0.67	5.00	0.00	2.02	2.02
5.60	0.44	0.67	5.00	0.00	2.01	2.01
5.65	0.44	0.67	5.00	0.00	2.00	2.00
5.70	0.44	0.67	5.00	0.00	2.00	2.00
5.75	0.45	0.67	5.00	0.00	1.99	1.99
5.80	0.45	0.67	5.00	0.00	1.99	1.99
5.85	0.45	0.67	5.00	0.00	1.98	1.98
5.90	0.46	0.67	5.00	0.00	1.97	1.97
5.95	0.47	0.67	5.00	0.00	1.97	1.97
6.00	0.50	0.67	5.00	0.00	1.96	1.96
6.05	0.52	0.67	5.00	0.00	1.96	1.96
6.10	0.54	0.67	5.00	0.00	1.95	1.95
6.15	0.57	0.67	5.00	0.00	1.95	1.95

6.20	0.59	0.67	5.00	0.00	1.94	1.94
6.25	0.62	0.67	5.00	0.00	1.94	1.94
6.30	0.63	0.67	5.00	0.00	1.93	1.93
6.35	0.63	0.67	5.00	0.00	1.93	1.93
6.40	0.63	0.67	5.00	0.00	1.92	1.92
6.45	0.62	0.67	5.00	0.00	1.92	1.92
6.50	0.61	0.67	5.00	0.00	1.91	1.91
6.55	0.60	0.67	5.00	0.00	1.91	1.91
6.60	0.60	0.67	5.00	0.00	1.91	1.91
6.65	0.60	0.67	5.00	0.00	1.90	1.90
6.70	0.60	0.67	5.00	0.00	1.90	1.90
6.75	0.60	0.67	5.00	0.00	1.89	1.89
6.80	0.59	0.67	5.00	0.00	1.89	1.89
6.85	0.59	0.67	5.00	0.00	1.88	1.88
6.90	0.58	0.67	5.00	0.00	1.88	1.88
6.95	0.56	0.67	5.00	0.00	1.87	1.87
7.00	0.55	0.67	5.00	0.00	1.87	1.87
7.05	0.54	0.67	5.00	0.00	1.86	1.86
7.10	0.52	0.67	5.00	0.00	1.86	1.86
7.15	0.50	0.67	5.00	0.00	1.85	1.85
7.20	0.47	0.67	5.00	0.00	1.85	1.85
7.25	0.45	0.67	5.00	0.00	1.84	1.84
7.30	0.44	0.67	5.00	0.00	1.84	1.84
7.35	0.42	0.67	5.00	0.00	1.83	1.83
7.40	0.41	0.67	5.00	0.00	1.83	1.83
7.45	0.39	0.67	5.00	0.00	1.82	1.82
7.50	0.38	0.67	5.00	0.00	1.81	1.81
7.55	0.37	0.67	5.00	0.00	1.81	1.81
7.60	0.37	0.67	5.00	0.00	1.80	1.80
7.65	0.36	0.67	5.00	0.00	1.79	1.79
7.70	0.36	0.67	5.00	0.00	1.79	1.79
7.75	0.36	0.67	5.00	0.00	1.78	1.78
7.80	0.36	0.67	5.00	0.00	1.77	1.77
7.85	0.37	0.67	5.00	0.00	1.77	1.77
7.90	0.37	0.67	5.00	0.00	1.76	1.76
7.95	0.38	0.67	5.00	0.00	1.75	1.75
8.00	0.38	0.67	5.00	0.00	1.75	1.75
8.05	0.38	0.67	5.00	0.00	1.74	1.74
8.10	0.39	0.67	5.00	0.00	1.73	1.73
8.15	0.39	0.67	5.00	0.00	1.73	1.73
8.20	0.39	0.67	5.00	0.00	1.72	1.72
8.25	0.39	0.67	5.00	0.00	1.71	1.71
8.30	0.39	0.67	5.00	0.00	1.71	1.71
8.35	0.39	0.67	5.00	0.00	1.70	1.70
8.40	0.39	0.67	5.00	0.00	1.69	1.69
8.45	0.38	0.67	5.00	0.00	1.68	1.68
8.50	0.36	0.67	5.00	0.00	1.68	1.68
8.55	0.34	0.67	5.00	0.00	1.67	1.67
8.60	0.32	0.67	5.00	0.00	1.66	1.66
8.65	0.31	0.67	5.00	0.00	1.66	1.66

8.70	0.30	0.67	5.00	0.00	1.65	1.65
8.75	0.29	0.67	5.00	0.00	1.64	1.64
8.80	0.28	0.67	5.00	0.00	1.63	1.63
8.85	0.27	0.67	5.00	0.00	1.62	1.62
8.90	0.26	0.67	5.00	0.00	1.61	1.61
8.95	0.26	0.67	5.00	0.00	1.61	1.61
9.00	0.26	0.67	5.00	0.00	1.60	1.60
9.05	0.26	0.67	5.00	0.00	1.59	1.59
9.10	0.26	0.67	5.00	0.00	1.58	1.58
9.15	0.26	0.67	5.00	0.00	1.58	1.58
9.20	0.26	0.67	5.00	0.00	1.58	1.58
9.25	0.26	0.67	5.00	0.00	1.57	1.57
9.30	0.26	0.67	5.00	0.00	1.57	1.57
9.35	0.26	0.67	5.00	0.00	1.56	1.56
9.40	0.26	0.67	5.00	0.00	1.56	1.56
9.45	0.27	0.67	5.00	0.00	1.56	1.56
9.50	0.27	0.67	5.00	0.00	1.55	1.55
9.55	0.27	0.67	5.00	0.00	1.55	1.55
9.60	0.27	0.67	5.00	0.00	1.54	1.54
9.65	0.26	0.67	5.00	0.00	1.54	1.54
9.70	0.26	0.67	5.00	0.00	1.54	1.54
9.75	0.23	0.67	5.00	0.00	1.53	1.53
9.80	0.23	0.67	5.00	0.00	1.53	1.53
9.85	0.24	0.67	5.00	0.00	1.52	1.52
9.90	0.24	0.67	5.00	0.00	1.52	1.52
9.95	0.23	0.67	5.00	0.00	1.51	1.51
10.00	0.22	0.67	5.00	0.00	1.51	1.51
10.05	2.00	0.67	5.00	0.00	1.50	1.50
10.10	2.00	0.67	5.00	0.00	1.50	1.50
10.15	2.00	0.67	5.00	0.00	1.50	1.50
10.20	2.00	0.67	5.00	0.00	1.50	1.50
10.25	2.00	0.67	5.00	0.00	1.50	1.50
10.30	2.00	0.67	5.00	0.00	1.50	1.50
10.35	2.00	0.67	5.00	0.00	1.50	1.50
10.40	2.00	0.67	5.00	0.00	1.50	1.50
10.45	2.00	0.67	5.00	0.00	1.50	1.50
10.50	2.00	0.67	5.00	0.00	1.50	1.50
10.55	2.00	0.67	5.00	0.00	1.50	1.50
10.60	2.00	0.67	5.00	0.00	1.50	1.50
10.65	2.00	0.67	5.00	0.00	1.50	1.50
10.70	2.00	0.67	5.00	0.00	1.50	1.50
10.75	2.00	0.67	5.00	0.00	1.50	1.50
10.80	2.00	0.67	5.00	0.00	1.50	1.50
10.85	2.00	0.67	5.00	0.00	1.50	1.50
10.90	2.00	0.67	5.00	0.00	1.50	1.50
10.95	2.00	0.67	5.00	0.00	1.50	1.50
11.00	2.00	0.66	5.00	0.00	1.50	1.50
11.05	2.00	0.66	5.00	0.00	1.50	1.50
11.10	2.00	0.66	5.00	0.00	1.50	1.50
11.15	2.00	0.66	5.00	0.00	1.50	1.50

11.20	2.00	0.66	5.00	0.00	1.50	1.50
11.25	2.00	0.66	5.00	0.00	1.50	1.50
11.30	2.00	0.66	5.00	0.00	1.50	1.50
11.35	2.00	0.66	5.00	0.00	1.50	1.50
11.40	2.00	0.66	5.00	0.00	1.50	1.50
11.45	2.00	0.66	5.00	0.00	1.50	1.50
11.50	2.00	0.66	5.00	0.00	1.50	1.50
11.55	2.00	0.66	5.00	0.00	1.50	1.50
11.60	2.00	0.66	5.00	0.00	1.50	1.50
11.65	2.00	0.66	5.00	0.00	1.50	1.50
11.70	2.00	0.66	5.00	0.00	1.50	1.50
11.75	2.00	0.66	5.00	0.00	1.50	1.50
11.80	2.00	0.66	5.00	0.00	1.50	1.50
11.85	2.00	0.66	5.00	0.00	1.50	1.50
11.90	2.00	0.66	5.00	0.00	1.50	1.50
11.95	2.00	0.66	5.00	0.00	1.50	1.50
12.00	2.00	0.66	5.00	0.00	1.50	1.50
12.05	2.00	0.66	5.00	0.00	1.50	1.50
12.10	2.00	0.66	5.00	0.00	1.50	1.50
12.15	2.00	0.66	5.00	0.00	1.50	1.50
12.20	2.00	0.66	5.00	0.00	1.50	1.50
12.25	2.00	0.66	5.00	0.00	1.50	1.50
12.30	2.00	0.66	5.00	0.00	1.50	1.50
12.35	2.00	0.66	5.00	0.00	1.50	1.50
12.40	2.00	0.66	5.00	0.00	1.50	1.50
12.45	2.00	0.66	5.00	0.00	1.50	1.50
12.50	2.00	0.66	5.00	0.00	1.50	1.50
12.55	2.00	0.66	5.00	0.00	1.50	1.50
12.60	2.00	0.66	5.00	0.00	1.50	1.50
12.65	2.00	0.66	5.00	0.00	1.50	1.50
12.70	2.00	0.66	5.00	0.00	1.50	1.50
12.75	2.00	0.66	5.00	0.00	1.50	1.50
12.80	2.00	0.66	5.00	0.00	1.50	1.50
12.85	2.00	0.66	5.00	0.00	1.50	1.50
12.90	2.00	0.66	5.00	0.00	1.50	1.50
12.95	2.00	0.66	5.00	0.00	1.50	1.50
13.00	2.00	0.66	5.00	0.00	1.50	1.50
13.05	2.00	0.66	5.00	0.00	1.50	1.50
13.10	2.00	0.66	5.00	0.00	1.50	1.50
13.15	2.00	0.66	5.00	0.00	1.50	1.50
13.20	2.00	0.66	5.00	0.00	1.50	1.50
13.25	2.00	0.66	5.00	0.00	1.50	1.50
13.30	2.00	0.66	5.00	0.00	1.50	1.50
13.35	2.00	0.66	5.00	0.00	1.50	1.50
13.40	2.00	0.66	5.00	0.00	1.50	1.50
13.45	2.00	0.66	5.00	0.00	1.50	1.50
13.50	2.00	0.66	5.00	0.00	1.50	1.50
13.55	2.00	0.66	5.00	0.00	1.50	1.50
13.60	2.00	0.66	5.00	0.00	1.50	1.50
13.65	2.00	0.66	5.00	0.00	1.50	1.50

13.70	2.00	0.66	5.00	0.00	1.50	1.50
13.75	2.00	0.66	5.00	0.00	1.50	1.50
13.80	2.00	0.66	5.00	0.00	1.50	1.50
13.85	2.00	0.66	5.00	0.00	1.50	1.50
13.90	2.00	0.66	5.00	0.00	1.50	1.50
13.95	2.00	0.66	5.00	0.00	1.50	1.50
14.00	2.00	0.66	5.00	0.00	1.50	1.50
14.05	2.00	0.66	5.00	0.00	1.50	1.50
14.10	2.00	0.66	5.00	0.00	1.50	1.50
14.15	2.00	0.66	5.00	0.00	1.50	1.50
14.20	2.00	0.66	5.00	0.00	1.50	1.50
14.25	2.00	0.66	5.00	0.00	1.50	1.50
14.30	2.00	0.66	5.00	0.00	1.50	1.50
14.35	2.00	0.66	5.00	0.00	1.50	1.50
14.40	2.00	0.66	5.00	0.00	1.50	1.50
14.45	2.00	0.66	5.00	0.00	1.50	1.50
14.50	2.00	0.66	5.00	0.00	1.50	1.50
14.55	2.00	0.66	5.00	0.00	1.50	1.50
14.60	2.00	0.66	5.00	0.00	1.50	1.50
14.65	2.00	0.66	5.00	0.00	1.50	1.50
14.70	2.00	0.66	5.00	0.00	1.50	1.50
14.75	2.00	0.66	5.00	0.00	1.50	1.50
14.80	2.00	0.66	5.00	0.00	1.50	1.50
14.85	2.00	0.66	5.00	0.00	1.50	1.50
14.90	2.00	0.66	5.00	0.00	1.50	1.50
14.95	2.00	0.66	5.00	0.00	1.50	1.50
15.00	2.00	0.66	5.00	0.00	1.50	1.50
15.05	0.44	0.66	5.00	0.00	1.50	1.50
15.10	0.22	0.66	5.00	0.00	1.50	1.50
15.15	0.21	0.66	5.00	0.00	1.49	1.49
15.20	0.25	0.66	5.00	0.00	1.48	1.48
15.25	0.30	0.66	5.00	0.00	1.47	1.47
15.30	0.38	0.66	5.00	0.00	1.47	1.47
15.35	0.46	0.66	5.00	0.00	1.46	1.46
15.40	0.53	0.66	5.00	0.00	1.45	1.45
15.45	0.57	0.66	5.00	0.00	1.44	1.44
15.50	0.61	0.66	5.00	0.00	1.44	1.44
15.55	0.64	0.66	5.00	0.00	1.43	1.43
15.60	0.68	0.66	5.00	0.00	1.43	1.43
15.65	0.72	0.66	5.00	0.00	1.42	1.42
15.70	0.75	0.66	5.00	0.00	1.42	1.42
15.75	0.79	0.66	5.00	0.00	1.41	1.41
15.80	0.82	0.66	5.00	0.00	1.41	1.41
15.85	0.86	0.66	5.00	0.00	1.40	1.40
15.90	0.88	0.66	5.00	0.00	1.40	1.40
15.95	0.91	0.66	5.00	0.00	1.40	1.40
16.00	0.94	0.66	5.00	0.00	1.39	1.39
16.05	0.97	0.66	5.00	0.00	1.39	1.39
16.10	1.00	0.66	5.00	0.00	1.38	1.38
16.15	1.04	0.66	5.00	0.00	1.38	1.38

16.20	1.07	0.66	5.00	0.00	1.38	1.38
16.25	1.10	0.66	5.00	0.00	1.37	1.37
16.30	1.12	0.66	5.00	0.00	1.37	1.37
16.35	1.14	0.66	5.00	0.00	1.36	1.36
16.40	1.12	0.66	5.00	0.00	1.36	1.36
16.45	0.89	0.66	5.00	0.00	1.36	1.36
16.50	0.75	0.66	5.00	0.00	1.35	1.35
16.55	0.76	0.66	5.00	0.00	1.35	1.35
16.60	0.78	0.66	5.00	0.00	1.34	1.34
16.65	0.84	0.66	5.00	0.00	1.34	1.34
16.70	0.89	0.66	5.00	0.00	1.33	1.33
16.75	0.93	0.66	5.00	0.00	1.33	1.33
16.80	1.01	0.66	5.00	0.00	1.32	1.32
16.85	1.09	0.66	5.00	0.00	1.32	1.32
16.90	1.09	0.66	5.00	0.00	1.32	1.32
16.95	1.08	0.66	5.00	0.00	1.31	1.31
17.00	1.05	0.66	5.00	0.00	1.31	1.31
17.05	1.03	0.66	5.00	0.00	1.30	1.30
17.10	0.97	0.66	5.00	0.00	1.30	1.30
17.15	0.90	0.66	5.00	0.00	1.30	1.30
17.20	0.84	0.66	5.00	0.00	1.29	1.29
17.25	0.80	0.66	5.00	0.00	1.29	1.29
17.30	0.77	0.65	5.00	0.00	1.28	1.28
17.35	0.77	0.65	5.00	0.00	1.28	1.28
17.40	0.78	0.65	5.00	0.00	1.28	1.28
17.45	0.77	0.65	5.00	0.00	1.27	1.27
17.50	0.77	0.65	5.00	0.00	1.27	1.27
17.55	0.76	0.65	5.00	0.00	1.26	1.26
17.60	0.74	0.65	5.00	0.00	1.26	1.26
17.65	0.73	0.65	5.00	0.00	1.26	1.26
17.70	0.70	0.65	5.00	0.00	1.25	1.25
17.75	0.68	0.65	5.00	0.00	1.25	1.25
17.80	0.65	0.65	5.00	0.00	1.24	1.24
17.85	0.62	0.65	5.00	0.00	1.24	1.24
17.90	0.60	0.65	5.00	0.00	1.23	1.23
17.95	0.60	0.65	5.00	0.00	1.23	1.23
18.00	0.59	0.65	5.00	0.00	1.22	1.22
18.05	0.60	0.65	5.00	0.00	1.22	1.22
18.10	0.64	0.65	5.00	0.00	1.21	1.21
18.15	0.67	0.65	5.00	0.00	1.21	1.21
18.20	0.69	0.65	5.00	0.00	1.20	1.20
18.25	0.70	0.65	5.00	0.00	1.20	1.20
18.30	0.70	0.65	5.00	0.00	1.19	1.19
18.35	0.69	0.65	5.00	0.00	1.19	1.19
18.40	0.67	0.65	5.00	0.00	1.18	1.18
18.45	0.66	0.65	5.00	0.00	1.18	1.18
18.50	0.65	0.65	5.00	0.00	1.17	1.17
18.55	0.65	0.65	5.00	0.00	1.17	1.17
18.60	0.65	0.65	5.00	0.00	1.16	1.16
18.65	0.66	0.65	5.00	0.00	1.16	1.16

18.70	0.67	0.65	5.00	0.00	1.15	1.15
18.75	0.68	0.65	5.00	0.00	1.15	1.15
18.80	0.70	0.65	5.00	0.00	1.14	1.14
18.85	0.71	0.65	5.00	0.00	1.14	1.14
18.90	0.72	0.65	5.00	0.00	1.13	1.13
18.95	0.71	0.65	5.00	0.00	1.13	1.13
19.00	0.70	0.65	5.00	0.00	1.12	1.12
19.05	0.68	0.65	5.00	0.00	1.12	1.12
19.10	0.67	0.65	5.00	0.00	1.11	1.11
19.15	0.65	0.65	5.00	0.00	1.11	1.11
19.20	0.64	0.65	5.00	0.00	1.10	1.10
19.25	0.63	0.65	5.00	0.00	1.09	1.09
19.30	0.63	0.65	5.00	0.00	1.09	1.09
19.35	0.63	0.65	5.00	0.00	1.08	1.08
19.40	0.64	0.65	5.00	0.00	1.08	1.08
19.45	0.62	0.65	5.00	0.00	1.07	1.07
19.50	0.64	0.65	5.00	0.00	1.07	1.07
19.55	0.66	0.65	5.00	0.00	1.06	1.06
19.60	0.69	0.65	5.00	0.00	1.06	1.06
19.65	0.71	0.65	5.00	0.00	1.05	1.05
19.70	0.77	0.65	5.00	0.00	1.05	1.05
19.75	0.80	0.65	5.00	0.00	1.04	1.04
19.80	0.83	0.65	5.00	0.00	1.04	1.04
19.85	0.83	0.65	5.00	0.00	1.04	1.04
19.90	0.82	0.65	5.00	0.00	1.04	1.04
19.95	0.81	0.65	5.00	0.00	1.04	1.04
20.00	0.79	0.65	5.00	0.00	1.04	1.04
20.05	0.74	0.65	5.00	0.00	1.03	1.03
20.10	0.65	0.65	5.00	0.00	1.03	1.03
20.15	0.65	0.65	5.00	0.00	1.03	1.03
20.20	0.66	0.65	5.00	0.00	1.03	1.03
20.25	0.66	0.65	5.00	0.00	1.03	1.03
20.30	0.66	0.65	5.00	0.00	1.02	1.02
20.35	0.67	0.65	5.00	0.00	1.02	1.02
20.40	0.68	0.65	5.00	0.00	1.02	1.02
20.45	0.68	0.65	5.00	0.00	1.02	1.02
20.50	0.69	0.65	5.00	0.00	1.01	1.01
20.55	0.70	0.65	5.00	0.00	1.01	1.01
20.60	0.73	0.65	5.00	0.00	1.01	1.01
20.65	0.77	0.65	5.00	0.00	1.01	1.01
20.70	0.80	0.65	5.00	0.00	1.01	1.01
20.75	0.82	0.65	5.00	0.00	1.00	1.00
20.80	0.83	0.65	5.00	0.00	1.00	1.00
20.85	0.84	0.65	5.00	0.00	1.00	1.00
20.90	0.85	0.65	5.00	0.00	1.00	1.00
20.95	0.86	0.65	5.00	0.00	1.00	1.00
21.00	0.88	0.65	5.00	0.00	0.99	0.99
21.05	0.90	0.65	5.00	0.00	0.99	0.99
21.10	0.92	0.65	5.00	0.00	0.99	0.99
21.15	0.93	0.65	5.00	0.00	0.99	0.99

21.20	0.94	0.65	5.00	0.00	0.99	0.99
21.25	0.95	0.65	5.00	0.00	0.99	0.99
21.30	0.95	0.65	5.00	0.00	0.98	0.98
21.35	0.94	0.65	5.00	0.00	0.98	0.98
21.40	0.93	0.65	5.00	0.00	0.98	0.98
21.45	0.91	0.65	5.00	0.00	0.98	0.98
21.50	0.88	0.65	5.00	0.00	0.98	0.98
21.55	0.83	0.65	5.00	0.00	0.98	0.98
21.60	0.79	0.65	5.00	0.00	0.97	0.97
21.65	0.74	0.65	5.00	0.00	0.97	0.97
21.70	0.69	0.65	5.00	0.00	0.97	0.97
21.75	0.63	0.65	5.00	0.00	0.97	0.97
21.80	0.58	0.65	5.00	0.00	0.96	0.96
21.85	0.54	0.65	5.00	0.00	0.96	0.96
21.90	0.51	0.65	5.00	0.00	0.96	0.96
21.95	0.47	0.65	5.00	0.00	0.95	0.95
22.00	0.42	0.65	5.00	0.00	0.95	0.95
22.05	2.00	0.65	5.00	0.00	0.94	0.94
22.10	2.00	0.65	5.00	0.00	0.94	0.94
22.15	2.00	0.65	5.00	0.00	0.94	0.94
22.20	2.00	0.65	5.00	0.00	0.94	0.94
22.25	2.00	0.65	5.00	0.00	0.94	0.94
22.30	2.00	0.65	5.00	0.00	0.94	0.94
22.35	2.00	0.65	5.00	0.00	0.94	0.94
22.40	2.00	0.65	5.00	0.00	0.94	0.94
22.45	2.00	0.65	5.00	0.00	0.94	0.94
22.50	2.00	0.65	5.00	0.00	0.94	0.94
22.55	2.00	0.65	5.00	0.00	0.94	0.94
22.60	2.00	0.65	5.00	0.00	0.94	0.94
22.65	2.00	0.65	5.00	0.00	0.94	0.94
22.70	2.00	0.65	5.00	0.00	0.94	0.94
22.75	2.00	0.65	5.00	0.00	0.94	0.94
22.80	2.00	0.65	5.00	0.00	0.94	0.94
22.85	2.00	0.65	5.00	0.00	0.94	0.94
22.90	2.00	0.65	5.00	0.00	0.94	0.94
22.95	2.00	0.65	5.00	0.00	0.94	0.94
23.00	2.00	0.65	5.00	0.00	0.94	0.94
23.05	2.00	0.65	5.00	0.00	0.94	0.94
23.10	2.00	0.65	5.00	0.00	0.94	0.94
23.15	2.00	0.65	5.00	0.00	0.94	0.94
23.20	2.00	0.65	5.00	0.00	0.94	0.94
23.25	2.00	0.65	5.00	0.00	0.94	0.94
23.30	2.00	0.65	5.00	0.00	0.94	0.94
23.35	2.00	0.65	5.00	0.00	0.94	0.94
23.40	2.00	0.65	5.00	0.00	0.94	0.94
23.45	2.00	0.65	5.00	0.00	0.94	0.94
23.50	2.00	0.65	5.00	0.00	0.94	0.94
23.55	2.00	0.65	5.00	0.00	0.94	0.94
23.60	2.00	0.64	5.00	0.00	0.94	0.94
23.65	2.00	0.64	5.00	0.00	0.94	0.94

23.70	2.00	0.64	5.00	0.00	0.94	0.94
23.75	2.00	0.64	5.00	0.00	0.94	0.94
23.80	2.00	0.64	5.00	0.00	0.94	0.94
23.85	2.00	0.64	5.00	0.00	0.94	0.94
23.90	2.00	0.64	5.00	0.00	0.94	0.94
23.95	2.00	0.64	5.00	0.00	0.94	0.94
24.00	2.00	0.64	5.00	0.00	0.94	0.94
24.05	2.00	0.64	5.00	0.00	0.94	0.94
24.10	2.00	0.64	5.00	0.00	0.94	0.94
24.15	2.00	0.64	5.00	0.00	0.94	0.94
24.20	2.00	0.64	5.00	0.00	0.94	0.94
24.25	2.00	0.64	5.00	0.00	0.94	0.94
24.30	2.00	0.64	5.00	0.00	0.94	0.94
24.35	2.00	0.64	5.00	0.00	0.94	0.94
24.40	2.00	0.64	5.00	0.00	0.94	0.94
24.45	2.00	0.64	5.00	0.00	0.94	0.94
24.50	2.00	0.64	5.00	0.00	0.94	0.94
24.55	2.00	0.64	5.00	0.00	0.94	0.94
24.60	2.00	0.64	5.00	0.00	0.94	0.94
24.65	2.00	0.64	5.00	0.00	0.94	0.94
24.70	2.00	0.64	5.00	0.00	0.94	0.94
24.75	2.00	0.64	5.00	0.00	0.94	0.94
24.80	2.00	0.64	5.00	0.00	0.94	0.94
24.85	2.00	0.64	5.00	0.00	0.94	0.94
24.90	2.00	0.64	5.00	0.00	0.94	0.94
24.95	2.00	0.64	5.00	0.00	0.94	0.94
25.00	2.00	0.64	5.00	0.00	0.94	0.94
25.05	0.21	0.64	5.00	0.00	0.94	0.94
25.10	0.26	0.64	5.00	0.00	0.93	0.93
25.15	0.30	0.64	5.00	0.00	0.93	0.93
25.20	0.33	0.64	5.00	0.00	0.92	0.92
25.25	0.36	0.64	5.00	0.00	0.91	0.91
25.30	0.38	0.64	5.00	0.00	0.90	0.90
25.35	0.39	0.64	5.00	0.00	0.89	0.89
25.40	0.38	0.64	5.00	0.00	0.88	0.88
25.45	0.37	0.64	5.00	0.00	0.88	0.88
25.50	0.35	0.64	5.00	0.00	0.87	0.87
25.55	0.33	0.64	5.00	0.00	0.86	0.86
25.60	0.30	0.64	5.00	0.00	0.85	0.85
25.65	0.28	0.64	5.00	0.00	0.84	0.84
25.70	0.27	0.64	5.00	0.00	0.83	0.83
25.75	0.25	0.64	5.00	0.00	0.83	0.83
25.80	0.24	0.64	5.00	0.00	0.82	0.82
25.85	0.23	0.64	5.00	0.00	0.81	0.81
25.90	0.24	0.64	5.00	0.00	0.80	0.80
25.95	0.30	0.64	5.00	0.00	0.79	0.79
26.00	2.00	0.64	5.00	0.00	0.79	0.79
26.05	2.00	0.64	5.00	0.00	0.79	0.79
26.10	2.00	0.64	5.00	0.00	0.79	0.79
26.15	2.00	0.64	5.00	0.00	0.79	0.79

26.20	2.00	0.64	5.00	0.00	0.79	0.79
26.25	2.00	0.64	5.00	0.00	0.79	0.79
26.30	2.00	0.64	5.00	0.00	0.79	0.79
26.35	2.00	0.64	5.00	0.00	0.79	0.79
26.40	2.00	0.64	5.00	0.00	0.79	0.79
26.45	2.00	0.64	5.00	0.00	0.79	0.79
26.50	2.00	0.64	5.00	0.00	0.79	0.79
26.55	2.00	0.64	5.00	0.00	0.79	0.79
26.60	2.00	0.64	5.00	0.00	0.79	0.79
26.65	2.00	0.64	5.00	0.00	0.79	0.79
26.70	2.00	0.64	5.00	0.00	0.79	0.79
26.75	2.00	0.64	5.00	0.00	0.79	0.79
26.80	2.00	0.64	5.00	0.00	0.79	0.79
26.85	2.00	0.64	5.00	0.00	0.79	0.79
26.90	2.00	0.64	5.00	0.00	0.79	0.79
26.95	2.00	0.64	5.00	0.00	0.79	0.79
27.00	2.00	0.64	5.00	0.00	0.79	0.79
27.05	2.00	0.64	5.00	0.00	0.79	0.79
27.10	2.00	0.64	5.00	0.00	0.79	0.79
27.15	2.00	0.64	5.00	0.00	0.79	0.79
27.20	2.00	0.64	5.00	0.00	0.79	0.79
27.25	2.00	0.64	5.00	0.00	0.79	0.79
27.30	2.00	0.64	5.00	0.00	0.79	0.79
27.35	2.00	0.64	5.00	0.00	0.79	0.79
27.40	2.00	0.64	5.00	0.00	0.79	0.79
27.45	2.00	0.64	5.00	0.00	0.79	0.79
27.50	2.00	0.64	5.00	0.00	0.79	0.79
27.55	2.00	0.64	5.00	0.00	0.79	0.79
27.60	2.00	0.64	5.00	0.00	0.79	0.79
27.65	2.00	0.64	5.00	0.00	0.79	0.79
27.70	2.00	0.64	5.00	0.00	0.79	0.79
27.75	2.00	0.64	5.00	0.00	0.79	0.79
27.80	2.00	0.64	5.00	0.00	0.79	0.79
27.85	2.00	0.64	5.00	0.00	0.79	0.79
27.90	2.00	0.64	5.00	0.00	0.79	0.79
27.95	2.00	0.64	5.00	0.00	0.79	0.79
28.00	2.00	0.64	5.00	0.00	0.79	0.79
28.05	2.00	0.64	5.00	0.00	0.79	0.79
28.10	2.00	0.64	5.00	0.00	0.79	0.79
28.15	2.00	0.64	5.00	0.00	0.79	0.79
28.20	2.00	0.64	5.00	0.00	0.79	0.79
28.25	2.00	0.64	5.00	0.00	0.79	0.79
28.30	2.00	0.64	5.00	0.00	0.79	0.79
28.35	2.00	0.64	5.00	0.00	0.79	0.79
28.40	2.00	0.64	5.00	0.00	0.79	0.79
28.45	2.00	0.64	5.00	0.00	0.79	0.79
28.50	2.00	0.64	5.00	0.00	0.79	0.79
28.55	2.00	0.64	5.00	0.00	0.79	0.79
28.60	2.00	0.64	5.00	0.00	0.79	0.79
28.65	2.00	0.64	5.00	0.00	0.79	0.79

28.70	2.00	0.64	5.00	0.00	0.79	0.79
28.75	2.00	0.64	5.00	0.00	0.79	0.79
28.80	2.00	0.64	5.00	0.00	0.79	0.79
28.85	2.00	0.64	5.00	0.00	0.79	0.79
28.90	2.00	0.64	5.00	0.00	0.79	0.79
28.95	2.00	0.64	5.00	0.00	0.79	0.79
29.00	2.00	0.64	5.00	0.00	0.79	0.79
29.05	2.00	0.64	5.00	0.00	0.79	0.79
29.10	2.00	0.64	5.00	0.00	0.79	0.79
29.15	2.00	0.64	5.00	0.00	0.79	0.79
29.20	2.00	0.64	5.00	0.00	0.79	0.79
29.25	2.00	0.64	5.00	0.00	0.79	0.79
29.30	2.00	0.64	5.00	0.00	0.79	0.79
29.35	2.00	0.64	5.00	0.00	0.79	0.79
29.40	2.00	0.64	5.00	0.00	0.79	0.79
29.45	2.00	0.64	5.00	0.00	0.79	0.79
29.50	2.00	0.64	5.00	0.00	0.79	0.79
29.55	2.00	0.64	5.00	0.00	0.79	0.79
29.60	2.00	0.64	5.00	0.00	0.79	0.79
29.65	2.00	0.64	5.00	0.00	0.79	0.79
29.70	2.00	0.64	5.00	0.00	0.79	0.79
29.75	2.00	0.64	5.00	0.00	0.79	0.79
29.80	2.00	0.64	5.00	0.00	0.79	0.79
29.85	2.00	0.63	5.00	0.00	0.79	0.79
29.90	2.00	0.63	5.00	0.00	0.79	0.79
29.95	2.00	0.63	5.00	0.00	0.79	0.79
30.00	2.00	0.63	5.00	0.00	0.79	0.79
30.05	0.14	0.63	5.00	0.00	0.79	0.79
30.10	0.16	0.63	5.00	0.00	0.77	0.77
30.15	0.17	0.63	5.00	0.00	0.76	0.76
30.20	0.20	0.63	5.00	0.00	0.75	0.75
30.25	0.22	0.63	5.00	0.00	0.74	0.74
30.30	0.24	0.63	5.00	0.00	0.73	0.73
30.35	0.26	0.63	5.00	0.00	0.72	0.72
30.40	0.27	0.63	5.00	0.00	0.71	0.71
30.45	0.30	0.63	5.00	0.00	0.70	0.70
30.50	0.32	0.63	5.00	0.00	0.69	0.69
30.55	0.34	0.63	5.00	0.00	0.69	0.69
30.60	0.34	0.63	5.00	0.00	0.68	0.68
30.65	0.33	0.63	5.00	0.00	0.67	0.67
30.70	0.32	0.63	5.00	0.00	0.66	0.66
30.75	0.32	0.63	5.00	0.00	0.66	0.66
30.80	0.32	0.63	5.00	0.00	0.65	0.65
30.85	0.31	0.63	5.00	0.00	0.64	0.64
30.90	0.32	0.63	5.00	0.00	0.63	0.63
30.95	0.34	0.63	5.00	0.00	0.63	0.63
31.00	0.36	0.63	5.00	0.00	0.62	0.62
31.05	0.38	0.63	5.00	0.00	0.61	0.61
31.10	0.42	0.63	5.00	0.00	0.60	0.60
31.15	0.45	0.63	5.00	0.00	0.60	0.60

31.20	0.49	0.63	5.00	0.00	0.59	0.59
31.25	0.54	0.63	5.00	0.00	0.59	0.59
31.30	0.59	0.63	5.00	0.00	0.58	0.58
31.35	0.63	0.63	5.00	0.00	0.58	0.58
31.40	0.65	0.63	5.00	0.00	0.57	0.57
31.45	0.66	0.63	5.00	0.00	0.57	0.57
31.50	0.65	0.63	5.00	0.00	0.56	0.56
31.55	0.63	0.63	5.00	0.00	0.56	0.56
31.60	0.61	0.63	5.00	0.00	0.55	0.55
31.65	0.58	0.63	5.00	0.00	0.54	0.54
31.70	0.56	0.63	5.00	0.00	0.54	0.54
31.75	0.53	0.62	5.00	0.00	0.53	0.53
31.80	0.50	0.62	5.00	0.00	0.53	0.53
31.85	0.47	0.62	5.00	0.00	0.52	0.52
31.90	0.44	0.62	5.00	0.00	0.51	0.51
31.95	0.41	0.62	5.00	0.00	0.51	0.51
32.00	0.38	0.62	5.00	0.00	0.50	0.50
32.05	0.36	0.62	5.00	0.00	0.49	0.49
32.10	0.34	0.62	5.00	0.00	0.48	0.48
32.15	0.32	0.62	5.00	0.00	0.47	0.47
32.20	0.30	0.62	5.00	0.00	0.47	0.47
32.25	0.28	0.62	5.00	0.00	0.46	0.46
32.30	0.27	0.62	5.00	0.00	0.45	0.45
32.35	0.25	0.62	5.00	0.00	0.44	0.44
32.40	0.24	0.62	5.00	0.00	0.43	0.43
32.45	0.23	0.62	5.00	0.00	0.42	0.42
32.50	0.22	0.62	5.00	0.00	0.41	0.41
32.55	2.00	0.62	5.00	0.00	0.40	0.40
32.60	2.00	0.62	5.00	0.00	0.40	0.40
32.65	2.00	0.62	5.00	0.00	0.40	0.40
32.70	2.00	0.62	5.00	0.00	0.40	0.40
32.75	2.00	0.62	5.00	0.00	0.40	0.40
32.80	2.00	0.62	5.00	0.00	0.40	0.40
32.85	2.00	0.62	5.00	0.00	0.40	0.40
32.90	2.00	0.62	5.00	0.00	0.40	0.40
32.95	2.00	0.62	5.00	0.00	0.40	0.40
33.00	2.00	0.62	5.00	0.00	0.40	0.40
33.05	2.00	0.62	5.00	0.00	0.40	0.40
33.10	2.00	0.62	5.00	0.00	0.40	0.40
33.15	2.00	0.62	5.00	0.00	0.40	0.40
33.20	2.00	0.62	5.00	0.00	0.40	0.40
33.25	2.00	0.62	5.00	0.00	0.40	0.40
33.30	2.00	0.62	5.00	0.00	0.40	0.40
33.35	2.00	0.62	5.00	0.00	0.40	0.40
33.40	2.00	0.62	5.00	0.00	0.40	0.40
33.45	2.00	0.62	5.00	0.00	0.40	0.40
33.50	2.00	0.62	5.00	0.00	0.40	0.40
33.55	2.00	0.61	5.00	0.00	0.40	0.40
33.60	2.00	0.61	5.00	0.00	0.40	0.40
33.65	2.00	0.61	5.00	0.00	0.40	0.40

33.70	2.00	0.61	5.00	0.00	0.40	0.40
33.75	2.00	0.61	5.00	0.00	0.40	0.40
33.80	2.00	0.61	5.00	0.00	0.40	0.40
33.85	2.00	0.61	5.00	0.00	0.40	0.40
33.90	2.00	0.61	5.00	0.00	0.40	0.40
33.95	2.00	0.61	5.00	0.00	0.40	0.40
34.00	2.00	0.61	5.00	0.00	0.40	0.40
34.05	2.00	0.61	5.00	0.00	0.40	0.40
34.10	2.00	0.61	5.00	0.00	0.40	0.40
34.15	2.00	0.61	5.00	0.00	0.40	0.40
34.20	2.00	0.61	5.00	0.00	0.40	0.40
34.25	2.00	0.61	5.00	0.00	0.40	0.40
34.30	2.00	0.61	5.00	0.00	0.40	0.40
34.35	2.00	0.61	5.00	0.00	0.40	0.40
34.40	2.00	0.61	5.00	0.00	0.40	0.40
34.45	2.00	0.61	5.00	0.00	0.40	0.40
34.50	2.00	0.61	5.00	0.00	0.40	0.40
34.55	2.00	0.61	5.00	0.00	0.40	0.40
34.60	2.00	0.61	5.00	0.00	0.40	0.40
34.65	2.00	0.61	5.00	0.00	0.40	0.40
34.70	2.00	0.61	5.00	0.00	0.40	0.40
34.75	2.00	0.61	5.00	0.00	0.40	0.40
34.80	2.00	0.61	5.00	0.00	0.40	0.40
34.85	2.00	0.61	5.00	0.00	0.40	0.40
34.90	2.00	0.61	5.00	0.00	0.40	0.40
34.95	2.00	0.61	5.00	0.00	0.40	0.40
35.00	2.00	0.61	5.00	0.00	0.40	0.40
35.05	2.00	0.61	5.00	0.00	0.40	0.40
35.10	2.00	0.61	5.00	0.00	0.40	0.40
35.15	2.00	0.61	5.00	0.00	0.40	0.40
35.20	2.00	0.61	5.00	0.00	0.40	0.40
35.25	2.00	0.61	5.00	0.00	0.40	0.40
35.30	2.00	0.61	5.00	0.00	0.40	0.40
35.35	2.00	0.60	5.00	0.00	0.40	0.40
35.40	2.00	0.60	5.00	0.00	0.40	0.40
35.45	2.00	0.60	5.00	0.00	0.40	0.40
35.50	2.00	0.60	5.00	0.00	0.40	0.40
35.55	2.00	0.60	5.00	0.00	0.40	0.40
35.60	2.00	0.60	5.00	0.00	0.40	0.40
35.65	2.00	0.60	5.00	0.00	0.40	0.40
35.70	2.00	0.60	5.00	0.00	0.40	0.40
35.75	2.00	0.60	5.00	0.00	0.40	0.40
35.80	2.00	0.60	5.00	0.00	0.40	0.40
35.85	2.00	0.60	5.00	0.00	0.40	0.40
35.90	2.00	0.60	5.00	0.00	0.40	0.40
35.95	2.00	0.60	5.00	0.00	0.40	0.40
36.00	2.00	0.60	5.00	0.00	0.40	0.40
36.05	2.00	0.60	5.00	0.00	0.40	0.40
36.10	2.00	0.60	5.00	0.00	0.40	0.40
36.15	2.00	0.60	5.00	0.00	0.40	0.40

36.20	2.00	0.60	5.00	0.00	0.40	0.40
36.25	2.00	0.60	5.00	0.00	0.40	0.40
36.30	2.00	0.60	5.00	0.00	0.40	0.40
36.35	2.00	0.60	5.00	0.00	0.40	0.40
36.40	2.00	0.60	5.00	0.00	0.40	0.40
36.45	2.00	0.60	5.00	0.00	0.40	0.40
36.50	2.00	0.60	5.00	0.00	0.40	0.40
36.55	2.00	0.60	5.00	0.00	0.40	0.40
36.60	2.00	0.60	5.00	0.00	0.40	0.40
36.65	2.00	0.60	5.00	0.00	0.40	0.40
36.70	2.00	0.60	5.00	0.00	0.40	0.40
36.75	2.00	0.60	5.00	0.00	0.40	0.40
36.80	2.00	0.60	5.00	0.00	0.40	0.40
36.85	2.00	0.60	5.00	0.00	0.40	0.40
36.90	2.00	0.60	5.00	0.00	0.40	0.40
36.95	2.00	0.60	5.00	0.00	0.40	0.40
37.00	2.00	0.60	5.00	0.00	0.40	0.40
37.05	2.00	0.60	5.00	0.00	0.40	0.40
37.10	2.00	0.60	5.00	0.00	0.40	0.40
37.15	2.00	0.59	5.00	0.00	0.40	0.40
37.20	2.00	0.59	5.00	0.00	0.40	0.40
37.25	2.00	0.59	5.00	0.00	0.40	0.40
37.30	2.00	0.59	5.00	0.00	0.40	0.40
37.35	2.00	0.59	5.00	0.00	0.40	0.40
37.40	2.00	0.59	5.00	0.00	0.40	0.40
37.45	2.00	0.59	5.00	0.00	0.40	0.40
37.50	2.00	0.59	5.00	0.00	0.40	0.40
37.55	2.00	0.59	5.00	0.00	0.40	0.40
37.60	2.00	0.59	5.00	0.00	0.40	0.40
37.65	2.00	0.59	5.00	0.00	0.40	0.40
37.70	2.00	0.59	5.00	0.00	0.40	0.40
37.75	2.00	0.59	5.00	0.00	0.40	0.40
37.80	2.00	0.59	5.00	0.00	0.40	0.40
37.85	2.00	0.59	5.00	0.00	0.40	0.40
37.90	2.00	0.59	5.00	0.00	0.40	0.40
37.95	2.00	0.59	5.00	0.00	0.40	0.40
38.00	2.00	0.59	5.00	0.00	0.40	0.40
38.05	0.31	0.59	5.00	0.00	0.40	0.40
38.10	0.35	0.59	5.00	0.00	0.39	0.39
38.15	0.37	0.59	5.00	0.00	0.39	0.39
38.20	0.39	0.59	5.00	0.00	0.38	0.38
38.25	0.41	0.59	5.00	0.00	0.37	0.37
38.30	0.42	0.59	5.00	0.00	0.37	0.37
38.35	0.41	0.59	5.00	0.00	0.36	0.36
38.40	0.40	0.59	5.00	0.00	0.36	0.36
38.45	0.38	0.59	5.00	0.00	0.35	0.35
38.50	0.36	0.59	5.00	0.00	0.34	0.34
38.55	0.34	0.59	5.00	0.00	0.34	0.34
38.60	0.33	0.59	5.00	0.00	0.33	0.33
38.65	0.32	0.59	5.00	0.00	0.33	0.33

38.70	0.36	0.59	5.00	0.00	0.32	0.32
38.75	2.00	0.59	5.00	0.00	0.31	0.31
38.80	2.00	0.59	5.00	0.00	0.31	0.31
38.85	2.00	0.59	5.00	0.00	0.31	0.31
38.90	2.00	0.59	5.00	0.00	0.31	0.31
38.95	2.00	0.58	5.00	0.00	0.31	0.31
39.00	2.00	0.58	5.00	0.00	0.31	0.31
39.05	2.00	0.58	5.00	0.00	0.31	0.31
39.10	2.00	0.58	5.00	0.00	0.31	0.31
39.15	2.00	0.58	5.00	0.00	0.31	0.31
39.20	2.00	0.58	5.00	0.00	0.31	0.31
39.25	2.00	0.58	5.00	0.00	0.31	0.31
39.30	2.00	0.58	5.00	0.00	0.31	0.31
39.35	2.00	0.58	5.00	0.00	0.31	0.31
39.40	2.00	0.58	5.00	0.00	0.31	0.31
39.45	2.00	0.58	5.00	0.00	0.31	0.31
39.50	2.00	0.58	5.00	0.00	0.31	0.31
39.55	2.00	0.58	5.00	0.00	0.31	0.31
39.60	2.00	0.58	5.00	0.00	0.31	0.31
39.65	2.00	0.58	5.00	0.00	0.31	0.31
39.70	2.00	0.58	5.00	0.00	0.31	0.31
39.75	2.00	0.58	5.00	0.00	0.31	0.31
39.80	2.00	0.58	5.00	0.00	0.31	0.31
39.85	2.00	0.58	5.00	0.00	0.31	0.31
39.90	2.00	0.58	5.00	0.00	0.31	0.31
39.95	2.00	0.58	5.00	0.00	0.31	0.31
40.00	2.00	0.58	5.00	0.00	0.31	0.31
40.05	2.00	0.58	5.00	0.00	0.31	0.31
40.10	2.00	0.58	5.00	0.00	0.31	0.31
40.15	2.00	0.58	5.00	0.00	0.31	0.31
40.20	2.00	0.58	5.00	0.00	0.31	0.31
40.25	2.00	0.58	5.00	0.00	0.31	0.31
40.30	2.00	0.58	5.00	0.00	0.31	0.31
40.35	2.00	0.58	5.00	0.00	0.31	0.31
40.40	2.00	0.58	5.00	0.00	0.31	0.31
40.45	2.00	0.58	5.00	0.00	0.31	0.31
40.50	2.00	0.58	5.00	0.00	0.31	0.31
40.55	2.00	0.58	5.00	0.00	0.31	0.31
40.60	2.00	0.58	5.00	0.00	0.31	0.31
40.65	2.00	0.58	5.00	0.00	0.31	0.31
40.70	2.00	0.58	5.00	0.00	0.31	0.31
40.75	2.00	0.57	5.00	0.00	0.31	0.31
40.80	2.00	0.57	5.00	0.00	0.31	0.31
40.85	2.00	0.57	5.00	0.00	0.31	0.31
40.90	2.00	0.57	5.00	0.00	0.31	0.31
40.95	2.00	0.57	5.00	0.00	0.31	0.31
41.00	2.00	0.57	5.00	0.00	0.31	0.31
41.05	2.00	0.57	5.00	0.00	0.31	0.31
41.10	2.00	0.57	5.00	0.00	0.31	0.31
41.15	2.00	0.57	5.00	0.00	0.31	0.31

41.20	2.00	0.57	5.00	0.00	0.31	0.31
41.25	2.00	0.57	5.00	0.00	0.31	0.31
41.30	2.00	0.57	5.00	0.00	0.31	0.31
41.35	2.00	0.57	5.00	0.00	0.31	0.31
41.40	2.00	0.57	5.00	0.00	0.31	0.31
41.45	2.00	0.57	5.00	0.00	0.31	0.31
41.50	2.00	0.57	5.00	0.00	0.31	0.31
41.55	2.00	0.57	5.00	0.00	0.31	0.31
41.60	2.00	0.57	5.00	0.00	0.31	0.31
41.65	2.00	0.57	5.00	0.00	0.31	0.31
41.70	2.00	0.57	5.00	0.00	0.31	0.31
41.75	2.00	0.57	5.00	0.00	0.31	0.31
41.80	2.00	0.57	5.00	0.00	0.31	0.31
41.85	2.00	0.57	5.00	0.00	0.31	0.31
41.90	2.00	0.57	5.00	0.00	0.31	0.31
41.95	2.00	0.57	5.00	0.00	0.31	0.31
42.00	2.00	0.57	5.00	0.00	0.31	0.31
42.05	2.00	0.57	5.00	0.00	0.31	0.31
42.10	2.00	0.57	5.00	0.00	0.31	0.31
42.15	2.00	0.57	5.00	0.00	0.31	0.31
42.20	2.00	0.57	5.00	0.00	0.31	0.31
42.25	2.00	0.57	5.00	0.00	0.31	0.31
42.30	2.00	0.57	5.00	0.00	0.31	0.31
42.35	2.00	0.57	5.00	0.00	0.31	0.31
42.40	2.00	0.57	5.00	0.00	0.31	0.31
42.45	2.00	0.57	5.00	0.00	0.31	0.31
42.50	2.00	0.57	5.00	0.00	0.31	0.31
42.55	2.00	0.56	5.00	0.00	0.31	0.31
42.60	2.00	0.56	5.00	0.00	0.31	0.31
42.65	2.00	0.56	5.00	0.00	0.31	0.31
42.70	2.00	0.56	5.00	0.00	0.31	0.31
42.75	2.00	0.56	5.00	0.00	0.31	0.31
42.80	2.00	0.56	5.00	0.00	0.31	0.31
42.85	2.00	0.56	5.00	0.00	0.31	0.31
42.90	2.00	0.56	5.00	0.00	0.31	0.31
42.95	2.00	0.56	5.00	0.00	0.31	0.31
43.00	2.00	0.56	5.00	0.00	0.31	0.31
43.05	0.25	0.56	5.00	0.00	0.31	0.31
43.10	0.25	0.56	5.00	0.00	0.31	0.31
43.15	0.26	0.56	5.00	0.00	0.31	0.31
43.20	0.27	0.56	5.00	0.00	0.30	0.30
43.25	0.28	0.56	5.00	0.00	0.30	0.30
43.30	0.31	0.56	5.00	0.00	0.30	0.30
43.35	0.34	0.56	5.00	0.00	0.30	0.30
43.40	0.35	0.56	5.00	0.00	0.29	0.29
43.45	0.36	0.56	5.00	0.00	0.29	0.29
43.50	0.40	0.56	5.00	0.00	0.29	0.29
43.55	0.47	0.56	5.00	0.00	0.29	0.29
43.60	0.51	0.56	5.00	0.00	0.28	0.28
43.65	0.53	0.56	5.00	0.00	0.28	0.28

43.70	0.54	0.56	5.00	0.00	0.28	0.28
43.75	0.54	0.56	5.00	0.00	0.28	0.28
43.80	0.52	0.56	5.00	0.00	0.28	0.28
43.85	0.49	0.56	5.00	0.00	0.28	0.28
43.90	0.48	0.56	5.00	0.00	0.27	0.27
43.95	0.47	0.56	5.00	0.00	0.27	0.27
44.00	0.48	0.56	5.00	0.00	0.27	0.27
44.05	0.48	0.56	5.00	0.00	0.27	0.27
44.10	0.49	0.56	5.00	0.00	0.27	0.27
44.15	0.49	0.56	5.00	0.00	0.26	0.26
44.20	0.48	0.56	5.00	0.00	0.26	0.26
44.25	0.47	0.56	5.00	0.00	0.26	0.26
44.30	0.46	0.56	5.00	0.00	0.26	0.26
44.35	0.44	0.55	5.00	0.00	0.26	0.26
44.40	0.42	0.55	5.00	0.00	0.25	0.25
44.45	0.40	0.55	5.00	0.00	0.25	0.25
44.50	0.38	0.55	5.00	0.00	0.25	0.25
44.55	0.36	0.55	5.00	0.00	0.25	0.25
44.60	0.35	0.55	5.00	0.00	0.24	0.24
44.65	0.35	0.55	5.00	0.00	0.24	0.24
44.70	0.34	0.55	5.00	0.00	0.24	0.24
44.75	0.33	0.55	5.00	0.00	0.24	0.24
44.80	0.32	0.55	5.00	0.00	0.23	0.23
44.85	0.29	0.55	5.00	0.00	0.23	0.23
44.90	0.28	0.55	5.00	0.00	0.23	0.23
44.95	0.22	0.55	5.00	0.00	0.23	0.23
45.00	0.18	0.55	5.00	0.00	0.22	0.22
45.05	0.16	0.55	5.00	0.00	0.22	0.22
45.10	0.17	0.55	5.00	0.00	0.21	0.21
45.15	0.19	0.55	5.00	0.00	0.20	0.20
45.20	2.00	0.55	5.00	0.00	0.20	0.20
45.25	2.00	0.55	5.00	0.00	0.20	0.20
45.30	2.00	0.55	5.00	0.00	0.20	0.20
45.35	2.00	0.55	5.00	0.00	0.20	0.20
45.40	2.00	0.55	5.00	0.00	0.20	0.20
45.45	2.00	0.55	5.00	0.00	0.20	0.20
45.50	2.00	0.55	5.00	0.00	0.20	0.20
45.55	0.22	0.55	5.00	0.00	0.20	0.20
45.60	0.24	0.55	5.00	0.00	0.19	0.19
45.65	0.27	0.55	5.00	0.00	0.19	0.19
45.70	0.32	0.55	5.00	0.00	0.18	0.18
45.75	0.37	0.55	5.00	0.00	0.18	0.18
45.80	0.41	0.55	5.00	0.00	0.18	0.18
45.85	0.45	0.55	5.00	0.00	0.17	0.17
45.90	0.42	0.55	5.00	0.00	0.17	0.17
45.95	0.45	0.55	5.00	0.00	0.17	0.17
46.00	0.50	0.55	5.00	0.00	0.16	0.16
46.05	0.55	0.55	5.00	0.00	0.16	0.16
46.10	0.59	0.55	5.00	0.00	0.16	0.16
46.15	0.61	0.54	5.00	0.00	0.15	0.15

46.20	0.63	0.54	5.00	0.00	0.15	0.15
46.25	0.64	0.54	5.00	0.00	0.15	0.15
46.30	0.64	0.54	5.00	0.00	0.15	0.15
46.35	0.64	0.54	5.00	0.00	0.15	0.15
46.40	0.63	0.54	5.00	0.00	0.14	0.14
46.45	0.62	0.54	5.00	0.00	0.14	0.14
46.50	0.60	0.54	5.00	0.00	0.14	0.14
46.55	0.58	0.54	5.00	0.00	0.14	0.14
46.60	0.56	0.54	5.00	0.00	0.13	0.13
46.65	0.55	0.54	5.00	0.00	0.13	0.13
46.70	0.53	0.54	5.00	0.00	0.13	0.13
46.75	0.50	0.54	5.00	0.00	0.13	0.13
46.80	0.48	0.54	5.00	0.00	0.13	0.13
46.85	0.45	0.54	5.00	0.00	0.12	0.12
46.90	0.43	0.54	5.00	0.00	0.12	0.12
46.95	0.40	0.54	5.00	0.00	0.12	0.12
47.00	0.33	0.54	5.00	0.00	0.11	0.11
47.05	0.31	0.54	5.00	0.00	0.11	0.11
47.10	0.30	0.54	5.00	0.00	0.10	0.10
47.15	0.30	0.54	5.00	0.00	0.10	0.10
47.20	0.31	0.54	5.00	0.00	0.10	0.10
47.25	0.33	0.54	5.00	0.00	0.09	0.09
47.30	0.34	0.54	5.00	0.00	0.09	0.09
47.35	0.30	0.54	5.00	0.00	0.08	0.08
47.40	0.38	0.54	5.00	0.00	0.08	0.08
47.45	0.46	0.54	5.00	0.00	0.08	0.08
47.50	0.50	0.54	5.00	0.00	0.08	0.08
47.55	0.54	0.54	5.00	0.00	0.07	0.07
47.60	0.57	0.54	5.00	0.00	0.07	0.07
47.65	0.58	0.54	5.00	0.00	0.07	0.07
47.70	0.59	0.54	5.00	0.00	0.07	0.07
47.75	0.59	0.54	5.00	0.00	0.07	0.07
47.80	0.58	0.54	5.00	0.00	0.06	0.06
47.85	0.57	0.54	5.00	0.00	0.06	0.06
47.90	0.56	0.54	5.00	0.00	0.06	0.06
47.95	0.56	0.53	5.00	0.00	0.06	0.06
48.00	0.56	0.53	5.00	0.00	0.06	0.06
48.05	0.57	0.53	5.00	0.00	0.05	0.05
48.10	0.58	0.53	5.00	0.00	0.05	0.05
48.15	0.58	0.53	5.00	0.00	0.05	0.05
48.20	0.58	0.53	5.00	0.00	0.05	0.05
48.25	0.57	0.53	5.00	0.00	0.05	0.05
48.30	0.58	0.53	5.00	0.00	0.05	0.05
48.35	0.59	0.53	5.00	0.00	0.04	0.04
48.40	0.60	0.53	5.00	0.00	0.04	0.04
48.45	0.62	0.53	5.00	0.00	0.04	0.04
48.50	0.64	0.53	5.00	0.00	0.04	0.04
48.55	0.66	0.53	5.00	0.00	0.04	0.04
48.60	0.68	0.53	5.00	0.00	0.04	0.04
48.65	0.70	0.53	5.00	0.00	0.04	0.04

48.70	0.74	0.53	5.00	0.00	0.03	0.03
48.75	0.76	0.53	5.00	0.00	0.03	0.03
48.80	0.79	0.53	5.00	0.00	0.03	0.03
48.85	0.80	0.53	5.00	0.00	0.03	0.03
48.90	0.81	0.53	5.00	0.00	0.03	0.03
48.95	0.82	0.53	5.00	0.00	0.03	0.03
49.00	0.82	0.53	5.00	0.00	0.03	0.03
49.05	0.82	0.53	5.00	0.00	0.02	0.02
49.10	0.82	0.53	5.00	0.00	0.02	0.02
49.15	0.82	0.53	5.00	0.00	0.02	0.02
49.20	0.83	0.53	5.00	0.00	0.02	0.02
49.25	0.84	0.53	5.00	0.00	0.02	0.02
49.30	0.86	0.53	5.00	0.00	0.02	0.02
49.35	0.87	0.53	5.00	0.00	0.02	0.02
49.40	0.89	0.53	5.00	0.00	0.02	0.02
49.45	0.90	0.53	5.00	0.00	0.01	0.01
49.50	0.90	0.53	5.00	0.00	0.01	0.01
49.55	0.90	0.53	5.00	0.00	0.01	0.01
49.60	0.90	0.53	5.00	0.00	0.01	0.01
49.65	0.89	0.53	5.00	0.00	0.01	0.01
49.70	0.88	0.53	5.00	0.00	0.01	0.01
49.75	0.87	0.52	5.00	0.00	0.01	0.01
49.80	0.85	0.52	5.00	0.00	0.01	0.01
49.85	0.82	0.52	5.00	0.00	0.00	0.00
49.90	0.79	0.52	5.00	0.00	0.00	0.00
49.95	0.75	0.52	5.00	0.00	0.00	0.00
50.00	0.73	0.52	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2,   CSR is limited to 2)

Units   Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

_

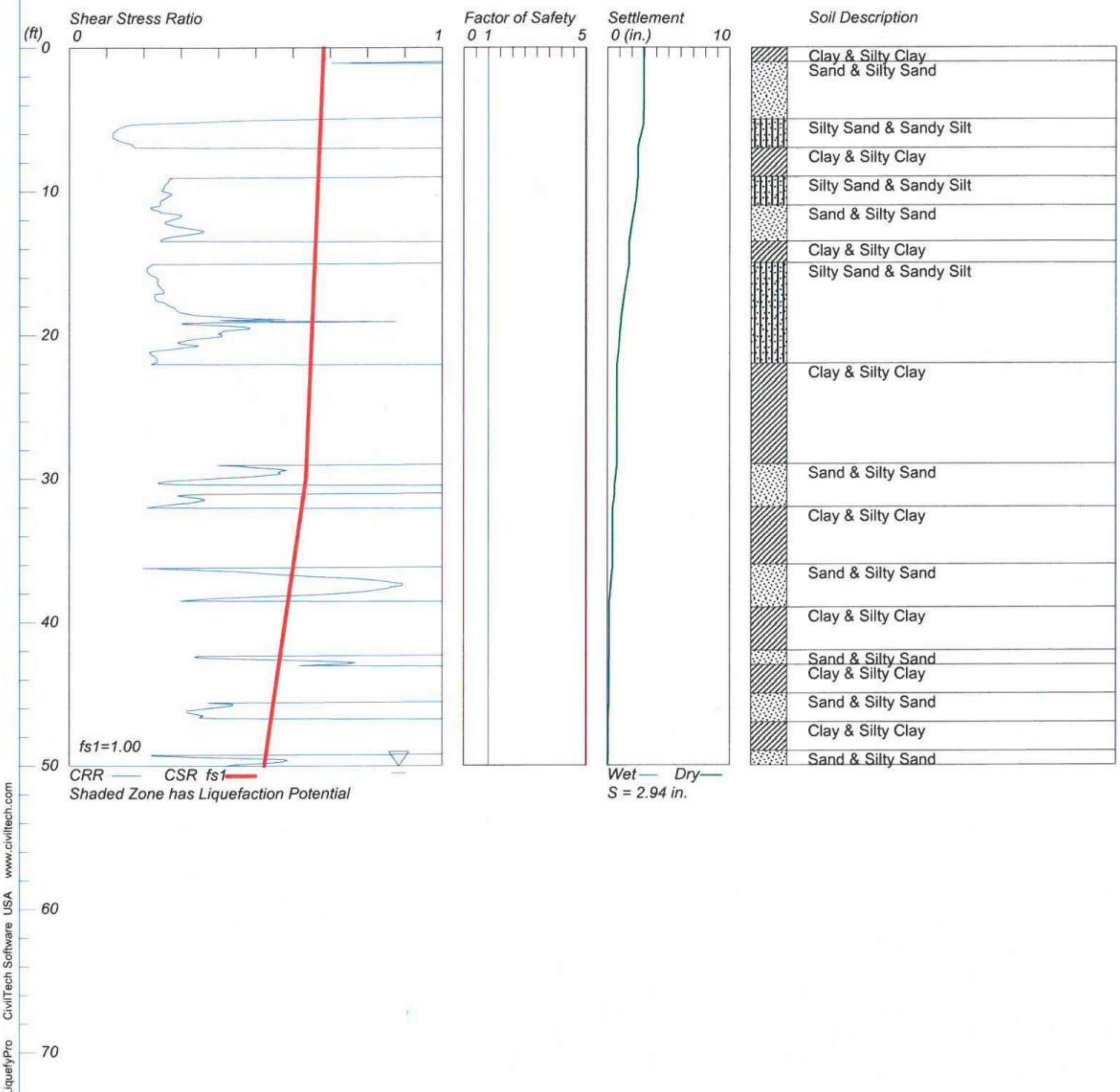
CRRm   Cyclic resistance ratio from soils
CSRfs   Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.   Factor of Safety against liquefaction, F.S.=CRRm/CSRfs
S_sat   Settlement from saturated sands
S_dry   Settlement from dry sands
S_all   Total settlement from saturated and dry sands
NoLiq   No-Liquefy Soils

LIQUEFACTION ANALYSIS

Industrial Bldgs - Hardt & Brier Streets

Hole No.=CPT-6 Water Depth=50 ft

Magnitude=7.5
Acceleration=1.05g



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*************************************************************************************
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                                    LIQUEFACTION ANALYSIS CALCULATION SHEET

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*************************************************************************************
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        Input File Name: R:\Projects\40-3959G Geo. Inv. Multi-Building
Development\seismic settlement analyses\CPT-6.liq
        Title:  Industrial Bldgs - Hardt & Brier Streets
        Subtitle:  40-3959G

        Surface Elev.=
        Hole No.=CPT-6
        Depth of Hole= 50.0 ft
        Water Table during Earthquake= 50.0 ft
        Water Table during In-Situ Testing= 50.0 ft
        Max. Acceleration= 1.05 g
        Earthquake Magnitude= 7.5

 Input Data:
        Surface Elev.=
        Hole No.=CPT-6
        Depth of Hole=50.0 ft
        Water Table during Earthquake= 50.0 ft
        Water Table during In-Situ Testing= 50.0 ft
        Max. Acceleration=1.05 g
        Earthquake Magnitude=7.5

        1. CPT Calulation Method: Modified Robertson*
        2. Settlement Analysis Method: Ishihara / Yoshimine*
        3. Fines Correction for Liquefaction: Idriss/Seed (SPT only)
        4. Fine Correction for Settlement: During Liquefaction*
        5. Settlement Calculation in: All zones*
        6. Hammer Energy Ratio,                                  Ce = 1
        7. Borehole Diameter,                                        Cb= 1
        8. Sampling Method,                                       Cs= 1
        9. User request factor of safety (apply to CSR) ,   User= 1
           Plot one CSR curve (fs1=User)
        10. Use Curve Smoothing: Yes*
        * Recommended Options

        In-Situ Test Data:
```

Depth ft	qc tsf	fs tsf	gamma pcf	Fines %	D50 mm
0.0	-0.1	0.0	115.0	NoLiq	0.0
0.1	3.0	0.0	115.0	NoLiq	0.0
0.2	3.0	0.0	115.0	NoLiq	0.0
0.2	3.8	0.0	115.0	NoLiq	0.0
0.3	4.5	0.1	115.0	NoLiq	0.0
0.4	4.2	0.2	115.0	NoLiq	0.0
0.4	7.4	0.2	115.0	NoLiq	0.0
0.5	10.0	0.2	115.0	NoLiq	0.0
0.6	17.0	0.3	115.0	NoLiq	0.0
0.6	18.3	0.3	115.0	NoLiq	0.0
0.7	24.5	0.3	115.0	NoLiq	0.0
0.8	35.4	0.3	115.0	NoLiq	0.0
0.8	33.6	0.3	115.0	NoLiq	0.0
0.9	23.7	0.3	115.0	NoLiq	0.0
0.9	24.3	0.3	115.0	NoLiq	0.0
1.0	41.1	0.3	115.0	20.0	0.3
1.1	49.9	0.4	115.0	20.0	0.3
1.1	72.1	0.6	115.0	20.0	0.3
1.2	93.5	0.7	115.0	20.0	0.3
1.3	107.4	0.8	115.0	20.0	0.3
1.3	126.9	1.0	115.0	20.0	0.3
1.4	145.3	1.2	115.0	20.0	0.3
1.5	156.0	1.2	115.0	20.0	0.3
1.5	168.9	1.1	115.0	20.0	0.3
1.6	187.0	1.2	115.0	20.0	0.3
1.7	194.5	1.5	115.0	20.0	0.3
1.7	202.0	1.6	115.0	20.0	0.3
1.8	221.1	1.6	115.0	20.0	0.3
1.9	242.8	1.5	115.0	20.0	0.3
1.9	264.5	1.4	115.0	20.0	0.3
2.0	271.2	1.5	115.0	20.0	0.3
2.0	288.1	1.6	115.0	20.0	0.3
2.1	293.6	1.7	115.0	20.0	0.3
2.2	299.4	1.7	115.0	20.0	0.3
2.3	315.7	1.8	115.0	20.0	0.3
2.3	321.0	1.9	115.0	20.0	0.3
2.4	329.7	2.0	115.0	20.0	0.3
2.4	338.3	2.1	115.0	20.0	0.3
2.5	341.9	2.1	115.0	20.0	0.3
2.6	353.8	2.3	115.0	20.0	0.3
2.6	355.8	2.3	115.0	20.0	0.3
2.7	358.1	2.4	115.0	20.0	0.3
2.8	357.8	2.5	115.0	20.0	0.3
2.9	358.2	2.9	115.0	20.0	0.3
2.9	355.8	3.1	115.0	20.0	0.3
3.0	357.8	3.3	115.0	20.0	0.3
3.0	357.4	3.2	115.0	20.0	0.3

3.1	371.4	3.3	115.0	20.0	0.3
3.2	368.7	3.6	115.0	20.0	0.3
3.3	368.0	3.7	115.0	20.0	0.3
3.3	383.3	3.5	115.0	20.0	0.3
3.4	382.1	3.4	115.0	20.0	0.3
3.4	363.1	3.4	115.0	20.0	0.3
3.5	349.0	3.4	115.0	20.0	0.3
3.6	348.5	3.4	115.0	20.0	0.3
3.6	348.4	3.5	115.0	20.0	0.3
3.7	348.3	3.5	115.0	20.0	0.3
3.8	348.2	3.5	115.0	20.0	0.3
3.8	350.6	3.5	115.0	20.0	0.3
3.9	308.2	2.9	115.0	20.0	0.3
3.9	298.5	2.8	115.0	20.0	0.3
4.0	292.7	3.2	115.0	20.0	0.3
4.1	301.3	3.2	115.0	20.0	0.3
4.2	316.0	3.2	115.0	20.0	0.3
4.2	265.1	3.2	115.0	20.0	0.3
4.3	265.7	3.3	115.0	20.0	0.3
4.3	238.0	3.5	115.0	20.0	0.3
4.4	242.0	3.6	115.0	20.0	0.3
4.5	224.0	3.3	115.0	20.0	0.3
4.5	206.5	3.0	115.0	20.0	0.3
4.6	182.8	2.7	115.0	20.0	0.3
4.7	157.9	2.5	115.0	20.0	0.3
4.7	121.2	2.6	115.0	20.0	0.3
4.8	107.2	2.5	115.0	20.0	0.3
4.9	73.6	2.1	115.0	20.0	0.3
4.9	67.1	2.0	115.0	20.0	0.3
5.0	62.1	1.7	120.0	50.0	0.1
5.1	38.5	1.2	120.0	50.0	0.1
5.1	35.6	1.1	120.0	50.0	0.1
5.2	34.1	1.0	120.0	50.0	0.1
5.3	32.9	0.8	120.0	50.0	0.1
5.4	32.7	0.5	120.0	50.0	0.1
5.4	30.9	0.5	120.0	50.0	0.1
5.5	32.4	0.4	120.0	50.0	0.1
5.6	32.4	0.4	120.0	50.0	0.1
5.6	30.3	0.4	120.0	50.0	0.1
5.7	25.8	0.4	120.0	50.0	0.1
5.7	25.5	0.3	120.0	50.0	0.1
5.8	25.3	0.3	120.0	50.0	0.1
5.9	24.6	0.3	120.0	50.0	0.1
5.9	23.8	0.3	120.0	50.0	0.1
6.0	23.3	0.3	120.0	50.0	0.1
6.1	22.8	0.3	120.0	50.0	0.1
6.1	22.8	0.3	120.0	50.0	0.1
6.2	22.7	0.3	120.0	50.0	0.1
6.3	25.0	0.3	120.0	50.0	0.1
6.3	28.6	0.3	120.0	50.0	0.1

6.4	30.4	0.4	120.0	50.0	0.1
6.5	32.0	0.4	120.0	50.0	0.1
6.5	33.2	0.4	120.0	50.0	0.1
6.6	34.0	0.5	120.0	50.0	0.1
6.6	35.7	0.6	120.0	50.0	0.1
6.7	36.8	0.6	120.0	50.0	0.1
6.8	36.8	0.6	120.0	50.0	0.1
6.8	35.8	0.6	120.0	50.0	0.1
6.9	33.0	0.6	120.0	50.0	0.1
7.0	30.5	0.6	115.0	NoLiq	0.0
7.0	29.5	0.7	115.0	NoLiq	0.0
7.1	27.8	0.7	115.0	NoLiq	0.0
7.2	27.4	0.7	115.0	NoLiq	0.0
7.2	27.5	0.7	115.0	NoLiq	0.0
7.3	27.9	0.7	115.0	NoLiq	0.0
7.4	28.2	0.7	115.0	NoLiq	0.0
7.4	28.5	0.7	115.0	NoLiq	0.0
7.5	29.6	0.7	115.0	NoLiq	0.0
7.6	30.0	0.7	115.0	NoLiq	0.0
7.6	29.3	0.7	115.0	NoLiq	0.0
7.7	28.7	0.7	115.0	NoLiq	0.0
7.8	27.0	0.7	115.0	NoLiq	0.0
7.8	25.4	0.6	115.0	NoLiq	0.0
7.9	24.6	0.6	115.0	NoLiq	0.0
8.0	23.3	0.6	115.0	NoLiq	0.0
8.0	24.6	0.6	115.0	NoLiq	0.0
8.1	23.4	0.6	115.0	NoLiq	0.0
8.2	24.5	0.6	115.0	NoLiq	0.0
8.2	25.4	0.6	115.0	NoLiq	0.0
8.3	24.3	0.7	115.0	NoLiq	0.0
8.3	20.1	0.7	115.0	NoLiq	0.0
8.4	28.6	0.7	115.0	NoLiq	0.0
8.5	29.1	0.7	115.0	NoLiq	0.0
8.6	29.1	0.7	115.0	NoLiq	0.0
8.6	28.9	0.7	115.0	NoLiq	0.0
8.7	30.6	0.8	115.0	NoLiq	0.0
8.8	31.9	0.9	115.0	NoLiq	0.0
8.8	32.8	1.0	115.0	NoLiq	0.0
8.9	36.8	1.1	115.0	NoLiq	0.0
9.0	38.5	1.1	115.0	NoLiq	0.0
9.0	41.0	1.1	120.0	50.0	0.1
9.1	43.4	1.1	120.0	50.0	0.1
9.2	47.2	1.2	120.0	50.0	0.1
9.2	48.9	1.2	120.0	50.0	0.1
9.3	52.7	1.2	120.0	50.0	0.1
9.3	54.3	1.2	120.0	50.0	0.1
9.4	55.2	1.2	120.0	50.0	0.1
9.5	55.4	1.2	120.0	50.0	0.1
9.5	55.2	1.2	120.0	50.0	0.1
9.6	55.5	1.2	120.0	50.0	0.1

9.7	57.5	1.2	120.0	50.0	0.1
9.8	60.5	1.2	120.0	50.0	0.1
9.8	62.2	1.1	120.0	50.0	0.1
9.9	62.5	1.1	120.0	50.0	0.1
9.9	62.5	1.1	120.0	50.0	0.1
10.0	62.6	1.2	120.0	50.0	0.1
10.1	62.3	1.2	120.0	50.0	0.1
10.1	62.0	1.3	120.0	50.0	0.1
10.2	61.4	1.3	120.0	50.0	0.1
10.3	59.4	1.3	120.0	50.0	0.1
10.3	58.7	1.3	120.0	50.0	0.1
10.4	59.9	1.3	120.0	50.0	0.1
10.5	62.7	1.2	120.0	50.0	0.1
10.5	65.4	1.2	120.0	50.0	0.1
10.6	66.6	1.1	120.0	50.0	0.1
10.6	69.0	1.1	120.0	50.0	0.1
10.7	70.5	1.1	120.0	50.0	0.1
10.8	71.8	1.0	120.0	50.0	0.1
10.8	72.6	1.0	120.0	50.0	0.1
10.9	74.6	1.0	120.0	50.0	0.1
11.0	75.3	1.0	120.0	50.0	0.1
11.0	76.2	0.9	115.0	20.0	0.3
11.1	77.2	0.8	115.0	20.0	0.3
11.2	79.2	0.8	115.0	20.0	0.3
11.2	80.7	0.8	115.0	20.0	0.3
11.3	84.3	0.7	115.0	20.0	0.3
11.4	88.6	0.7	115.0	20.0	0.3
11.4	88.8	0.7	115.0	20.0	0.3
11.5	95.8	0.7	115.0	20.0	0.3
11.6	102.0	0.7	115.0	20.0	0.3
11.6	105.6	0.7	115.0	20.0	0.3
11.7	106.5	0.7	115.0	20.0	0.3
11.8	106.0	0.7	115.0	20.0	0.3
11.8	105.5	0.7	115.0	20.0	0.3
11.9	103.5	0.7	115.0	20.0	0.3
11.9	102.2	0.7	115.0	20.0	0.3
12.0	99.8	0.7	115.0	20.0	0.3
12.1	97.2	0.7	115.0	20.0	0.3
12.2	94.8	0.8	115.0	20.0	0.3
12.2	94.8	0.8	115.0	20.0	0.3
12.3	94.8	0.8	115.0	20.0	0.3
12.4	94.9	1.0	115.0	20.0	0.3
12.4	96.5	1.0	115.0	20.0	0.3
12.5	97.1	1.1	115.0	20.0	0.3
12.5	97.0	1.2	115.0	20.0	0.3
12.6	98.2	1.3	115.0	20.0	0.3
12.7	101.7	1.4	115.0	20.0	0.3
12.7	104.0	1.4	115.0	20.0	0.3
12.8	104.5	1.4	115.0	20.0	0.3
12.9	103.2	1.3	115.0	20.0	0.3

12.9	102.5	1.3	115.0	20.0	0.3
13.0	100.2	1.2	115.0	20.0	0.3
13.1	99.2	1.1	115.0	20.0	0.3
13.1	96.5	1.0	115.0	20.0	0.3
13.2	94.8	1.0	115.0	20.0	0.3
13.3	91.3	1.0	115.0	20.0	0.3
13.3	88.4	1.0	115.0	20.0	0.3
13.4	87.4	1.0	115.0	20.0	0.3
13.5	85.1	1.1	115.0	NoLiq	0.0
13.5	84.1	1.1	115.0	NoLiq	0.0
13.6	82.3	1.2	115.0	NoLiq	0.0
13.6	80.6	1.3	115.0	NoLiq	0.0
13.8	73.5	1.4	115.0	NoLiq	0.0
13.8	66.1	1.5	115.0	NoLiq	0.0
13.9	61.8	1.5	115.0	NoLiq	0.0
13.9	46.8	1.4	115.0	NoLiq	0.0
14.0	42.7	1.3	115.0	NoLiq	0.0
14.1	37.5	1.3	115.0	NoLiq	0.0
14.1	34.7	1.2	115.0	NoLiq	0.0
14.2	32.2	1.0	115.0	NoLiq	0.0
14.3	34.8	1.2	115.0	NoLiq	0.0
14.3	31.6	1.1	115.0	NoLiq	0.0
14.4	34.9	1.2	115.0	NoLiq	0.0
14.5	36.1	1.3	115.0	NoLiq	0.0
14.6	42.2	1.4	115.0	NoLiq	0.0
14.6	43.5	1.5	115.0	NoLiq	0.0
14.6	44.9	1.5	115.0	NoLiq	0.0
14.7	46.4	1.5	115.0	NoLiq	0.0
14.8	49.1	1.5	115.0	NoLiq	0.0
14.8	51.1	1.4	115.0	NoLiq	0.0
14.9	55.2	1.4	115.0	NoLiq	0.0
15.0	60.2	1.4	120.0	NoLiq	0.1
15.0	64.6	1.3	120.0	50.0	0.1
15.1	67.9	1.3	120.0	50.0	0.1
15.1	68.6	1.2	120.0	50.0	0.1
15.2	70.8	1.2	120.0	50.0	0.1
15.3	73.0	1.1	120.0	50.0	0.1
15.4	74.6	1.1	120.0	50.0	0.1
15.5	74.9	1.1	120.0	50.0	0.1
15.5	74.9	1.1	120.0	50.0	0.1
15.6	75.3	1.1	120.0	50.0	0.1
15.6	76.9	1.1	120.0	50.0	0.1
15.7	79.2	1.1	120.0	50.0	0.1
15.8	80.6	1.1	120.0	50.0	0.1
15.8	81.9	1.1	120.0	50.0	0.1
15.9	86.2	1.2	120.0	50.0	0.1
16.0	88.4	1.2	120.0	50.0	0.1
16.0	89.7	1.1	120.0	50.0	0.1
16.1	92.1	1.1	120.0	50.0	0.1
16.2	92.6	1.1	120.0	50.0	0.1

16.2	91.8	1.1	120.0	50.0	0.1
16.3	91.0	1.2	120.0	50.0	0.1
16.3	89.8	1.2	120.0	50.0	0.1
16.4	88.8	1.2	120.0	50.0	0.1
16.5	88.1	1.2	120.0	50.0	0.1
16.5	88.0	1.3	120.0	50.0	0.1
16.6	87.8	1.3	120.0	50.0	0.1
16.7	87.3	1.3	120.0	50.0	0.1
16.7	86.9	1.4	120.0	50.0	0.1
16.8	86.9	1.4	120.0	50.0	0.1
16.9	86.7	1.4	120.0	50.0	0.1
17.0	86.5	1.4	120.0	50.0	0.1
17.0	85.0	1.5	120.0	50.0	0.1
17.1	83.8	1.4	120.0	50.0	0.1
17.1	80.6	1.3	120.0	50.0	0.1
17.2	76.4	1.4	120.0	50.0	0.1
17.3	71.4	1.4	120.0	50.0	0.1
17.3	68.9	1.4	120.0	50.0	0.1
17.4	68.9	1.4	120.0	50.0	0.1
17.5	68.9	1.4	120.0	50.0	0.1
17.5	69.0	1.4	120.0	50.0	0.1
17.6	74.2	1.5	120.0	50.0	0.1
17.7	76.5	1.5	120.0	50.0	0.1
17.7	79.9	1.6	120.0	50.0	0.1
17.8	82.1	1.6	120.0	50.0	0.1
17.9	87.7	1.6	120.0	50.0	0.1
17.9	89.3	1.6	120.0	50.0	0.1
18.0	91.7	1.6	120.0	50.0	0.1
18.1	92.2	1.7	120.0	50.0	0.1
18.1	91.6	1.7	120.0	50.0	0.1
18.2	92.1	1.7	120.0	50.0	0.1
18.3	94.8	1.7	120.0	50.0	0.1
18.3	97.8	1.7	120.0	50.0	0.1
18.4	100.1	1.7	120.0	50.0	0.1
18.4	101.9	1.8	120.0	50.0	0.1
18.5	102.2	1.8	120.0	50.0	0.1
18.6	102.3	2.0	120.0	50.0	0.1
18.6	101.7	2.2	120.0	50.0	0.1
18.7	92.7	2.5	120.0	50.0	0.1
18.8	77.3	2.6	120.0	50.0	0.1
18.9	62.4	2.3	120.0	50.0	0.1
18.9	55.6	2.1	120.0	50.0	0.1
19.0	61.7	2.0	120.0	50.0	0.1
19.1	46.8	1.9	120.0	50.0	0.1
19.1	61.0	1.9	120.0	50.0	0.1
19.2	77.4	1.9	120.0	50.0	0.1
19.3	118.2	2.0	120.0	50.0	0.1
19.3	125.9	2.0	120.0	50.0	0.1
19.4	140.3	2.0	120.0	50.0	0.1
19.4	147.7	2.0	120.0	50.0	0.1

19.5	149.1	2.1	120.0	50.0	0.1
19.6	147.3	2.1	120.0	50.0	0.1
19.6	138.9	2.1	120.0	50.0	0.1
19.7	129.3	2.1	120.0	50.0	0.1
19.8	129.9	2.1	120.0	50.0	0.1
19.8	129.9	2.1	120.0	50.0	0.1
19.9	130.5	2.0	120.0	50.0	0.1
19.9	134.7	2.0	120.0	50.0	0.1
20.0	137.5	2.0	120.0	50.0	0.1
20.1	136.1	2.0	120.0	50.0	0.1
20.2	133.3	1.8	120.0	50.0	0.1
20.2	127.5	1.7	120.0	50.0	0.1
20.3	123.2	1.7	120.0	50.0	0.1
20.4	107.8	1.8	120.0	50.0	0.1
20.4	102.1	1.9	120.0	50.0	0.1
20.5	84.8	1.9	120.0	50.0	0.1
20.6	75.4	2.0	120.0	50.0	0.1
20.6	72.1	2.0	120.0	50.0	0.1
20.7	63.5	1.9	120.0	50.0	0.1
20.8	60.1	1.9	120.0	50.0	0.1
20.8	61.3	1.8	120.0	50.0	0.1
20.9	61.1	1.7	120.0	50.0	0.1
21.0	64.7	1.7	120.0	50.0	0.1
21.0	68.0	1.7	120.0	50.0	0.1
21.1	71.8	1.6	120.0	50.0	0.1
21.1	74.9	1.5	120.0	50.0	0.1
21.2	77.8	1.5	120.0	50.0	0.1
21.3	81.1	1.5	120.0	50.0	0.1
21.3	82.6	1.5	120.0	50.0	0.1
21.4	85.1	1.5	120.0	50.0	0.1
21.5	85.4	1.6	120.0	50.0	0.1
21.5	85.0	1.6	120.0	50.0	0.1
21.6	84.2	1.6	120.0	50.0	0.1
21.7	83.2	1.6	120.0	50.0	0.1
21.7	82.9	1.6	120.0	50.0	0.1
21.8	82.3	1.6	120.0	50.0	0.1
21.9	81.8	1.6	120.0	50.0	0.1
21.9	80.9	1.6	120.0	50.0	0.1
22.0	80.3	1.5	115.0	NoLiq	0.0
22.1	78.1	1.5	115.0	NoLiq	0.0
22.1	75.9	1.4	115.0	NoLiq	0.0
22.2	70.4	1.4	115.0	NoLiq	0.0
22.2	66.5	1.4	115.0	NoLiq	0.0
22.3	52.0	1.4	115.0	NoLiq	0.0
22.4	42.4	1.4	115.0	NoLiq	0.0
22.4	38.5	1.4	115.0	NoLiq	0.0
22.5	33.7	1.3	115.0	NoLiq	0.0
22.6	28.5	1.3	115.0	NoLiq	0.0
22.6	24.3	1.3	115.0	NoLiq	0.0
22.7	20.2	1.2	115.0	NoLiq	0.0

22.8	18.5	1.1	115.0	NoLiq	0.0
22.9	17.3	1.0	115.0	NoLiq	0.0
22.9	15.3	0.9	115.0	NoLiq	0.0
23.0	13.6	0.8	115.0	NoLiq	0.0
23.0	12.8	0.8	115.0	NoLiq	0.0
23.1	13.1	0.8	115.0	NoLiq	0.0
23.2	17.1	0.7	115.0	NoLiq	0.0
23.2	20.7	0.8	115.0	NoLiq	0.0
23.3	27.2	1.0	115.0	NoLiq	0.0
23.4	29.3	1.2	115.0	NoLiq	0.0
23.4	34.6	1.4	115.0	NoLiq	0.0
23.5	36.5	1.5	115.0	NoLiq	0.0
23.6	46.3	1.5	115.0	NoLiq	0.0
23.6	59.3	1.6	115.0	NoLiq	0.0
23.7	72.7	1.6	115.0	NoLiq	0.0
23.8	79.0	1.6	115.0	NoLiq	0.0
23.8	90.3	1.7	115.0	NoLiq	0.0
23.9	93.1	1.8	115.0	NoLiq	0.0
24.0	88.2	1.8	115.0	NoLiq	0.0
24.0	79.8	1.9	115.0	NoLiq	0.0
24.1	68.8	1.8	115.0	NoLiq	0.0
24.2	59.4	1.8	115.0	NoLiq	0.0
24.2	56.0	1.8	115.0	NoLiq	0.0
24.3	54.2	1.7	115.0	NoLiq	0.0
24.4	56.7	1.7	115.0	NoLiq	0.0
24.4	67.0	1.7	115.0	NoLiq	0.0
24.5	68.1	1.8	115.0	NoLiq	0.0
24.6	60.7	1.9	115.0	NoLiq	0.0
24.6	57.6	1.9	115.0	NoLiq	0.0
24.7	51.5	1.8	115.0	NoLiq	0.0
24.7	45.1	1.7	115.0	NoLiq	0.0
24.8	39.4	1.6	115.0	NoLiq	0.0
24.9	37.1	1.6	115.0	NoLiq	0.0
25.0	32.4	1.4	115.0	NoLiq	0.0
25.0	32.5	1.4	115.0	NoLiq	0.0
25.1	36.0	1.5	115.0	NoLiq	0.0
25.1	40.8	1.5	115.0	NoLiq	0.0
25.2	47.0	1.5	115.0	NoLiq	0.0
25.3	50.5	1.6	115.0	NoLiq	0.0
25.3	50.3	1.6	115.0	NoLiq	0.0
25.4	48.5	1.6	115.0	NoLiq	0.0
25.5	48.8	1.6	115.0	NoLiq	0.0
25.5	51.1	1.7	115.0	NoLiq	0.0
25.6	52.2	1.7	115.0	NoLiq	0.0
25.7	55.0	1.8	115.0	NoLiq	0.0
25.7	56.6	1.7	115.0	NoLiq	0.0
25.8	56.5	1.7	115.0	NoLiq	0.0
25.9	58.1	1.8	115.0	NoLiq	0.0
25.9	67.0	1.8	115.0	NoLiq	0.0
26.0	82.5	1.9	115.0	NoLiq	0.0

26.1	99.6	2.0	115.0	NoLiq	0.0
26.1	112.2	2.3	115.0	NoLiq	0.0
26.2	121.1	2.3	115.0	NoLiq	0.0
26.3	125.6	2.3	115.0	NoLiq	0.0
26.4	134.8	2.3	115.0	NoLiq	0.0
26.4	136.1	2.4	115.0	NoLiq	0.0
26.5	135.8	2.5	115.0	NoLiq	0.0
26.5	113.9	2.5	115.0	NoLiq	0.0
26.6	121.9	2.4	115.0	NoLiq	0.0
26.7	112.7	2.4	115.0	NoLiq	0.0
26.7	106.5	2.3	115.0	NoLiq	0.0
26.8	90.9	2.3	115.0	NoLiq	0.0
26.9	73.3	2.2	115.0	NoLiq	0.0
26.9	56.7	2.1	115.0	NoLiq	0.0
27.0	49.1	1.9	115.0	NoLiq	0.0
27.1	35.9	1.6	115.0	NoLiq	0.0
27.1	32.9	1.5	115.0	NoLiq	0.0
27.2	27.8	1.4	115.0	NoLiq	0.0
27.3	23.6	1.1	115.0	NoLiq	0.0
27.3	20.9	1.0	115.0	NoLiq	0.0
27.4	19.6	0.9	115.0	NoLiq	0.0
27.5	18.0	0.8	115.0	NoLiq	0.0
27.5	17.9	0.8	115.0	NoLiq	0.0
27.6	17.9	0.7	115.0	NoLiq	0.0
27.6	20.2	0.7	115.0	NoLiq	0.0
27.7	21.2	0.7	115.0	NoLiq	0.0
27.8	21.4	0.7	115.0	NoLiq	0.0
27.8	21.3	0.7	115.0	NoLiq	0.0
27.9	20.5	0.7	115.0	NoLiq	0.0
28.0	19.3	0.7	115.0	NoLiq	0.0
28.0	18.9	0.7	115.0	NoLiq	0.0
28.1	19.0	0.7	115.0	NoLiq	0.0
28.1	19.6	0.8	115.0	NoLiq	0.0
28.2	21.5	0.9	115.0	NoLiq	0.0
28.3	24.0	1.1	115.0	NoLiq	0.0
28.4	28.8	1.2	115.0	NoLiq	0.0
28.4	35.6	1.2	115.0	NoLiq	0.0
28.5	39.1	1.2	115.0	NoLiq	0.0
28.5	43.7	1.2	115.0	NoLiq	0.0
28.6	64.7	1.3	115.0	NoLiq	0.0
28.7	86.1	1.3	115.0	NoLiq	0.0
28.8	108.0	1.4	115.0	NoLiq	0.0
28.8	127.6	1.4	115.0	NoLiq	0.0
28.9	144.2	1.5	115.0	NoLiq	0.0
28.9	152.7	1.5	115.0	NoLiq	0.0
29.0	170.6	1.6	115.0	20.0	0.3
29.1	192.9	2.0	115.0	20.0	0.3
29.1	199.5	1.9	115.0	20.0	0.3
29.2	209.4	1.7	115.0	20.0	0.3
29.3	218.1	1.9	115.0	20.0	0.3

29.3	220.9	1.9	115.0	20.0	0.3
29.4	224.1	2.0	115.0	20.0	0.3
29.5	219.4	2.0	115.0	20.0	0.3
29.6	217.8	2.1	115.0	20.0	0.3
29.6	220.7	2.0	115.0	20.0	0.3
29.7	220.1	2.0	115.0	20.0	0.3
29.7	216.4	2.0	115.0	20.0	0.3
29.8	207.1	1.9	115.0	20.0	0.3
29.9	202.7	1.9	115.0	20.0	0.3
29.9	189.9	1.8	115.0	20.0	0.3
30.0	173.2	1.8	115.0	20.0	0.3
30.1	153.6	1.7	115.0	20.0	0.3
30.1	143.4	1.8	115.0	20.0	0.3
30.2	124.9	1.8	115.0	20.0	0.3
30.3	101.9	2.0	115.0	20.0	0.3
30.3	80.9	2.0	115.0	20.0	0.3
30.4	62.0	2.0	115.0	20.0	0.3
30.4	54.2	2.0	115.0	20.0	0.3
30.5	44.0	1.9	115.0	20.0	0.3
30.6	36.9	1.9	115.0	20.0	0.3
30.6	36.7	1.9	115.0	20.0	0.3
30.7	39.5	1.9	115.0	20.0	0.3
30.8	41.0	1.9	115.0	20.0	0.3
30.8	47.2	2.0	115.0	20.0	0.3
31.0	57.3	2.2	115.0	20.0	0.3
31.0	62.3	2.3	115.0	20.0	0.3
31.1	76.5	2.4	115.0	20.0	0.3
31.1	86.0	2.4	115.0	20.0	0.3
31.2	122.7	2.4	115.0	20.0	0.3
31.2	133.2	2.4	115.0	20.0	0.3
31.3	150.1	2.4	115.0	20.0	0.3
31.4	162.1	2.2	115.0	20.0	0.3
31.5	168.4	2.1	115.0	20.0	0.3
31.5	170.4	2.1	115.0	20.0	0.3
31.6	169.0	1.9	115.0	20.0	0.3
31.7	166.2	1.8	115.0	20.0	0.3
31.7	160.3	1.7	115.0	20.0	0.3
31.8	151.3	1.6	115.0	20.0	0.3
31.9	141.5	1.6	115.0	20.0	0.3
31.9	135.3	1.5	115.0	20.0	0.3
32.0	121.6	1.5	115.0	20.0	0.3
32.0	108.0	1.6	115.0	NoLiq	0.0
32.1	92.0	1.6	115.0	NoLiq	0.0
32.2	84.6	1.7	115.0	NoLiq	0.0
32.3	66.5	1.7	115.0	NoLiq	0.0
32.3	62.7	1.6	115.0	NoLiq	0.0
32.4	54.2	1.6	115.0	NoLiq	0.0
32.4	49.5	1.7	115.0	NoLiq	0.0
32.5	37.5	1.6	115.0	NoLiq	0.0
32.6	26.8	1.6	115.0	NoLiq	0.0

32.6	30.0	1.5	115.0	NoLiq	0.0
32.7	26.3	1.3	115.0	NoLiq	0.0
32.8	22.9	1.2	115.0	NoLiq	0.0
32.8	20.0	1.1	115.0	NoLiq	0.0
32.9	20.1	1.1	115.0	NoLiq	0.0
33.0	20.3	1.0	115.0	NoLiq	0.0
33.0	20.3	1.1	115.0	NoLiq	0.0
33.1	21.3	1.1	115.0	NoLiq	0.0
33.2	25.1	1.2	115.0	NoLiq	0.0
33.2	29.7	1.3	115.0	NoLiq	0.0
33.3	32.0	1.3	115.0	NoLiq	0.0
33.3	35.0	1.3	115.0	NoLiq	0.0
33.4	32.4	1.2	115.0	NoLiq	0.0
33.5	30.7	1.2	115.0	NoLiq	0.0
33.5	25.5	1.1	115.0	NoLiq	0.0
33.6	21.6	1.0	115.0	NoLiq	0.0
33.7	20.0	1.0	115.0	NoLiq	0.0
33.7	21.7	0.9	115.0	NoLiq	0.0
33.8	20.2	0.9	115.0	NoLiq	0.0
33.9	21.8	0.9	115.0	NoLiq	0.0
33.9	23.9	0.9	115.0	NoLiq	0.0
34.0	25.3	0.9	115.0	NoLiq	0.0
34.1	25.5	0.8	115.0	NoLiq	0.0
34.1	25.4	0.8	115.0	NoLiq	0.0
34.2	24.4	0.8	115.0	NoLiq	0.0
34.3	22.5	0.8	115.0	NoLiq	0.0
34.3	20.1	0.8	115.0	NoLiq	0.0
34.4	19.5	0.8	115.0	NoLiq	0.0
34.5	17.7	0.7	115.0	NoLiq	0.0
34.5	17.2	0.7	115.0	NoLiq	0.0
34.6	16.9	0.7	115.0	NoLiq	0.0
34.7	16.5	0.7	115.0	NoLiq	0.0
34.7	16.8	0.8	115.0	NoLiq	0.0
34.8	19.9	0.8	115.0	NoLiq	0.0
34.8	24.1	0.8	115.0	NoLiq	0.0
34.9	34.4	0.9	115.0	NoLiq	0.0
35.0	35.5	1.0	115.0	NoLiq	0.0
35.0	31.7	1.0	115.0	NoLiq	0.0
35.1	25.5	1.0	115.0	NoLiq	0.0
35.2	21.7	1.0	115.0	NoLiq	0.0
35.3	25.5	1.1	115.0	NoLiq	0.0
35.3	20.9	1.3	115.0	NoLiq	0.0
35.4	25.5	1.4	115.0	NoLiq	0.0
35.5	33.2	1.5	115.0	NoLiq	0.0
35.5	37.6	1.6	115.0	NoLiq	0.0
35.6	43.0	1.7	115.0	NoLiq	0.0
35.7	45.0	1.9	115.0	NoLiq	0.0
35.7	46.3	1.9	115.0	NoLiq	0.0
35.8	47.0	1.9	115.0	NoLiq	0.0
35.8	43.5	1.9	115.0	NoLiq	0.0

35.9	40.1	1.9	115.0	NoLiq	0.0
36.0	36.8	1.9	115.0	NoLiq	0.3
36.0	35.7	1.8	115.0	20.0	0.3
36.1	52.7	1.8	115.0	20.0	0.3
36.2	70.5	1.8	115.0	20.0	0.3
36.2	121.7	1.8	115.0	20.0	0.3
36.3	166.1	1.9	115.0	20.0	0.3
36.4	198.5	2.1	115.0	20.0	0.3
36.4	216.0	2.1	115.0	20.0	0.3
36.5	229.5	2.2	115.0	20.0	0.3
36.6	237.0	2.3	115.0	20.0	0.3
36.6	239.4	2.4	115.0	20.0	0.3
36.7	244.5	2.5	115.0	20.0	0.3
36.7	253.4	2.6	115.0	20.0	0.3
36.8	267.8	2.6	115.0	20.0	0.3
36.9	274.6	2.7	115.0	20.0	0.3
36.9	285.3	2.7	115.0	20.0	0.3
37.0	296.3	2.7	115.0	20.0	0.3
37.1	299.1	2.7	115.0	20.0	0.3
37.1	303.0	2.6	115.0	20.0	0.3
37.2	306.9	2.6	115.0	20.0	0.3
37.3	310.2	2.6	115.0	20.0	0.3
37.3	310.7	2.6	115.0	20.0	0.3
37.4	310.7	2.6	115.0	20.0	0.3
37.5	308.8	2.7	115.0	20.0	0.3
37.5	307.5	2.7	115.0	20.0	0.3
37.6	306.3	2.7	115.0	20.0	0.3
37.7	302.0	2.7	115.0	20.0	0.3
37.8	300.8	2.7	115.0	20.0	0.3
37.8	297.9	2.6	115.0	20.0	0.3
37.9	296.4	2.6	115.0	20.0	0.3
38.0	291.0	2.5	115.0	20.0	0.3
38.0	283.8	2.4	115.0	20.0	0.3
38.1	279.2	2.4	115.0	20.0	0.3
38.1	265.1	2.2	115.0	20.0	0.3
38.2	251.9	1.8	115.0	20.0	0.3
38.3	244.5	1.4	115.0	20.0	0.3
38.3	228.3	1.4	115.0	20.0	0.3
38.4	206.8	1.6	115.0	20.0	0.3
38.5	178.5	1.9	115.0	NoLiq	0.0
38.5	164.3	2.0	115.0	NoLiq	0.0
38.6	118.5	2.3	115.0	NoLiq	0.0
38.7	110.2	2.5	115.0	NoLiq	0.0
38.7	102.2	2.5	115.0	NoLiq	0.0
38.8	91.7	2.8	115.0	NoLiq	0.0
38.8	91.4	3.0	115.0	NoLiq	0.0
38.9	86.4	3.2	115.0	NoLiq	0.0
39.0	84.8	3.4	115.0	NoLiq	0.0
39.1	89.6	3.6	115.0	NoLiq	0.0
39.1	94.9	3.7	115.0	NoLiq	0.0

39.2	109.8	3.7	115.0	NoLiq	0.0
39.2	127.8	3.8	115.0	NoLiq	0.0
39.3	141.4	3.8	115.0	NoLiq	0.0
39.4	152.2	3.8	115.0	NoLiq	0.0
39.5	149.9	3.8	115.0	NoLiq	0.0
39.5	143.5	3.6	115.0	NoLiq	0.0
39.6	134.7	3.5	115.0	NoLiq	0.0
39.6	112.7	3.2	115.0	NoLiq	0.0
39.7	89.4	2.9	115.0	NoLiq	0.0
39.8	70.3	2.5	115.0	NoLiq	0.0
39.8	63.0	2.2	115.0	NoLiq	0.0
39.9	42.1	1.6	115.0	NoLiq	0.0
40.0	36.8	1.5	115.0	NoLiq	0.0
40.0	28.9	1.3	115.0	NoLiq	0.0
40.1	26.3	1.1	115.0	NoLiq	0.0
40.2	23.2	1.0	115.0	NoLiq	0.0
40.3	23.6	1.0	115.0	NoLiq	0.0
40.3	24.2	1.0	115.0	NoLiq	0.0
40.3	25.3	1.1	115.0	NoLiq	0.0
40.4	26.1	1.2	115.0	NoLiq	0.0
40.5	26.4	1.2	115.0	NoLiq	0.0
40.5	25.4	1.2	115.0	NoLiq	0.0
40.6	23.4	1.2	115.0	NoLiq	0.0
40.7	21.8	1.2	115.0	NoLiq	0.0
40.8	21.0	1.1	115.0	NoLiq	0.0
40.9	20.9	1.0	115.0	NoLiq	0.0
40.9	20.8	1.0	115.0	NoLiq	0.0
41.0	20.6	1.0	115.0	NoLiq	0.0
41.0	20.6	1.1	115.0	NoLiq	0.0
41.1	23.6	1.2	115.0	NoLiq	0.0
41.2	26.3	1.1	115.0	NoLiq	0.0
41.2	32.5	1.2	115.0	NoLiq	0.0
41.3	39.0	1.5	115.0	NoLiq	0.0
41.3	42.2	1.6	115.0	NoLiq	0.0
41.4	45.9	1.7	115.0	NoLiq	0.0
41.5	39.5	1.7	115.0	NoLiq	0.0
41.5	41.2	1.6	115.0	NoLiq	0.0
41.6	37.0	1.5	115.0	NoLiq	0.0
41.7	32.0	1.4	115.0	NoLiq	0.0
41.8	27.4	1.4	115.0	NoLiq	0.0
41.8	25.5	1.4	115.0	NoLiq	0.0
41.9	24.2	1.5	115.0	NoLiq	0.0
42.0	29.1	1.7	115.0	NoLiq	0.0
42.0	33.8	1.9	115.0	20.0	0.3
42.1	45.4	2.1	115.0	20.0	0.3
42.2	55.7	2.3	115.0	20.0	0.3
42.2	71.9	2.7	115.0	20.0	0.3
42.3	82.5	2.9	115.0	20.0	0.3
42.3	100.0	3.1	115.0	20.0	0.3
42.4	120.2	3.3	115.0	20.0	0.3

42.5	149.7	3.7	115.0	20.0	0.3
42.5	171.2	3.8	115.0	20.0	0.3
42.6	214.6	4.1	115.0	20.0	0.3
42.7	257.9	4.3	115.0	20.0	0.3
42.7	267.0	4.3	115.0	20.0	0.3
42.8	281.0	4.2	115.0	20.0	0.3
42.9	283.0	3.9	115.0	20.0	0.3
42.9	274.8	3.7	115.0	20.0	0.3
43.0	266.5	3.5	115.0	20.0	0.3
43.0	247.3	3.3	115.0	NoLiq	0.0
43.1	218.3	2.9	115.0	NoLiq	0.0
43.2	187.9	2.8	115.0	NoLiq	0.0
43.3	148.8	2.8	115.0	NoLiq	0.0
43.3	114.0	2.7	115.0	NoLiq	0.0
43.4	98.9	2.7	115.0	NoLiq	0.0
43.5	72.3	2.6	115.0	NoLiq	0.0
43.5	56.4	2.6	115.0	NoLiq	0.0
43.6	45.9	2.5	115.0	NoLiq	0.0
43.6	42.9	2.4	115.0	NoLiq	0.0
43.7	38.5	2.3	115.0	NoLiq	0.0
43.8	34.0	2.2	115.0	NoLiq	0.0
43.8	31.0	1.8	115.0	NoLiq	0.0
43.9	30.0	1.6	115.0	NoLiq	0.0
44.0	28.7	1.5	115.0	NoLiq	0.0
44.1	28.4	1.5	115.0	NoLiq	0.0
44.1	29.4	1.5	115.0	NoLiq	0.0
44.2	35.1	1.5	115.0	NoLiq	0.0
44.2	43.0	1.5	115.0	NoLiq	0.0
44.3	53.0	1.7	115.0	NoLiq	0.0
44.4	55.0	1.8	115.0	NoLiq	0.0
44.5	53.1	2.0	115.0	NoLiq	0.0
44.5	41.1	2.1	115.0	NoLiq	0.0
44.6	47.7	2.2	115.0	NoLiq	0.0
44.6	47.7	2.2	115.0	NoLiq	0.0
44.7	47.7	2.2	115.0	NoLiq	0.0
44.8	47.7	2.1	115.0	NoLiq	0.0
44.8	53.0	2.0	115.0	NoLiq	0.0
44.9	55.8	2.0	115.0	NoLiq	0.0
45.0	53.2	2.0	115.0	NoLiq	0.0
45.0	51.3	2.0	115.0	NoLiq	0.0
45.1	50.5	2.2	115.0	NoLiq	0.0
45.2	58.2	2.7	115.0	NoLiq	0.0
45.2	80.2	3.0	115.0	NoLiq	0.0
45.3	91.1	3.0	115.0	NoLiq	0.0
45.4	101.6	3.2	115.0	NoLiq	0.0
45.4	104.0	3.2	115.0	NoLiq	0.0
45.5	123.2	3.2	115.0	NoLiq	0.0
45.6	188.9	3.2	115.0	20.0	0.3
45.6	205.2	3.2	115.0	20.0	0.3
45.7	224.6	3.2	115.0	20.0	0.3

45.7	229.7	3.1	115.0	20.0	0.3
45.8	229.8	3.0	115.0	20.0	0.3
45.9	225.7	3.0	115.0	20.0	0.3
45.9	215.0	3.0	115.0	20.0	0.3
46.0	194.7	3.0	115.0	20.0	0.3
46.1	187.1	3.1	115.0	20.0	0.3
46.2	170.4	3.1	115.0	20.0	0.3
46.2	156.5	3.3	115.0	20.0	0.3
46.3	141.7	3.4	115.0	20.0	0.3
46.3	126.8	3.5	115.0	20.0	0.3
46.4	118.5	3.5	115.0	20.0	0.3
46.5	111.8	3.5	115.0	20.0	0.3
46.5	112.6	3.5	115.0	20.0	0.3
46.6	114.9	3.5	115.0	20.0	0.3
46.7	113.0	3.5	115.0	20.0	0.3
46.7	96.6	3.5	115.0	20.0	0.3
46.8	78.1	3.2	115.0	20.0	0.3
46.9	70.1	2.9	115.0	20.0	0.3
47.0	49.3	2.6	115.0	20.0	0.3
47.0	44.1	2.5	115.0	NoLiq	0.0
47.1	37.2	2.2	115.0	NoLiq	0.0
47.1	32.9	2.0	115.0	NoLiq	0.0
47.2	28.5	1.7	115.0	NoLiq	0.0
47.3	26.7	1.8	115.0	NoLiq	0.0
47.3	26.2	1.9	115.0	NoLiq	0.0
47.4	43.1	1.9	115.0	NoLiq	0.0
47.5	56.2	2.2	115.0	NoLiq	0.0
47.5	57.2	2.3	115.0	NoLiq	0.0
47.6	47.8	2.4	115.0	NoLiq	0.0
47.7	53.8	2.3	115.0	NoLiq	0.0
47.7	49.2	2.1	115.0	NoLiq	0.0
47.8	47.5	2.1	115.0	NoLiq	0.0
47.8	44.3	2.2	115.0	NoLiq	0.0
47.9	41.2	2.0	115.0	NoLiq	0.0
48.0	37.2	1.9	115.0	NoLiq	0.0
48.0	37.1	1.9	115.0	NoLiq	0.0
48.1	45.8	1.9	115.0	NoLiq	0.0
48.2	60.7	2.0	115.0	NoLiq	0.0
48.2	65.4	2.0	115.0	NoLiq	0.0
48.3	61.5	2.0	115.0	NoLiq	0.0
48.4	50.6	1.9	115.0	NoLiq	0.0
48.4	45.8	1.8	115.0	NoLiq	0.0
48.5	38.2	1.7	115.0	NoLiq	0.0
48.6	32.0	1.7	115.0	NoLiq	0.0
48.6	28.6	1.6	115.0	NoLiq	0.0
48.7	25.8	1.5	115.0	NoLiq	0.0
48.8	24.5	1.2	115.0	NoLiq	0.0
48.8	24.5	1.2	115.0	NoLiq	0.0
48.9	24.5	1.2	115.0	NoLiq	0.0
49.0	26.8	1.3	115.0	NoLiq	0.0

49.0	29.7	1.6	115.0	20.0	0.3
49.1	33.7	1.8	115.0	20.0	0.3
49.2	38.9	2.0	115.0	20.0	0.3
49.3	94.9	2.4	115.0	20.0	0.3
49.3	127.7	2.6	115.0	20.0	0.3
49.4	192.4	2.8	115.0	20.0	0.3
49.4	218.1	3.0	115.0	20.0	0.3
49.5	274.2	3.1	115.0	20.0	0.3
49.6	296.8	3.0	115.0	20.0	0.3
49.6	302.7	2.8	115.0	20.0	0.3
49.7	305.1	2.6	115.0	20.0	0.3
49.8	301.4	2.6	115.0	20.0	0.3
49.8	291.1	2.6	115.0	20.0	0.3
49.9	273.9	2.6	115.0	20.0	0.3
50.0	251.3	2.8	115.0	20.0	0.3

Output Results:

Settlement of saturated sands=0.00 in.
Settlement of dry sands=2.94 in.
Total settlement of saturated and dry sands=2.94 in.
Differential Settlement=1.471 to 1.942 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.68	5.00	0.00	2.94	2.94
0.05	2.00	0.68	5.00	0.00	2.94	2.94
0.10	2.00	0.68	5.00	0.00	2.94	2.94
0.15	2.00	0.68	5.00	0.00	2.94	2.94
0.20	2.00	0.68	5.00	0.00	2.94	2.94
0.25	2.00	0.68	5.00	0.00	2.94	2.94
0.30	2.00	0.68	5.00	0.00	2.94	2.94
0.35	2.00	0.68	5.00	0.00	2.94	2.94
0.40	2.00	0.68	5.00	0.00	2.94	2.94
0.45	2.00	0.68	5.00	0.00	2.94	2.94
0.50	2.00	0.68	5.00	0.00	2.94	2.94
0.55	2.00	0.68	5.00	0.00	2.94	2.94
0.60	2.00	0.68	5.00	0.00	2.94	2.94
0.65	2.00	0.68	5.00	0.00	2.94	2.94
0.70	2.00	0.68	5.00	0.00	2.94	2.94
0.75	2.00	0.68	5.00	0.00	2.94	2.94
0.80	2.00	0.68	5.00	0.00	2.94	2.94
0.85	2.00	0.68	5.00	0.00	2.94	2.94
0.90	2.00	0.68	5.00	0.00	2.94	2.94
0.95	2.00	0.68	5.00	0.00	2.94	2.94
1.00	2.00	0.68	5.00	0.00	2.94	2.94
1.05	0.70	0.68	5.00	0.00	2.94	2.94
1.10	1.39	0.68	5.00	0.00	2.94	2.94
1.15	2.08	0.68	5.00	0.00	2.94	2.94

1.20	2.08	0.68	5.00	0.00	2.94	2.94
1.25	2.08	0.68	5.00	0.00	2.94	2.94
1.30	2.08	0.68	5.00	0.00	2.94	2.94
1.35	2.08	0.68	5.00	0.00	2.94	2.94
1.40	2.08	0.68	5.00	0.00	2.94	2.94
1.45	2.08	0.68	5.00	0.00	2.94	2.94
1.50	2.08	0.68	5.00	0.00	2.94	2.94
1.55	2.08	0.68	5.00	0.00	2.94	2.94
1.60	2.08	0.68	5.00	0.00	2.94	2.94
1.65	2.08	0.68	5.00	0.00	2.94	2.94
1.70	2.08	0.68	5.00	0.00	2.94	2.94
1.75	2.08	0.68	5.00	0.00	2.94	2.94
1.80	2.08	0.68	5.00	0.00	2.94	2.94
1.85	2.08	0.68	5.00	0.00	2.94	2.94
1.90	2.08	0.68	5.00	0.00	2.94	2.94
1.95	2.08	0.68	5.00	0.00	2.94	2.94
2.00	2.08	0.68	5.00	0.00	2.94	2.94
2.05	2.08	0.68	5.00	0.00	2.94	2.94
2.10	2.08	0.68	5.00	0.00	2.94	2.94
2.15	2.08	0.68	5.00	0.00	2.94	2.94
2.20	2.08	0.68	5.00	0.00	2.94	2.94
2.25	2.08	0.68	5.00	0.00	2.94	2.94
2.30	2.08	0.68	5.00	0.00	2.94	2.94
2.35	2.08	0.68	5.00	0.00	2.94	2.94
2.40	2.08	0.68	5.00	0.00	2.94	2.94
2.45	2.08	0.68	5.00	0.00	2.94	2.94
2.50	2.08	0.68	5.00	0.00	2.94	2.94
2.55	2.08	0.68	5.00	0.00	2.94	2.94
2.60	2.08	0.68	5.00	0.00	2.94	2.94
2.65	2.08	0.68	5.00	0.00	2.94	2.94
2.70	2.08	0.68	5.00	0.00	2.94	2.94
2.75	2.08	0.68	5.00	0.00	2.94	2.94
2.80	2.08	0.68	5.00	0.00	2.94	2.94
2.85	2.08	0.68	5.00	0.00	2.94	2.94
2.90	2.08	0.68	5.00	0.00	2.94	2.94
2.95	2.08	0.68	5.00	0.00	2.94	2.94
3.00	2.08	0.68	5.00	0.00	2.94	2.94
3.05	2.08	0.68	5.00	0.00	2.94	2.94
3.10	2.08	0.68	5.00	0.00	2.94	2.94
3.15	2.08	0.68	5.00	0.00	2.94	2.94
3.20	2.08	0.68	5.00	0.00	2.94	2.94
3.25	2.08	0.68	5.00	0.00	2.94	2.94
3.30	2.08	0.68	5.00	0.00	2.94	2.94
3.35	2.08	0.68	5.00	0.00	2.94	2.94
3.40	2.08	0.68	5.00	0.00	2.94	2.94
3.45	2.08	0.68	5.00	0.00	2.94	2.94
3.50	2.08	0.68	5.00	0.00	2.94	2.94
3.55	2.08	0.68	5.00	0.00	2.94	2.94
3.60	2.08	0.68	5.00	0.00	2.94	2.94
3.65	2.08	0.68	5.00	0.00	2.94	2.94

3.70	2.08	0.68	5.00	0.00	2.94	2.94
3.75	2.08	0.68	5.00	0.00	2.93	2.93
3.80	2.08	0.68	5.00	0.00	2.93	2.93
3.85	2.08	0.68	5.00	0.00	2.93	2.93
3.90	2.08	0.68	5.00	0.00	2.93	2.93
3.95	2.08	0.68	5.00	0.00	2.93	2.93
4.00	2.08	0.68	5.00	0.00	2.93	2.93
4.05	2.08	0.68	5.00	0.00	2.93	2.93
4.10	2.08	0.68	5.00	0.00	2.93	2.93
4.15	2.08	0.68	5.00	0.00	2.93	2.93
4.20	2.08	0.68	5.00	0.00	2.93	2.93
4.25	2.08	0.68	5.00	0.00	2.93	2.93
4.30	2.08	0.68	5.00	0.00	2.93	2.93
4.35	2.08	0.68	5.00	0.00	2.93	2.93
4.40	2.08	0.68	5.00	0.00	2.93	2.93
4.45	2.08	0.68	5.00	0.00	2.93	2.93
4.50	2.08	0.68	5.00	0.00	2.93	2.93
4.55	2.08	0.68	5.00	0.00	2.93	2.93
4.60	2.08	0.68	5.00	0.00	2.93	2.93
4.65	2.08	0.68	5.00	0.00	2.93	2.93
4.70	2.08	0.68	5.00	0.00	2.93	2.93
4.75	1.88	0.67	5.00	0.00	2.93	2.93
4.80	1.55	0.67	5.00	0.00	2.93	2.93
4.85	1.15	0.67	5.00	0.00	2.93	2.93
4.90	0.86	0.67	5.00	0.00	2.93	2.93
4.95	0.71	0.67	5.00	0.00	2.93	2.93
5.00	0.60	0.67	5.00	0.00	2.93	2.93
5.05	0.48	0.67	5.00	0.00	2.93	2.93
5.10	0.42	0.67	5.00	0.00	2.92	2.92
5.15	0.38	0.67	5.00	0.00	2.92	2.92
5.20	0.32	0.67	5.00	0.00	2.92	2.92
5.25	0.25	0.67	5.00	0.00	2.91	2.91
5.30	0.20	0.67	5.00	0.00	2.91	2.91
5.35	0.17	0.67	5.00	0.00	2.90	2.90
5.40	0.16	0.67	5.00	0.00	2.89	2.89
5.45	0.15	0.67	5.00	0.00	2.88	2.88
5.50	0.14	0.67	5.00	0.00	2.86	2.86
5.55	0.14	0.67	5.00	0.00	2.85	2.85
5.60	0.13	0.67	5.00	0.00	2.84	2.84
5.65	0.13	0.67	5.00	0.00	2.82	2.82
5.70	0.13	0.67	5.00	0.00	2.81	2.81
5.75	0.12	0.67	5.00	0.00	2.80	2.80
5.80	0.12	0.67	5.00	0.00	2.78	2.78
5.85	0.12	0.67	5.00	0.00	2.77	2.77
5.90	0.12	0.67	5.00	0.00	2.75	2.75
5.95	0.12	0.67	5.00	0.00	2.74	2.74
6.00	0.12	0.67	5.00	0.00	2.72	2.72
6.05	0.12	0.67	5.00	0.00	2.71	2.71
6.10	0.12	0.67	5.00	0.00	2.69	2.69
6.15	0.12	0.67	5.00	0.00	2.68	2.68

6.20	0.12	0.67	5.00	0.00	2.66	2.66
6.25	0.12	0.67	5.00	0.00	2.65	2.65
6.30	0.12	0.67	5.00	0.00	2.63	2.63
6.35	0.12	0.67	5.00	0.00	2.62	2.62
6.40	0.13	0.67	5.00	0.00	2.60	2.60
6.45	0.13	0.67	5.00	0.00	2.59	2.59
6.50	0.14	0.67	5.00	0.00	2.57	2.57
6.55	0.14	0.67	5.00	0.00	2.56	2.56
6.60	0.15	0.67	5.00	0.00	2.55	2.55
6.65	0.16	0.67	5.00	0.00	2.54	2.54
6.70	0.17	0.67	5.00	0.00	2.53	2.53
6.75	0.17	0.67	5.00	0.00	2.51	2.51
6.80	0.17	0.67	5.00	0.00	2.50	2.50
6.85	0.17	0.67	5.00	0.00	2.49	2.49
6.90	0.17	0.67	5.00	0.00	2.48	2.48
6.95	0.18	0.67	5.00	0.00	2.47	2.47
7.00	2.00	0.67	5.00	0.00	2.46	2.46
7.05	2.00	0.67	5.00	0.00	2.46	2.46
7.10	2.00	0.67	5.00	0.00	2.46	2.46
7.15	2.00	0.67	5.00	0.00	2.46	2.46
7.20	2.00	0.67	5.00	0.00	2.46	2.46
7.25	2.00	0.67	5.00	0.00	2.46	2.46
7.30	2.00	0.67	5.00	0.00	2.46	2.46
7.35	2.00	0.67	5.00	0.00	2.46	2.46
7.40	2.00	0.67	5.00	0.00	2.46	2.46
7.45	2.00	0.67	5.00	0.00	2.46	2.46
7.50	2.00	0.67	5.00	0.00	2.46	2.46
7.55	2.00	0.67	5.00	0.00	2.46	2.46
7.60	2.00	0.67	5.00	0.00	2.46	2.46
7.65	2.00	0.67	5.00	0.00	2.46	2.46
7.70	2.00	0.67	5.00	0.00	2.46	2.46
7.75	2.00	0.67	5.00	0.00	2.46	2.46
7.80	2.00	0.67	5.00	0.00	2.46	2.46
7.85	2.00	0.67	5.00	0.00	2.46	2.46
7.90	2.00	0.67	5.00	0.00	2.46	2.46
7.95	2.00	0.67	5.00	0.00	2.46	2.46
8.00	2.00	0.67	5.00	0.00	2.46	2.46
8.05	2.00	0.67	5.00	0.00	2.46	2.46
8.10	2.00	0.67	5.00	0.00	2.46	2.46
8.15	2.00	0.67	5.00	0.00	2.46	2.46
8.20	2.00	0.67	5.00	0.00	2.46	2.46
8.25	2.00	0.67	5.00	0.00	2.46	2.46
8.30	2.00	0.67	5.00	0.00	2.46	2.46
8.35	2.00	0.67	5.00	0.00	2.46	2.46
8.40	2.00	0.67	5.00	0.00	2.46	2.46
8.45	2.00	0.67	5.00	0.00	2.46	2.46
8.50	2.00	0.67	5.00	0.00	2.46	2.46
8.55	2.00	0.67	5.00	0.00	2.46	2.46
8.60	2.00	0.67	5.00	0.00	2.46	2.46
8.65	2.00	0.67	5.00	0.00	2.46	2.46

8.70	2.00	0.67	5.00	0.00	2.46	2.46
8.75	2.00	0.67	5.00	0.00	2.46	2.46
8.80	2.00	0.67	5.00	0.00	2.46	2.46
8.85	2.00	0.67	5.00	0.00	2.46	2.46
8.90	2.00	0.67	5.00	0.00	2.46	2.46
8.95	2.00	0.67	5.00	0.00	2.46	2.46
9.00	2.00	0.67	5.00	0.00	2.46	2.46
9.05	0.27	0.67	5.00	0.00	2.46	2.46
9.10	0.27	0.67	5.00	0.00	2.46	2.46
9.15	0.27	0.67	5.00	0.00	2.45	2.45
9.20	0.27	0.67	5.00	0.00	2.44	2.44
9.25	0.27	0.67	5.00	0.00	2.43	2.43
9.30	0.27	0.67	5.00	0.00	2.43	2.43
9.35	0.27	0.67	5.00	0.00	2.42	2.42
9.40	0.26	0.67	5.00	0.00	2.42	2.42
9.45	0.26	0.67	5.00	0.00	2.42	2.42
9.50	0.26	0.67	5.00	0.00	2.41	2.41
9.55	0.26	0.67	5.00	0.00	2.41	2.41
9.60	0.25	0.67	5.00	0.00	2.40	2.40
9.65	0.25	0.67	5.00	0.00	2.40	2.40
9.70	0.25	0.67	5.00	0.00	2.39	2.39
9.75	0.26	0.67	5.00	0.00	2.39	2.39
9.80	0.25	0.67	5.00	0.00	2.38	2.38
9.85	0.25	0.67	5.00	0.00	2.38	2.38
9.90	0.25	0.67	5.00	0.00	2.37	2.37
9.95	0.25	0.67	5.00	0.00	2.37	2.37
10.00	0.26	0.67	5.00	0.00	2.36	2.36
10.05	0.26	0.67	5.00	0.00	2.36	2.36
10.10	0.27	0.67	5.00	0.00	2.35	2.35
10.15	0.27	0.67	5.00	0.00	2.35	2.35
10.20	0.27	0.67	5.00	0.00	2.34	2.34
10.25	0.27	0.67	5.00	0.00	2.34	2.34
10.30	0.27	0.67	5.00	0.00	2.33	2.33
10.35	0.26	0.67	5.00	0.00	2.33	2.33
10.40	0.26	0.67	5.00	0.00	2.32	2.32
10.45	0.26	0.67	5.00	0.00	2.31	2.31
10.50	0.26	0.67	5.00	0.00	2.31	2.31
10.55	0.25	0.67	5.00	0.00	2.30	2.30
10.60	0.25	0.67	5.00	0.00	2.29	2.29
10.65	0.25	0.67	5.00	0.00	2.29	2.29
10.70	0.24	0.67	5.00	0.00	2.28	2.28
10.75	0.24	0.67	5.00	0.00	2.27	2.27
10.80	0.24	0.67	5.00	0.00	2.26	2.26
10.85	0.24	0.67	5.00	0.00	2.25	2.25
10.90	0.24	0.67	5.00	0.00	2.24	2.24
10.95	0.24	0.67	5.00	0.00	2.23	2.23
11.00	0.24	0.66	5.00	0.00	2.23	2.23
11.05	0.23	0.66	5.00	0.00	2.22	2.22
11.10	0.22	0.66	5.00	0.00	2.21	2.21
11.15	0.22	0.66	5.00	0.00	2.20	2.20

11.20	0.22	0.66	5.00	0.00	2.19	2.19
11.25	0.23	0.66	5.00	0.00	2.17	2.17
11.30	0.23	0.66	5.00	0.00	2.16	2.16
11.35	0.24	0.66	5.00	0.00	2.15	2.15
11.40	0.24	0.66	5.00	0.00	2.14	2.14
11.45	0.24	0.66	5.00	0.00	2.13	2.13
11.50	0.26	0.66	5.00	0.00	2.12	2.12
11.55	0.28	0.66	5.00	0.00	2.11	2.11
11.60	0.30	0.66	5.00	0.00	2.10	2.10
11.65	0.30	0.66	5.00	0.00	2.10	2.10
11.70	0.30	0.66	5.00	0.00	2.09	2.09
11.75	0.30	0.66	5.00	0.00	2.08	2.08
11.80	0.29	0.66	5.00	0.00	2.07	2.07
11.85	0.29	0.66	5.00	0.00	2.06	2.06
11.90	0.28	0.66	5.00	0.00	2.05	2.05
11.95	0.28	0.66	5.00	0.00	2.04	2.04
12.00	0.27	0.66	5.00	0.00	2.03	2.03
12.05	0.26	0.66	5.00	0.00	2.02	2.02
12.10	0.26	0.66	5.00	0.00	2.01	2.01
12.15	0.26	0.66	5.00	0.00	2.00	2.00
12.20	0.26	0.66	5.00	0.00	1.99	1.99
12.25	0.26	0.66	5.00	0.00	1.98	1.98
12.30	0.27	0.66	5.00	0.00	1.97	1.97
12.35	0.28	0.66	5.00	0.00	1.96	1.96
12.40	0.29	0.66	5.00	0.00	1.95	1.95
12.45	0.30	0.66	5.00	0.00	1.94	1.94
12.50	0.31	0.66	5.00	0.00	1.93	1.93
12.55	0.32	0.66	5.00	0.00	1.93	1.93
12.60	0.33	0.66	5.00	0.00	1.92	1.92
12.65	0.34	0.66	5.00	0.00	1.91	1.91
12.70	0.36	0.66	5.00	0.00	1.90	1.90
12.75	0.36	0.66	5.00	0.00	1.90	1.90
12.80	0.36	0.66	5.00	0.00	1.89	1.89
12.85	0.36	0.66	5.00	0.00	1.88	1.88
12.90	0.35	0.66	5.00	0.00	1.87	1.87
12.95	0.33	0.66	5.00	0.00	1.87	1.87
13.00	0.32	0.66	5.00	0.00	1.86	1.86
13.05	0.30	0.66	5.00	0.00	1.85	1.85
13.10	0.29	0.66	5.00	0.00	1.84	1.84
13.15	0.27	0.66	5.00	0.00	1.83	1.83
13.20	0.26	0.66	5.00	0.00	1.82	1.82
13.25	0.26	0.66	5.00	0.00	1.81	1.81
13.30	0.25	0.66	5.00	0.00	1.80	1.80
13.35	0.25	0.66	5.00	0.00	1.80	1.80
13.40	0.24	0.66	5.00	0.00	1.79	1.79
13.45	0.24	0.66	5.00	0.00	1.78	1.78
13.50	2.00	0.66	5.00	0.00	1.77	1.77
13.55	2.00	0.66	5.00	0.00	1.77	1.77
13.60	2.00	0.66	5.00	0.00	1.77	1.77
13.65	2.00	0.66	5.00	0.00	1.77	1.77

13.70	2.00	0.66	5.00	0.00	1.77	1.77
13.75	2.00	0.66	5.00	0.00	1.77	1.77
13.80	2.00	0.66	5.00	0.00	1.77	1.77
13.85	2.00	0.66	5.00	0.00	1.77	1.77
13.90	2.00	0.66	5.00	0.00	1.77	1.77
13.95	2.00	0.66	5.00	0.00	1.77	1.77
14.00	2.00	0.66	5.00	0.00	1.77	1.77
14.05	2.00	0.66	5.00	0.00	1.77	1.77
14.10	2.00	0.66	5.00	0.00	1.77	1.77
14.15	2.00	0.66	5.00	0.00	1.77	1.77
14.20	2.00	0.66	5.00	0.00	1.77	1.77
14.25	2.00	0.66	5.00	0.00	1.77	1.77
14.30	2.00	0.66	5.00	0.00	1.77	1.77
14.35	2.00	0.66	5.00	0.00	1.77	1.77
14.40	2.00	0.66	5.00	0.00	1.77	1.77
14.45	2.00	0.66	5.00	0.00	1.77	1.77
14.50	2.00	0.66	5.00	0.00	1.77	1.77
14.55	2.00	0.66	5.00	0.00	1.77	1.77
14.60	2.00	0.66	5.00	0.00	1.77	1.77
14.65	2.00	0.66	5.00	0.00	1.77	1.77
14.70	2.00	0.66	5.00	0.00	1.77	1.77
14.75	2.00	0.66	5.00	0.00	1.77	1.77
14.80	2.00	0.66	5.00	0.00	1.77	1.77
14.85	2.00	0.66	5.00	0.00	1.77	1.77
14.90	2.00	0.66	5.00	0.00	1.77	1.77
14.95	2.00	0.66	5.00	0.00	1.77	1.77
15.00	2.00	0.66	5.00	0.00	1.77	1.77
15.05	0.22	0.66	5.00	0.00	1.77	1.77
15.10	0.22	0.66	5.00	0.00	1.76	1.76
15.15	0.22	0.66	5.00	0.00	1.75	1.75
15.20	0.21	0.66	5.00	0.00	1.74	1.74
15.25	0.21	0.66	5.00	0.00	1.73	1.73
15.30	0.21	0.66	5.00	0.00	1.72	1.72
15.35	0.21	0.66	5.00	0.00	1.71	1.71
15.40	0.21	0.66	5.00	0.00	1.70	1.70
15.45	0.21	0.66	5.00	0.00	1.69	1.69
15.50	0.21	0.66	5.00	0.00	1.68	1.68
15.55	0.21	0.66	5.00	0.00	1.67	1.67
15.60	0.21	0.66	5.00	0.00	1.66	1.66
15.65	0.21	0.66	5.00	0.00	1.65	1.65
15.70	0.22	0.66	5.00	0.00	1.64	1.64
15.75	0.22	0.66	5.00	0.00	1.63	1.63
15.80	0.22	0.66	5.00	0.00	1.62	1.62
15.85	0.22	0.66	5.00	0.00	1.61	1.61
15.90	0.23	0.66	5.00	0.00	1.61	1.61
15.95	0.23	0.66	5.00	0.00	1.60	1.60
16.00	0.24	0.66	5.00	0.00	1.59	1.59
16.05	0.24	0.66	5.00	0.00	1.58	1.58
16.10	0.24	0.66	5.00	0.00	1.57	1.57
16.15	0.24	0.66	5.00	0.00	1.56	1.56

16.20	0.24	0.66	5.00	0.00	1.55	1.55
16.25	0.24	0.66	5.00	0.00	1.54	1.54
16.30	0.24	0.66	5.00	0.00	1.53	1.53
16.35	0.24	0.66	5.00	0.00	1.52	1.52
16.40	0.24	0.66	5.00	0.00	1.51	1.51
16.45	0.24	0.66	5.00	0.00	1.50	1.50
16.50	0.24	0.66	5.00	0.00	1.49	1.49
16.55	0.24	0.66	5.00	0.00	1.48	1.48
16.60	0.24	0.66	5.00	0.00	1.47	1.47
16.65	0.24	0.66	5.00	0.00	1.47	1.47
16.70	0.25	0.66	5.00	0.00	1.46	1.46
16.75	0.25	0.66	5.00	0.00	1.45	1.45
16.80	0.25	0.66	5.00	0.00	1.44	1.44
16.85	0.25	0.66	5.00	0.00	1.43	1.43
16.90	0.25	0.66	5.00	0.00	1.42	1.42
16.95	0.25	0.66	5.00	0.00	1.41	1.41
17.00	0.26	0.66	5.00	0.00	1.40	1.40
17.05	0.25	0.66	5.00	0.00	1.40	1.40
17.10	0.24	0.66	5.00	0.00	1.39	1.39
17.15	0.23	0.66	5.00	0.00	1.38	1.38
17.20	0.23	0.66	5.00	0.00	1.37	1.37
17.25	0.23	0.66	5.00	0.00	1.36	1.36
17.30	0.23	0.65	5.00	0.00	1.35	1.35
17.35	0.23	0.65	5.00	0.00	1.34	1.34
17.40	0.23	0.65	5.00	0.00	1.34	1.34
17.45	0.23	0.65	5.00	0.00	1.33	1.33
17.50	0.23	0.65	5.00	0.00	1.32	1.32
17.55	0.23	0.65	5.00	0.00	1.31	1.31
17.60	0.24	0.65	5.00	0.00	1.30	1.30
17.65	0.24	0.65	5.00	0.00	1.29	1.29
17.70	0.25	0.65	5.00	0.00	1.29	1.29
17.75	0.26	0.65	5.00	0.00	1.28	1.28
17.80	0.26	0.65	5.00	0.00	1.27	1.27
17.85	0.26	0.65	5.00	0.00	1.26	1.26
17.90	0.27	0.65	5.00	0.00	1.25	1.25
17.95	0.27	0.65	5.00	0.00	1.25	1.25
18.00	0.27	0.65	5.00	0.00	1.24	1.24
18.05	0.28	0.65	5.00	0.00	1.23	1.23
18.10	0.28	0.65	5.00	0.00	1.22	1.22
18.15	0.28	0.65	5.00	0.00	1.21	1.21
18.20	0.29	0.65	5.00	0.00	1.21	1.21
18.25	0.29	0.65	5.00	0.00	1.20	1.20
18.30	0.29	0.65	5.00	0.00	1.19	1.19
18.35	0.29	0.65	5.00	0.00	1.18	1.18
18.40	0.30	0.65	5.00	0.00	1.17	1.17
18.45	0.31	0.65	5.00	0.00	1.17	1.17
18.50	0.32	0.65	5.00	0.00	1.16	1.16
18.55	0.33	0.65	5.00	0.00	1.15	1.15
18.60	0.34	0.65	5.00	0.00	1.14	1.14
18.65	0.37	0.65	5.00	0.00	1.14	1.14

18.70	0.40	0.65	5.00	0.00	1.13	1.13
18.75	0.43	0.65	5.00	0.00	1.13	1.13
18.80	0.47	0.65	5.00	0.00	1.12	1.12
18.85	0.51	0.65	5.00	0.00	1.12	1.12
18.90	0.58	0.65	5.00	0.00	1.11	1.11
18.95	0.41	0.65	5.00	0.00	1.11	1.11
19.00	0.48	0.65	5.00	0.00	1.10	1.10
19.05	0.88	0.65	5.00	0.00	1.10	1.10
19.10	0.40	0.65	5.00	0.00	1.10	1.10
19.15	0.30	0.65	5.00	0.00	1.09	1.09
19.20	0.31	0.65	5.00	0.00	1.08	1.08
19.25	0.36	0.65	5.00	0.00	1.08	1.08
19.30	0.39	0.65	5.00	0.00	1.07	1.07
19.35	0.43	0.65	5.00	0.00	1.06	1.06
19.40	0.47	0.65	5.00	0.00	1.06	1.06
19.45	0.48	0.65	5.00	0.00	1.05	1.05
19.50	0.49	0.65	5.00	0.00	1.04	1.04
19.55	0.48	0.65	5.00	0.00	1.04	1.04
19.60	0.46	0.65	5.00	0.00	1.03	1.03
19.65	0.43	0.65	5.00	0.00	1.03	1.03
19.70	0.41	0.65	5.00	0.00	1.02	1.02
19.75	0.41	0.65	5.00	0.00	1.02	1.02
19.80	0.41	0.65	5.00	0.00	1.01	1.01
19.85	0.41	0.65	5.00	0.00	1.01	1.01
19.90	0.40	0.65	5.00	0.00	1.01	1.01
19.95	0.41	0.65	5.00	0.00	1.00	1.00
20.00	0.41	0.65	5.00	0.00	1.00	1.00
20.05	0.41	0.65	5.00	0.00	0.99	0.99
20.10	0.40	0.65	5.00	0.00	0.99	0.99
20.15	0.38	0.65	5.00	0.00	0.99	0.99
20.20	0.36	0.65	5.00	0.00	0.98	0.98
20.25	0.34	0.65	5.00	0.00	0.98	0.98
20.30	0.33	0.65	5.00	0.00	0.97	0.97
20.35	0.31	0.65	5.00	0.00	0.97	0.97
20.40	0.31	0.65	5.00	0.00	0.96	0.96
20.45	0.29	0.65	5.00	0.00	0.96	0.96
20.50	0.29	0.65	5.00	0.00	0.95	0.95
20.55	0.30	0.65	5.00	0.00	0.95	0.95
20.60	0.31	0.65	5.00	0.00	0.95	0.95
20.65	0.33	0.65	5.00	0.00	0.94	0.94
20.70	0.35	0.65	5.00	0.00	0.94	0.94
20.75	0.35	0.65	5.00	0.00	0.94	0.94
20.80	0.32	0.65	5.00	0.00	0.93	0.93
20.85	0.31	0.65	5.00	0.00	0.93	0.93
20.90	0.29	0.65	5.00	0.00	0.93	0.93
20.95	0.28	0.65	5.00	0.00	0.93	0.93
21.00	0.26	0.65	5.00	0.00	0.92	0.92
21.05	0.24	0.65	5.00	0.00	0.92	0.92
21.10	0.22	0.65	5.00	0.00	0.91	0.91
21.15	0.22	0.65	5.00	0.00	0.90	0.90

21.20	0.21	0.65	5.00	0.00	0.90	0.90
21.25	0.22	0.65	5.00	0.00	0.89	0.89
21.30	0.22	0.65	5.00	0.00	0.88	0.88
21.35	0.22	0.65	5.00	0.00	0.87	0.87
21.40	0.23	0.65	5.00	0.00	0.86	0.86
21.45	0.23	0.65	5.00	0.00	0.86	0.86
21.50	0.23	0.65	5.00	0.00	0.85	0.85
21.55	0.23	0.65	5.00	0.00	0.84	0.84
21.60	0.23	0.65	5.00	0.00	0.83	0.83
21.65	0.23	0.65	5.00	0.00	0.83	0.83
21.70	0.24	0.65	5.00	0.00	0.82	0.82
21.75	0.24	0.65	5.00	0.00	0.81	0.81
21.80	0.24	0.65	5.00	0.00	0.80	0.80
21.85	0.24	0.65	5.00	0.00	0.80	0.80
21.90	0.23	0.65	5.00	0.00	0.79	0.79
21.95	0.22	0.65	5.00	0.00	0.78	0.78
22.00	0.22	0.65	5.00	0.00	0.77	0.77
22.05	2.00	0.65	5.00	0.00	0.77	0.77
22.10	2.00	0.65	5.00	0.00	0.77	0.77
22.15	2.00	0.65	5.00	0.00	0.77	0.77
22.20	2.00	0.65	5.00	0.00	0.77	0.77
22.25	2.00	0.65	5.00	0.00	0.77	0.77
22.30	2.00	0.65	5.00	0.00	0.77	0.77
22.35	2.00	0.65	5.00	0.00	0.77	0.77
22.40	2.00	0.65	5.00	0.00	0.77	0.77
22.45	2.00	0.65	5.00	0.00	0.77	0.77
22.50	2.00	0.65	5.00	0.00	0.77	0.77
22.55	2.00	0.65	5.00	0.00	0.77	0.77
22.60	2.00	0.65	5.00	0.00	0.77	0.77
22.65	2.00	0.65	5.00	0.00	0.77	0.77
22.70	2.00	0.65	5.00	0.00	0.77	0.77
22.75	2.00	0.65	5.00	0.00	0.77	0.77
22.80	2.00	0.65	5.00	0.00	0.77	0.77
22.85	2.00	0.65	5.00	0.00	0.77	0.77
22.90	2.00	0.65	5.00	0.00	0.77	0.77
22.95	2.00	0.65	5.00	0.00	0.77	0.77
23.00	2.00	0.65	5.00	0.00	0.77	0.77
23.05	2.00	0.65	5.00	0.00	0.77	0.77
23.10	2.00	0.65	5.00	0.00	0.77	0.77
23.15	2.00	0.65	5.00	0.00	0.77	0.77
23.20	2.00	0.65	5.00	0.00	0.77	0.77
23.25	2.00	0.65	5.00	0.00	0.77	0.77
23.30	2.00	0.65	5.00	0.00	0.77	0.77
23.35	2.00	0.65	5.00	0.00	0.77	0.77
23.40	2.00	0.65	5.00	0.00	0.77	0.77
23.45	2.00	0.65	5.00	0.00	0.77	0.77
23.50	2.00	0.65	5.00	0.00	0.77	0.77
23.55	2.00	0.65	5.00	0.00	0.77	0.77
23.60	2.00	0.64	5.00	0.00	0.77	0.77
23.65	2.00	0.64	5.00	0.00	0.77	0.77

23.70	2.00	0.64	5.00	0.00	0.77	0.77
23.75	2.00	0.64	5.00	0.00	0.77	0.77
23.80	2.00	0.64	5.00	0.00	0.77	0.77
23.85	2.00	0.64	5.00	0.00	0.77	0.77
23.90	2.00	0.64	5.00	0.00	0.77	0.77
23.95	2.00	0.64	5.00	0.00	0.77	0.77
24.00	2.00	0.64	5.00	0.00	0.77	0.77
24.05	2.00	0.64	5.00	0.00	0.77	0.77
24.10	2.00	0.64	5.00	0.00	0.77	0.77
24.15	2.00	0.64	5.00	0.00	0.77	0.77
24.20	2.00	0.64	5.00	0.00	0.77	0.77
24.25	2.00	0.64	5.00	0.00	0.77	0.77
24.30	2.00	0.64	5.00	0.00	0.77	0.77
24.35	2.00	0.64	5.00	0.00	0.77	0.77
24.40	2.00	0.64	5.00	0.00	0.77	0.77
24.45	2.00	0.64	5.00	0.00	0.77	0.77
24.50	2.00	0.64	5.00	0.00	0.77	0.77
24.55	2.00	0.64	5.00	0.00	0.77	0.77
24.60	2.00	0.64	5.00	0.00	0.77	0.77
24.65	2.00	0.64	5.00	0.00	0.77	0.77
24.70	2.00	0.64	5.00	0.00	0.77	0.77
24.75	2.00	0.64	5.00	0.00	0.77	0.77
24.80	2.00	0.64	5.00	0.00	0.77	0.77
24.85	2.00	0.64	5.00	0.00	0.77	0.77
24.90	2.00	0.64	5.00	0.00	0.77	0.77
24.95	2.00	0.64	5.00	0.00	0.77	0.77
25.00	2.00	0.64	5.00	0.00	0.77	0.77
25.05	2.00	0.64	5.00	0.00	0.77	0.77
25.10	2.00	0.64	5.00	0.00	0.77	0.77
25.15	2.00	0.64	5.00	0.00	0.77	0.77
25.20	2.00	0.64	5.00	0.00	0.77	0.77
25.25	2.00	0.64	5.00	0.00	0.77	0.77
25.30	2.00	0.64	5.00	0.00	0.77	0.77
25.35	2.00	0.64	5.00	0.00	0.77	0.77
25.40	2.00	0.64	5.00	0.00	0.77	0.77
25.45	2.00	0.64	5.00	0.00	0.77	0.77
25.50	2.00	0.64	5.00	0.00	0.77	0.77
25.55	2.00	0.64	5.00	0.00	0.77	0.77
25.60	2.00	0.64	5.00	0.00	0.77	0.77
25.65	2.00	0.64	5.00	0.00	0.77	0.77
25.70	2.00	0.64	5.00	0.00	0.77	0.77
25.75	2.00	0.64	5.00	0.00	0.77	0.77
25.80	2.00	0.64	5.00	0.00	0.77	0.77
25.85	2.00	0.64	5.00	0.00	0.77	0.77
25.90	2.00	0.64	5.00	0.00	0.77	0.77
25.95	2.00	0.64	5.00	0.00	0.77	0.77
26.00	2.00	0.64	5.00	0.00	0.77	0.77
26.05	2.00	0.64	5.00	0.00	0.77	0.77
26.10	2.00	0.64	5.00	0.00	0.77	0.77
26.15	2.00	0.64	5.00	0.00	0.77	0.77

26.20	2.00	0.64	5.00	0.00	0.77	0.77
26.25	2.00	0.64	5.00	0.00	0.77	0.77
26.30	2.00	0.64	5.00	0.00	0.77	0.77
26.35	2.00	0.64	5.00	0.00	0.77	0.77
26.40	2.00	0.64	5.00	0.00	0.77	0.77
26.45	2.00	0.64	5.00	0.00	0.77	0.77
26.50	2.00	0.64	5.00	0.00	0.77	0.77
26.55	2.00	0.64	5.00	0.00	0.77	0.77
26.60	2.00	0.64	5.00	0.00	0.77	0.77
26.65	2.00	0.64	5.00	0.00	0.77	0.77
26.70	2.00	0.64	5.00	0.00	0.77	0.77
26.75	2.00	0.64	5.00	0.00	0.77	0.77
26.80	2.00	0.64	5.00	0.00	0.77	0.77
26.85	2.00	0.64	5.00	0.00	0.77	0.77
26.90	2.00	0.64	5.00	0.00	0.77	0.77
26.95	2.00	0.64	5.00	0.00	0.77	0.77
27.00	2.00	0.64	5.00	0.00	0.77	0.77
27.05	2.00	0.64	5.00	0.00	0.77	0.77
27.10	2.00	0.64	5.00	0.00	0.77	0.77
27.15	2.00	0.64	5.00	0.00	0.77	0.77
27.20	2.00	0.64	5.00	0.00	0.77	0.77
27.25	2.00	0.64	5.00	0.00	0.77	0.77
27.30	2.00	0.64	5.00	0.00	0.77	0.77
27.35	2.00	0.64	5.00	0.00	0.77	0.77
27.40	2.00	0.64	5.00	0.00	0.77	0.77
27.45	2.00	0.64	5.00	0.00	0.77	0.77
27.50	2.00	0.64	5.00	0.00	0.77	0.77
27.55	2.00	0.64	5.00	0.00	0.77	0.77
27.60	2.00	0.64	5.00	0.00	0.77	0.77
27.65	2.00	0.64	5.00	0.00	0.77	0.77
27.70	2.00	0.64	5.00	0.00	0.77	0.77
27.75	2.00	0.64	5.00	0.00	0.77	0.77
27.80	2.00	0.64	5.00	0.00	0.77	0.77
27.85	2.00	0.64	5.00	0.00	0.77	0.77
27.90	2.00	0.64	5.00	0.00	0.77	0.77
27.95	2.00	0.64	5.00	0.00	0.77	0.77
28.00	2.00	0.64	5.00	0.00	0.77	0.77
28.05	2.00	0.64	5.00	0.00	0.77	0.77
28.10	2.00	0.64	5.00	0.00	0.77	0.77
28.15	2.00	0.64	5.00	0.00	0.77	0.77
28.20	2.00	0.64	5.00	0.00	0.77	0.77
28.25	2.00	0.64	5.00	0.00	0.77	0.77
28.30	2.00	0.64	5.00	0.00	0.77	0.77
28.35	2.00	0.64	5.00	0.00	0.77	0.77
28.40	2.00	0.64	5.00	0.00	0.77	0.77
28.45	2.00	0.64	5.00	0.00	0.77	0.77
28.50	2.00	0.64	5.00	0.00	0.77	0.77
28.55	2.00	0.64	5.00	0.00	0.77	0.77
28.60	2.00	0.64	5.00	0.00	0.77	0.77
28.65	2.00	0.64	5.00	0.00	0.77	0.77

28.70	2.00	0.64	5.00	0.00	0.77	0.77
28.75	2.00	0.64	5.00	0.00	0.77	0.77
28.80	2.00	0.64	5.00	0.00	0.77	0.77
28.85	2.00	0.64	5.00	0.00	0.77	0.77
28.90	2.00	0.64	5.00	0.00	0.77	0.77
28.95	2.00	0.64	5.00	0.00	0.77	0.77
29.00	2.00	0.64	5.00	0.00	0.77	0.77
29.05	0.40	0.64	5.00	0.00	0.77	0.77
29.10	0.45	0.64	5.00	0.00	0.76	0.76
29.15	0.47	0.64	5.00	0.00	0.75	0.75
29.20	0.49	0.64	5.00	0.00	0.75	0.75
29.25	0.52	0.64	5.00	0.00	0.74	0.74
29.30	0.56	0.64	5.00	0.00	0.73	0.73
29.35	0.57	0.64	5.00	0.00	0.73	0.73
29.40	0.59	0.64	5.00	0.00	0.72	0.72
29.45	0.57	0.64	5.00	0.00	0.71	0.71
29.50	0.57	0.64	5.00	0.00	0.71	0.71
29.55	0.56	0.64	5.00	0.00	0.70	0.70
29.60	0.57	0.64	5.00	0.00	0.69	0.69
29.65	0.57	0.64	5.00	0.00	0.69	0.69
29.70	0.55	0.64	5.00	0.00	0.68	0.68
29.75	0.53	0.64	5.00	0.00	0.68	0.68
29.80	0.51	0.64	5.00	0.00	0.67	0.67
29.85	0.48	0.63	5.00	0.00	0.66	0.66
29.90	0.44	0.63	5.00	0.00	0.66	0.66
29.95	0.40	0.63	5.00	0.00	0.65	0.65
30.00	0.37	0.63	5.00	0.00	0.64	0.64
30.05	0.33	0.63	5.00	0.00	0.63	0.63
30.10	0.30	0.63	5.00	0.00	0.62	0.62
30.15	0.27	0.63	5.00	0.00	0.62	0.62
30.20	0.25	0.63	5.00	0.00	0.61	0.61
30.25	0.24	0.63	5.00	0.00	0.60	0.60
30.30	0.24	0.63	5.00	0.00	0.59	0.59
30.35	0.26	0.63	5.00	0.00	0.58	0.58
30.40	0.35	0.63	5.00	0.00	0.58	0.58
30.45	2.00	0.63	5.00	0.00	0.57	0.57
30.50	2.00	0.63	5.00	0.00	0.57	0.57
30.55	2.00	0.63	5.00	0.00	0.57	0.57
30.60	2.00	0.63	5.00	0.00	0.57	0.57
30.65	2.00	0.63	5.00	0.00	0.57	0.57
30.70	2.00	0.63	5.00	0.00	0.57	0.57
30.75	2.00	0.63	5.00	0.00	0.57	0.57
30.80	2.00	0.63	5.00	0.00	0.57	0.57
30.85	2.00	0.63	5.00	0.00	0.57	0.57
30.90	2.00	0.63	5.00	0.00	0.57	0.57
30.95	2.00	0.63	5.00	0.00	0.57	0.57
31.00	2.00	0.63	5.00	0.00	0.57	0.57
31.05	0.37	0.63	5.00	0.00	0.57	0.57
31.10	0.32	0.63	5.00	0.00	0.57	0.57
31.15	0.29	0.63	5.00	0.00	0.56	0.56

31.20	0.30	0.63	5.00	0.00	0.55	0.55
31.25	0.32	0.63	5.00	0.00	0.55	0.55
31.30	0.34	0.63	5.00	0.00	0.54	0.54
31.35	0.35	0.63	5.00	0.00	0.53	0.53
31.40	0.36	0.63	5.00	0.00	0.52	0.52
31.45	0.36	0.63	5.00	0.00	0.52	0.52
31.50	0.36	0.63	5.00	0.00	0.51	0.51
31.55	0.35	0.63	5.00	0.00	0.50	0.50
31.60	0.34	0.63	5.00	0.00	0.49	0.49
31.65	0.33	0.63	5.00	0.00	0.49	0.49
31.70	0.31	0.63	5.00	0.00	0.48	0.48
31.75	0.29	0.62	5.00	0.00	0.47	0.47
31.80	0.27	0.62	5.00	0.00	0.46	0.46
31.85	0.25	0.62	5.00	0.00	0.45	0.45
31.90	0.24	0.62	5.00	0.00	0.44	0.44
31.95	0.22	0.62	5.00	0.00	0.43	0.43
32.00	0.21	0.62	5.00	0.00	0.42	0.42
32.05	2.00	0.62	5.00	0.00	0.41	0.41
32.10	2.00	0.62	5.00	0.00	0.41	0.41
32.15	2.00	0.62	5.00	0.00	0.41	0.41
32.20	2.00	0.62	5.00	0.00	0.41	0.41
32.25	2.00	0.62	5.00	0.00	0.41	0.41
32.30	2.00	0.62	5.00	0.00	0.41	0.41
32.35	2.00	0.62	5.00	0.00	0.41	0.41
32.40	2.00	0.62	5.00	0.00	0.41	0.41
32.45	2.00	0.62	5.00	0.00	0.41	0.41
32.50	2.00	0.62	5.00	0.00	0.41	0.41
32.55	2.00	0.62	5.00	0.00	0.41	0.41
32.60	2.00	0.62	5.00	0.00	0.41	0.41
32.65	2.00	0.62	5.00	0.00	0.41	0.41
32.70	2.00	0.62	5.00	0.00	0.41	0.41
32.75	2.00	0.62	5.00	0.00	0.41	0.41
32.80	2.00	0.62	5.00	0.00	0.41	0.41
32.85	2.00	0.62	5.00	0.00	0.41	0.41
32.90	2.00	0.62	5.00	0.00	0.41	0.41
32.95	2.00	0.62	5.00	0.00	0.41	0.41
33.00	2.00	0.62	5.00	0.00	0.41	0.41
33.05	2.00	0.62	5.00	0.00	0.41	0.41
33.10	2.00	0.62	5.00	0.00	0.41	0.41
33.15	2.00	0.62	5.00	0.00	0.41	0.41
33.20	2.00	0.62	5.00	0.00	0.41	0.41
33.25	2.00	0.62	5.00	0.00	0.41	0.41
33.30	2.00	0.62	5.00	0.00	0.41	0.41
33.35	2.00	0.62	5.00	0.00	0.41	0.41
33.40	2.00	0.62	5.00	0.00	0.41	0.41
33.45	2.00	0.62	5.00	0.00	0.41	0.41
33.50	2.00	0.62	5.00	0.00	0.41	0.41
33.55	2.00	0.61	5.00	0.00	0.41	0.41
33.60	2.00	0.61	5.00	0.00	0.41	0.41
33.65	2.00	0.61	5.00	0.00	0.41	0.41

33.70	2.00	0.61	5.00	0.00	0.41	0.41
33.75	2.00	0.61	5.00	0.00	0.41	0.41
33.80	2.00	0.61	5.00	0.00	0.41	0.41
33.85	2.00	0.61	5.00	0.00	0.41	0.41
33.90	2.00	0.61	5.00	0.00	0.41	0.41
33.95	2.00	0.61	5.00	0.00	0.41	0.41
34.00	2.00	0.61	5.00	0.00	0.41	0.41
34.05	2.00	0.61	5.00	0.00	0.41	0.41
34.10	2.00	0.61	5.00	0.00	0.41	0.41
34.15	2.00	0.61	5.00	0.00	0.41	0.41
34.20	2.00	0.61	5.00	0.00	0.41	0.41
34.25	2.00	0.61	5.00	0.00	0.41	0.41
34.30	2.00	0.61	5.00	0.00	0.41	0.41
34.35	2.00	0.61	5.00	0.00	0.41	0.41
34.40	2.00	0.61	5.00	0.00	0.41	0.41
34.45	2.00	0.61	5.00	0.00	0.41	0.41
34.50	2.00	0.61	5.00	0.00	0.41	0.41
34.55	2.00	0.61	5.00	0.00	0.41	0.41
34.60	2.00	0.61	5.00	0.00	0.41	0.41
34.65	2.00	0.61	5.00	0.00	0.41	0.41
34.70	2.00	0.61	5.00	0.00	0.41	0.41
34.75	2.00	0.61	5.00	0.00	0.41	0.41
34.80	2.00	0.61	5.00	0.00	0.41	0.41
34.85	2.00	0.61	5.00	0.00	0.41	0.41
34.90	2.00	0.61	5.00	0.00	0.41	0.41
34.95	2.00	0.61	5.00	0.00	0.41	0.41
35.00	2.00	0.61	5.00	0.00	0.41	0.41
35.05	2.00	0.61	5.00	0.00	0.41	0.41
35.10	2.00	0.61	5.00	0.00	0.41	0.41
35.15	2.00	0.61	5.00	0.00	0.41	0.41
35.20	2.00	0.61	5.00	0.00	0.41	0.41
35.25	2.00	0.61	5.00	0.00	0.41	0.41
35.30	2.00	0.61	5.00	0.00	0.41	0.41
35.35	2.00	0.60	5.00	0.00	0.41	0.41
35.40	2.00	0.60	5.00	0.00	0.41	0.41
35.45	2.00	0.60	5.00	0.00	0.41	0.41
35.50	2.00	0.60	5.00	0.00	0.41	0.41
35.55	2.00	0.60	5.00	0.00	0.41	0.41
35.60	2.00	0.60	5.00	0.00	0.41	0.41
35.65	2.00	0.60	5.00	0.00	0.41	0.41
35.70	2.00	0.60	5.00	0.00	0.41	0.41
35.75	2.00	0.60	5.00	0.00	0.41	0.41
35.80	2.00	0.60	5.00	0.00	0.41	0.41
35.85	2.00	0.60	5.00	0.00	0.41	0.41
35.90	2.00	0.60	5.00	0.00	0.41	0.41
35.95	2.00	0.60	5.00	0.00	0.41	0.41
36.00	2.00	0.60	5.00	0.00	0.41	0.41
36.05	2.00	0.60	5.00	0.00	0.41	0.41
36.10	2.00	0.60	5.00	0.00	0.41	0.41
36.15	2.00	0.60	5.00	0.00	0.41	0.41

36.20	0.20	0.60	5.00	0.00	0.41	0.41
36.25	0.24	0.60	5.00	0.00	0.40	0.40
36.30	0.30	0.60	5.00	0.00	0.39	0.39
36.35	0.35	0.60	5.00	0.00	0.39	0.39
36.40	0.40	0.60	5.00	0.00	0.38	0.38
36.45	0.45	0.60	5.00	0.00	0.37	0.37
36.50	0.47	0.60	5.00	0.00	0.36	0.36
36.55	0.50	0.60	5.00	0.00	0.36	0.36
36.60	0.53	0.60	5.00	0.00	0.35	0.35
36.65	0.55	0.60	5.00	0.00	0.35	0.35
36.70	0.58	0.60	5.00	0.00	0.34	0.34
36.75	0.62	0.60	5.00	0.00	0.33	0.33
36.80	0.66	0.60	5.00	0.00	0.33	0.33
36.85	0.70	0.60	5.00	0.00	0.32	0.32
36.90	0.73	0.60	5.00	0.00	0.32	0.32
36.95	0.77	0.60	5.00	0.00	0.31	0.31
37.00	0.79	0.60	5.00	0.00	0.31	0.31
37.05	0.82	0.60	5.00	0.00	0.30	0.30
37.10	0.84	0.60	5.00	0.00	0.30	0.30
37.15	0.85	0.59	5.00	0.00	0.29	0.29
37.20	0.86	0.59	5.00	0.00	0.29	0.29
37.25	0.87	0.59	5.00	0.00	0.28	0.28
37.30	0.89	0.59	5.00	0.00	0.28	0.28
37.35	0.90	0.59	5.00	0.00	0.27	0.27
37.40	0.89	0.59	5.00	0.00	0.27	0.27
37.45	0.89	0.59	5.00	0.00	0.27	0.27
37.50	0.88	0.59	5.00	0.00	0.26	0.26
37.55	0.86	0.59	5.00	0.00	0.26	0.26
37.60	0.86	0.59	5.00	0.00	0.25	0.25
37.65	0.85	0.59	5.00	0.00	0.25	0.25
37.70	0.83	0.59	5.00	0.00	0.24	0.24
37.75	0.82	0.59	5.00	0.00	0.24	0.24
37.80	0.81	0.59	5.00	0.00	0.23	0.23
37.85	0.79	0.59	5.00	0.00	0.23	0.23
37.90	0.77	0.59	5.00	0.00	0.22	0.22
37.95	0.75	0.59	5.00	0.00	0.22	0.22
38.00	0.71	0.59	5.00	0.00	0.21	0.21
38.05	0.68	0.59	5.00	0.00	0.21	0.21
38.10	0.63	0.59	5.00	0.00	0.20	0.20
38.15	0.58	0.59	5.00	0.00	0.20	0.20
38.20	0.51	0.59	5.00	0.00	0.19	0.19
38.25	0.47	0.59	5.00	0.00	0.18	0.18
38.30	0.42	0.59	5.00	0.00	0.18	0.18
38.35	0.38	0.59	5.00	0.00	0.17	0.17
38.40	0.35	0.59	5.00	0.00	0.16	0.16
38.45	0.32	0.59	5.00	0.00	0.15	0.15
38.50	0.30	0.59	5.00	0.00	0.14	0.14
38.55	2.00	0.59	5.00	0.00	0.14	0.14
38.60	2.00	0.59	5.00	0.00	0.14	0.14
38.65	2.00	0.59	5.00	0.00	0.14	0.14

38.70	2.00	0.59	5.00	0.00	0.14	0.14
38.75	2.00	0.59	5.00	0.00	0.14	0.14
38.80	2.00	0.59	5.00	0.00	0.14	0.14
38.85	2.00	0.59	5.00	0.00	0.14	0.14
38.90	2.00	0.59	5.00	0.00	0.14	0.14
38.95	2.00	0.58	5.00	0.00	0.14	0.14
39.00	2.00	0.58	5.00	0.00	0.14	0.14
39.05	2.00	0.58	5.00	0.00	0.14	0.14
39.10	2.00	0.58	5.00	0.00	0.14	0.14
39.15	2.00	0.58	5.00	0.00	0.14	0.14
39.20	2.00	0.58	5.00	0.00	0.14	0.14
39.25	2.00	0.58	5.00	0.00	0.14	0.14
39.30	2.00	0.58	5.00	0.00	0.14	0.14
39.35	2.00	0.58	5.00	0.00	0.14	0.14
39.40	2.00	0.58	5.00	0.00	0.14	0.14
39.45	2.00	0.58	5.00	0.00	0.14	0.14
39.50	2.00	0.58	5.00	0.00	0.14	0.14
39.55	2.00	0.58	5.00	0.00	0.14	0.14
39.60	2.00	0.58	5.00	0.00	0.14	0.14
39.65	2.00	0.58	5.00	0.00	0.14	0.14
39.70	2.00	0.58	5.00	0.00	0.14	0.14
39.75	2.00	0.58	5.00	0.00	0.14	0.14
39.80	2.00	0.58	5.00	0.00	0.14	0.14
39.85	2.00	0.58	5.00	0.00	0.14	0.14
39.90	2.00	0.58	5.00	0.00	0.14	0.14
39.95	2.00	0.58	5.00	0.00	0.14	0.14
40.00	2.00	0.58	5.00	0.00	0.14	0.14
40.05	2.00	0.58	5.00	0.00	0.14	0.14
40.10	2.00	0.58	5.00	0.00	0.14	0.14
40.15	2.00	0.58	5.00	0.00	0.14	0.14
40.20	2.00	0.58	5.00	0.00	0.14	0.14
40.25	2.00	0.58	5.00	0.00	0.14	0.14
40.30	2.00	0.58	5.00	0.00	0.14	0.14
40.35	2.00	0.58	5.00	0.00	0.14	0.14
40.40	2.00	0.58	5.00	0.00	0.14	0.14
40.45	2.00	0.58	5.00	0.00	0.14	0.14
40.50	2.00	0.58	5.00	0.00	0.14	0.14
40.55	2.00	0.58	5.00	0.00	0.14	0.14
40.60	2.00	0.58	5.00	0.00	0.14	0.14
40.65	2.00	0.58	5.00	0.00	0.14	0.14
40.70	2.00	0.58	5.00	0.00	0.14	0.14
40.75	2.00	0.57	5.00	0.00	0.14	0.14
40.80	2.00	0.57	5.00	0.00	0.14	0.14
40.85	2.00	0.57	5.00	0.00	0.14	0.14
40.90	2.00	0.57	5.00	0.00	0.14	0.14
40.95	2.00	0.57	5.00	0.00	0.14	0.14
41.00	2.00	0.57	5.00	0.00	0.14	0.14
41.05	2.00	0.57	5.00	0.00	0.14	0.14
41.10	2.00	0.57	5.00	0.00	0.14	0.14
41.15	2.00	0.57	5.00	0.00	0.14	0.14

41.20	2.00	0.57	5.00	0.00	0.14	0.14
41.25	2.00	0.57	5.00	0.00	0.14	0.14
41.30	2.00	0.57	5.00	0.00	0.14	0.14
41.35	2.00	0.57	5.00	0.00	0.14	0.14
41.40	2.00	0.57	5.00	0.00	0.14	0.14
41.45	2.00	0.57	5.00	0.00	0.14	0.14
41.50	2.00	0.57	5.00	0.00	0.14	0.14
41.55	2.00	0.57	5.00	0.00	0.14	0.14
41.60	2.00	0.57	5.00	0.00	0.14	0.14
41.65	2.00	0.57	5.00	0.00	0.14	0.14
41.70	2.00	0.57	5.00	0.00	0.14	0.14
41.75	2.00	0.57	5.00	0.00	0.14	0.14
41.80	2.00	0.57	5.00	0.00	0.14	0.14
41.85	2.00	0.57	5.00	0.00	0.14	0.14
41.90	2.00	0.57	5.00	0.00	0.14	0.14
41.95	2.00	0.57	5.00	0.00	0.14	0.14
42.00	2.00	0.57	5.00	0.00	0.14	0.14
42.05	2.00	0.57	5.00	0.00	0.14	0.14
42.10	2.00	0.57	5.00	0.00	0.14	0.14
42.15	2.00	0.57	5.00	0.00	0.14	0.14
42.20	2.00	0.57	5.00	0.00	0.14	0.14
42.25	2.00	0.57	5.00	0.00	0.14	0.14
42.30	2.00	0.57	5.00	0.00	0.14	0.14
42.35	0.34	0.57	5.00	0.00	0.14	0.14
42.40	0.34	0.57	5.00	0.00	0.13	0.13
42.45	0.35	0.57	5.00	0.00	0.13	0.13
42.50	0.38	0.57	5.00	0.00	0.13	0.13
42.55	0.45	0.56	5.00	0.00	0.13	0.13
42.60	0.55	0.56	5.00	0.00	0.12	0.12
42.65	0.62	0.56	5.00	0.00	0.12	0.12
42.70	0.69	0.56	5.00	0.00	0.12	0.12
42.75	0.73	0.56	5.00	0.00	0.12	0.12
42.80	0.77	0.56	5.00	0.00	0.12	0.12
42.85	0.76	0.56	5.00	0.00	0.12	0.12
42.90	0.74	0.56	5.00	0.00	0.11	0.11
42.95	0.68	0.56	5.00	0.00	0.11	0.11
43.00	0.62	0.56	5.00	0.00	0.11	0.11
43.05	2.00	0.56	5.00	0.00	0.11	0.11
43.10	2.00	0.56	5.00	0.00	0.11	0.11
43.15	2.00	0.56	5.00	0.00	0.11	0.11
43.20	2.00	0.56	5.00	0.00	0.11	0.11
43.25	2.00	0.56	5.00	0.00	0.11	0.11
43.30	2.00	0.56	5.00	0.00	0.11	0.11
43.35	2.00	0.56	5.00	0.00	0.11	0.11
43.40	2.00	0.56	5.00	0.00	0.11	0.11
43.45	2.00	0.56	5.00	0.00	0.11	0.11
43.50	2.00	0.56	5.00	0.00	0.11	0.11
43.55	2.00	0.56	5.00	0.00	0.11	0.11
43.60	2.00	0.56	5.00	0.00	0.11	0.11
43.65	2.00	0.56	5.00	0.00	0.11	0.11

43.70	2.00	0.56	5.00	0.00	0.11	0.11
43.75	2.00	0.56	5.00	0.00	0.11	0.11
43.80	2.00	0.56	5.00	0.00	0.11	0.11
43.85	2.00	0.56	5.00	0.00	0.11	0.11
43.90	2.00	0.56	5.00	0.00	0.11	0.11
43.95	2.00	0.56	5.00	0.00	0.11	0.11
44.00	2.00	0.56	5.00	0.00	0.11	0.11
44.05	2.00	0.56	5.00	0.00	0.11	0.11
44.10	2.00	0.56	5.00	0.00	0.11	0.11
44.15	2.00	0.56	5.00	0.00	0.11	0.11
44.20	2.00	0.56	5.00	0.00	0.11	0.11
44.25	2.00	0.56	5.00	0.00	0.11	0.11
44.30	2.00	0.56	5.00	0.00	0.11	0.11
44.35	2.00	0.55	5.00	0.00	0.11	0.11
44.40	2.00	0.55	5.00	0.00	0.11	0.11
44.45	2.00	0.55	5.00	0.00	0.11	0.11
44.50	2.00	0.55	5.00	0.00	0.11	0.11
44.55	2.00	0.55	5.00	0.00	0.11	0.11
44.60	2.00	0.55	5.00	0.00	0.11	0.11
44.65	2.00	0.55	5.00	0.00	0.11	0.11
44.70	2.00	0.55	5.00	0.00	0.11	0.11
44.75	2.00	0.55	5.00	0.00	0.11	0.11
44.80	2.00	0.55	5.00	0.00	0.11	0.11
44.85	2.00	0.55	5.00	0.00	0.11	0.11
44.90	2.00	0.55	5.00	0.00	0.11	0.11
44.95	2.00	0.55	5.00	0.00	0.11	0.11
45.00	2.00	0.55	5.00	0.00	0.11	0.11
45.05	2.00	0.55	5.00	0.00	0.11	0.11
45.10	2.00	0.55	5.00	0.00	0.11	0.11
45.15	2.00	0.55	5.00	0.00	0.11	0.11
45.20	2.00	0.55	5.00	0.00	0.11	0.11
45.25	2.00	0.55	5.00	0.00	0.11	0.11
45.30	2.00	0.55	5.00	0.00	0.11	0.11
45.35	2.00	0.55	5.00	0.00	0.11	0.11
45.40	2.00	0.55	5.00	0.00	0.11	0.11
45.45	2.00	0.55	5.00	0.00	0.11	0.11
45.50	2.00	0.55	5.00	0.00	0.11	0.11
45.55	2.00	0.55	5.00	0.00	0.11	0.11
45.60	0.37	0.55	5.00	0.00	0.11	0.11
45.65	0.41	0.55	5.00	0.00	0.11	0.11
45.70	0.44	0.55	5.00	0.00	0.10	0.10
45.75	0.44	0.55	5.00	0.00	0.10	0.10
45.80	0.43	0.55	5.00	0.00	0.10	0.10
45.85	0.42	0.55	5.00	0.00	0.09	0.09
45.90	0.41	0.55	5.00	0.00	0.09	0.09
45.95	0.39	0.55	5.00	0.00	0.09	0.09
46.00	0.37	0.55	5.00	0.00	0.08	0.08
46.05	0.35	0.55	5.00	0.00	0.08	0.08
46.10	0.34	0.55	5.00	0.00	0.08	0.08
46.15	0.32	0.54	5.00	0.00	0.07	0.07

46.20	0.32	0.54	5.00	0.00	0.07	0.07
46.25	0.32	0.54	5.00	0.00	0.07	0.07
46.30	0.32	0.54	5.00	0.00	0.07	0.07
46.35	0.33	0.54	5.00	0.00	0.06	0.06
46.40	0.34	0.54	5.00	0.00	0.06	0.06
46.45	0.35	0.54	5.00	0.00	0.06	0.06
46.50	0.36	0.54	5.00	0.00	0.06	0.06
46.55	0.36	0.54	5.00	0.00	0.05	0.05
46.60	0.35	0.54	5.00	0.00	0.05	0.05
46.65	0.36	0.54	5.00	0.00	0.05	0.05
46.70	0.41	0.54	5.00	0.00	0.05	0.05
46.75	2.00	0.54	5.00	0.00	0.05	0.05
46.80	2.00	0.54	5.00	0.00	0.05	0.05
46.85	2.00	0.54	5.00	0.00	0.05	0.05
46.90	2.00	0.54	5.00	0.00	0.05	0.05
46.95	2.00	0.54	5.00	0.00	0.05	0.05
47.00	2.00	0.54	5.00	0.00	0.05	0.05
47.05	2.00	0.54	5.00	0.00	0.05	0.05
47.10	2.00	0.54	5.00	0.00	0.05	0.05
47.15	2.00	0.54	5.00	0.00	0.05	0.05
47.20	2.00	0.54	5.00	0.00	0.05	0.05
47.25	2.00	0.54	5.00	0.00	0.05	0.05
47.30	2.00	0.54	5.00	0.00	0.05	0.05
47.35	2.00	0.54	5.00	0.00	0.05	0.05
47.40	2.00	0.54	5.00	0.00	0.05	0.05
47.45	2.00	0.54	5.00	0.00	0.05	0.05
47.50	2.00	0.54	5.00	0.00	0.05	0.05
47.55	2.00	0.54	5.00	0.00	0.05	0.05
47.60	2.00	0.54	5.00	0.00	0.05	0.05
47.65	2.00	0.54	5.00	0.00	0.05	0.05
47.70	2.00	0.54	5.00	0.00	0.05	0.05
47.75	2.00	0.54	5.00	0.00	0.05	0.05
47.80	2.00	0.54	5.00	0.00	0.05	0.05
47.85	2.00	0.54	5.00	0.00	0.05	0.05
47.90	2.00	0.54	5.00	0.00	0.05	0.05
47.95	2.00	0.53	5.00	0.00	0.05	0.05
48.00	2.00	0.53	5.00	0.00	0.05	0.05
48.05	2.00	0.53	5.00	0.00	0.05	0.05
48.10	2.00	0.53	5.00	0.00	0.05	0.05
48.15	2.00	0.53	5.00	0.00	0.05	0.05
48.20	2.00	0.53	5.00	0.00	0.05	0.05
48.25	2.00	0.53	5.00	0.00	0.05	0.05
48.30	2.00	0.53	5.00	0.00	0.05	0.05
48.35	2.00	0.53	5.00	0.00	0.05	0.05
48.40	2.00	0.53	5.00	0.00	0.05	0.05
48.45	2.00	0.53	5.00	0.00	0.05	0.05
48.50	2.00	0.53	5.00	0.00	0.05	0.05
48.55	2.00	0.53	5.00	0.00	0.05	0.05
48.60	2.00	0.53	5.00	0.00	0.05	0.05
48.65	2.00	0.53	5.00	0.00	0.05	0.05

48.70	2.00	0.53	5.00	0.00	0.05	0.05
48.75	2.00	0.53	5.00	0.00	0.05	0.05
48.80	2.00	0.53	5.00	0.00	0.05	0.05
48.85	2.00	0.53	5.00	0.00	0.05	0.05
48.90	2.00	0.53	5.00	0.00	0.05	0.05
48.95	2.00	0.53	5.00	0.00	0.05	0.05
49.00	2.00	0.53	5.00	0.00	0.05	0.05
49.05	2.00	0.53	5.00	0.00	0.05	0.05
49.10	2.00	0.53	5.00	0.00	0.05	0.05
49.15	2.00	0.53	5.00	0.00	0.05	0.05
49.20	2.00	0.53	5.00	0.00	0.05	0.05
49.25	0.22	0.53	5.00	0.00	0.05	0.05
49.30	0.22	0.53	5.00	0.00	0.04	0.04
49.35	0.29	0.53	5.00	0.00	0.04	0.04
49.40	0.35	0.53	5.00	0.00	0.03	0.03
49.45	0.42	0.53	5.00	0.00	0.03	0.03
49.50	0.50	0.53	5.00	0.00	0.03	0.03
49.55	0.57	0.53	5.00	0.00	0.02	0.02
49.60	0.59	0.53	5.00	0.00	0.02	0.02
49.65	0.58	0.53	5.00	0.00	0.02	0.02
49.70	0.58	0.53	5.00	0.00	0.02	0.02
49.75	0.56	0.52	5.00	0.00	0.01	0.01
49.80	0.54	0.52	5.00	0.00	0.01	0.01
49.85	0.50	0.52	5.00	0.00	0.01	0.01
49.90	0.46	0.52	5.00	0.00	0.01	0.01
49.95	0.43	0.52	5.00	0.00	0.00	0.00
50.00	0.43	0.52	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

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CRRm Cyclic resistance ratio from soils
CSRfs Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRfs
S_sat Settlement from saturated sands
S_dry Settlement from dry sands
S_all Total settlement from saturated and dry sands
NoLiq No-Liquefy Soils

APPENDIX D

STANDARD SPECIFICATIONS FOR GRADING AND TRENCH BACKFILL

RECOMMENDED EARTHWORK SPECIFICATIONS

The following specifications are recommended to provide a basis for quality control during the placement of compacted fill or backfill as applicable.

1. Areas that are to receive compacted fill shall be observed by Soil/Geotechnical Engineer (GE) or his/her representative prior to the placement of fill.

2. All drainage devices shall be properly installed and observed by GE and/or owner's representative(s) prior to placement of backfill.

3. Fill soils shall consist of imported soils or on-site soils free of organics, cobbles, and deleterious material provided each material is approved by GE. GE shall evaluate and/or test the import material for its conformance with the report recommendations prior to its delivery to the site. The contractor shall notify GE 72 hours prior to importing material to the site

4. Fill shall be placed in controlled layers (lifts), the thickness of which is compatible with the type of compaction equipment used. The fill materials shall be brought to optimum moisture content or above, thoroughly mixed during spreading to obtain a near uniform moisture condition and uniform blend of materials, and then placed in layers with a thickness (loose) not exceeding 8 inches. Each layer shall be compacted to a minimum compaction of 90% relative to the maximum dry density determined per the latest ASTM D1557 test. Density testing shall be performed by GE to verify relative compaction. The contractor shall provide proper access and level areas for testing.

5. Rocks or rock fragments less than eight (8) inches in the largest dimension may be utilized in the fill, provided they are not placed in concentrated pockets, except rocks larger than four (4) inches shall not be placed within three (3) feet of finish grade.

6. Rocks greater than eight (8) inches in largest dimension shall be taken offsite, or placed in accordance with the recommendation of the Soils Engineer in areas designated as suitable for rock disposal.

7. Where space limitations do not allow for conventional fill compaction operations, special backfill materials and procedures may be required. Pea gravel or other select fill can be used in areas of limited space. A sand and Portland cement slurry (2 sacks per cubic-yard mix) shall be used in limited space areas for shallow backfill near final pad grade, and pea gravel shall be placed in deeper backfill near drainage systems.

8. GE shall observe the placement of fill and conduct in-place field density tests on the compacted fill to check for adequate moisture content and the required relative compaction. Where less than specified relative compaction is indicated, additional compacting effort shall be applied and the soil moisture conditioned as necessary until adequate relative compaction is attained.

9. The Contractor shall comply with the minimum relative compaction out to the finish slope face of fill slopes, buttresses, and stabilization fills as set forth in the specifications for compacted fill. This may be achieved by either overbuilding the slope and cutting back as necessary, or by direct compaction of the slope face with suitable equipment, or by any other procedure that produces the required result.

10. Any abandoned underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipelines or others not discovered prior to grading are to be removed or treated to the satisfaction of the Soils Engineer and/or the controlling agency for the project.

11. The Contractor shall have suitable and sufficient equipment during a particular operation to handle the volume of fill being placed. When necessary, fill placement equipment shall be shut down temporarily in order to permit proper compaction of fills, correction of deficient areas, or to facilitate required field-testing.

12. The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications.

13. Final reports shall be submitted after completion of earthwork and after the Soils Engineer and Engineering Geologist have finished their observations of the work. No additional excavation or filling shall be performed without prior notification to the Soils Engineer and/or Engineering Geologist.

14. Whenever the words “supervision”, “inspection” or “control” are used, they shall mean <u>observation</u> of the work and/or testing of the compacted fill by GE to assess whether substantial compliance with plans, specifications and design concepts has been achieved, and does not include direction of the actual work of the contractor or the contractor’s workmen.

RECOMMENDED SPECIFICATIONS FOR PLACEMENT OF TRENCH BACKFILL

1. Trench excavations to receive backfill shall be free of trash, debris or other unsatisfactory materials prior to backfill placement, and shall be observed by project soil/geotechnical engineer (GE) representative.

2. Except as stipulated herein, soils obtained from the excavation may be used as backfill if they are essentially free of organics and deleterious materials.

3. Rocks generated from the trench excavation not exceeding three (3) inches in largest dimension may be used as backfill material. However, such material may not be placed within 12 inches of the top of the pipeline. No more than 30 percent of the backfill volume shall contain particles larger than 1-½ inches in diameter, and rocks shall be well mixed with finer soil.

4. Soils (other than aggregates) with a Sand Equivalent (SE) greater than or equal to 30, as determined by ASTM D 2419 Standard Test Method or at the discretion of the engineer or representative in the field, may be used for bedding and shading material in the pipe zone areas. These soils are considered satisfactory for compaction by jetting procedures.

5. No jetting will be permitted in utility trenches within the top 2 feet of the subgrade of concrete slabs-on-grade.

6. Trench backfill other than bedding and shading shall be compacted by mechanical methods as tamping sheepsfoot, vibrating or pneumatic rollers or other mechanical tampers to achieve the density specified herein. The backfill materials shall be brought to optimum moisture content or above, thoroughly mixed during spreading to obtain a near uniform moisture condition and uniform blend of materials, and then placed in horizontal layers with a thickness (loose) not exceeding 8 inches. Trench backfills shall be compacted to a minimum compaction of 90 percent relative to the maximum dry density determined per the latest ASTM D1557 test.

7. The contractor shall select the equipment and process to be used to achieve the specified density without damage to the pipeline, the adjacent ground, existing improvements or completed work.

8. Observations and field tests shall be carried on during construction by GE to confirm that the required degree of compaction has been obtained. Where compaction is less than that specified, additional compaction effort shall be made with adjustment of the moisture content as necessary until the specified compaction is obtained. Field density tests may be omitted at the discretion of the engineer or his representative in the field.

9. Whenever, in the opinion of GE or the Owner's Representative(s), an unstable condition is being created, either by cutting or filling, the work shall not proceed until an investigation has been made and the excavation plan revised, if deemed necessary.

10. Fill material shall not be placed, spread, or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests by GE indicate the moisture content and density of the fill are as specified.

11. Whenever the words "supervision", "inspection", or "control" are used, they shall mean <u>observation</u> of the work and/or testing of the compacted fill by GE to assess whether substantial compliance with plans, specifications and design concepts has been achieved.