CITY OF IMPERIAL BEACH

PRIORITY DEVELOPMENT PROJECT (PDP)
STORM WATER QUALITY MANAGEMENT PLAN (SWQMP)
FOR
BLUE WAVE
PERMIT APPLICATION NUMBER: XXXX (Pending)

550 HIGHWAY 75
IMPERIAL BEACH, CA 91932

ASSESSOR'S PARCEL NUMBER(S):
APN # 625-140-08-00

ENGINEER OF WORK:

_____

DR. LUIS PARRA, RCE# 66377 EXP. 6/30/2020

PREPARED FOR:

BLUE WAVE ENTERPRISE, LLC
11273 CAMINTO ACLARA
SAN DIEGO, CA 92126

PDP SWQMP PREPARED BY:

REC CONSULTANTS, INC.
27349 JEFFERSON AVE, STE. 112
TEMECULA, CA 92590
(951) 693-2400

DATE OF SWQMP:
November 15, 2018

PLANS PREPARED BY:
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SAN DIEGO, CA 92121
(858) 558-4500

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ACRONYMS

APN	Assessor's Parcel Number
BMP	Best Management Practice
HMP	Hydromodification Management Plan
HSG	Hydrologic Soil Group
MS4	Municipal Separate Storm Sewer System
N/A	Not Applicable
NRCS	Natural Resources Conservation Service
PDP	Priority Development Project
PE	Professional Engineer
SC	Source Control
SD	Site Design
SDRWQCB	San Diego Regional Water Quality Control Board
SIC	Standard Industrial Classification
SWQMP	Storm Water Quality Management Plan

PDP SWQMP PREPARER'S CERTIFICATION PAGE

Project Name: Blue Wave
Permit Application Number:

PREPARER'S CERTIFICATION

I hereby declare that I am the Engineer in Responsible Charge of design of storm water best management practices (BMPs) for this project, and that I have exercised responsible charge over the design of the BMPs as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the PDP requirements of the City of Imperial Beach BMP Design Manual, which is a design manual for compliance with local City of Imperial Beach and regional MS4 Permit (California Regional Water Quality Control Board San Diego Region Order No. R9-2015-0100) requirements for storm water management.

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

RCE# 66377, Exp. 6/30/2020

_____

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

Dr. Luis Parra, RCE# 66377, Exp. 6/30/2020

_____

Print Name

REC Consultants, Inc.

_____

Company

_____

Date

Engineer's Seal:

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PDP SWQMP PROJECT OWNER'S CERTIFICATION PAGE

Project Name: Blue Wave
Permit Application Number:

PROJECT OWNER'S CERTIFICATION

This PDP SWQMP has been prepared for Blue Wave Enterprise, LLC by REC Consultants, Inc. The PDP SWQMP is intended to comply with the PDP requirements of the City of Imperial Beach BMP Design Manual, which is a design manual for compliance with local City of Imperial Beach and regional MS4 Permit (California Regional Water Quality Control Board San Diego Region Order No. R9-2015-0100) requirements for storm water management.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan. Once the undersigned transfers its interests in the property, its successor-in-interest shall bear the aforementioned responsibility to implement the best management practices (BMPs) described within this plan, including ensuring on-going operation and maintenance of structural BMPs. A signed copy of this document shall be available on the subject property into perpetuity.

_____
Project Owner's Signature

_____
Print Name

Blue Wave Enterprise, LLC._____
Company

_____
Date

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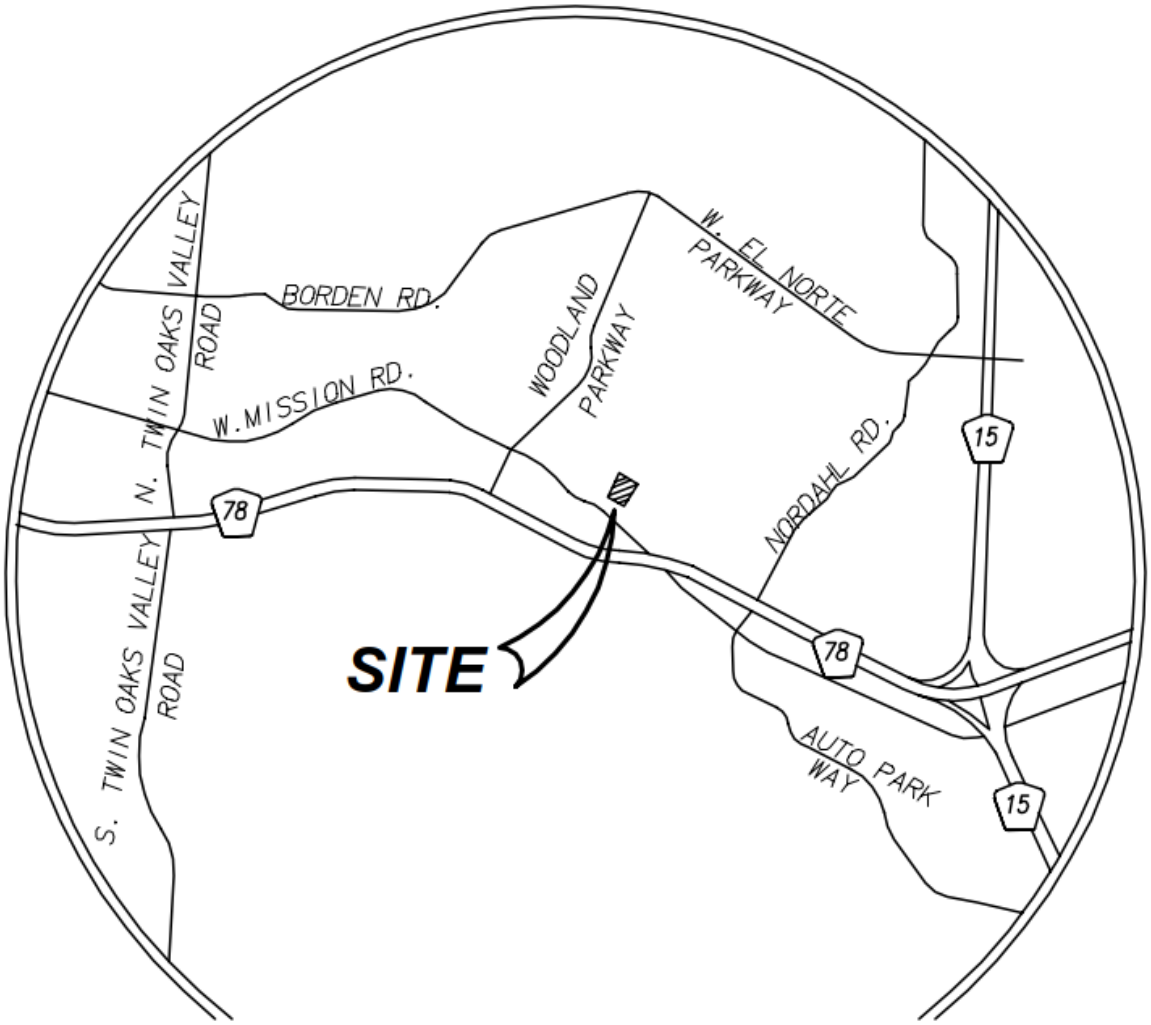
SUBMITTAL RECORD

Use this Table to keep a record of submittals of this PDP SWQMP. Each time the PDP SWQMP is re-submitted, provide the date and status of the project. In column 4 summarize the changes that have been made or indicate if response to plancheck comments is included. When applicable, insert response to plancheck comments behind this page.

Submittal Number	Date	Project Status	Summary of Changes
1	08/24/2018	☑ Preliminary Design / Planning/ CEQA ☐ Final Design	Initial Submittal
2	11/15/18	☑ Preliminary Design / Planning/ CEQA ☐ Final Design	Second Review
3		☐ Preliminary Design / Planning/ CEQA ☐ Final Design	
4		☐ Preliminary Design / Planning/ CEQA ☐ Final Design	

PROJECT VICINITY MAP

Project Name: Blue Wave
Permit Application Number:



VICINITY MAP

NTS

Applicability of Storm Water Best Management Practices (BMP) Requirements

(Storm Water Intake Form for all Development Permit Applications)

Form I-1
[March 15, 2016]

Project Identification

Project Name: Blue Wave

Description: The currently undeveloped project site is 1.31 acres proposes the construction of a commercial and residential development inclusive of open space, sidewalks and recreational areas. Access to the site will be via an entrance from the adjacent Highway 75 to the south of the project site.

Permit Application Number (if applicable): | Date: August 2018

Project Address: 550 Highway 75, Imperial Beach, CA 91932

Determination of Requirements

This form is required as part of the City's application process. The purpose of this form is to identify potential land development planning storm water requirements that apply to development projects.

Development projects are defined as construction, rehabilitation, redevelopment, or reconstruction of any public or private projects. In addition, the identification of a development project, as it relates to storm water regulations, would truly apply to development and redevelopment activities that have the potential to contact storm water and contribute a source of pollutants, or reduce the natural absorption and infiltration abilities of the land.

To access the BMP Design Manual, Storm Water Quality Management Plan (SWQMP) templates, and other pertinent information related to this program please refer to:
http://www.san-marcos.net/departments/development-services/stormwater/development-planning

Please answer each of the following steps below, starting with Step 1 and progressing through each step until reaching "Stop".

Step	Answer	Progression
Step 1: Based on the above, Is the project a "development project" (See definition above)? See Section 1.3 of the BMP Design Manual for further guidance if necessary.	☑ Yes	Go to Step 2.
	☐ No	Permanent BMP requirements do not apply. No SWQMP will be required. Provide brief discussion below. **STOP.**
Discussion / justification if the project is not a "development project" (e.g., the project includes *only* interior remodels within an existing building):		
Step 2: Is the project a Standard Project, Priority Development Project (PDP), or exception to PDP definitions? **To answer this item, complete Form I-2, Project Type Determination. See Section 1.4 of the BMP Design Manual *in its entirety* for guidance.** **In addition to Section 1.4, please refer to the City's SWQMP Submittal Requirements form.**	☐ Standard Project	Only Standard Project requirements apply, including Standard Project SWQMP. **STOP.**
	☑ PDP	Standard and PDP requirements apply, including PDP SWQMP. **Go to Step 3 on the following page.**
	☐ Exception to PDP definitions	Standard Project requirements apply, and any additional requirements specific to the type of project. Provide discussion and list any additional requirements below. Prepare Standard Project SWQMP. **STOP.**
Discussion / justification, and additional requirements for exceptions to PDP definitions, if applicable:		

Form I-1 Page 2, Form Date: March 15, 2016		
Step 3 (PDPs only). Please answer the list of questions in this section to determine if hydromodification requirements reply to the proposed PDP. Does the project:		
Step 3a. Discharge storm water runoff directly to the Pacific Ocean?	☐ Yes	**STOP**. Hydromodification requirements do not apply.
	☑ No	Continue to Step 3b.
Step 3b. Discharge storm water runoff directly to an enclosed embayment, not within protected areas?	☑ Yes	**STOP**. Hydromodification requirements do not apply.
	☐ No	Continue to Step 3c.
Step 3c. Discharge storm water runoff directly to a water storage reservoir or lake, below spillway or normal operating level?	☐ Yes	**STOP**. Hydromodification requirements do not apply.
	☐ No	Continue to Step 3d.
Step 3d. Discharge storm water runoff directly to an area identified in WMAA?	☐ Yes	**STOP**. Hydromodification requirements do not apply.
	☐ No	Hydromodification requirements apply to the project. Go to Step 4.
Discussion / justification if hydromodification control requirements do <u>not</u> apply:		
Step 4 (PDPs subject to hydromodification control requirements only). Does protection of critical coarse sediment yield areas apply based on review of WMAA Potential Critical Coarse Sediment Yield Area Map? See Section 6.2 of the BMP Design Manual for guidance.	☐ Yes	Management measures required for protection of critical coarse sediment yield areas (Chapter 6.2). Stop.
	☑ No	Management measures not required for protection of critical coarse sediment yield areas. Provide brief discussion below. Stop. The WMAA map was overlaid on to the site location and determined that it was not located within an area requiring preservation of critical coarse sediment. See exhibit in Attachment 2b for graphical representation of overlay.

Project Type Determination Checklist			Form I-2 [March 15, 2016]
Project Information			
Project Name/Description: Blue Wave			
Permit Application Number (if applicable):			Date: August 2018
Project Address: 550 Highway 75, Imperial Beach, CA 91932			
Project Type Determination: Standard Project or Priority Development Project (PDP)			
The project is (select one): ☑ New Development ☐ Redevelopment			
The total proposed newly created or replaced impervious area is: _48,724_ ft^2 (_1.12___) acres			
Is the project in any of the following categories, (a) through (f)?			
Yes ☑	No ☐	(a)	New development projects that create 10,000 square feet or more of impervious surfaces (collectively over the entire project site). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
Yes ☐	No ☑	(b)	Redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site on an existing site of 10,000 square feet or more of impervious surfaces). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
Yes ☑	No ☐	(c)	New and redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site), and support one or more of the following uses: (i) Restaurants. This category is defined as a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (Standard Industrial Classification (SIC) code 5812). (ii) Hillside development projects. This category includes development on any natural slope that is twenty-five percent or greater. (iii) Parking lots. This category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce. (iv) Streets, roads, highways, freeways, and driveways. This category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles.

Form I-2 Page 2, Form Date: March 15, 2016			
Yes ☐	No ☑	(d)	New or redevelopment projects that create and/or replace 2,500 square feet or more of impervious surface (collectively over the entire project site), and discharging directly to an Environmentally Sensitive Area (ESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands). *Note: ESAs are areas that include but are not limited to all Clean Water Act Section 303(d) impaired water bodies; areas designated as Areas of Special Biological Significance by the State Water Board and San Diego Water Board; State Water Quality Protected Areas; water bodies designated with the RARE beneficial use by the State Water Board and San Diego Water Board; and any other equivalent environmentally sensitive areas which have been identified by the Copermittees. See BMP Design Manual Section 1.4.2 for additional guidance.*
Yes ☐	No ☑	(e)	New development projects, or redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface, that support one or more of the following uses: (i) Automotive repair shops. This category is defined as a facility that is categorized in any one of the following SIC codes: 5013, 5014, 5541, 7532-7534, or 7536-7539. (ii) Retail gasoline outlets (RGOs). This category includes RGOs that meet the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day.
Yes ☑	No ☐	(f)	New or redevelopment projects that result in the disturbance of one or more acres of land and are expected to generate pollutants post construction. *Note: See BMP Design Manual Section 1.4.2 for additional guidance.*

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

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

☑ Yes – the project is a Priority Development Project (PDP).

The following is for redevelopment PDPs only:

The area of existing (pre-project) impervious area at the project site is: 4,589 ft^2 (A)

The total proposed newly created or replaced impervious area is 48,724 ft^2 (B)

Percent impervious surface created or replaced (B/A)*100: 1061 %

The percent impervious surface created or replaced is (select one based on the above calculation):

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

OR

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

Site Information Checklist For PDPs	Form I-3B (PDPs) [March 15, 2016]
Project Summary Information	
Project Name	Blue Wave
Project Address	550 Highway 75, Imperial Beach, CA 91932
Assessor's Parcel Number(s) (APN(s))	625-140-08-00, 626-070-033-00
Permit Application Number	
Project Hydrologic Unit	Select One: ☐ Santa Margarita 902 ☐ San Luis Rey 903 ☐ Carlsbad 904 ☐ San Dieguito 905 ☐ Penasquitos 906 ☐ San Diego 907 ☐ Pueblo San Diego 908 ☐ Sweetwater 909 ☑ Otay 910 ☐ Tijuana 911
Project Watershed (Complete Hydrologic Unit, Area, and Subarea Name with Numeric Identifier)	Otay Hydrologic Unit Otay Valley Hydrologic Area (910.2)
Parcel Area (total area of Assessor's Parcel(s) associated with the project)	___1.31_ Acres (_____57,000____ Square Feet)
Area to be Disturbed by the Project (Project Area)	__1.33__ Acres (_____57,9348 ___ Square Feet)
Project Proposed Impervious Area (subset of Project Area)	__1.12__ Acres (_____48,724____ Square Feet)
Project Proposed Pervious Area (subset of Project Area)	__0.28__ Acres (_____9,211_____ Square Feet)
Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Parcel Area. The developed area is greater than the parcel size as a portion of SR-75 is to be improved as part of the entrance to the project site. This improvement area will be intercepted by the site and treated onsite.	

Description of Existing Site Condition

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

☑ Existing development
☐ Previously graded but not built out
☐ Demolition completed without new construction
☐ Agricultural or other non-impervious use
☑ Vacant, undeveloped/natural

Description / Additional Information:
The site is currently a vacant lot inclusive of light vegetation with a smaller developed single family residence located to the east of the main vacant lot Runoff drains via overland flow in a north westerly direction towards the adjacent development north of the project site, ultimately draining to the salt ponds/San Diego Bay to the north of the project site.

Existing Land Cover Includes (select all that apply):

☑ Vegetative Cover
☐ Non-Vegetated Pervious Areas
☑ Impervious Areas

Description / Additional Information:
The impervious surfaces on the site includes roof, sidewalk, and asphalt (parking). The pervious surfaces consist of vegetated grass areas.

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

☐ NRCS Type A
☐ NRCS Type B
☐ NRCS Type C
☑ NRCS Type D

Approximate Depth to Groundwater (GW):

☐ GW Depth < 5 feet
☐ 5 feet < GW Depth < 10 feet
☑ 10 feet < GW Depth < 20 feet
☐ GW Depth > 20 feet

Existing Natural Hydrologic Features (select all that apply):

☐ Watercourses
☐ Seeps
☐ Springs
☐ Wetlands
☑ None

Description / Additional Information:
The site is currently sparsely vegetated with no onsite hydrologic features.

Description of Existing Site Drainage Patterns

How is storm water runoff conveyed from the site? At a minimum, this description should answer:
(1) whether existing drainage conveyance is natural or urban;
(2) Is runoff from offsite conveyed through the site? if yes, quantify all offsite drainage areas, design flows, and locations where offsite flows enter the project site, and summarize how such flows are conveyed through the site;
(3)Provide details regarding existing project site drainage conveyance network, including any existing storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural or constructed channels; and
(4) Identify all discharge locations from the existing project site along with a summary of conveyance system size and capacity for each of the discharge locations. Provide summary of the pre-project drainage areas and design flows to each of the existing runoff discharge locations.

Describe existing site drainage patterns:

The site is currently a vacant lot inclusive of light vegetation with a smaller developed single family residence located to the east of the main vacant lot. Runoff drains via overland flow in a north westerly direction towards the adjacent development north of the project site, ultimately draining to the salt ponds/San Diego Bay to the north of the project site.

The existing discharge location from the site is located at the northwest corner the site adjacent to the northern development. Per the TM Drainage Study for Blue Wave prepared by REC Consultants (November 2018), the existing condition peak flowrate generated from the site is 1.7 cfs.

Description of Proposed Site Development

Project Description / Proposed Land Use and/or Activities:
The project proposes the construction of a commercial and residential development inclusive of open space, sidewalks and recreational areas. Access to the site will be via an entrance from the adjacent Highway 75 to the south of the project site.

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

The impervious features of the site include roofs, patios, asphalt roadway, parking stalls, and sidewalk.

List/describe proposed pervious features of the project (e.g., landscape areas):
The site proposes to include pervious features such as landscaped open spaces.

Does the project include grading and changes to site topography?
☑ Yes
☐ No

Description / Additional Information:
The site will require minor grading. However, the general drainage patterns will be maintained.

Description of Proposed Site Drainage Patterns

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

☑ Yes

☐ No

If yes, provide details regarding the proposed project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural or constructed channels, and the method for conveying offsite flows through or around the proposed project site. Identify all discharge locations from the proposed project site along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide a summary of pre- and post-project drainage areas and design flows to each of the runoff discharge locations. Reference the drainage study for detailed calculations.

Describe proposed site drainage patterns:

Runoff from the majority of the proposed project site will be intercepted by an onsite storm drain system and conveyed to an underground detention vault located within the northwest corner of the project site. Peak flows are mitigated by this detention vault and are then discharged via storm drain to the existing storm drain system located within the adjacent Highway 75 to the south of the project site.

A portion of the frontage of the project site is unable to discharge to this aforementioned detention system and drains directly to the existing storm drain system within Highway 75.

Ultimately the peak flow from the project site is mitigated by the detention vault such that post developed condition flows are equal to those experienced in the current existing condition.

Please refer to the TM Drainage Study for Blue Wave prepared by REC Consultants, dated November 2018.

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

- ☑ On-site storm drain inlets
- ☑Interior floor drains and elevator shaft sump pumps
- ☑ Interior parking garages
- ☑ Need for future indoor & structural pest control
- ☑ Landscape/Outdoor Pesticide Use
- ☑ Pools, spas, ponds, decorative fountains, and other water features
- ☑ Food service
- ☐ Refuse areas
- ☐ Industrial processes
- ☐ Outdoor storage of equipment or materials
- ☐ Vehicle and Equipment Cleaning
- ☐ Vehicle/Equipment Repair and Maintenance
- ☐ Fuel Dispensing Areas
- ☐ Loading Docks
- ☑ Fire Sprinkler Test Water
- ☐ Miscellaneous Drain or Wash Water
- ☑ Plazas, sidewalks, and parking lots

Description / Additional Information:

Identification and Narrative of Receiving Water and Pollutants of Concern

Describe flow path of storm water from the project site discharge location(s), through urban storm conveyance systems as applicable, to receiving creeks, rivers, and lagoons as applicable, and ultimate discharge to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable):

The proposed site storm drain will tie in to the storm drain located within the adjacent Highway 75 located to the south of the project site. This storm drain discharges flows to the salt ponds located to the north of the project area prior to ultimately discharging to San Diego Bay.

List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs and/or Highest Priority Pollutants from the WQIP for the impaired water bodies:

303(d) Impaired Water Body	Pollutant(s)/Stressor(s)	TMDLs / WQIP Highest Priority Pollutant
San Diego Bay	PCBs, Copper	Heavy Metals

Identification of Project Site Pollutants*

***Identification of project site pollutants is only required if flow-thru treatment BMPs are implemented onsite in lieu of retention or biofiltration BMPs (note the project must also participate in an alternative compliance program unless prior lawful approval to meet earlier PDP requirements is demonstrated)**

Identify pollutants expected from the project site based on all proposed use(s) of the site (see BMP Design Manual Appendix B.6):

Pollutant	Not Applicable to the Project Site	Expected from the Project Site	Also a Receiving Water Pollutant of Concern
Sediment		☒	
Nutrients		☒	
Heavy Metals		☒	☒
Organic Compounds		Potential	
Trash & Debris		☒	
Oxygen Demanding Substances		Potential	
Oil & Grease		☒	
Bacteria & Viruses		☒	
Pesticides		☒	

Hydromodification Management Requirements

Do hydromodification management requirements apply (see Section 1.6 of the BMP Design Manual)?

☐ Yes, hydromodification management flow control structural BMPs required.

☐ No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean.

☑ No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean.

☐ No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides.

Description / Additional Information (to be provided if a 'No' answer has been selected above):

The project site drains directly to a hardline receiving storm drain system that discharges to the salt pond/San Diego Bay and is thus HMP exempt.

Critical Coarse Sediment Yield Areas*

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

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

☐ Yes

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

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

☐ 6.2.1 Verification of Geomorphic Landscape Units (GLUs) Onsite

☐ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment

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

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

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

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

☐ Critical coarse sediment yield areas exist but additional analysis has determined that protection is not required. Documentation attached in Attachment 2.b of the SWQMP.

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

Discussion / Additional Information:
See Attachment 2b for overlay of WMAA map.

Flow Control for Post-Project Runoff*

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

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

Not applicable.

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

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

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

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

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

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

Discussion / Additional Information: (optional)

Other Site Requirements and Constraints

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

Optional Additional Information or Continuation of Previous Sections As Needed

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

Source Control BMP Checklist for All Development Projects (Standard Projects and Priority Development Projects)	Form I-4 [March 15, 2016]

Project Identification

Project Name: Blue Wave

Permit Application Number:

Source Control BMPs

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

Answer each category below pursuant to the following.

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

Source Control Requirement	Applied?		
SC-1 Prevention of Illicit Discharges into the MS4	☑ Yes	☐ No	☐ N/A
Discussion / justification if SC-1 not implemented:			
SC-2 Storm Drain Stenciling or Signage	☑ Yes	☐ No	☐ N/A
Discussion / justification if SC-2 not implemented:			
SC-3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☑ N/A
Discussion / justification if SC-3 not implemented:			
SC-4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☑ N/A
Discussion / justification if SC-4 not implemented:			

Form I-4 Page 2 of 2, Form Date: March 15, 2016			
Source Control Requirement	**Applied?**		
SC-5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☑Yes	☐ No	☐ N/A
Discussion / justification if SC-5 not implemented:			
SC-6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below)			
☑ On-site storm drain inlets	☑Yes	☐ No	☐ N/A
☑ Interior floor drains and elevator shaft sump pumps	☑ Yes	☐ No	☐ N/A
☑ Interior parking garages	☑ Yes	☐ No	☐ N/A
☑ Need for future indoor & structural pest control	☑ Yes	☐ No	☐ N/A
☑ Landscape/Outdoor Pesticide Use	☑ Yes	☐ No	☐ N/A
☑ Pools, spas, ponds, decorative fountains, and other water features	☑ Yes	☐ No	☐ N/A
☑ Food service	☑ Yes	☐ No	☐ N/A
☐ Refuse areas	☐ Yes	☐ No	☑ N/A
☐ Industrial processes	☐ Yes	☐ No	☑ N/A
☐ Outdoor storage of equipment or materials	☐ Yes	☐ No	☑ N/A
☐ Vehicle and Equipment Cleaning	☐ Yes	☐ No	☑ N/A
☐ Vehicle/Equipment Repair and Maintenance	☐ Yes	☐ No	☑ N/A
☐ Fuel Dispensing Areas	☐ Yes	☐ No	☑ N/A
☐ Loading Docks	☐ Yes	☐ No	☑ N/A
☑ Fire Sprinkler Test Water	☑ Yes	☐ No	☐ N/A
☐ Miscellaneous Drain or Wash Water	☐ Yes	☐ No	☑ N/A
☑ Plazas, sidewalks, and parking lots	☑ Yes	☐ No	☐ N/A
Discussion / justification if SC-6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for <u>all</u> "No" answers shown above.			

Site Design BMP Checklist for All Development Projects (Standard Projects and Priority Development Projects)	Form I-5 [March 15, 2016]

Project Identification

Project Name: Blue Wave

Permit Application Number:

Site Design BMPs

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

Answer each category below pursuant to the following.

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

Site Design Requirement	Applied?		
SD-1 Maintain Natural Drainage Pathways and Hydrologic Features	☑ Yes	☐ No	☐ N/A
Discussion / justification if SD-1 not implemented:			
SD-2 Conserve Natural Areas, Soils, and Vegetation	☐ Yes	☑ No	☐ N/A
Discussion / justification if SD-2 not implemented: The project site currently consists of light scrub vegetation of limited density with the majority of the site featuring open space, such that there is limited to no natural areas to conserve. As part of the developed site, landscaped areas will be provided to maintain some vegetation on the site.			
SD-3 Minimize Impervious Area	☑ Yes	☐ No	☐ N/A
Discussion / justification if SD-3 not implemented: Streets widths have been minimized. Sidewalks are only utilized wherever necessary. Additionally landscaped areas have been incorporated within the project site promote permeable surface areas wherever possible on the project site.			
SD-4 Minimize Soil Compaction	☐ Yes	☑ No	☐ N/A
Discussion / justification if SD-4 not implemented: Due the structural requirements of the building design, soil compaction will be required throughout the project site.			
SD-5 Impervious Area Dispersion	☑ Yes	☐ No	☐ N/A
Discussion / justification if SD-5 not implemented: Runoff from the rooftops of the northern structure is drained via downspouts to a receiving landscaped swale located adjacent to the structure and the northern project boundary. These flows are then intercepted by the onsite storm drain prior to draining to the receiving treatment BMP.			

Form I-5 Page 2 of 2, Form Date: March 15, 2016			
Site Design Requirement	**Applied?**		
SD-6 Runoff Collection	☐ Yes	☑ No	☐ N/A
Discussion / justification if SD-6 not implemented: This site is small and does not present locations where SD-6 can be feasibly utilized.			
SD-7 Landscaping with Native or Drought Tolerant Species	☑ Yes	☐ No	☐ N/A
Discussion / justification if SD-7 not implemented:			
SD-8 Harvesting and Using Precipitation	☐ Yes	☑ No	☐ N/A
Discussion / justification if SD-8 not implemented: Harvest and Use was determined to be infeasible.			

Summary of PDP Structural BMPs	Form I-6 (PDPs) [March 15, 2016]

Project Identification

Project Name: Blue Wave

Permit Application Number:

PDP Structural BMPs

All PDPs must implement structural BMPs for storm water pollutant control (see Chapter 5 of the BMP Design Manual). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in Chapter 5. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see Chapter 6 of the BMP Design Manual). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s).

PDP structural BMPs must be verified by the local jurisdiction at the completion of construction. This may include requiring the project owner or project owner's representative and engineer of record to certify construction of the structural BMPs (see Section 1.12 of the BMP Design Manual). PDP structural BMPs must be maintained into perpetuity, and the local jurisdiction must confirm the maintenance (see Section 7 of the BMP Design Manual).

Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page 3 of this form) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).

Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the BMP Design Manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate.

The 1.31-acre site is proposed to be developed with residential units within multiple building structures. The proposed onsite drainage will be routed through the site via an onsite storm drain system inclusive of two (2) modular wetland biofiltration facilities and an underground peak flow detention vault. The proposed underground detention vault storage facility will mitigate the peak 100-year flows prior to discharging downstream into the existing storm drain located along Highway 75. These aforementioned BMPs also treat additional offsite area from the entrance located to the south of the project site adjacent to SR-75.

Runoff tributary to the northern DMA will drain via an overland vegetated swale to encourage infiltration as part of a passive LID BMP treatment train. As a conservative practice, no reduction in DCV has been assumed for this dispersion area.

Additionally, a small entrance to the east of the project site is unable to be captured by the onsite drainage system. This area is approximately 154 square feet and as such qualifies for the de minimus designation. A second de minimis area is located to the south of the project site associated with the improvement of SR-75, this area is a hardscape improvement that does not drain to the project site and as such is unable to be treated by the onsite BMPs.

Runoff generated by the parking ramp is intercepted by a French drain, these flows are then to be pumped to the receiving storm drain and receiving treatment control BMP.

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

(Continued from page 1)

This project proposes to employ several structural BMP strategies for pollutant control including flow-based proprietary modular biofiltration, and a peak flow-control storage facility. In accordance with Section 5.1 of the BMP Design Manual, the following steps were taken in selecting the site's BMPs:

1. The onsite drainage subareas (DMAs) were delineated. A total of four (4) subareas were defined with two having its own treatment facility and the remaining two qualifying as a de minimus areas not requiring treatment. This project is considered an 'infill site' and as such, will consist of a tying into the existing surrounding storm drain infrastructure. It will be required to comply with the most recent City of Imperial Beach BMP standards. The site's layout is very limited in available above-ground areas for placement of biofiltration facilities. Numerous site configurations were contemplated in consideration of all the constraints such as parking requirements, building setbacks, utility separation distances, and land use requirements. The final proposed site design presented the best overall configuration to appease all constraints. BF-3-1 and BF-3-2 represent the flow-based proprietary modular units which will treat the site runoff via biofiltration. Worksheet B.2-1 from the City of Imperial Beach BMP Design Manual was utilized in calculating the DCV for each of the subareas.

2. A Harvest and Use Feasibility Screening was performed using Worksheet B.3-1 of the City of Imperial Beach BMP Design Manual. See Attachment 1c. The analysis determined that harvest and use is considered to be infeasible for this project.

3. Soils data information from the National Resources Conservation Service (NRCS) website indicates that the site is located within an area consisting of hydrologic soil groups D. This soil type is characterized as having very slow infiltration rates and therefore, based on this site information, it would be infeasible to expect any significant amount of infiltration. The proposed structural BMP method is biofiltration via proprietary modular units. Attachment 1d includes the preliminary design infiltration assessment.

4. After DCV and feasibility determination was completed per Steps 1-3 above, the worksheets to calculate the treatment sizes were completed. The Design Flows Worksheet B.6-1 was also completed to determine the minimum treatment flowrates needed to meet pollutant control standards for the two proposed proprietary biofiltration units.

Placement of the required BMPs was restricted to fit within the proposed site design's vertical and horizontal constraints as well as other development requirements for parking, setbacks, and driveway widths. The following Step (4B) describes the remaining design process and considerations which were then evaluated in determining the final pollutant and flow control design for the site.

All treatment control BMPs determined above for all subareas are effective at addressing the site's pollutant of concern, which are heavy metals.

5. Step 5 is not applicable to this project since Steps 4A and 4B treat the entire DCV.

6. This SWQMP is prepared as Step 6.

7. Maintenance Thresholds for the proposed site BMPs are included within Attachment 3a. Maintenance agreements associated with this project will processed during the final engineering phase and are therefore not included as part of this SWQMP.

Structural BMP Summary Information
(Copy this page as needed to provide information for each individual proposed structural BMP)

Structural BMP ID No. BF-3-1 and BF-3-2

Construction Plan Sheet No.

Type of structural BMP:
- ☐ Retention by harvest and use (HU-1)
- ☐ Retention by infiltration basin (INF-1)
- ☐ Retention by bioretention (INF-2)
- ☐ Retention by permeable pavement (INF-3)
- ☐ Partial retention by biofiltration with partial retention (PR-1)
- ☐ Biofiltration (BF-1)
- ☐ Biofiltration with Nutrient Sensitive Media Design (BF-2)
- ☑ Proprietary Biofiltration (BF-3) meeting all requirements of Appendix F
- ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)
- ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
- ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)
- ☐ Detention pond or vault for hydromodification management
- ☐ Other (describe in discussion section below)

Purpose:
- ☑ Pollutant control only
- ☐ Hydromodification control only
- ☐ Combined pollutant control and hydromodification control
- ☐ Pre-treatment/forebay for another structural BMP
- ☐ Other (describe in discussion section below)

Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the BMP Design Manual)	EOW (Hunsaker & Associates) for the project at the time of construction
Who will be the final owner of this BMP?	HOA for Blue Wave
Who will maintain this BMP into perpetuity?	HOA for Blue Wave
What is the funding mechanism for maintenance?	Privately maintained by HOA for Blue Wave

Form I-6 Page 4 of 4 (Copy as many as needed) , Form Date: March 15, 2016
Structural BMP ID No.
Construction Plan Sheet No.
Discussion (as needed):

ATTACHMENT 1
BACKUP FOR PDP POLLUTANT CONTROL BMPS

This is the cover sheet for Attachment 1.

Indicate which Items are Included behind this cover sheet:

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

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

The DMA Exhibit must identify:

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

ATTACHMENT 1a
DMA EXHIBIT

LEGEND

- PROJECT BOUNDARY
- DMA BOUNDARY
- FLOW DIRECTION
- DMA # (1)
- SUBAREA ACREAGE (X ACRES)

- BUILDING ROOF AREA
- ONSITE PERVIOUS AREA
- SIDEWALKS
- ROADWAY/ PARKING
- OFFSITE IMPERVIOUS AREA

H&A

20 0 20 40 60
SCALE 1" = 20'

SOURCE CONTROL BMPS:

SC-1 PREVENTION OF ILLICIT DISCHARGES INTO THE MS4
SC-2 STORM DRAIN STENCILING OR SIGNAGE
SC-6 ADDITIONAL BMPs BASED ON POTENTIAL SOURCES OF RUNOFF:
- ON-SITE STORM DRAIN INLETS
- INTERIOR PARKING GARAGES
- NEED FOR FUTURE INDOOR & STRUCTURAL PEST CONTROL
- LANDSCAPE/OUTDOOR PESTICIDE USE
- PLAZAS, SIDEWALKS, AND PARKING LOTS

SITE DESIGN / LID BMPS:

SD-1 MAINTAIN NATURAL DRAINAGE PATHS
SD-2 CONSERVE NATURAL AREAS
SD-3 MINIMIZE IMPERVIOUS AREA
SD-4 MINIMIZE SOIL COMPACTION
SD-5 IMPERVIOUS AREA DISPERSION
SD-7 USE NATIVE OR DROUGHT TOLERANT SPECIES

STRUCTURAL BMPS:

BF-3-# PROPRIETARY BIOFILTRATION* (*)

*Modular Wetland Unit (MWS) or approved equal.

DMA#1 : MWS-1: Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.52	inches
2	Area tributary to BMP (s)	A=	1.05	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.80	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	1,590	cubic-feet

DMA#2: MWS-2: Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.52	inches
2	Area tributary to BMP (s)	A=	0.27	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.67	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	345	cubic-feet

	DMA#	1		2		3	
	Runoff Factor	MWS-1	Summation RF x A	MWS-2	Summation RF x A	DM-1	Summation RF x A
		(ac.)		(ac.)		(sq. ft.)	
ROOFS	0.90	0.26	0.23	0.15	0.14	0.00	0.00
CONCRETE OR ASPHALT	0.90	0.66	0.60	0.04	0.04	154	0.14
UNIT PAVERS (grouted)	0.90	0.00	0.00	0.00	0.00	0.00	0.00
DECOMPOSED GRANITE	0.30	0.00	0.00	0.00	0.00	0.00	0.00
COBBLES OR CRUSHED AGG.	0.30	0.00	0.00	0.00	0.00	0.00	0.00
AMENDED SOIL/ LANDSCAPE	0.10	0.13	0.01	0.08	0.01	0.00	0.00
	Totals:	1.05	0.84	0.27	0.18	154.00	0.14
	Weighted Runoff Factors:		0.80		0.67		0.90

DRAINAGE MANAGEMENT AREA FOR:

BLUE WAVE MIXED USE

550 HIGHWAY 75
CITY OF IMPERIAL BEACH, CALIFORNIA

SHEET 1 OF 1

W.O.# 107-275

ATTACHMENT 1b
TABULAR SUMMARY OF DMAs

BLUE WAVE
DMA CALCULATIONS

	DMA#	1		2		3	
	Runoff Factor	**MWS-1**	Summation RF x A	**MWS-2**	Summation RF x A	**DM-1**	Summation RF x A
		(ac.)		(ac.)		(sq. ft.)	
ROOFS	0.90	0.26	0.23	0.15	0.14	0.00	0.00
CONCRETE OR ASPHALT	0.90	0.66	0.60	0.04	0.04	154	0.14
UNIT PAVERS (grouted)	0.90	0.00	0.00	0.00	0.00	0.00	0.00
DECOMPOSED GRANITE	0.30	0.00	0.00	0.00	0.00	0.00	0.00
COBBLES OR CRUSHED AGG.	0.30	0.00	0.00	0.00	0.00	0.00	0.00
AMENDED SOIL/ LANDSCAPE	0.10	0.13	0.01	0.08	0.01	0.00	0.00
	Totals:	**1.05**	0.84	**0.27**	0.18	**154.00**	0.14
	Weighted Runoff Factors:		**0.80**		**0.67**		**0.90**

ATTACHMENT 1c

FORM I-7, HARVEST AND USE FEASIBLITY SCREENING CHECKLIST

Worksheet B.3-1. Harvest and Use Feasibility Screening

Harvest and Use Feasibility Screening		Worksksheet B.3-1
1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season? ☒ Toilet and urinal flushing ☒ Landscape irrigation ☐ Other:_____		
2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2. 36 hr toilet use per resident= 9.3 gal x 2.5 residents per unit x 24units x 1.5 days = 837 gallons= 112 cf 36 hour landscape use/acre= 390 gls /ac x 0.36 ac= 141 gals= 19 cf Total anticipated 36 hr use = 131 cf		
3. Calculate the DCV using worksheet B-2.1. DCV = 1,935 cf		
3a. Is the 36-hour demand greater than or equal to the DCV? Yes / No ⇨ ⇩	3b. Is the 36-hour demand greater than 0.25DCV but less than the full DCV? Yes / No ⇨ ⇩	3c. Is the 36-hour demand less than 0.25DCV? Yes ⇩
Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.	Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.	Harvest and use is considered to be infeasible.

ATTACHMENT 1d

FORM I-8, CATEGORIZATION OF INFILTRATION FEASIBILITY CONDITION

Construction Testing & Engineering, South, Inc.
Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

REPORT OF GEOTECHNICAL INVESTIGATION
PROPOSED BLUE WAVE HOTEL AND RESIDENCES
550 HIGHWAY 75
IMPERIAL BEACH, CALIFORNIA

PREPARED FOR:

BLUE WAVE ENTERPRISE, LLC
MR. DAVID BRIENZA
11273 CAMINITO ACLARA
SAN DIEGO, CALIFORNIA 92126

PREPARED BY:

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

CTE JOB NO. 40-3618G **JULY 10, 2018**

TABLE OF CONTENTS

REFERENCES

FIGURES

APPENDICES

1.0 INTRODUCTION AND SCOPE OF SERVICES

1.1 Introduction

Construction Testing and Engineering, South, Inc. (CTE) has prepared this report for Blue Wave Enterprise, LLC. 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 improvements. Figure 1 shows the site location.

1.2 Site Description and Proposed Construction

The Blue Wave Hotel and Residences will be located at 550 Highway 75 in Imperial Beach, California. The site is relatively level with sparse vegetation. It has an area of approximately 1.27 acres. Site coordinates are 32.5853°N and 117.1189°W. The site elevations range from approximately 16 feet above mean sea level (MSL) to approximately 21 feet MSL. The site was previously occupied by a motel which has been removed. A pool was also located on the site which has been demolished and backfilled with site soils.

We understand that construction is to consist of dividing the parcel into a four-level hotel and residential properties. An additional lot was obtained to provide access to 7th Street, additional parking and about 12 additional apartments. Included will be a restaurant and a single-level parking garage. The garage floor slab will be four to eight feet below the existing ground surface. The structures will be wood-framed with a post-tensioned base floor slab. The slab will be eight-inches thick. On-site soils will be utilized with no export anticipated.

1.3 Scope of Services

The scope of services provided included:

- Review of referenced geologic and soils reports.
- Coordination of limited utility mark-out and location.
- Obtaining a San Diego County Department of Environmental Health (SD DEH) Boring Permit.
- Excavation of exploratory borings and soil sampling with a truck-mounted drill rig.
- Laboratory testing of selected soil samples.
- Description of the geology and evaluation of potential geologic hazards.
- Engineering and geologic analysis.
- On site percolation tests and calculation of storm water infiltration rates
- Preparation of this summary report.

2.0 FIELD INVESTIGATION AND LABORATORY TESTING

2.1 Field Investigation

CTE conducted a field investigation on May 21, 2018 that included visual reconnaissance and the excavation of seven exploratory borings and four percolation test holes. The geotechnical borings were excavated with a CME 75 truck-mounted drill rig equipped with six-inch diameter, hollow-stem augers extending to a maximum explored depth of up to approximately 46.5 feet below the ground surface (bgs). Additionally, four borings were excavated for percolation testing. Bulk and relatively undisturbed samples were collected from the cuttings and by driving Standard Penetration Test and Modified California samplers.

The soils were logged in the field by a CTE Engineering Geologist, and were visually classified in general accordance with the Unified Soil Classification System. The field descriptions have been modified, where appropriate, to reflect laboratory test results. Boring logs, including descriptions of the soils encountered, are included in Appendix A. Approximate locations of the borings are shown on Figure 2.

2.2 Laboratory Testing

Laboratory tests were conducted on selected soil samples for classification purposes and to evaluate physical properties and engineering characteristics. Laboratory tests conducted include: In-Place Moisture Content and Dry Density, Direct Shear, Consolidation, Gradation, Expansion Index (EI), Atterberg Limits, and Chemical Characteristics. Test descriptions and laboratory test results for the selected soils are included in Appendix B.

2.3 Percolation Tests

Percolation tests were performed for BMP basin design. Results are included in Appendix C.

3.0 GEOLOGY

3.1 General Setting

The San Diego region is located within the Peninsular Ranges physiographic province that is characterized by northwest-trending mountain ranges, intervening valleys, and predominantly northwest trending regional faults. The San Diego region can be further subdivided into the coastal plain area, a central mountain–valley area, and the eastern mountain valley area. The project site is located within the coastal plain area, which is generally underlain by Cretaceous

and Tertiary sedimentary deposits that onlap an eroded basement surface consisting of Jurassic and Cretaceous crystalline rocks.

3.2 Geologic Conditions

Based on the regional geologic map prepared by Kennedy and Tan (2008), the near surface geologic unit underlying the site consists of Quaternary Older Paralic Deposits- Unit 6. Based on recent site explorations, Quaternary Previously Placed Fill was encountered at the surface. The fill was observed to be underlain at shallow depths by the Paralic Deposits. Descriptions of the geologic units encountered during the investigation are presented below. Site geology is relatively uncomplicated with no significant stratigraphic, geo-structural features or other significant geotechnical conditions necessitating generalized geologic cross-sections. A regional fault and seismicity map is attached as Figure 3.

3.2.1 Quaternary Previously Placed Fill

Quaternary Previously Placed Fill was encountered in each of the explorations to a maximum depth of approximately 2.5 feet below ground surface (bgs). The fill soils observed were variable across the site and consisted generally of loose to medium dense, slightly moist, light brown to red brown, silty to clayey fine grained sand. Localized depths of fill soils may be greater than encountered during the explorations. Based on the noted conditions, fill soils are generally not suitable for support of improvements or additional fill in their current condition.

3.2.2 Quaternary Older Paralic Deposits, Unit 6

Quaternary Older Paralic Deposits, Unit 6 were encountered beneath the surficial fill in the borings and extended to the maximum explored depth of 43 feet bgs. Paralic Deposits observed in the explorations consist generally of stiff to hard, fine sandy clays and clayey sands beneath the fill soil (clays observed as deep as nine feet bgs in boring, B-1) as well as medium dense to very dense, slightly moist to wet (near groundwater elevation), gray brown to red brown, silty, fine grained to poorly graded sands with gravels and cobbles. Some interbedded silts were also observed.

3.3 Groundwater Conditions

Groundwater was encountered in Borings B-1 and B-2 at approximately 16.5 to 17 feet bgs, respectively. Groundwater conditions are anticipated to vary, especially during and after periods of sustained precipitation or irrigation, and may be tidally influenced based on the site's proximity to the San Diego Bay to the north and Pacific Ocean to the west. As such, deep excavations may require dewatering and stabilization. Subsurface water could seasonally impact excavations or earthwork during the proposed development and moisture conditioning of site soils may be necessary during grading.

3.4 Geologic Hazards

Geologic hazards that were considered to have potential impacts to site development were evaluated based on field observations, literature review, and laboratory test results. It appears that the geologic hazards at the site are primarily limited to those caused by shaking from earthquake-generated ground motions. It is noted that a tsunamic inundation risk is mapped near

but not onto the site. The following paragraphs discuss the geologic hazards considered and their potential risk to the site.

3.4.1 Surface Fault Rupture

Based on the site reconnaissance and review of referenced literature, the site is not within a State of California-designated Alquist-Priolo Earthquake Fault Studies Zone or City Special Studies Zone, and no known active fault traces underlie, or project toward the site. According to the California Division of Mines and Geology, a fault is active if it displays evidence of activity in the last 11,000 years (Hart and Bryant, revised 2007). Therefore, the potential for surface rupture from displacement or fault movement beneath the proposed improvements is considered to be low.

3.4.2 Local and Regional Faulting

The California Geological Survey (CGS) and the United States Geological Survey (USGS) broadly group faults as “Class A” or “Class B” (Cao, 2003; Frankel et al., 2002). Class A faults are generally identified based upon relatively well-defined paleoseismic activity, and a fault-slip rate of more than 5 millimeters per year (mm/yr). In contrast, Class B faults have comparatively less defined paleoseismic activity, and are considered to have a fault-slip rate less than 5 mm/yr. The controlling faults in the region are generally strike –slip. The nearest known Class B fault is the Rose Canyon Fault that is approximately 14.7 kilometers west of the site (Blake, T.F., 2000). The nearest known Class A fault is the Julian segment of the Elsinore Fault that is located approximately 77.2 kilometers northeast of the site. The following Table 1 presents the known faults

nearest to the site, including estimated magnitude and fault classification. Attached Figure 3 shows regional faults and seismicity with respect to the site.

TABLE 1
NEAR-SITE FAULT PARAMETERS

FAULT NAME	APPROXIMATE DISTANCE FROM SITE (KM)	MAXIMUM ESTIMATED EARTHQUAKE MAGNITUDE	CLASSIFICATION
Rose Canyon	14.0	7.2	B
Coronado Bank	17.6	7.6	B
Newport-Inglewood	69.8	7.1	B
Elsinore-Julian	76.4	7.1	A
Elsinore-Coyote Mountain	82.6	6.8	A
Earthquake Valley	82.6	6.5	B

The site could be subjected to significant shaking in the event of a major earthquake on any of the faults listed above or other faults in the southern California or northern Baja California area.

North trending faults are mapped by Kennedy and Tan (2008) to be offshore at an approximate distance of 6,800 feet west of the site. These faults do not trend toward or underlie the site. Activity of these faults has not been established.

3.4.3 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.

A quantitative liquefaction analysis was performed using the computer program LiquefyPro and the data obtained from borings B-1 and B-2. An anticipated high groundwater level of 15 feet was used for the analysis. A peak ground acceleration of 0.499g and earthquake magnitude of 7.2 were used. As recommended in California Geological Survey Special Publication 117A, a safety factor of 1.3 was used. The output file for the analysis is presented in Appendix C.

Potential total liquefaction settlement is estimated to be 1.69 inches and differential settlement of less than ½ inch over a distance of 30 feet. 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.

3.4.4 Tsunamis and Seiche Evaluation

According to State of California Emergency Management Agency (CalEMA, 2009) mapping, the site is not located within a tsunami inundation zone. It appears that tsunami inundation potential is located approximately 250 feet north of the northern property line. The inundation zone is subject to the limitations and uncertainties as stated by CalEMA

(2009). Damage resulting from oscillatory waves (seiches) is considered unlikely due to the absence of nearby confined bodies of water.

3.4.5 Landsliding

According to mapping by Tan (1995), the site is within an urbanized area considered "Marginally Susceptible" to landsliding. However, landslides are not mapped in the site area, and no evidence of landsliding was encountered during the recent field exploration. Based on the site conditions, such as low surface gradient relief, landsliding is not considered to be a significant geologic hazard within the subject site.

3.4.6 Compressible and Expansive Soils

Based on recent observations and testing, the Previously Placed Fill encountered at the site is generally considered to be compressible under the proposed loading conditions. Surficial soils were also found to be locally disturbed and weathered. Therefore, it is recommended that the Previously Placed Fill and disturbed soils be overexcavated, processed and compacted beneath improvement areas as recommended herein. Based on the investigation data, underlying dense native material is not considered to be subject to significant compressibility under the proposed loads.

Based on geologic observation and laboratory testing, the near-surface materials at the site are anticipated to exhibit a low expansion potential (Expansion Index of less than 51). However, clay soils tested from Boring B-6 at five feet bgs indicates an Expansion Index of 64, corresponding to a medium expansion potential. Therefore, the

recommendations provided herein are based upon the anticipated low to medium expansion potential of the site soils encountered. Additional evaluation of soil expansion potential should be conducted during grading and upon completion of rough grading.

3.4.7 Corrosive Soils

Chemical testing was performed to evaluate the potential effects that site soils may have on concrete foundations and various types of buried metallic utilities. Soil environments detrimental to concrete generally have elevated levels of soluble sulfates and/or pH levels less than 5.5. According to American Concrete Institute (ACI) Table 318 4.3.1, specific guidelines have been provided for concrete where concentrations of soluble sulfate (SO_4) in soil exceed 0.1 percent by weight. These guidelines include low water: cement ratios, increased compressive strength, and specific cement type requirements. Based on the results of the sulfate and pH testing performed, onsite soils are anticipated to generally have a low to moderate corrosion potential to portland cement concrete improvements (ACI Exposure Category S0). We recommend that Type II or Type V cement be used. We further recommend that at least a 3-inch thick concrete cover be maintained over the reinforcing steel in concrete in contact with the soil.

A minimum resistivity value less than approximately 5,000 ohm-cm, and/or soluble chloride levels in excess of 200 ppm generally indicate a corrosive environment to buried metallic utilities and untreated conduits. Based on the obtained minimum resistivity values of 285 ohm-cm and soluble chloride level of 473 ppm in Boring, B-2, on-site soils are anticipated to have a moderate to very severe corrosion potential for buried

uncoated/unprotected metallic conduits. Based on these results, at a minimum, the use of buried plastic piping or conduits would appear logical, where feasible.

The results of the chemical tests performed are presented in Appendix B. CTE does not practice corrosion engineering. Therefore, a corrosion engineer or other qualified consultant could be contacted if site specific corrosivity issues are of more significant concern.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 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.

4.2 Site Preparation

4.2.1 General

Prior to grading, the site should be cleared of existing pavement, debris and deleterious materials including utilities, flatwork and footings, if present from previous site improvements. In areas to receive structures or distress-sensitive improvements,

expansive, surficial eroded, desiccated, burrowed, or otherwise loose or disturbed soils should be removed to the depth of competent natural material. Concrete, organic and other deleterious materials not suitable for use as structural backfill, should be disposed of offsite at a legal disposal site. The former pool location should be excavated and backfilled with compacted fill. Excavated fill from the pool area used for backfill should be free of debris and deleterious materials, including concrete and other pool materials.

4.2.2 Remedial Grading and Excavations

In order to provide uniform slab support, building pads should be excavated to a depth of five feet below existing grade. The excavation should extend 5 feet beyond the outside edge of the proposed footings. The soils exposed at the base of the excavation should be observed by a geotechnical representative of this office to determine their suitability prior to fill placement.

Temporary, unsurcharged excavations up to four 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. Permanent slopes should be no steeper than 2:1. Vehicles and storage loads should not be placed within 10 feet of the top of the excavation. Deeper temporary slopes may be sloped or retained with shoring. Design values for temporary shoring can be provided on request.

If temporary slopes are to be maintained during the rainy season, berms are recommended along the tops of slopes to divert runoff water from entering the excavation and eroding the slope faces.

4.2.3 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 above optimum moisture content and compacted to at least 90 percent of the maximum dry density as determined by ASTM D 1557.

4.2.4 Fill Placement and Compaction

Structural fill and backfill should be compacted to at least 90 percent of the maximum dry density (per ASTM D 1557) at a moisture content above optimum. 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. Generally, 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.

Rocks or other soil fragments greater than three inches in least dimension should not be used in the fills. On-site soils are considered to be acceptable for fill provided they do not contain deleterious materials. 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.

4.2.5 Utility Trenches

Utility trenches should be excavated in accordance with the recommendations presented in Section 4.2.2. 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 a moisture content above optimum.

4.3 Foundations and Slab Recommendations

4.3.1 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 or competent natural soils. These recommendations assume that the foundation soils will have medium potential for expansion.

4.3.2 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 15 inches wide and be founded at least 18 inches below the lowest adjacent rough grade elevation. Dimensions for isolated footings should be a minimum of 24 inches square and founded at least 18 inches below top of slab elevation.

Foundation dimensions should be based on an allowable bearing pressure of 2,500 pounds per square foot (psf) for the minimum footing dimensions noted above. 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.

Lateral loads for structures supported on spread footings may be resisted by soil friction and by the passive resistance of the soils. A coefficient of friction of 0.3 may be used between foundations and the properly compacted fill supporting materials. The passive resistance of the soils may be assumed equal to the pressure developed by a fluid with a density of 250 pounds per cubic foot. A one-third increase in the passive value may be used for wind or seismic loads.

4.3.3 Settlement of Shallow 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. Anticipated settlements are related to an applied bearing pressure for the proposed building of 2,500 psf and a footing width of approximately 15 inches.

It is anticipated that shallow foundations designed and constructed as recommended will experience maximum 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.

4.3.4 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 4 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 200 pci may be used for elastic design. 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 moisture vapor retarder (10-mil or thicker) should be placed beneath the slab. A four-inch layer of crushed stone (#4 x3/4") should underlie the moisture vapor retarder. To protect the membrane during steel and concrete placement, a maximum two-inch layer of sand may be placed over 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.

As an alternative, a post-tensioned slab may be constructed. Based on our analysis, the following design recommendations may be used:

Allowable Bearing Capacity- 2,500 psf
Building Pad Over-excavation- 5 feet
Friction Coefficient- 0.3
Lateral Load Resistance- 250 pcf
Modulus of Subgrade Reaction- 200 pci (uncorrected)

The following are our recommendations for a post-tensioned slab based on the methods of the Post Tensioning Institute:

Expansion Index		Low to Medium
Assumed Percent Clay		50
Clay Type		Montmorillonite
Approximate Depth of Constant Suction (feet)		7.0
Approximate Soil Suction (pF)		3.6
Approximate Velocity or Moisture Flow (Inches per Month)		0.7
Thornwaite Index		-20
Average Edge Moisture Variation Depth, em (Feet)	Center Lift	5.3
	Edge Lift	2.5
Anticipated Swell, ym (Inches)	Center Lift	3.2
	Edge Lift	0.8

4.3.5 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/or the friction between the pipe and adjacent soil. Thrust blocks may be designed using a passive resistance equal to the pressure developed by a fluid with a density of 250 pounds per cubic foot. A friction value of 0.25 may be used between the pipe and adjacent soil.

4.4 Seismic Design Criteria

The seismic ground motion values listed in Table 2 below were derived in accordance with the ASCE 7-10 Standard that is incorporated into the California Building Code, 2016 (effective January 1, 2017). 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 2016 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 32.5853°N and 117.1189°W. Site Class D was used for the analysis.

TABLE 2
SEISMIC GROUND MOTION VALUES

PARAMETER	VALUE	CBC REFERENCE (2016)
Site Class	D	ASCE 7, Chapter 20
Mapped Spectral Response Acceleration Parameter, S_S	1.137g	Figure 1613.3.1 (1)
Mapped Spectral Response Acceleration Parameter, S_1	0.432g	Figure 1613.3.1 (2)
Seismic Coefficient, F_a	1.000	Table 1613.3.3 (1)
Seismic Coefficient, F_v	1.500	Table 1613.3.3 (2)
MCE Spectral Response Acceleration Parameter, S_{MS}	1.189g	Section 1613.3.3
MCE Spectral Response Acceleration Parameter, S_{M1}	0.678g	Section 1613.3.3
Design Spectral Response Acceleration Parameter, S_{DS}	0.792g	Section 1613.3.4
Design Spectral Response Acceleration Parameter, S_{D1}	0.452g	Section 1613.3.4
Mapped MCE Geometric Peak Ground Acceleration, PGA_m	0.499g	ASCE 7, Chapter 11
Seismic Design Category	D	ASCE 7, Chapter 11

4.5 Retaining Walls

If retaining walls are proposed, the following recommendations should be incorporated into design and construction. For the design of walls where the surface of the backfill is level, it may be assumed that the on-site sandy soils will exert an active lateral pressure equal to that developed by a fluid with a density of 40 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 60 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).

For cantilever retaining walls (yielding walls) 6 feet or more in height, lateral pressures 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) = 0.33g

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.

4.6 Parking Structure

The below-ground parking will be founded four to eight feet below the existing surface. Based on the anticipated grading, the structure may be founded on spread footings designed in accordance with the foundation recommendations previously presented.

For parking structure walls below grade, we recommend that they be designed for a triangular pressure distribution of 40 pcf. The seismic pressure should be added as outlined in section 4.5.

The recommended earth pressure assumes that a drainage system will be installed the behind the base of the walls, so that external water pressure will not develop against the basement walls.

In addition to the recommended earth pressures, the walls adjacent to vehicular traffic areas should be designed to resist a uniform lateral pressure of 100 pounds per square foot, acting as a result of an assumed 300 pounds per square foot surcharge behind the walls due to normal traffic.

4.6.1 Drainage System

Walls below grade should be properly drained. Drainage behind the parking garage walls may be provided by a geosynthetic drainage composite. In our opinion, Miradrain 6000 (or the equivalent), attached to the back of the wall before backfilling, would provide satisfactory drainage. The drain should be placed continuously along the back of the wall and connected to a 6-inch-diameter perforated discharge pipe. The pipe should be sloped at least 2% and surrounded by one cubic foot per foot of filter gravel wrapped in geo-fabric. The drain should discharge through a solid pipe to a sump or other appropriate outlet. The wall should be appropriately waterproofed.

The filter gravel should meet the requirements of Class II Permeable Material as defined in the current State of California, Department of Transportation, Standard Specifications. If Class II Permeable Material is not available, 3/4-inch crushed rock or gravel can be used. The crushed rock or gravel should have less than 5% passing a No. 200 sieve.

4.7 Vehicular Pavements

Pavement sections were evaluated using a design 'R' value of 10, correlating to a modulus of subgrade reaction of approximately 50 pci for site subgrade soil. 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 3.

TABLE 3

PORTLAND CEMENT CONCRETE (PCC) PAVEMENT SECTION

Traffic Area	Assumed Traffic Index	Design Modulus of Subgrade Reaction (pci)	PCC Thickness (inches)
Parking Lots	5.0	50	6.5
Drive Lanes	6.0	50	6.5

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 4.

TABLE 4

PRELIMINARY ASPHALT CONCRETE (AC) PAVEMENT SECTIONS

Traffic Area	Assumed Traffic Index	Design 'R' Value	AC Thickness (inches)	Aggregate Base Thickness* (inches)
Parking Lots	5.0	10	3	9.0
Drive Lanes	6.0	10	3	12.0

* 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.

4.8 Exterior Flatwork

Exterior concrete flatwork should have a minimum thickness of four inches, unless otherwise specified by the project architect. 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 driveways, sidewalks, and architectural features, should be installed with crack control joints. 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.

4.9 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. Downspouts should have extensions at least three feet long to direct water away from the foundations. The project civil engineer should thoroughly evaluate the on-site drainage and make provisions as necessary to keep surface water from entering structural areas.

4.10 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.

5.0 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 and foundation related activities prior to the solicitation of construction bids.

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

Respectfully submitted,
CONSTRUCTION TESTING & ENGINEERING, SOUTH, INC.

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Senior Geotechnical Engineer

Vincent J. Patula, CEG #2057
Senior Engineering Geologist

Robert L. Ellerbusch
Staff Geologist

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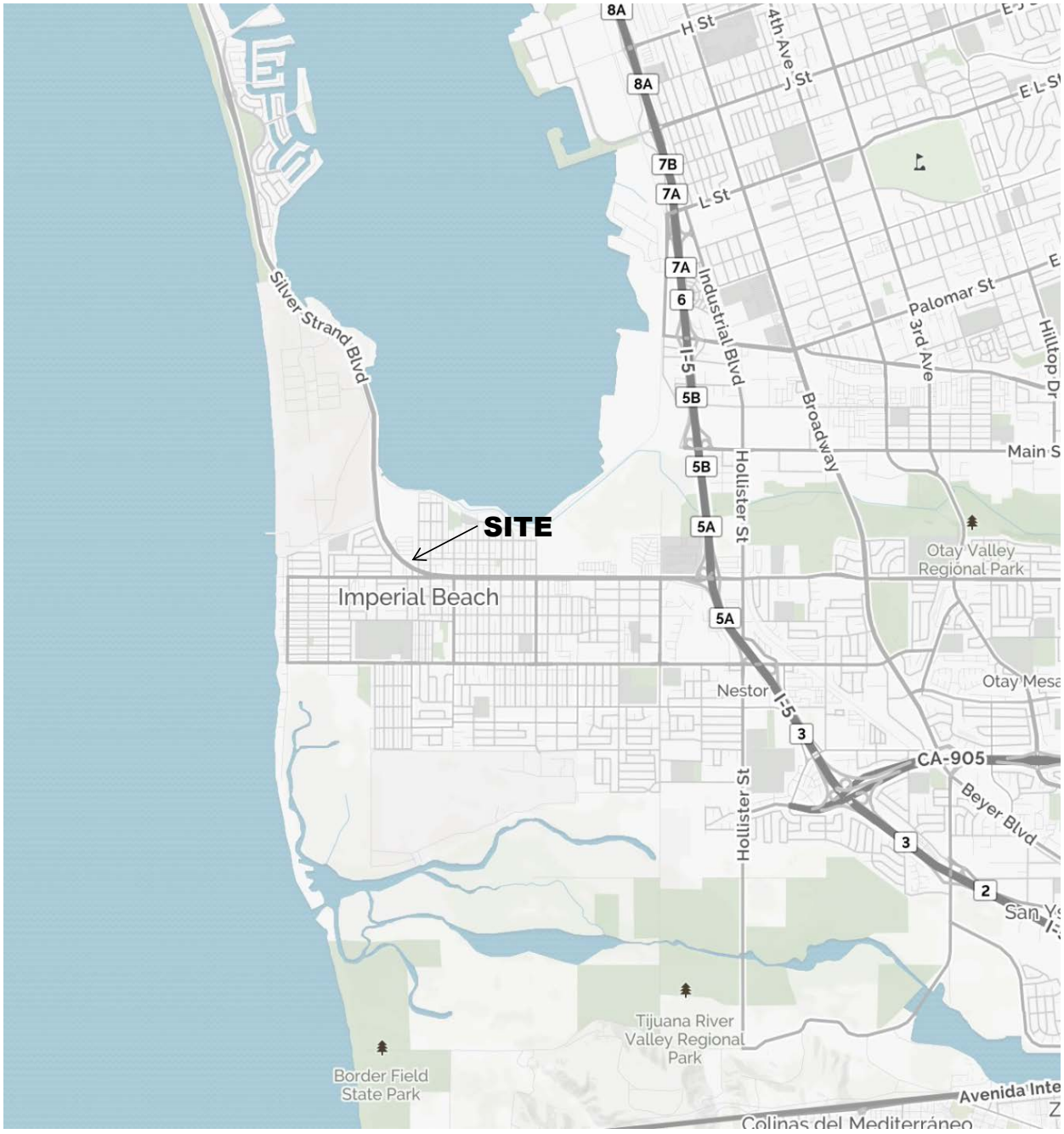


NORTH

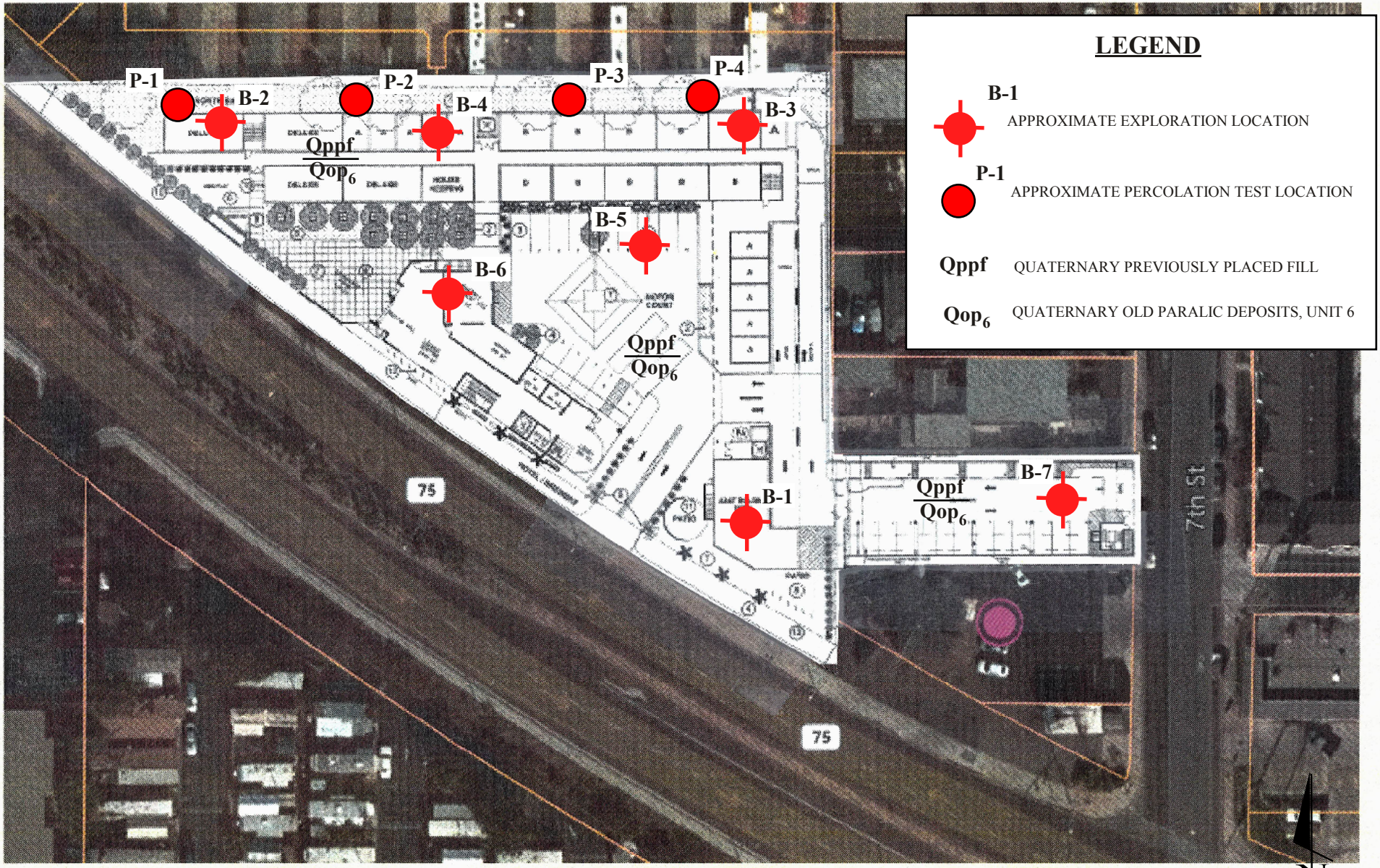
NO SCALE

CTE SOUTH Construction Testing & Engineering, South, Inc.
Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

SITE LOCATION MAP

PROPOSED BLUE WAVE HOTEL & RESIDENCES
555 HIGHWAY 75, IMPERIAL BEACH, CALIFORNIA

Job No.	Date	Figure
40-3618G	JUNE 2018	1



CTE INC.

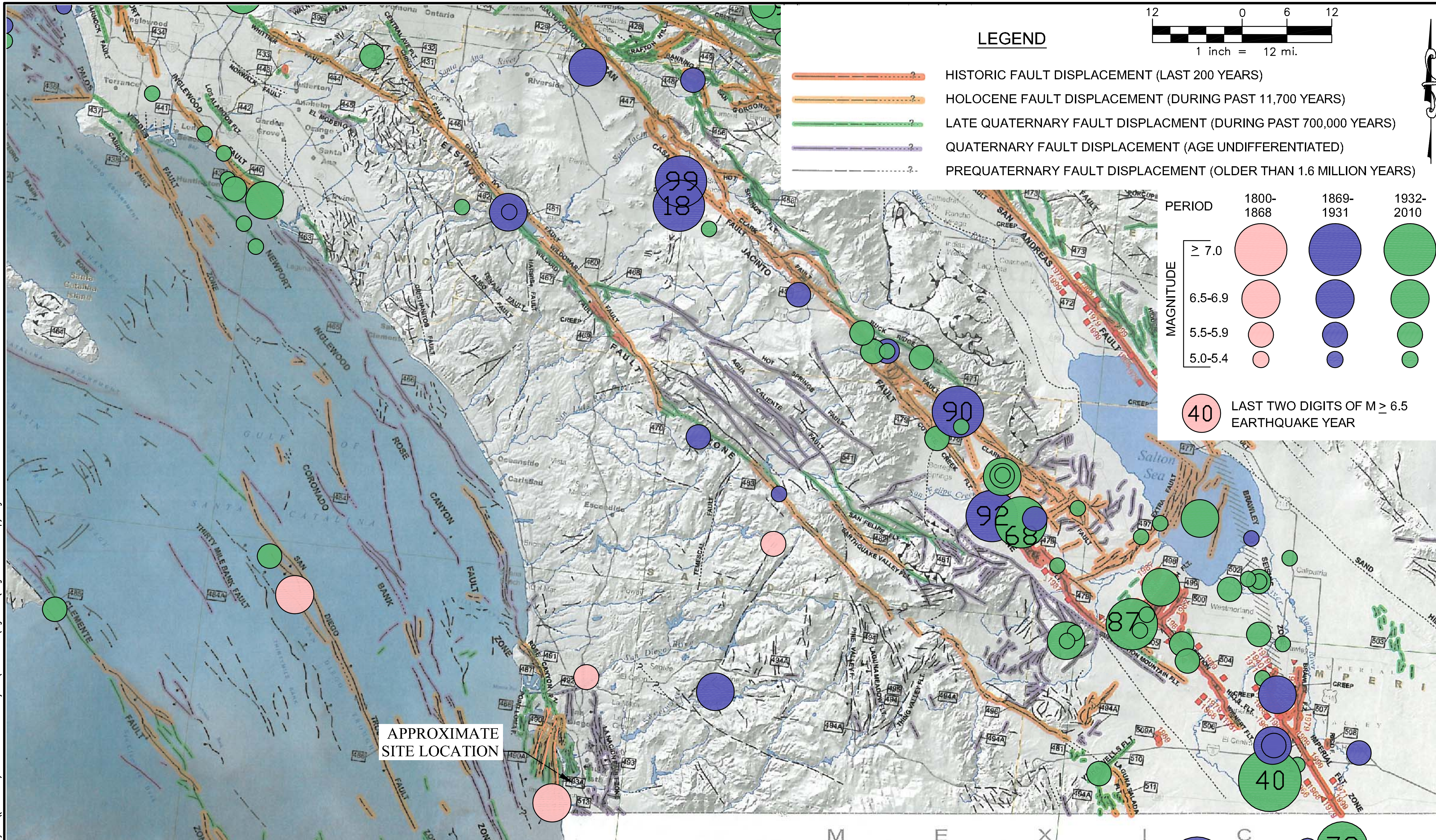
Construction Testing & Engineering, Inc.

Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

EXPLORATION LOCATION / GEOLOGIC MAP

PROPOSED IMPERIAL BEACH BLUE WAVE PROJECT
550 HIGHWAY 75
IMPERIAL BEACH, CALIFORNIA

CTE JOB NO:	40-3618G
SCALE:	NONE
DATE: 05/18	FIGURE: 2



NOTES: FAULT ACTIVITY MAP OF CALIFORNIA, 2010, CALIFORNIA GEOLOGIC DATA MAP SERIES MAP NO. 6;
EPICENTERS OF AND AREAS DAMAGED BY M≥5 CALIFORNIA EARTHQUAKES, 1800-1999 ADAPTED AFTER TOPPOZADA, BRANUM, PETERSEN, HALLSTORM, CRAMER, AND REICHLE, 2000, CDMG MAP SHEET 49
REFERENCE FOR ADDITIONAL EXPLANATION; MODIFIED WITH CISN AND USGS SEISMIC MAPS

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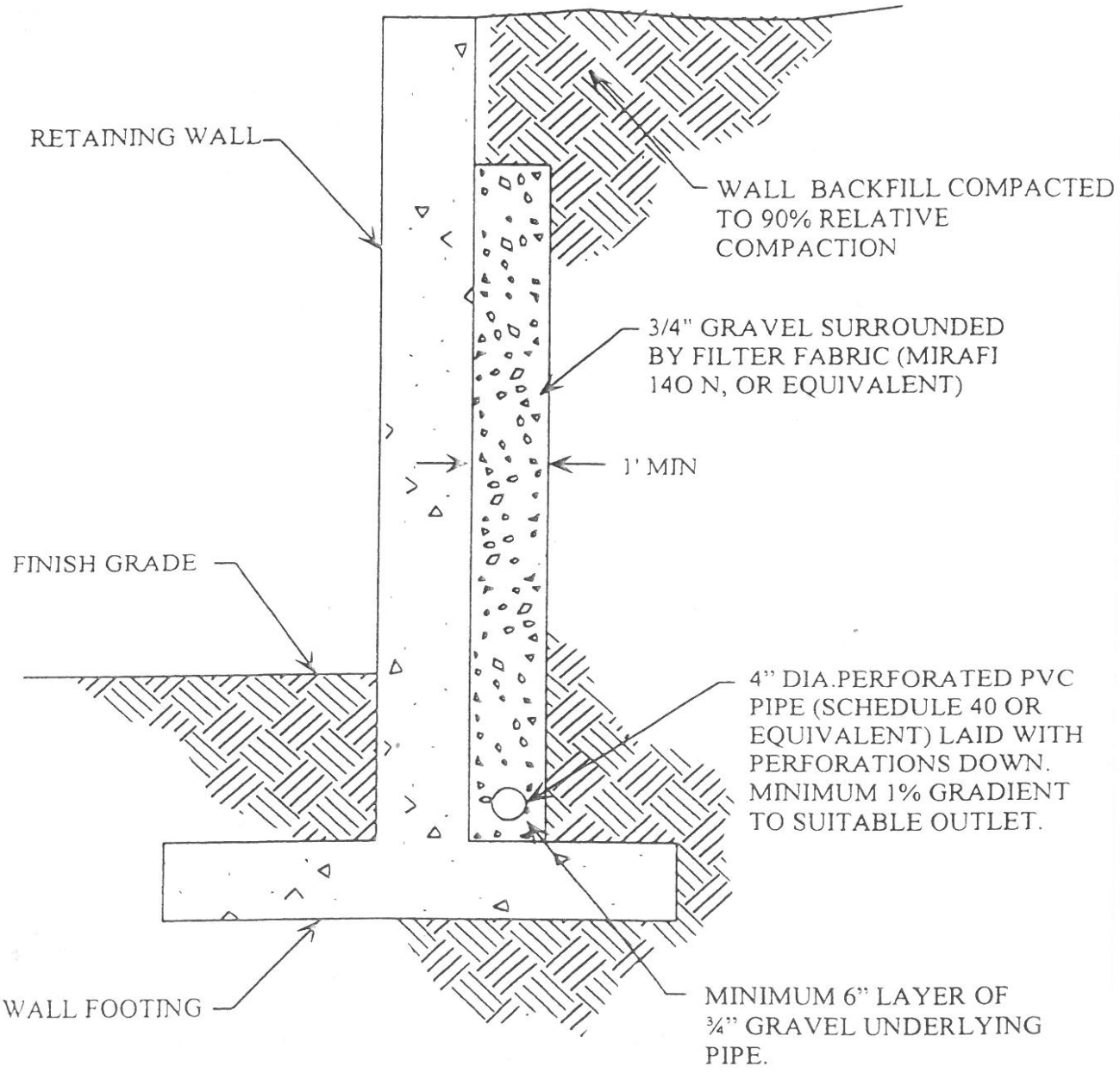
REGIONAL FAULT AND SEISMICITY MAP
Proposed Blue Wave Hotel & Residences
550 Highway 75
Imperial Beach, California

CTE JOB NO:	40-3618G
SCALE:	1 inch = 12 miles
DATE: 6/18	FIGURE: 3

\\ESC_SERVER\Projects\(40-0000) Riverside Office Projects\40-3618G\Figure 3 (Regional Fault Map).dwg



CTE SOUTH

RETAINING WALL DRAIN DETAIL

PROPOSED BLUE WAVE HOTEL & RESIDENCES
555 HIGHWAY 75, IMPERIAL BEACH, CALIFORNIA

Job No.	Date	Figure
40-3618G	JUNE 2018	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

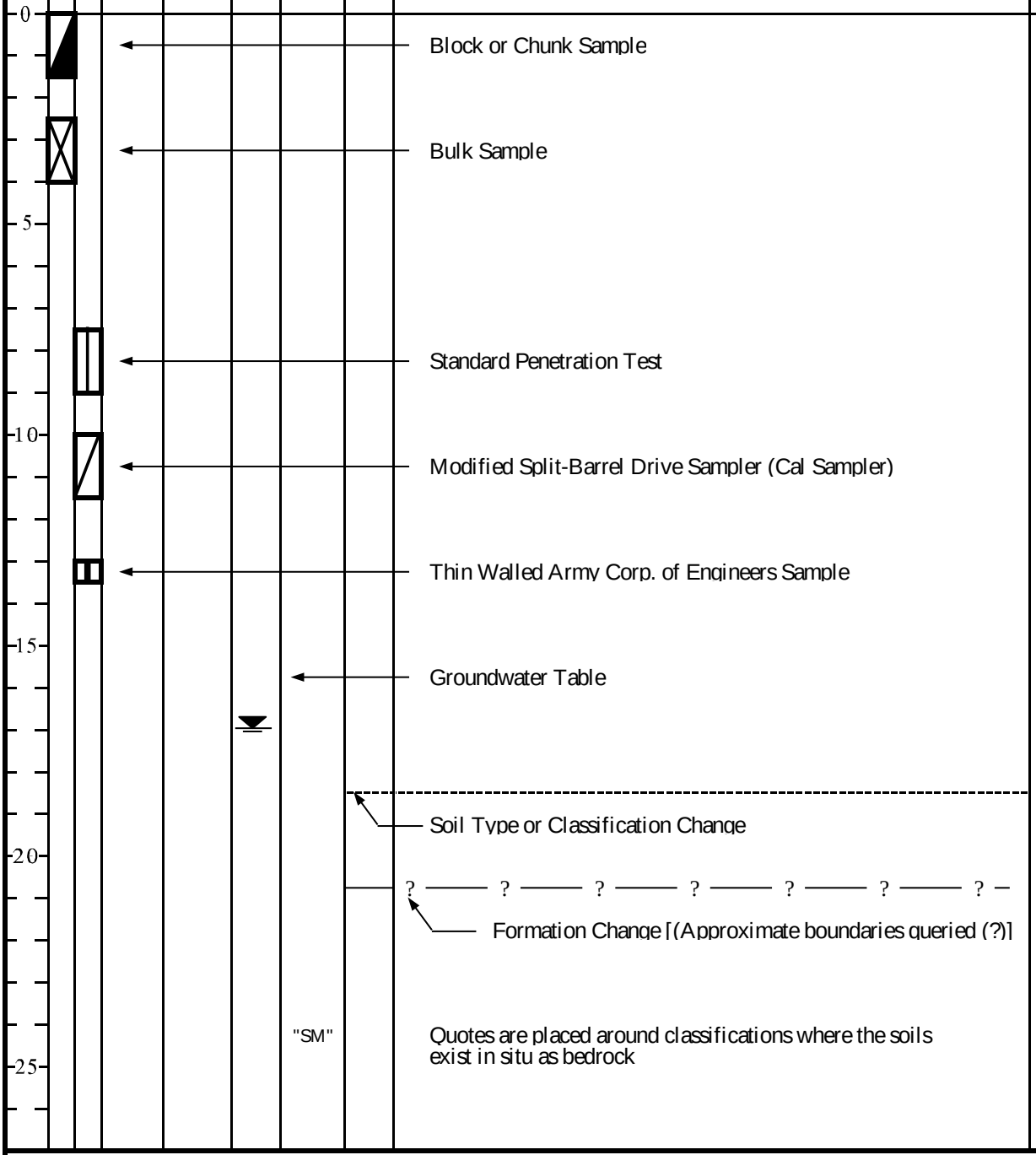

FIGURE: BL2

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PROJECT:	Blue Wave Imperial Beach	DRILLER:	Baja Exploration	SHEET:	1 of 1
CTE JOB NO:	40-3618G	DRILL METHOD:	CME 75	DRILLING DATE:	5.21.18
LOGGED BY:	DK	SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~19'

BORING: B-1

Depth (Feet)	Bulk Sample	Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests/PID Readings
0						SM		Quaternary Previously Placed Fill (Qppf): Loose to medium dense, slightly moist, light brown to red brown silty fine SAND, trace clay and gravel.	PID: Ambient: 1-2 ppm
						CL		Quaternary Old Paralic Deposits, Unit 6 (Qop_6). Stiff to very stiff, slightly moist, red brown, fine sandy CLAY with silt.	EI, CHEM
			10 14 21	109.5	14.3				MD
5			12 20 21		15.5			Hard.	PID: <5 ppm AL, M
10			18 32 30			SM		Dense, slightly moist, light gray brown, silty fineSAND, friable.	GS
15			22 21 20		▼	SP-SM		Dense, moist, light gray brown, poorly graded SAND with silt. Hydrocarbon odor noted. Groundwater @ ~17 feet.	GS PID: 60-65 ppm
20			12 15 20					Wet, increasing silt.	GS 22-23 ppm
25									

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PROJECT:	Blue Wave Imperial Beach	DRILLER:	Baja Exploration	SHEET:	2 of 2
CTE JOB NO:	40-3618G	DRILL METHOD:	CME 75	DRILLING DATE:	5.21.18
LOGGED BY:	DK	SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~19'

BORING: B-1

Depth (Feet)	Bulk Sample	Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests/PID Readings
25			10 21 25			SM		Dense, wet, gray brown, silty fine SAND with medium to coarse sands, trace mica.	GS 3 ppm
30			3 3 7			SP-SM		Loose, wet, gray brown, poorly graded SAND with silt.	GS 2 ppm
35			12 20 27			ML		Interbedded very stiff, wet, gray, fine sandy SILT. Oxidation lamination, trace gravel @36'.	3 ppm GS
						SM		Dense, wet, gray brown, silty fine SAND with medium to coarse sands, trace mica.	
40			35 50/5"					Gravels. Difficult drilling on gravel/cobble.	5 ppm
45								Total Depth: 43' Groundwater @ ~17' Backfilled Per San Diego DEH SAM Manual and CA Well Standards Bulletin Guidelines	
50									

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PROJECT:	Blue Wave Imperial Beach	DRILLER:	Baja Exploration	SHEET:	1 of 1
CTE JOB NO:	40-3618G	DRILL METHOD:	CME 75	DRILLING DATE:	
LOGGED BY:	DK	SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~17'

BORING: B-2

Depth (Feet)	Bulk Sample	Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests/PID Readings
0						SM		Quaternary Previously Placed Fill (Qppf): Loose to medium dense, slightly moist, light brown to red brown silty fine SAND, trace clay and concrete debris.	CHEM
						CL		Quaternary Old Paralic Deposits, Unit 6 (Qop_6). Stiff to very stiff, slightly moist, red brown, fine sandy CLAY.	
5			9 8 8			SM		Medium dense, slightly moist, mottled gray and red brown, silty fine grained SAND.	61 ppm
10			8 10 9			SP-SM		Medium dense, slightly moist, gray and brown, silty to poorly graded fine SAND with trace medium to coarse sand.	GS 0 ppm
15			11 17 16		▼			Dense, wet. Groundwater @ ~16.5'.	GS 9 ppm
						ML		Very stiff, moist, gray, fine sandy SILT, interbedded to laminated.	
20			12 18 43			SM/SP		Silty to poorly graded SAND.	
						SM		Silty SAND.	5 ppm
						SM/SP		Silty to poorly graded SAND.	
25						SM			

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PROJECT:	Blue Wave Imperial Beach	DRILLER:	Baja Exploration	SHEET:	2 of 4
CTE JOB NO:	40-3618G	DRILL METHOD:	CME 75	DRILLING DATE:	5.21.18
LOGGED BY:	DK	SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~17'

BORING: B-2

Depth (Feet)	Bulk Sample	Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests/PID Readings
25			19 23 36			SM		Dense, moist, gray brown, silty fine SAND, trace shell fragments.	GS 3 ppm
30			16 14 23					With interbedded silt.	GS
35			21 48 37					With gravel and cobble, interbedded silts.	3 ppm
40			14 25 19					Dense to very dense with cobble.	GS
								Gravel/cobble, difficulty drilling.	
45			27 32 35						
								Total Depth: 43' Groundwater @ ~16.5' Backfilled Per San Diego DEH SAM Manual and CA Well Standards Bulletin Guidelines	
50									

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PROJECT:	Blue Wave Imperial Beach	DRILLER:	Baja Exploration	SHEET:	1 of 1
CTE JOB NO:	40-3618G	DRILL METHOD:	CME 75	DRILLING DATE:	5.21.18
LOGGED BY:	DK	SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~17'

BORING: B-3

Depth (Feet)	Bulk Sample	Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests/PID Readings
0						SM		Quaternary Previously Placed Fill (Qppf): Medium dense, dry to slightly moist, brown, silty fine SAND.	
								Quaternary Old Paralic Deposits, Unit 6 (Qop_6).	
5			4 7 11			SP-SM		Medium dense, slightly moist, gray brown to orange brown, poorly graded SAND with silt.	GS
10			13 31 34			SM		Very dense, slightly moist, gray brown to orange brown, silty fine SAND with trace medium sands and gravel.	<2 ppm
15			7 14 15					Moist, laminated gray and brown, friable.	<2 ppm
20								Total Depth: 16' No Groundwater Backfilled with Bentonite and Cuttings.	
25									

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PROJECT:	Blue Wave Imperial Beach	DRILLER:	Baja Exploration	SHEET:	1 of 1
CTE JOB NO:	40-3618G	DRILL METHOD:	CME 75	DRILLING DATE:	5.21.18
LOGGED BY:	DK	SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~17'

BORING: B-4

Depth (Feet)	Bulk Sample	Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM/SC		Quaternary Previously Placed Fill (Qppf): Medium dense, dry to slightly moist, brown, silty to clayey fine SAND with gravel.	
								Quaternary Old Paralic Deposits, Unit 6 (Qop_6).	
5			8 9 10			SM/SC		Medium dense, slightly moist, gray brown to red brown, silty to clayey fine grained SAND.	
10			19 25 28	112.4	7.5	SM		Dense, slightly moist, light gray, silty fine SAND.	DS, MD
15			11 18 26					Dense, moist, friable.	
								Total Depth: 16.5 No Groundwater Backfilled with Bentonite and Cuttings.	
20									
25									

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PROJECT:	Blue Wave Imperial Beach	DRILLER:	Baja Exploration	SHEET:	1 of 1
CTE JOB NO:	40-3618G	DRILL METHOD:	CME 75	DRILLING DATE:	5.21.18
LOGGED BY:	DK	SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~18'

BORING: B-5

Depth (Feet)	Sample: Bulk	Sample: Driven	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM/SC		Quaternary Previously Placed Fill (Qppf): Loose to medium dense, slightly moist, brown to red brown, silty to clayey fine SAND.	RV
								Quaternary Old Paralic Deposits, Unit 6 (Qop_6).	
5			10 14 16			SC		Dense, slightly moist, red brown, clayey fine SAND.	
10			7 7 7			SM/SC		Medium dense, slightly moist,red brown, silty to clayey fine SAND, trace medium to coarse sands.	
15			8 14 27					Dense.	
								Total Depth: 16.5 No Groundwater Backfilled with Bentonite and Cuttings.	
20									
25									

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PROJECT:	Blue Wave Imperial Beach	DRILLER:	Baja Exploration	SHEET:	1 of 1
CTE JOB NO:	40-3618G	DRILL METHOD:	CME 75	DRILLING DATE:	5.21.18
LOGGED BY:	DK	SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~18'

BORING: B-6

Depth (Feet)	Bulk Sample	Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM		Quaternary Previously Placed Fill (Qppf): Medium dense, slightly moist, light brown to red brown, silty fine SAND.	
								Quaternary Old Paralic Deposits, Unit 6 (Qop_6).	
5		▮	10 14 16			CL		Very stiff to hard, slightly moist, brown to gray brown, fine sandy CLAY with silt, trace manganese nodules.	EI
10		▮	7 7 7			SM		Medium dense, slightly moist,pale gray brown, silty fine SAND, becoming poorly graded, friable.	
15		▮	8 14 27	116.5	15.2	SP-SM		Medium dense, moist, gray brown to red brown, poorly graded SAND with silt.	CN, MD
								Total Depth: 16.5 No Groundwater Backfilled with Bentonite and Cuttings.	
20									
25									

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PROJECT:	Blue Wave Imperial Beach	DRILLER:	Baja Exploration	SHEET:	1 of 1
CTE JOB NO:	40-3618G	DRILL METHOD:	CME 75	DRILLING DATE:	5.21.18
LOGGED BY:	DK	SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~22'

BORING: B-7

Depth (Feet)	Bulk Sample	Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests/PID Readings
0								Concrete Flatwork: 3"	
	X	X				SM		Quaternary Previously Placed Fill (Qppf): Loose to medium dense, slightly moist, dark red brown, silty fine SAND.	
								Quaternary Old Paralic Deposits, Unit 6 (Qop_6). Stiff , slightly moist, red brown, fine sandy CLAY. CLAY with silt, trace manganese nodules.	
5			14 22 27		16.6	CL		Hard, with silt.	AL, M
10			8 12 13			SM		Medium dense, slightly moist, gray brown to red brown, silty fine SAND, friable.	
15			8 13 18					Dense.	<2 ppm
								Total Depth: 16.5 No Groundwater Backfilled with Bentonite and Cuttings.	
20									
25									

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PROJECT:	Blue Wave Imperial Beach			DRILLER:	Baja Exploration	SHEET:	1 of 1
CTE JOB NO:	40-3618G			DRILL METHOD:	CME 45-Equivalent	DRILLING DATE:	5.21.18
LOGGED BY:	DK			SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~17'

BORING: P-1

Depth (Feet)	Sample: Bulk	Sample: Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM		Quaternary Previously Placed Fill (Qppf): Loose to medium dense, slightly moist, light brown to red brown silty fine SAND, trace clay.	
						CL		Quaternary Old Paralic Deposits, Unit 6 (Qop_6). Stiff to very stiff, slightly moist, red brown, fine sandy CLAY.	
5								Total Depth: 5' No Groundwater Backfilled on 5.22.18	
10									
15									
20									
25									

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PROJECT:	Blue Wave Imperial Beach			DRILLER:	Baja Exploration	SHEET:	1 of 1
CTE JOB NO:	40-3618G			DRILL METHOD:	CME 45-Equivalent	DRILLING DATE:	5.21.18
LOGGED BY:	DK			SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~17'

BORING: P-2

Depth (Feet)	Sample: Bulk	Sample: Driven	Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0							SM		Quaternary Previously Placed Fill (Qppf): Loose to medium dense, slightly moist, dark red brown silty fine SAND, trace clay.	
5									Total Depth: 3' No Groundwater Backfilled on 5.22.18	
10										
15										
20										
25										

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PROJECT:	Blue Wave Imperial Beach			DRILLER:	Baja Exploration	SHEET:	1 of 1
CTE JOB NO:	40-3618G			DRILL METHOD:	CME 45-Equivalent	DRILLING DATE:	5.21.18
LOGGED BY:	DK			SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~18'

BORING: P-3

Depth (Feet)	Sample: Bulk	Sample: Driven	Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0							SM/SC		Quaternary Previously Placed Fill (Qppf): Medium dense, dry to slightly moist, brown, silty to clayey fine SAND with gravel.	
							SM		Quaternary Old Paralic Deposits, Unit 6 (Qop_6). Dense, slightly moist, light gray, silty fine SAND.	
5									Total Depth: 5' No Groundwater Backfilled on 5.22.18	
10										
15										
20										
25										

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PROJECT:	Blue Wave Imperial Beach			DRILLER:	Baja Exploration	SHEET:	1 of 1
CTE JOB NO:	40-3618G			DRILL METHOD:	CME 45-Equivalent	DRILLING DATE:	5.21.18
LOGGED BY:	DK			SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~18'

BORING: P-4

Depth (Feet)	Sample: Bulk	Sample: Driven	Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0							SM		Quaternary Previously Placed Fill (Qppf): Loose to medium dense, slightly moist, red brown silty fine SAND, trace clay.	
5									Total Depth: 3' No Groundwater Backfilled on 5.22.18	
10										
15										
20										
25										

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.

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 compressibility and volume change behavior when loaded and wetted, relatively undisturbed samples were subjected to consolidation in accordance with ASTM D 2435.

Direct Shear
A direct shear test was performed on a relatively undisturbed sample. Direct shear testing was performed in accordance with ASTM D 3080. The sample was inundated during shearing to represent adverse field conditions.

Expansion Index
Expansion Index testing was performed on selected samples of the on-site soils 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.

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/or 200 washes were performed on selected representative samples according to ASTM C 136 and D 1140 to determine grain-size distribution.

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REPORT OF RESISTANCE 'R' VALUE-EXPANSION PRESSURE

Project Name: Imperial Beach Hotel & Residential
Project No.: 40-3618
Sample Location: B-5 @ 0-5'
Soil Description: Moderate brown SM
Test Procedure: Cal 301

Lab No.: 28475
Sampled By: D.K. **Date:** 5/21/2018
Submitted By: D.K. **Date:** 5/22/2018
Tested By: Larry Sachs **Date:** 5/30/2018
Reviewed By: Chase Velarde **Date:** 6/5/2018

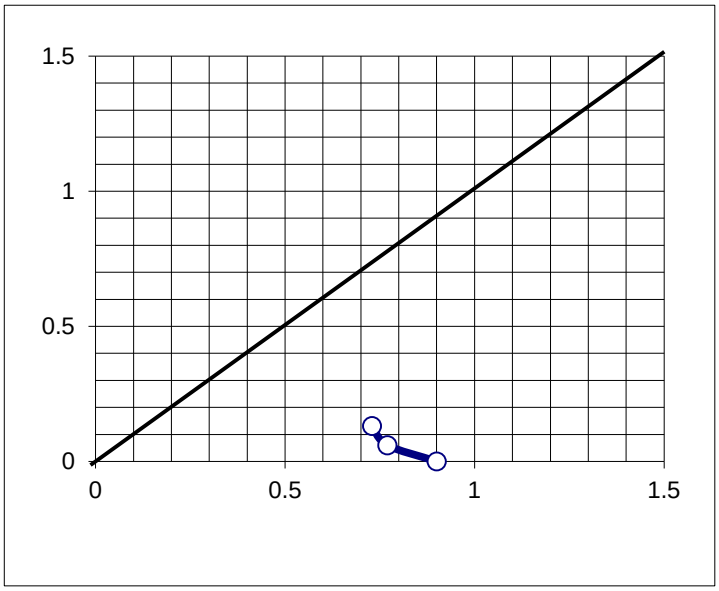
Specimen/ Mold No.	1	2	3	
Compactor Air Pressure, ft.lbs.	310	300	100	
Initial Moisture, %	4.1	4.1	4.1	
Wet Weight / Tare (g)	1946.0	1946.0	1946.0	
Dry Weight / Tare (g)	1898.3	1898.3	1898.3	
Tare (g)	745.2	745.2	745.2	
Water Added, ml	60	70	80	
Moisture at Compaction, %	9.3	10.2	11.1	
Wt. Of Briquette and Mold, g	3241	3201	3293	
Wt. Of Mold, g	2096	2096	2110	
Wt. Of Briquitte,g	1146	1104	1183	
Height of Briquette, in	2.44	2.41	2.59	
Dry Density, pcf	130.2	126.0	124.6	
Stabilometer PH @ 1000 lbs	41	48	62	
Stabilometer PH @ 2000 lbs	100	108	140	
Displacement	4.28	4.40	6.00	
R' Value	25	21	5	
Corrected 'R' Value	23	19	6	
Exudation Pressure, lbs	6500	5980	3350	
Exudation Pressure, psi	520	478	268	
Stabilometer Thickness - ft	0.73	0.77	0.90	
Expansion Pressure	0.0004	0.0002	0.0000	
Expansion Press, Thick-ft	0.13	0.06	0.00	

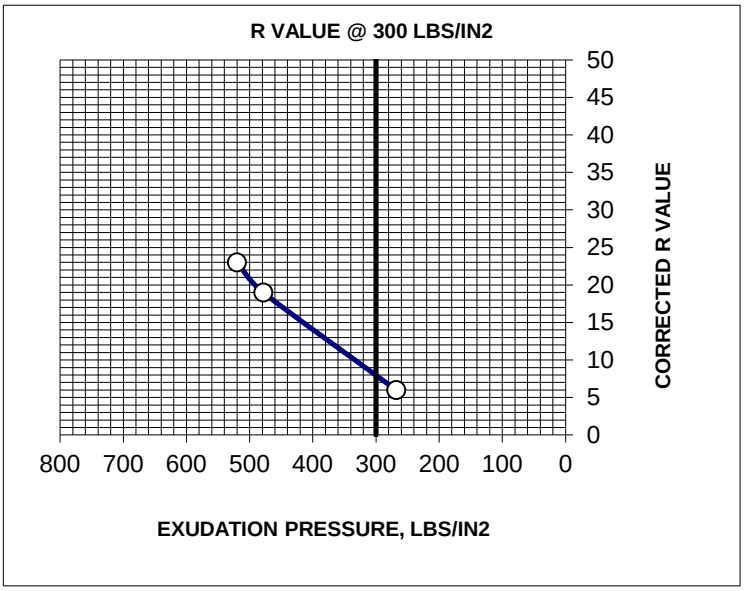
Exudation 8

Expansion 45

R-value **8**

TI	4.5
Expansion	45

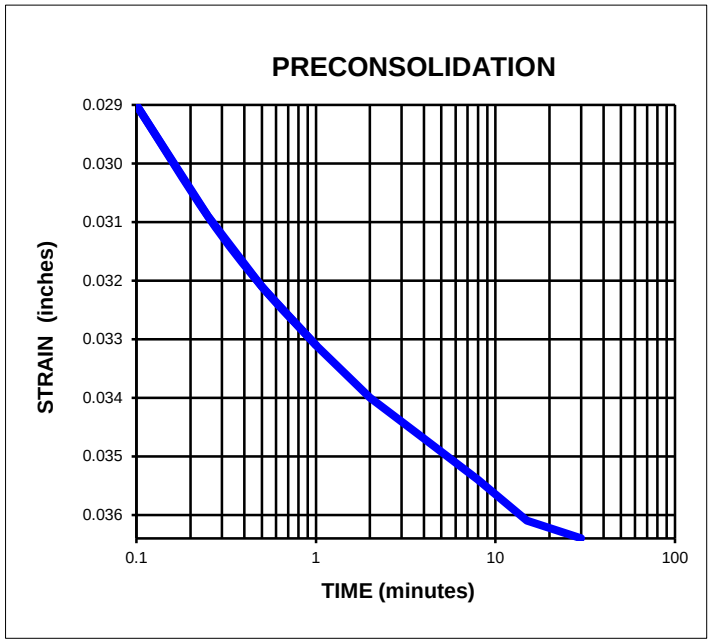


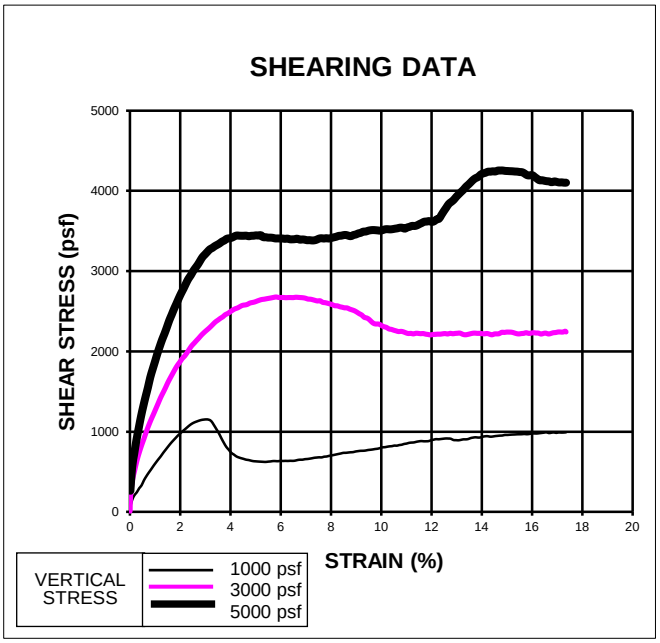


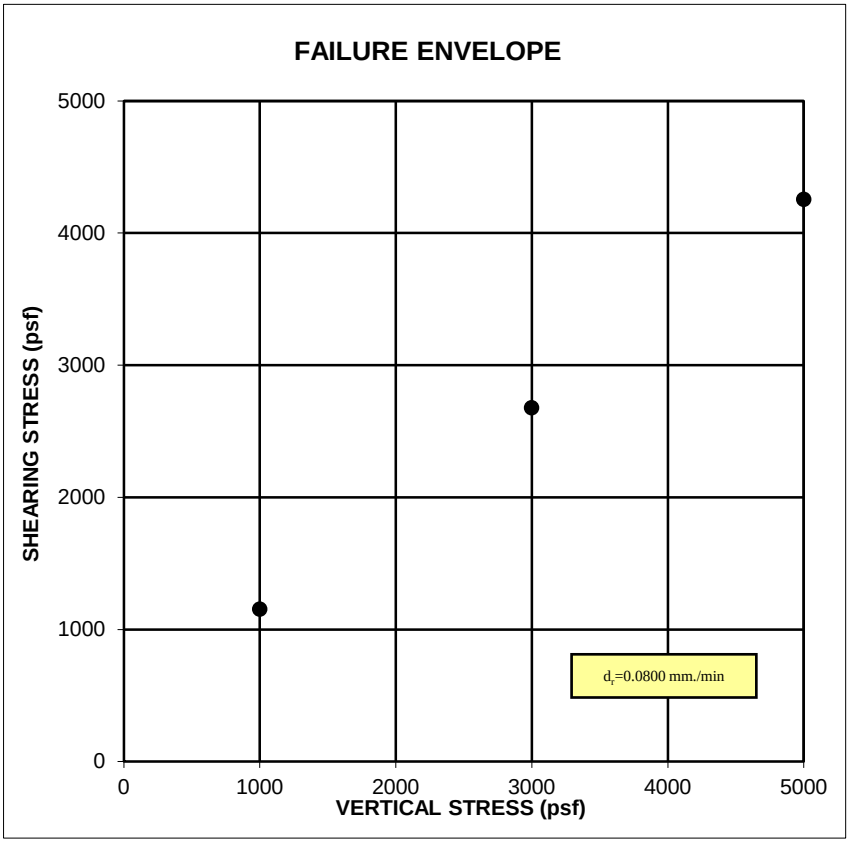
Cover Thickness by Expansion Pressure-Feet

Expansion From Graph:	0.53

Chase Velarde
Laboratory Manager







SHEAR STRENGTH TEST - ASTM D3080

Job Name:	Imperial Beach Hotel and Residential			Initial Dry Density (pcf):	112.4
Project Number:	40-3618G	Sample Date:	5/21/2018	Initial Moisture (%):	7.5
Lab Number:	28475	Test Date:	6/1/2018	Final Moisture (%):	15.8
Sample Location:	B-4 @ 10'	Tested by:	JNC	Cohesion:	360 psf
Sample Description:	Moderate brown SM			Angle Of Friction:	37.8

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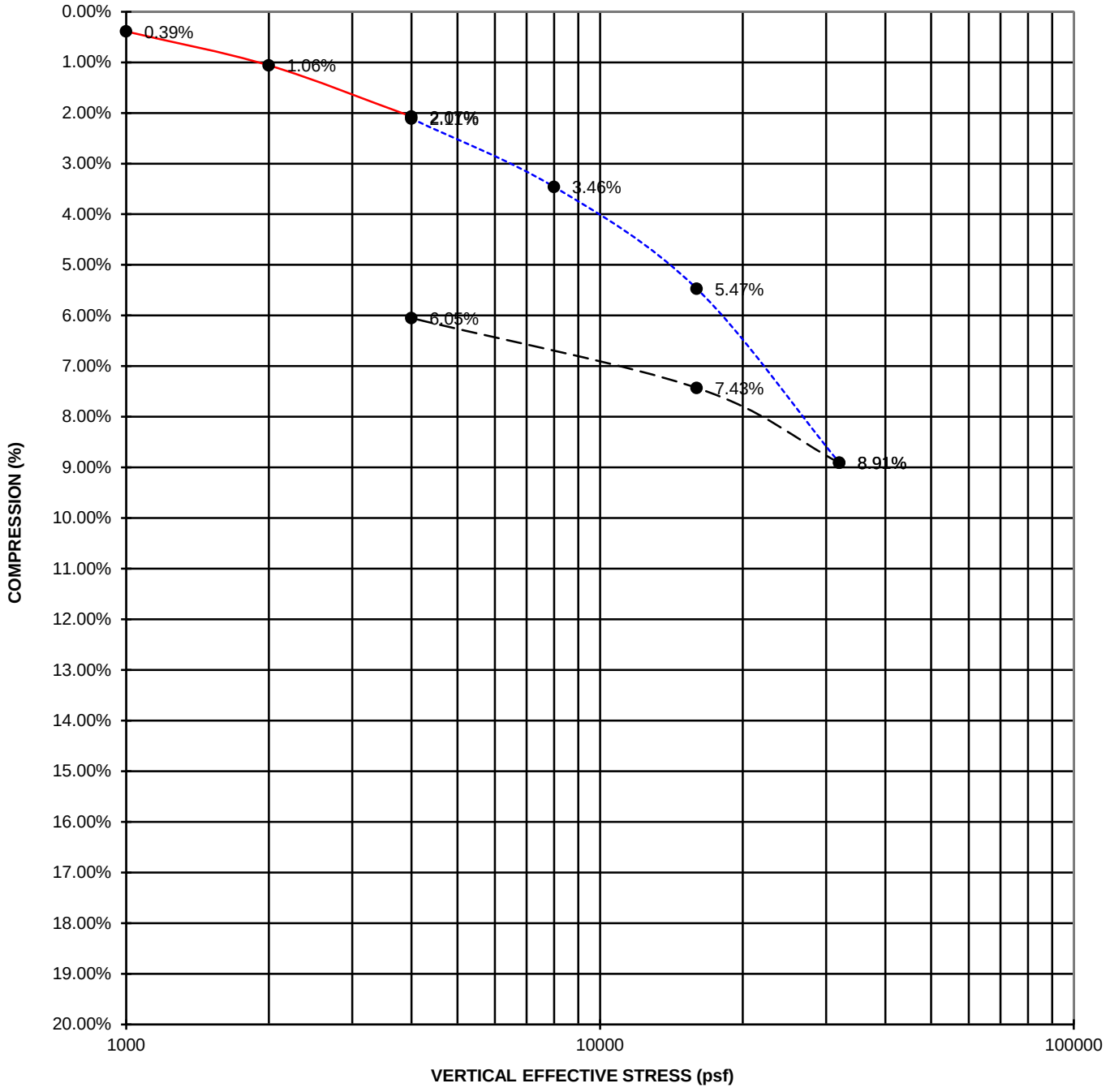

Consolidation Test ASTM D2435

Project Name:	Imperial Beach Hotel and Residential				
Project Number:	40-3618	Sample Date:	5/21/2018	Initial Moisture (%):	15.5
Lab Number:	28475	Test Date:	5/29/2018	Final Moisture (%):	16.4
Sample Location:	B-6 @ 15'	Tested By:	JNC	Initial Dry Density (PCF):	116.5
Sample Description:	Moderate grayish-brown SM			Final Dry Density (PCF):	123.7

Job Name:	Imperial Beach Hotel and Residential		
Job No:	40-3618G	**Tested By:**	JNC
Lab No:	28475	**Date Sampled:**	5/21/2018
Soil Location:	B-1 @ 0-5'	**Date Tested:**	5/29/2018
Soil Description:	Moderate Reddish Brown SC		

LAB WORK SHEET EXPANSION INDEX TEST

ASTM D 4829

TEST RESULTS

		Initial	Final
WET WEIGHT	(g)	114.9	438.5
DRY WEIGHT	(g)	105.8	375.5
% MOISTURE	(%)	8.6	16.8
WEIGHT OF RING & SOIL	(g)	**623.1**	
WEIGHT OF RING	(g)	207.3	
WEIGHT OF SOIL	(lbs.)	0.9166	
VOLUME OF RING	($ft.^3$)	0.0073	
WET DENSITY	(pcf)	126.0	
DRY DENSITY	(pcf)	116.1	
% SATURATION	(%)	**51.5**	

EXPANSION READING

DATE TIME: INITIAL READING INCH

0.1540

FINAL READING

0.1810

EXPANSION INDEX

27

VERY LOW	**0-20**
LOW	**21-50**
MEDIUM	**51 -90**
HIGH	**91-130**
VERY HIGH	**130>**

NOTES:

EI at saturation between 48-52%

Measured EI:	27
Measured Saturation:	51.5

EI at 48-52% Saturation: 27

Job Name:	Imperial Beach Hotel and Residential		
Job No:	40-3618	**Tested By:**	JNC
Lab No:	28475	**Date Sampled:**	5/21/2018
Soil Location:	B-6 @ 5'	**Date Tested:**	6/5/2018
Soil Description:	Light Brown CL		

LAB WORK SHEET

EXPANSION INDEX TEST

ASTM D 4829

TEST RESULTS

		Initial	Final
WET WEIGHT	(g)	114.7	428.7
DRY WEIGHT	(g)	103.8	347.6
% MOISTURE	(%)	10.5	23.3
WEIGHT OF RING & SOIL	(g)	**749.8**	
WEIGHT OF RING	(g)	366.3	
WEIGHT OF SOIL	(lbs.)	0.8454	
VOLUME OF RING	($ft.^3$)	0.0073	
WET DENSITY	(pcf)	116.2	
DRY DENSITY	(pcf)	105.2	
% SATURATION	(%)	**47.5**	

EXPANSION READING

DATE TIME: INITIAL READING INCH

0.0192

FINAL READING

0.0828

EXPANSION INDEX

64

VERY LOW	**0-20**
LOW	**21-50**
MEDIUM	**51 -90**
HIGH	**91-130**
VERY HIGH	**130>**

NOTES:

EI at saturation between 48-52%

Measured EI:	63.6
Measured Saturation:	47.5

EI at 48-52% Saturation: 64

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Report of Soil Testing

Project Name: Imperial Beach Hotel and Residential
Project Number: 40-3618G
Lab Number: 28475
Tested By: JNC/KG
Date Sampled: 5/21/2018
Date Tested: 5/23/2018

Sample	B-1	B-1	B-1	B-1	B-1	
Depth	10'	15'	20'	25'	30'	
Sieve Size	%Passing					
1 inch (25.4 mm)						
3/4 inch (19.1 mm)						
1/2 inch (12.7 mm)						
3/8 inch (9.5 mm)	100	100		100		
#4 (4.75 mm)	83	99	100	99	100	
#8 (2.36 mm)	81	98	98	98	98	
#16 (1.18 mm)	80	94	92	91	93	
#30 (0.6 mm)	72	70	62	74	73	
#50 (0.3 mm)	58	35	45	54	42	
#100 (0.15 mm)	37	15	10	39	22	
#200 (0.075 mm)	17.8	8.2	5.4	14.1	8.1	

Tested in Accordance with ASTM D6913, D1140

Reviewed By: Chase Velarde
Chase Velarde
Laboratory Manager

Date: June 1, 2018

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Report of Soil Testing

Project Name: Imperial Beach Hotel and Residential
Project Number: 40-3618G
Lab Number: 28475
Tested By: JNC/KG
Date Sampled: 5/21/2018
Date Tested: 5/23/2018

Sample	B-1	B-2	B-2	B-2	B-2	
Depth	35'	10'	15'	25'	30'	
Sieve Size	%Passing					
1 inch (25.4 mm)			100			
3/4 inch (19.1 mm)			85			
1/2 inch (12.7 mm)			76			
3/8 inch (9.5 mm)		100	73		100	
#4 (4.75 mm)	100	94	64		99	
#8 (2.36 mm)	99	92	49	100	99	
#16 (1.18 mm)	98	88	35	99	97	
#30 (0.6 mm)	97	66	22	97	91	
#50 (0.3 mm)	92	33	13	90	69	
#100 (0.15 mm)	74	14	9	75	49	
#200 (0.075 mm)	41.8	8.1	5.8	18.8	29.7	

Tested in Accordance with ASTM D6913, D1140

Reviewed By: Chase Velarde
Chase Velarde
Laboratory Manager

Date: June 1, 2018

Construction Testing & Engineering, Inc.

Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

Report of Soil Testing

Project Name: Imperial Beach Hotel and Residential
Project Number: 40-3618G
Lab Number: 28475
Tested By: JNC/KG
Date Sampled: 5/21/2018
Date Tested: 5/23/2018

Sample	B-2	B-3				
Depth	40'	5'				
Sieve Size	%Passing					
1-1/2 inch (38.1 mm)	100					
1 inch (25.4 mm)	85	100				
3/4 inch (19.1 mm)	83	98				
1/2 inch (12.7 mm)	83	95				
3/8 inch (9.5 mm)	82	93				
#4 (4.75 mm)	79	90				
#8 (2.36 mm)	78	85				
#16 (1.18 mm)	76	76				
#30 (0.6 mm)	70	52				
#50 (0.3 mm)	47	26				
#100 (0.15 mm)	27	15				
#200 (0.075 mm)	15.7	10.1				

Tested in Accordance with ASTM D6913, D1140

Reviewed By: Chase Velarde
Chase Velarde
Laboratory Manager

Date: May 29, 2018

Construction Testing & Engineering, Inc.

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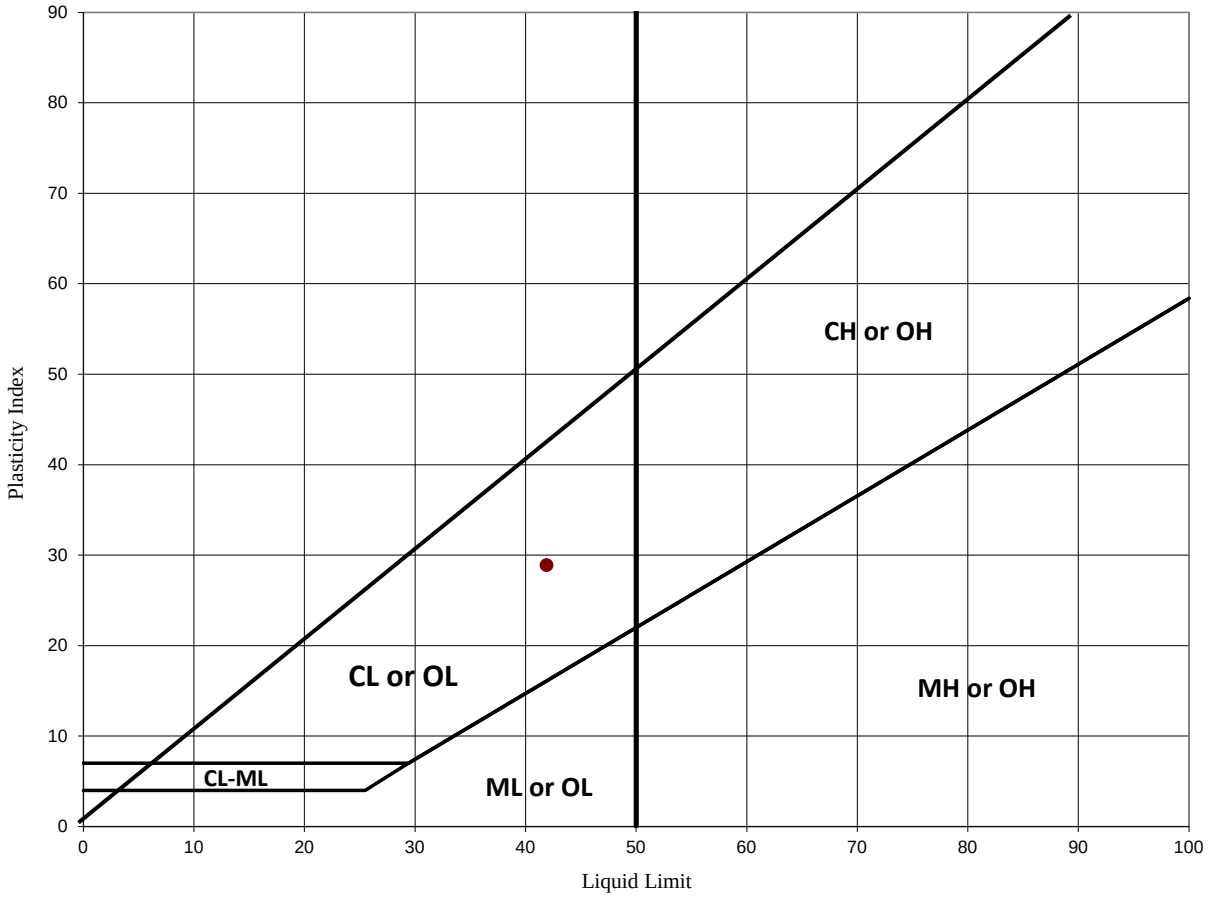
Standard Test Method for Atterberg Limits ASTM D4318

Job Name:	Imperial Beach Hotel and Residential		
Project Number:	40-3618G	**Sampled By:**	DK
Lab Number:	28475	**Tested By:**	JNC
Sample Location:	B-1 @ 5'	**Date Sampled:**	5/21/2018
Sample Description:	Moderate Brown	**Date Tested**	6/1/2018



Liquid Limit: 42

Plastic Limit: 13

Plasticity Index: 29

Procedures Used			
☐	Wet preparation	☐	Procedure A - Multipoint Test
☒	Dry Preparation	☒	Procedure B - One Point Test

Reviewed By: _____ **Date:** 6/1/2018

Chase Velarde, Laboratory Manager

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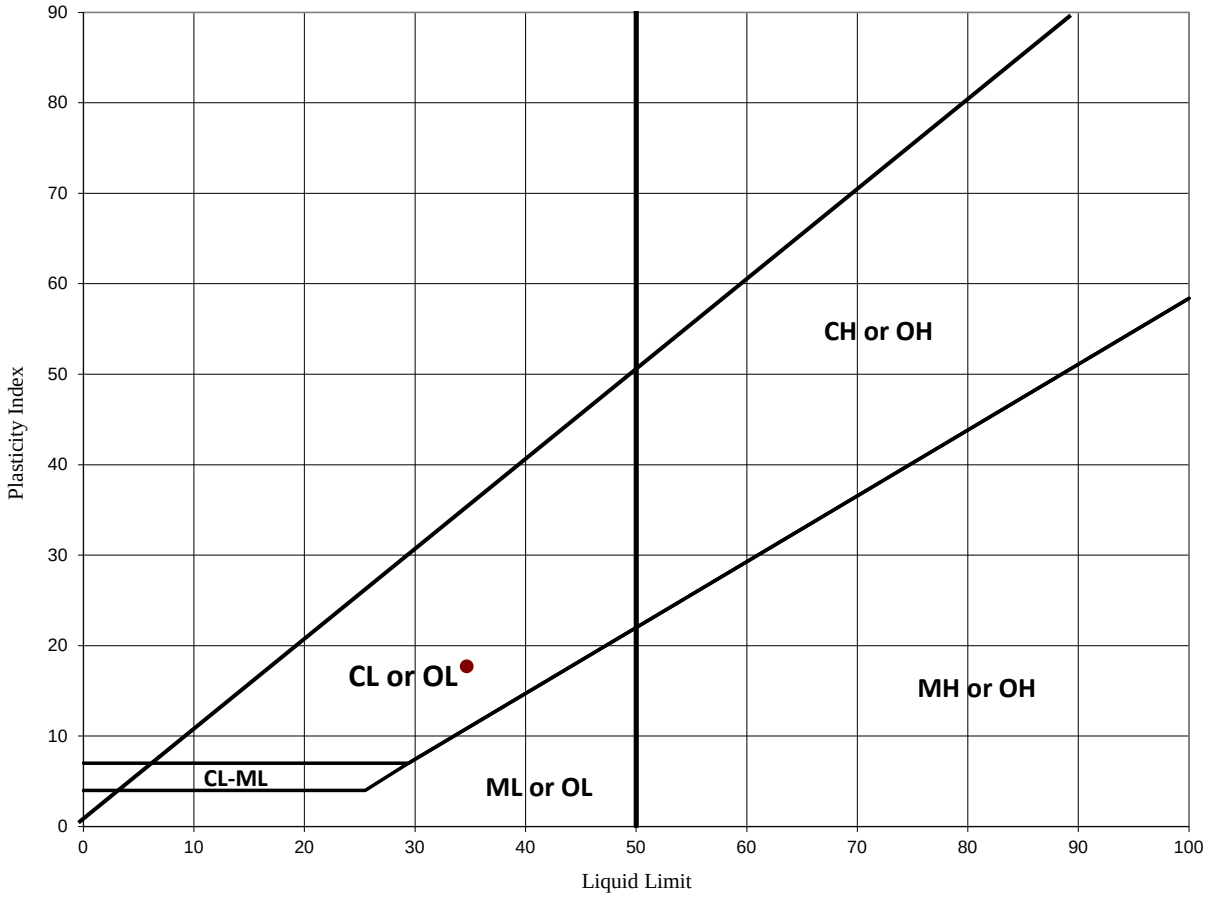
Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

Standard Test Method for Atterberg Limits ASTM D4318

Job Name:	Imperial Beach Hotel and Residential		
Project Number:	40-3618G	**Sampled By:**	DK
Lab Number:	28475	**Tested By:**	JNC
Sample Location:	B-7 @ 5'	**Date Sampled:**	5/21/2018
Sample Description:	Moderate Brown	**Date Tested**	5/31/2018



Liquid Limit: 35
Plastic Limit: 17
Plasticity Index: 18

Procedures Used			
☐	Wet preparation	☐	Procedure A - Multipoint Test
☒	Dry Preparation	☒	Procedure B - One Point Test

Reviewed By: _____ **Date:** 6/1/2018

Chase Velarde, Laboratory Manager

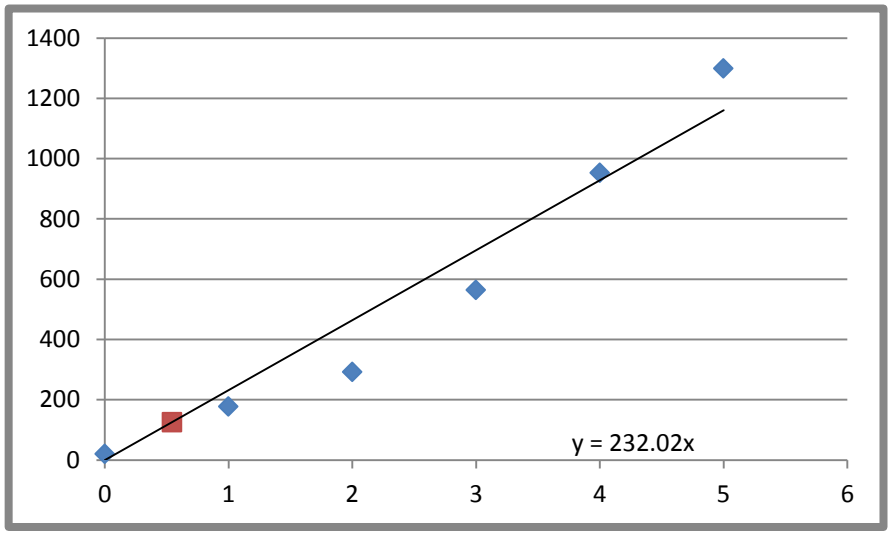
Construction Testing & Engineering, Inc.

Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

Standard Test Method for Sulfate Content CTM 417

Project Name:	Blue Walk IB	Date Sampled:	5/21/2018
Project Number:	40-3618G	Date Tested:	5/29/2018
Lab Number:	28475	Tested By:	K.Gallagher
Sample Number:	B-1 @ 0-5	Description:	Moderate brown SC/Cl

SULFATE CONCENTRATION



BLANK	82
FINAL	208
DELTA	126
Mg SO4	0.543

SULFATE CONTENT (PPM) 81.5

Standard Test Method For Testing Chloride Content CTM 422

CHLORIDE CONCENTRATION

SAMPLE	50	DELTA	1.3
INITIAL	3.3	**Chloride (PPM)**	**39.0**
FINAL	4.6		

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Standard Test Method for pH and Resistivity (CTM 643)

Project Name:	Blue Walk IB		
Project Number:	40-3618G	Date Sampled:	5/21/2018
Lab Number:	28475	Date Tested:	5/29/2018
Sample Location:	B-1 @ 0-5		

pH OF SAMPLE

TEST RESULTS	8.82	**pH**

RESISTIVITY OF SAMPLE

SAMPLE WEIGHT	300.5	g

TRIAL NO.	WATER ADDED (ml)	RESISTANCE (ohm)
1	30	2800
2	40	1800
3	50	1800
4		
5		
6		
7		
8		
9		
10		

Box Constants (CM): Small (1.000), Medium (0.432), Large (6.458)

RESISTIVITY

A) BOX CONSTANT (SMALL, MEDIUM, OR LARGE)	1.0	CM
B) LOW RESISTANCE X BOX CONSTANT (A)	1800	OHM-CM
C) TEMPERATURE AT MINIMUM RESISTIVITY	23.7	°C
D) CORRECTED RESISTIVITY FOR 15.5 °C	2169	OHM-CM

$$D = [B * (24.5 + C)]/ 40$$

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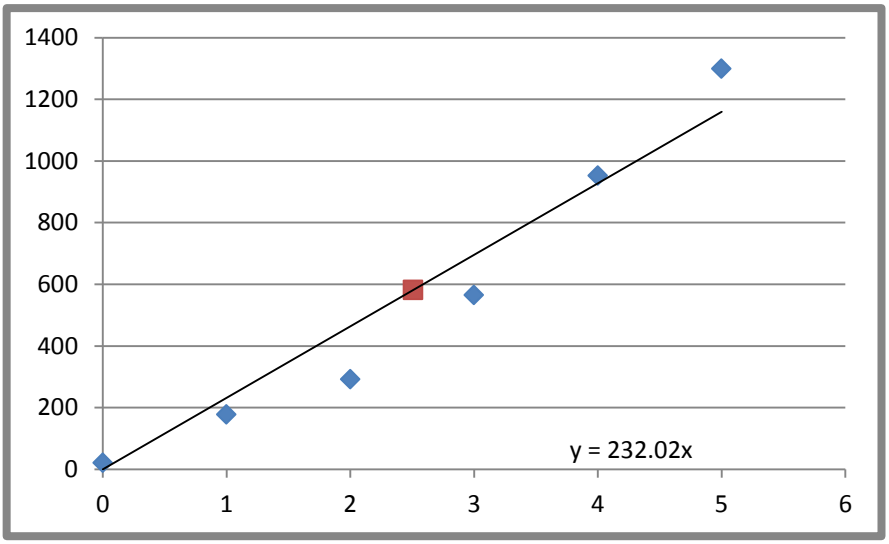
Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

Standard Test Method for Sulfate Content CTM 417

Project Name:	Blue Walk IB	Date Sampled:	5/21/2018
Project Number:	40-3618G	Date Tested:	5/29/2018
Lab Number:	28475	Tested By:	K.Gallagher
Sample Number:	B-2 @ 0-5	Description:	Moderate brown SM/SC

SULFATE CONCENTRATION



BLANK	26.3
FINAL	608
DELTA	581.7
Mg SO4	2.507

SULFATE CONTENT (PPM) 376.1

Standard Test Method For Testing Chloride Content CTM 422

CHLORIDE CONCENTRATION

SAMPLE	39	DELTA	12.3
INITIAL	0.7	**Chloride (PPM)**	**473.0**
FINAL	13		

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Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

Standard Test Method for pH and Resistivity (CTM 643)

Project Name:	Blue Walk IB		
Project Number:	40-3618G	Date Sampled:	5/21/2018
Lab Number:	28475	Date Tested:	5/29/2018
Sample Location:	B-2 @ 0-5		

pH OF SAMPLE

TEST RESULTS	8.44	**pH**

RESISTIVITY OF SAMPLE

SAMPLE WEIGHT	303.1	g

TRIAL NO.	WATER ADDED (ml)	RESISTANCE (ohm)
1	30	1000
2	40	500
3	50	280
4	60	260
5	70	250
6	80	240
7	90	250
8		
9		
10		

Box Constants (CM): Small (1.000), Medium (0.432), Large (6.458)

RESISTIVITY

A) BOX CONSTANT (SMALL, MEDIUM, OR LARGE)	1.0	CM
B) LOW RESISTANCE X BOX CONSTANT (A)	240	OHM-CM
C) TEMPERATURE AT MINIMUM RESISTIVITY	23.0	°C
D) CORRECTED RESISTIVITY FOR 15.5 °C	285	OHM-CM

$$D = [B * (24.5 + C)]/ 40$$

APPENDIX C

PERCOLATION TEST RESULTS AND CALCULATED INFILTRATION RATES

APPENDIX C

PERCOLATION TEST RESULTS AND CALCULATED INFILTRATION RATES

Appendix E provides calculated infiltration rates based upon the percolation test results placed within the proposed BMP basin. The work performed herein was conducted during the planning phase of the project. We understand that a BMP basin is proposed running east to west along the northern property line of the site. As such, four percolation test holes were placed to depths from 30 to 65 inches bgs within the proposed basin. Additionally, soil borings were placed within 50 feet of the proposed basin, and extended to at least 10 feet below the basin bottom excavation to allow an evaluation of the potential presence of groundwater at those locations. This report generally follows the City of San Diego storm water infiltration design requirements January 2018 edition Appendix C "Geotechnical and Groundwater Investigation Requirements: and Appendix D "Approved Infiltration Rate Assessment Methods for Selection of Storm Water BMPs." Geotechnical information including soil boring locations and distribution of geologic units is shown on the attached Figure 2. Soil boring logs are provided in Appendix B.

The proposed infiltration basin location was as directed to CTE by the client and has not been detailed on the project plans as of this writing. Depths tested are near anticipated infiltration elevations, however, grading plans and basin details were not provided as of this writing. CTE understands the project is in the planning phase of development, and a site specific evaluation of infiltration basins was performed as requested and necessary per Appendix C of the City of San Diego "Geotechnical and Groundwater Investigation Requirements". Associated Worksheet C.4-1 is attached at the end of this Appendix.

1.0 PERCOLATION TESTS AND CALCULATED INFILTRATION RATES

1.1 Percolation Tests

Four percolation tests were performed in general accordance with Appendix D of the City of San Diego Storm Water Design requirements. Based on visual and tactile identification, the percolation tests were performed in native materials and/or fill soils that were generally encountered as medium dense, silty to clayey sands and occasionally stiff, moist clays. Boring logs of the soils encountered in the test holes are included in Appendix B. The measured percolation rates are shown on following Table 1.1.

Project: BLUE WAVE PROJECT IMPERIAL BEACH

Project No. 40-3618G Table 1.2

Percolation Field Data and Calculated Rates

Boring P-1						**Total Depth**	**61.5 inches**
Time	Test Interval Time (minutes)	Test Refill	Water Level Initial/Start Depth /Inches	Water Level End/Final Depth /Inches	Incremental Water Level Change (inches)	Percolation Rate inches/minutes	Percolation Rate inches/hour
9:30:00	Initial	None	49.5000	initial	initial		
10:00:00	0:30	"	49.5000	49.5000	0.0000	0.0000	0.0000
10:30:00	0:30	"	49.5000	49.6250	0.1250	0.0042	0.2500
11:00:00	0:30	47.563	47.5625	47.5625	0.0000	0.0000	0.0000
11:30:00	0:30	"	47.5625	47.5625	0.0000	0.0000	0.0000
12:00:00	0:30	"	47.5625	47.6250	0.0625	0.0021	0.1250
12:30:00	0:30	"	47.6250	47.8125	0.1875	0.0063	0.3750
13:00:00	0:30	"	47.8125	47.9375	0.1250	0.0042	0.2500
13:30:00	0:30	"	47.9375	48.0625	0.1250	0.0042	0.2500

Boring P-2						**Total Depth**	**44 inches**
Time	Test Interval Time (minutes)	Test Refill	Water Level Initial/Start Depth /Inches	Water Level End/Final Depth /Inches	Incremental Water Level Change (inches)	Percolation Rate inches/minutes	Percolation Rate inches/hour
9:32:00	Initial	None	36.5000	initial	initial		
10:02:00	0:30	"	36.5000	36.5000	0.0000	0.0000	0.0000
10:32:00	0:30	"	36.5000	36.5000	0.0000	0.0000	0.0000
11:02:00	0:30	"	36.5000	36.5625	0.0625	0.0021	0.1250
11:32:00	0:30	"	36.5625	36.6250	0.0625	0.0021	0.1250
12:02:00	0:30	"	36.6250	36.6875	0.0625	0.0021	0.1250
12:32:00	0:30	"	36.6875	36.8750	0.1875	0.0063	0.3750
13:02:00	0:30	"	36.8750	36.9375	0.0625	0.0021	0.1250
13:32:00	0:30	"	36.9375	37.0000	0.0625	0.0021	0.1250

Boring P-3						Total Depth	65.5 inches
Time	Test Interval Time (minutes)	Test Refill	Water Level Initial/Start Depth /Inches	Water Level End/Final Depth /Inches	Incremental Water Level Change (inches)	Percolation Rate inches/minutes	Percolation Rate inches/hour
9:34:00	Initial	None	55.5625	initial	initial		
10:04:00	0:30	"	55.5625	56.6875	1.1250	0.0375	2.2500
10:34:00	0:30	55.250	55.2500	56.1250	0.8750	0.0292	1.7500
11:04:00	0:30	"	56.1250	56.5625	0.4375	0.0146	0.8750
11:34:00	0:30	55.500	55.5000	55.7500	0.2500	0.0083	0.5000
12:04:00	0:30	"	55.7500	56.1250	0.3750	0.0125	0.7500
12:34:00	0:30	"	56.1250	56.5625	0.4375	0.0146	0.8750
13:04:00	0:30	55.688	55.6875	56.0000	0.3125	0.0104	0.6250
13:34:00	0:30	"	56.0000	56.3125	0.3125	0.0104	0.6250

Boring P-4						Total Depth	40 inches
Time	Test Interval Time (minutes)	Test Refill	Water Level Initial/Start Depth /Inches	Water Level End/Final Depth /Inches	Incremental Water Level Change (inches)	Percolation Rate inches/minutes	Percolation Rate inches/hour
9:36:00	Initial	None	32.6875	initial	initial		
10:06:00	0:30	"	32.6875	33.1250	0.4375	0.0146	0.8750
10:36:00	0:30	"	33.1250	33.3750	0.2500	0.0083	0.5000
11:06:00	0:30	"	33.3750	33.6875	0.3125	0.0104	0.6250
11:36:00	0:30	31.625	31.6250	31.8125	0.1875	0.0063	0.3750
12:06:00	0:30	"	31.8125	32.0625	0.2500	0.0083	0.5000
12:36:00	0:30	"	32.0625	32.3750	0.3125	0.0104	0.6250
13:06:00	0:30	"	32.3750	32.5625	0.1875	0.0063	0.3750
13:36:00	0:30	"	32.5625	32.8125	0.2500	0.0083	0.5000

NOTES: Water Level as measured from a fixed location at the top of the hole.
The borehole had a 6-inch diameter.
The percolation test holes were presoaked approximately 24 hours prior to the tests.
Weather was overcast during the percolation test.

1.2 Calculated Infiltration Rates

As per the City of San Diego BMP design documents (January, 2018) infiltration rates are to be evaluated through the Porchet Method. CTE utilized the Porchet Method through guidance of the County of Riverside (2011). The intent of the infiltration rate is to account for the inherent bias in the percolation test borehole sidewall infiltration, as this would not occur at a basin bottom where such sidewalls are not present.

The infiltration rate (It) is derived by the equation:

$$I_t = \frac{\Delta H\ \pi r2\ 60}{\Delta t(\pi r2 + 2\pi r H_{avg})} = \frac{\Delta H\ 60\ r}{\Delta t(r + 2H_{avg})}$$

Where:

I_t = tested infiltration rate, inches/hour
ΔH = change in head over the time interval, inches
Δt = time interval, minutes
* r = effective radius of test hole
H_{avg} = average head over the time interval, inches

Given the measurement values of Table 1.1, the calculated infiltration rates without Safety Factor are as follows.

TABLE 1.2

JOB NAME: BLUE WAVE IMPERIAL BEACH PROJECT, 40-3618G

Percolation Rate Conversion P-1

		Inches
Time Interval,	Δt =	30
Final Depth of Water,	D_f =	48.0625
Test Hole Radius,	r =	4
Initial Depth to Water,	D_0 =	47.9375
Total Depth of Test Hole,	D_T =	61.5

H_o =	13.5625	in		
H_f =	13.4375	in		
$\Delta H = \Delta D$ =	0.125	in		
H_{avg} =	13.5	in		
I_t =	0.032	in/hr	=	**IF-1**

Percolation Rate Conversion P-2

		Inches
Time Interval,	Δt =	30
Final Depth of Water,	D_f =	37
Test Hole Radius,	r =	4
Initial Depth to Water,	D_0 =	36.9375
Total Depth of Test Hole,	D_T =	44

H_o =	7.0625	in		
H_f =	7	in		
$\Delta H = \Delta D$ =	0.0625	in		
H_{avg} =	7.03125	in		
I_t =	0.028	in/hr	=	**IF-2**

Percolation Rate Conversion P-3

		Inches
Time Interval,	Δt =	30
Final Depth of Water,	D_f =	56.3125
Test Hole Radius,	r =	4
Initial Depth to Water,	D_0 =	56
Total Depth of Test Hole,	D_T =	65.5

H_o =	9.5	in		
H_f =	9.1875	in		
$\Delta H = \Delta D$ =	0.3125	in		
H_{avg} =	9.34375	in		
I_t =	0.110	in/hr	=	**IF-3**

Percolation Rate Conversion P-4

		Inches
Time Interval,	Δt =	30
Final Depth of Water,	D_f =	32.8125
Test Hole Radius,	r =	4
Initial Depth to Water,	D_0 =	32.5625
Total Depth of Test Hole,	D_T =	40

H_o =	7.4375	in		
H_f =	7.1875	in		
$\Delta H = \Delta D$ =	0.25	in		
H_{avg} =	7.3125	in		
I_t =	0.107	In/hr	=	**IF-4**

1.3 Summary of Percolation and Infiltration Test Results

The following Table 1.3 presents the percolation rates observed in the field, the converted infiltration rates as discussed in Section 1.2 and as shown in Table 1.2, and the recommended rate for design (with safety factor applied).

TABLE 1.3
SUMMARY OF PERCOLATION AND INFILTRATION TEST RESULTS

Test Location	Soil Type	Soil Type (USCS)	Treatment Area	San Diego County Percolation Procedure	Depth (inches)	Percolation Rate (inches/hour)	Infiltration Rate (inches/hour)	Recommended Rate for Design* (inches/hour)
P-1	Qop6	SM/SC	Northern BMP	Case 3	61.5	0.250	0.032	0.016
P-2	Qppf	SM/SC	Northern BMP	Case 3	44	0.125	0.028	0.014
P-3	Qop6	SM/SC	Northern BMP	Case 3	65.5	0.625	0.110	0.055
P-4	Qop6	SM/SC	Northern BMP	Case 3	40	0.500	0.107	0.054

Qppf: Quaternary Previously Placed Fill, Qop6: Quaternary Older Paralic Deposits, Unit 6
* A safety factor of two (2) was applied to the calculated design infiltration rate

As stated in Appendix C of the Model BMP Design Manual, San Diego Region, (2018), and Worksheet C.4-1, sites with full infiltration potential should have infiltration rates at or above 0.5 inches per hour. The BMP Design Manual also considers infiltration rates of 0.05 inches per hour to be the cutoff between sites with partial infiltration potential and sites not suited for infiltration. Based on these parameters, and utilizing the lowest (conservative) rate, the infiltration rates of the soils within the BMP area are not suited for infiltration (see the attached Worksheet C.4-1. Therefore, based on the rates obtained, the basins should be lined with an impermeable geofabric/barrier and the filtered storm water collected via subsurface piping and discharged off site as designed by the project civil engineer or as required by the local governing agency. Additionally, infiltration at the site is not recommended as discussed below.

2.0 FEASIBILITY OF INFILTRATION

2.1 Groundwater

Groundwater was encountered in Boring B-2, adjacent to the proposed BMP at an approximate depth of 16.5 feet bgs. Based on regional information, redoximorphic features observed in borings, and a review of nearby groundwater data (Geotracker online at Geotracker.waterboards.ca.gov) seasonally high groundwater depths at the site are anticipated to fluctuate as high as 13 feet bgs in the BMP area. Therefore groundwater may be anticipated to rise within ten feet of the bottom of the proposed BMP limiting infiltration at the site. However, the approval agency should determine if this requirement can be reduced based upon the basin supporting beneficial use and maintaining groundwater quality. Potential existing contamination of the groundwater may be a limiting factor

in reducing the groundwater requirement. However, CTE does not recommend infiltration due to the groundwater elevation.

2.2 Slope Stability

Infiltration is not anticipated to destabilize existing or proposed slopes. However, as stated above, the rates indicate that the site is not suited for infiltration. Lining the BMP with an impermeable liner is recommended.

2.3 Settlement and Volume Change

Settlement and volume change of soils underlying biofiltration basins can limit the amount of infiltration of water into those soils. Less than one percent settlement of site soils once fully saturated would be anticipated. However, as stated above, the rates indicate that the site is not suited for infiltration. No significant volume change is anticipated with lining the BMP as recommended.

2.4 Utility Considerations

As stated above, the rates indicate that the site is not suited for infiltration. Infiltration has the potential to damage subsurface utilities, and geotechnical hazards can result from the introduction of infiltrated water.

2.5 Retaining Walls and Foundations

As stated above, the rates indicate that the site is not suited for infiltration. The proposed BMP's are anticipated to be lined with an impermeable geofabric as recommended herein. Any proposed retaining walls should be equipped with subdrains as standard practice and BMP's should be designed such that in the event of an overflow, the structural integrity of the wall is not compromised.

2.6 Separation from Seasonal High Water

As stated above, the rates indicate that the site is not suited for infiltration. Additionally, based upon the subsurface explorations in combination with regional information, redoximorphic features observed in borings, and a review of nearby groundwater data, groundwater may be anticipated to rise within ten feet of the bottom of the proposed BMP, limiting infiltration at the site.

2.7 Wellhead Protection

It is understood that the site does not include wells, and wells were not observed during CTE's site observations. As stated above, the rates indicate that the site is not suited for infiltration. Therefore, basins are not anticipated to adversely affect such wellheads.

2.8 Water Balance Impacts on Stream Flow

As stated above, the rates indicate that the site is not suited for infiltration. Therefore, infiltrate is not anticipated to adversely affect the natural water balance of regional streams or drainages.

2.9 Contaminated Soil and Groundwater

Based upon information obtained from Geotracker online, observed conditions during field explorations, and as noted in the CTE (2018) Phase 1 Environmental Site Assessment (performed under separate contract), impacted soil and groundwater from petroleum releases in the site vicinity have the potential to be affected by infiltration at the site BMP. Therefore, lining the BMP as noted

herein is recommended in reducing the potential to spread potential contaminates.

4.0 WORKSHEETS

The City of San Diego Appendix C (January 2018) required Worksheets C.4-1 “Categorization of Infiltration Feasibility Condition” is attached with this Appendix E.

5.0 CLOSING

This report has been prepared as per City of San Diego storm water control requirements. CTE does not accept any liabilities toward preparation of the City of San Diego required design requirements. It is noted that implementation of information provided herein is subject to interpretation and approval of the City of San Diego who has adopted the subject storm water requirements. CTE does not accept the rationale of the subject City of San Diego storm water design requirements other than preparation of this report as required by the City of San Diego storm water design documents.

Worksheet C.4-1: Categorization of Infiltration Feasibility Condition Based on Geotechnical Conditions[9]

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Worksheet C.4-1: Form I-8A[10]
Part 1 - Full Infiltration Feasibility Screening Criteria	
DMA(s) Being Analyzed:	Project Phase:
Blue Wave Imperial Beach Proposed Mix-Use Development	Planning
Criteria 1: Infiltration Rate Screening	
1A	Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper Type A or B and corroborated by available site soil data[11]? ☐ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result or continue to Step 1B if the applicant elects to perform infiltration testing. ☐ No; the mapped soil types are A or B but is not corroborated by available site soil data (continue to Step 1B). ☒ No; the mapped soil types are C, D, or "urban/unclassified" and is corroborated by available site soil data. Answer "No" to Criteria 1 Result. ☐ No; the mapped soil types are C, D, or "urban/unclassified" but is not corroborated by available site soil data (continue to Step 1B).
1B	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1? ☐ Yes; Continue to Step 1C. ☐ No; Skip to Step 1D.
1C	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1 greater than 0.5 inches per hour? ☐ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result. ☐ No; full infiltration is not required. Answer "No" to Criteria 1 Result.
1D	**Infiltration Testing Method.** Is the selected infiltration testing method suitable during the design phase (see Appendix D.3)? Note: Alternative testing standards may be allowed with appropriate rationales and documentation. ☐ Yes; continue to Step 1E. ☐ No; select an appropriate infiltration testing method.

[9] Note that it is not required to investigate each and every criterion in the worksheet, a single "no" answer in Part 1, Part 2, Part 3, or Part 4 determines a full, partial, or no infiltration condition.

[10] This form must be completed each time there is a change to the site layout that would affect the infiltration feasibility condition. Previously completed forms shall be retained to document the evolution of the site storm water design.

[11] Available data includes site-specific sampling or observation of soil types or texture classes, such as obtained from borings or test pits necessary to support other design elements.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Worksheet C.4-1: Form I-8A[10]
1E	**Number of Percolation/Infiltration Tests.** Does the infiltration testing method performed satisfy the minimum number of tests specified in Table D.3-2? ☐ Yes; continue to Step 1F. ☐ No; conduct appropriate number of tests.
IF	**Factor of Safety.** Is the suitable Factor of Safety selected for full infiltration design? See guidance in D.5; Tables D.5-1 and D.5-2; and Worksheet D.5-1 (Form I-9). ☐ Yes; continue to Step 1G. ☐ No; select appropriate factor of safety.
1G	**Full Infiltration Feasibility.** Is the average measured infiltration rate divided by the Factor of Safety greater than 0.5 inches per hour? ☐ Yes; answer "Yes" to Criteria 1 Result. ☐ No; answer "No" to Criteria 1 Result.
Criteria 1 Result	Is the estimated reliable infiltration rate greater than 0.5 inches per hour within the DMA where runoff can reasonably be routed to a BMP? ☐ Yes; the DMA may feasibly support full infiltration. Continue to Criteria 2. ☒ No; full infiltration is not required. Skip to Part 1 Result.

Summarize infiltration testing methods, testing locations, replicates, and results and summarize estimates of reliable infiltration rates according to procedures outlined in D.5. Documentation should be included in project geotechnical report.

FOUR TEST HOLES WERE PLACED WITHIN OR AS NEAR AS POSSIBLE TO THE PROPOSED BMP AND TO ANTICIPATED INFILTRATION DEPTHS/STRATA. TESTS WERE PERFORMED VIA COUNTY OF SAN DIEGO OPEN BOREHOLE METHOD AS ACCEPTABLE PER CITY OF SAN DIEGO STORMWATER INFILTRATION DESIGN REQUIREMENTS OF APPENDIX C AND APPENDIX D. CLAYEY SOILS RESULTED IN LOW INFILTRATION RATES AT THE PROPOSED BASIN. SEE GEOTECHNICAL REPORT APPENDIX E FOR DETAILED DISCUSSION OF TEST METHODS AND CALCULATED INFILTRATION RATES.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[10]	
Criteria 2: Geologic/Geotechnical Screening			
2A	If all questions in Step 2A are answered "Yes," continue to Step 2B. For any "No" answer in Step 2A answer "No" to Criteria 2, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
2A-1	Can the proposed full infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick below the infiltrating surface?	☐ Yes	☐ No
2A-2	Can the proposed full infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	☐ Yes	☐ No
2A-3	Can the proposed full infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	☐ Yes	☐ No
2B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 2B are answered "Yes," then answer "Yes" to Criteria 2 Result. If there are "No" answers continue to Step 2C.		
2B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can full infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	☐ Yes	☐ No
2B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can full infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	☐ Yes	☐ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[10]	
2B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011 or most recent edition). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can full infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	☐ Yes	☐ No
2B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can full infiltration BMPs be proposed within the DMA without increasing slope stability risks?	☐ Yes	☐ No
2B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can full infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	☐ Yes	☐ No
2B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can full infiltration BMPs be proposed within the DMA using established setbacks from underground utilities, structures, and/or retaining walls?	☐ Yes	☐ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[10]	
2C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 2B. Provide a discussion of geologic/geotechnical hazards that would prevent full infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for full infiltration BMPs? If the question in Step 2 is answered "Yes," then answer "Yes" to Criteria 2 Result. If the question in Step 2C is answered "No," then answer "No" to Criteria 2 Result.	☐ Yes	☐ No
Criteria 2 Result	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	☐ Yes	☐ No
Summarize findings and basis; provide references to related reports or exhibits.			
Part 1 Result – Full Infiltration Geotechnical Screening [12]		**Result**	
If answers to both Criteria 1 and Criteria 2 are "Yes", a full infiltration design is potentially feasible based on Geotechnical conditions only. If either answer to Criteria 1 or Criteria 2 is "No", a full infiltration design is not required.		☐ Full infiltration Condition ☒ Complete Part 2	

[12] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Worksheet C.4-1: Form I-8A[10]
Part 2 – Partial vs. No Infiltration Feasibility Screening Criteria	
DMA(s) Being Analyzed:	Project Phase:
Blue Wave Imperial Beach Proposed Mixed-Use Development	Planning

Criteria 3 : Infiltration Rate Screening	
3A	**NRCS Type C, D, or "urban/unclassified":** Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper is Type C, D, or "urban/unclassified" and corroborated by available site soil data? ☐ Yes; the site is mapped as C soils and a reliable infiltration rate of 0.15 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result. ☒ Yes; the site is mapped as D soils ~~or "urban/unclassified" and a reliable infiltration rate of 0.05 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result.~~ ☒ No; infiltration testing is conducted (refer to Table D.3-1), continue to Step 3B.
3B	**Infiltration Testing Result:** Is the reliable infiltration rate (i.e. average measured infiltration rate/2) greater than 0.05 in/hr. and less than or equal to 0.5 in/hr? ☐ Yes; the site may support partial infiltration. Answer "Yes" to Criteria 3 Result. ☒ No; the reliable infiltration rate (i.e. average measured rate/2) is less than 0.05 in/hr., partial infiltration is not required. Answer "No" to Criteria 3 Result.
Criteria 3 Result	Is the estimated reliable infiltration rate (i.e., average measured infiltration rate/2) greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour at any location within each DMA where runoff can reasonably be routed to a BMP? ☐ Yes; Continue to Criteria 4. ☒ No: Skip to Part 2 Result.

Summarize infiltration testing and/or mapping results (i.e. soil maps and series description used for infiltration rate).

As noted in 3A, the hydrologic soil group at the site is mapped as Type D. However, testing at the site indicated design infiltration rates less than 0.05 in/hr.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[10]	
Criteria 4: Geologic/Geotechnical Screening			
4A	If all questions in Step 4A are answered "Yes," continue to Step 2B. For any "No" answer in Step 4A answer "No" to Criteria 4 Result, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
4A-1	Can the proposed partial infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick?	☐ Yes	☐ No
4A-2	Can the proposed partial infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	☐ Yes	☐ No
4A-3	Can the proposed partial infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	☐ Yes	☐ No
4B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1 If all questions in Step 4B are answered "Yes," then answer "Yes" to Criteria 4 Result. If there are any "No" answers continue to Step 4C.		
4B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can partial infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	☐ Yes	☐ No
4B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can partial infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	☐ Yes	☐ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[10]	
4B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can partial infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	☐ Yes	☐ No
4B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can partial infiltration BMPs be proposed within the DMA without increasing slope stability risks?	☐ Yes	☐ No
4B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can partial infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	☐ Yes	☐ No
4B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can partial infiltration BMPs be proposed within the DMA using recommended setbacks from underground utilities, structures, and/or retaining walls?	☐ Yes	☐ No
4C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 4B. Provide a discussion on geologic/geotechnical hazards that would prevent partial infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for partial infiltration BMPs? If the question in Step 4C is answered "Yes," then answer "Yes" to Criteria 4 Result. If the question in Step 4C is answered "No," then answer "No" to Criteria 4 Result.	☐ Yes	☐ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[10]	
Criteria 4 Result	Can infiltration of greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour be allowed without increasing the risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	☐ Yes	☐ No
Summarize findings and basis; provide references to related reports or exhibits.			

Part 2 – Partial Infiltration Geotechnical Screening Result[13]	Result
If answers to both Criteria 3 and Criteria 4 are "Yes", a partial infiltration design is potentially feasible based on geotechnical conditions only. If answers to either Criteria 3 or Criteria 4 is "No", then infiltration of any volume is considered to be infeasible within the site.	☐ Partial Infiltration Condition ☒ No Infiltration Condition

[13] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

APPENDIX D

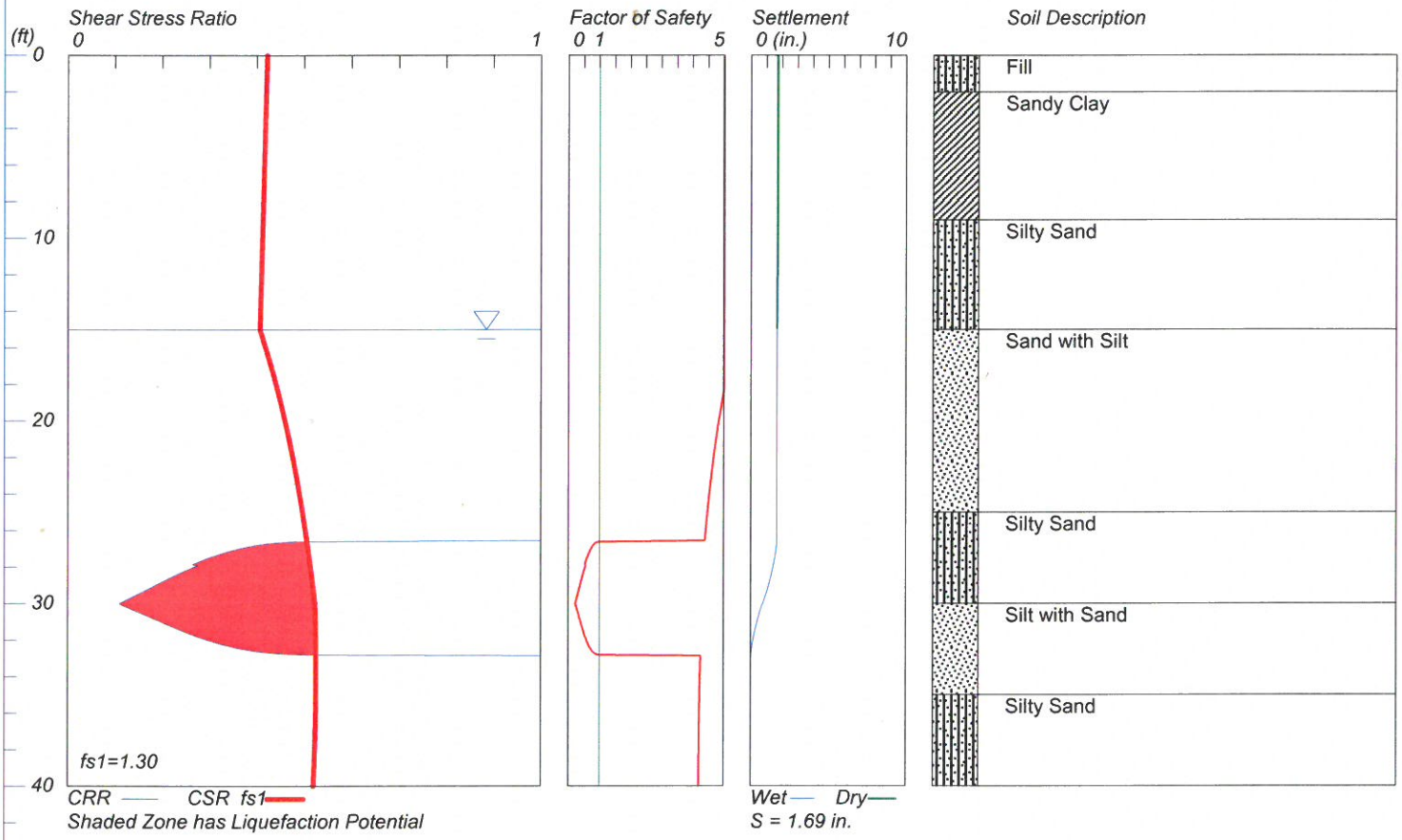
SEISMIC SETTLEMENT ANALYSIS

LIQUEFACTION ANALYSIS

Blue Wave Hotel & Residences

Hole No.=B-1 Water Depth=15 ft Surface Elev.=18

Magnitude=7.2
Acceleration=0.499g



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LIQUEFACTION ANALYSIS CALCULATION SHEET

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Input File Name: \\Server\projects\40-3618G Imperial Beach Hotel and Residential\B-1.liq
Title: Blue Wave Hotel & Residences
Subtitle: 40-3618G

Surface Elev.=18
Hole No.=B-1
Depth of Hole= 40.0 ft
Water Table during Earthquake= 15.0 ft
Water Table during In-Situ Testing= 17.0 ft
Max. Acceleration= 0.5 g
Earthquake Magnitude= 7.2

Input Data:
Surface Elev.=18
Hole No.=B-1
Depth of Hole=40.0 ft
Water Table during Earthquake= 15.0 ft
Water Table during In-Situ Testing= 17.0 ft
Max. Acceleration=0.5 g
Earthquake Magnitude=7.2

Earthquake Magnitude=7.2
2. Settlement Analysis Method: Ishihara / Yoshimine*
3. Fines Correction for Liquefaction: Stark/Olson et al.*
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= 1.3
Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.0	21.0	125.0	NoLiq
5.0	41.0	125.0	NoLiq
10.0	37.0	120.0	18.0
15.0	41.0	125.0	8.0
20.0	35.0	125.0	5.0
25.0	46.0	125.0	14.0
30.0	10.0	125.0	8.0
35.0	47.0	125.0	42.0
40.0	100.0	130.0	20.0

Output Results:

Settlement of saturated sands=1.65 in.
Settlement of dry sands=0.03 in.
Total settlement of saturated and dry sands=1.69 in.
Differential Settlement=0.843 to 1.113 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.42	5.00	1.65	0.03	1.69
0.05	2.00	0.42	5.00	1.65	0.03	1.69
0.10	2.00	0.42	5.00	1.65	0.03	1.69
0.15	2.00	0.42	5.00	1.65	0.03	1.69
0.20	2.00	0.42	5.00	1.65	0.03	1.69
0.25	2.00	0.42	5.00	1.65	0.03	1.69
0.30	2.00	0.42	5.00	1.65	0.03	1.69
0.35	2.00	0.42	5.00	1.65	0.03	1.69
0.40	2.00	0.42	5.00	1.65	0.03	1.69
0.45	2.00	0.42	5.00	1.65	0.03	1.69
0.50	2.00	0.42	5.00	1.65	0.03	1.69
0.55	2.00	0.42	5.00	1.65	0.03	1.69
0.60	2.00	0.42	5.00	1.65	0.03	1.69
0.65	2.00	0.42	5.00	1.65	0.03	1.69
0.70	2.00	0.42	5.00	1.65	0.03	1.69
0.75	2.00	0.42	5.00	1.65	0.03	1.69
0.80	2.00	0.42	5.00	1.65	0.03	1.69
0.85	2.00	0.42	5.00	1.65	0.03	1.69
0.90	2.00	0.42	5.00	1.65	0.03	1.69
0.95	2.00	0.42	5.00	1.65	0.03	1.69
1.00	2.00	0.42	5.00	1.65	0.03	1.69
1.05	2.00	0.42	5.00	1.65	0.03	1.69
1.10	2.00	0.42	5.00	1.65	0.03	1.69
1.15	2.00	0.42	5.00	1.65	0.03	1.69
1.20	2.00	0.42	5.00	1.65	0.03	1.69
1.25	2.00	0.42	5.00	1.65	0.03	1.69
1.30	2.00	0.42	5.00	1.65	0.03	1.69
1.35	2.00	0.42	5.00	1.65	0.03	1.69
1.40	2.00	0.42	5.00	1.65	0.03	1.69
1.45	2.00	0.42	5.00	1.65	0.03	1.69
1.50	2.00	0.42	5.00	1.65	0.03	1.69
1.55	2.00	0.42	5.00	1.65	0.03	1.69
1.60	2.00	0.42	5.00	1.65	0.03	1.69
1.65	2.00	0.42	5.00	1.65	0.03	1.69
1.70	2.00	0.42	5.00	1.65	0.03	1.69
1.75	2.00	0.42	5.00	1.65	0.03	1.69
1.80	2.00	0.42	5.00	1.65	0.03	1.69
1.85	2.00	0.42	5.00	1.65	0.03	1.69
1.90	2.00	0.42	5.00	1.65	0.03	1.69
1.95	2.00	0.42	5.00	1.65	0.03	1.69
2.00	2.00	0.42	5.00	1.65	0.03	1.69
2.05	2.00	0.42	5.00	1.65	0.03	1.69
2.10	2.00	0.42	5.00	1.65	0.03	1.69
2.15	2.00	0.42	5.00	1.65	0.03	1.69
2.20	2.00	0.42	5.00	1.65	0.03	1.69
2.25	2.00	0.42	5.00	1.65	0.03	1.69
2.30	2.00	0.42	5.00	1.65	0.03	1.69
2.35	2.00	0.42	5.00	1.65	0.03	1.69
2.40	2.00	0.42	5.00	1.65	0.03	1.69
2.45	2.00	0.42	5.00	1.65	0.03	1.69
2.50	2.00	0.42	5.00	1.65	0.03	1.69
2.55	2.00	0.42	5.00	1.65	0.03	1.69
2.60	2.00	0.42	5.00	1.65	0.03	1.69

2.65	2.00	0.42	5.00	1.65	0.03	1.69
2.70	2.00	0.42	5.00	1.65	0.03	1.69
2.75	2.00	0.42	5.00	1.65	0.03	1.69
2.80	2.00	0.42	5.00	1.65	0.03	1.69
2.85	2.00	0.42	5.00	1.65	0.03	1.69
2.90	2.00	0.42	5.00	1.65	0.03	1.69
2.95	2.00	0.42	5.00	1.65	0.03	1.69
3.00	2.00	0.42	5.00	1.65	0.03	1.69
3.05	2.00	0.42	5.00	1.65	0.03	1.69
3.10	2.00	0.42	5.00	1.65	0.03	1.69
3.15	2.00	0.42	5.00	1.65	0.03	1.69
3.20	2.00	0.42	5.00	1.65	0.03	1.69
3.25	2.00	0.42	5.00	1.65	0.03	1.69
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3.35	2.00	0.42	5.00	1.65	0.03	1.69
3.40	2.00	0.42	5.00	1.65	0.03	1.69
3.45	2.00	0.42	5.00	1.65	0.03	1.69
3.50	2.00	0.42	5.00	1.65	0.03	1.69
3.55	2.00	0.42	5.00	1.65	0.03	1.69
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3.65	2.00	0.42	5.00	1.65	0.03	1.69
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3.75	2.00	0.42	5.00	1.65	0.03	1.69
3.80	2.00	0.42	5.00	1.65	0.03	1.69
3.85	2.00	0.42	5.00	1.65	0.03	1.69
3.90	2.00	0.42	5.00	1.65	0.03	1.69
3.95	2.00	0.42	5.00	1.65	0.03	1.69
4.00	2.00	0.42	5.00	1.65	0.03	1.69
4.05	2.00	0.42	5.00	1.65	0.03	1.69
4.10	2.00	0.42	5.00	1.65	0.03	1.69
4.15	2.00	0.42	5.00	1.65	0.03	1.69
4.20	2.00	0.42	5.00	1.65	0.03	1.69
4.25	2.00	0.42	5.00	1.65	0.03	1.69
4.30	2.00	0.42	5.00	1.65	0.03	1.69
4.35	2.00	0.42	5.00	1.65	0.03	1.69
4.40	2.00	0.42	5.00	1.65	0.03	1.69
4.45	2.00	0.42	5.00	1.65	0.03	1.69
4.50	2.00	0.42	5.00	1.65	0.03	1.69
4.55	2.00	0.42	5.00	1.65	0.03	1.69
4.60	2.00	0.42	5.00	1.65	0.03	1.69
4.65	2.00	0.42	5.00	1.65	0.03	1.69
4.70	2.00	0.42	5.00	1.65	0.03	1.69
4.75	2.00	0.42	5.00	1.65	0.03	1.69
4.80	2.00	0.42	5.00	1.65	0.03	1.69
4.85	2.00	0.42	5.00	1.65	0.03	1.69
4.90	2.00	0.42	5.00	1.65	0.03	1.69
4.95	2.00	0.42	5.00	1.65	0.03	1.69
5.00	2.00	0.42	5.00	1.65	0.03	1.69
5.05	2.00	0.42	5.00	1.65	0.03	1.69
5.10	2.00	0.42	5.00	1.65	0.03	1.69
5.15	2.00	0.42	5.00	1.65	0.03	1.69
5.20	2.00	0.42	5.00	1.65	0.03	1.69
5.25	2.00	0.42	5.00	1.65	0.03	1.69
5.30	2.00	0.42	5.00	1.65	0.03	1.69
5.35	2.00	0.42	5.00	1.65	0.03	1.69
5.40	2.00	0.42	5.00	1.65	0.03	1.69
5.45	2.00	0.42	5.00	1.65	0.03	1.69
5.50	2.00	0.42	5.00	1.65	0.03	1.69
5.55	2.00	0.42	5.00	1.65	0.03	1.69
5.60	2.00	0.42	5.00	1.65	0.03	1.69
5.65	2.00	0.42	5.00	1.65	0.03	1.69
5.70	2.00	0.42	5.00	1.65	0.03	1.69
5.75	2.00	0.42	5.00	1.65	0.03	1.69

5.80	2.00	0.42	5.00	1.65	0.03	1.69
5.85	2.00	0.42	5.00	1.65	0.03	1.69
5.90	2.00	0.42	5.00	1.65	0.03	1.69
5.95	2.00	0.42	5.00	1.65	0.03	1.69
6.00	2.00	0.42	5.00	1.65	0.03	1.69
6.05	2.00	0.42	5.00	1.65	0.03	1.69
6.10	2.00	0.42	5.00	1.65	0.03	1.69
6.15	2.00	0.42	5.00	1.65	0.03	1.69
6.20	2.00	0.42	5.00	1.65	0.03	1.69
6.25	2.00	0.42	5.00	1.65	0.03	1.69
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6.45	2.00	0.42	5.00	1.65	0.03	1.69
6.50	2.00	0.42	5.00	1.65	0.03	1.69
6.55	2.00	0.42	5.00	1.65	0.03	1.69
6.60	2.00	0.42	5.00	1.65	0.03	1.69
6.65	2.00	0.42	5.00	1.65	0.03	1.69
6.70	2.00	0.42	5.00	1.65	0.03	1.69
6.75	2.00	0.42	5.00	1.65	0.03	1.69
6.80	2.00	0.41	5.00	1.65	0.03	1.69
6.85	2.00	0.41	5.00	1.65	0.03	1.69
6.90	2.00	0.41	5.00	1.65	0.03	1.69
6.95	2.00	0.41	5.00	1.65	0.03	1.69
7.00	2.00	0.41	5.00	1.65	0.03	1.69
7.05	2.00	0.41	5.00	1.65	0.03	1.69
7.10	2.00	0.41	5.00	1.65	0.03	1.69
7.15	2.00	0.41	5.00	1.65	0.03	1.69
7.20	2.00	0.41	5.00	1.65	0.03	1.69
7.25	2.00	0.41	5.00	1.65	0.03	1.69
7.30	2.00	0.41	5.00	1.65	0.03	1.69
7.35	2.00	0.41	5.00	1.65	0.03	1.69
7.40	2.00	0.41	5.00	1.65	0.03	1.69
7.45	2.00	0.41	5.00	1.65	0.03	1.69
7.50	2.00	0.41	5.00	1.65	0.03	1.69
7.55	2.00	0.41	5.00	1.65	0.03	1.69
7.60	2.00	0.41	5.00	1.65	0.03	1.69
7.65	2.00	0.41	5.00	1.65	0.03	1.69
7.70	2.00	0.41	5.00	1.65	0.03	1.69
7.75	2.00	0.41	5.00	1.65	0.03	1.69
7.80	2.00	0.41	5.00	1.65	0.03	1.69
7.85	2.00	0.41	5.00	1.65	0.03	1.69
7.90	2.00	0.41	5.00	1.65	0.03	1.69
7.95	2.00	0.41	5.00	1.65	0.03	1.69
8.00	2.00	0.41	5.00	1.65	0.03	1.69
8.05	2.00	0.41	5.00	1.65	0.03	1.69
8.10	2.00	0.41	5.00	1.65	0.03	1.69
8.15	2.00	0.41	5.00	1.65	0.03	1.69
8.20	2.00	0.41	5.00	1.65	0.03	1.69
8.25	2.00	0.41	5.00	1.65	0.03	1.69
8.30	2.00	0.41	5.00	1.65	0.03	1.69
8.35	2.00	0.41	5.00	1.65	0.03	1.69
8.40	2.00	0.41	5.00	1.65	0.03	1.69
8.45	2.00	0.41	5.00	1.65	0.03	1.69
8.50	2.00	0.41	5.00	1.65	0.03	1.69
8.55	2.00	0.41	5.00	1.65	0.03	1.69
8.60	2.00	0.41	5.00	1.65	0.03	1.69
8.65	2.00	0.41	5.00	1.65	0.03	1.69
8.70	2.00	0.41	5.00	1.65	0.03	1.69
8.75	2.00	0.41	5.00	1.65	0.03	1.69
8.80	2.00	0.41	5.00	1.65	0.03	1.69
8.85	2.00	0.41	5.00	1.65	0.03	1.69
8.90	2.00	0.41	5.00	1.65	0.03	1.69

8.95	2.00	0.41	5.00	1.65	0.03	1.69
9.00	2.00	0.41	5.00	1.65	0.03	1.69
9.05	2.00	0.41	5.00	1.65	0.03	1.69
9.10	2.00	0.41	5.00	1.65	0.03	1.69
9.15	2.00	0.41	5.00	1.65	0.03	1.69
9.20	2.00	0.41	5.00	1.65	0.03	1.69
9.25	2.00	0.41	5.00	1.65	0.03	1.69
9.30	2.00	0.41	5.00	1.65	0.03	1.69
9.35	2.00	0.41	5.00	1.65	0.03	1.69
9.40	2.00	0.41	5.00	1.65	0.03	1.69
9.45	2.00	0.41	5.00	1.65	0.03	1.69
9.50	2.00	0.41	5.00	1.65	0.03	1.69
9.55	2.00	0.41	5.00	1.65	0.03	1.69
9.60	2.00	0.41	5.00	1.65	0.03	1.69
9.65	2.00	0.41	5.00	1.65	0.03	1.69
9.70	2.00	0.41	5.00	1.65	0.03	1.69
9.75	2.00	0.41	5.00	1.65	0.03	1.69
9.80	2.00	0.41	5.00	1.65	0.03	1.69
9.85	2.00	0.41	5.00	1.65	0.03	1.69
9.90	2.00	0.41	5.00	1.65	0.03	1.69
9.95	2.00	0.41	5.00	1.65	0.03	1.69
10.00	2.22	0.41	5.00	1.65	0.03	1.69
10.05	2.22	0.41	5.00	1.65	0.03	1.69
10.10	2.22	0.41	5.00	1.65	0.03	1.69
10.15	2.22	0.41	5.00	1.65	0.03	1.69
10.20	2.22	0.41	5.00	1.65	0.03	1.69
10.25	2.22	0.41	5.00	1.65	0.03	1.69
10.30	2.22	0.41	5.00	1.65	0.03	1.69
10.35	2.22	0.41	5.00	1.65	0.03	1.69
10.40	2.22	0.41	5.00	1.65	0.03	1.69
10.45	2.22	0.41	5.00	1.65	0.03	1.68
10.50	2.22	0.41	5.00	1.65	0.03	1.68
10.55	2.22	0.41	5.00	1.65	0.03	1.68
10.60	2.22	0.41	5.00	1.65	0.03	1.68
10.65	2.22	0.41	5.00	1.65	0.03	1.68
10.70	2.22	0.41	5.00	1.65	0.03	1.68
10.75	2.22	0.41	5.00	1.65	0.03	1.68
10.80	2.22	0.41	5.00	1.65	0.03	1.68
10.85	2.22	0.41	5.00	1.65	0.03	1.68
10.90	2.22	0.41	5.00	1.65	0.03	1.68
10.95	2.22	0.41	5.00	1.65	0.03	1.68
11.00	2.22	0.41	5.00	1.65	0.03	1.68
11.05	2.22	0.41	5.00	1.65	0.03	1.68
11.10	2.22	0.41	5.00	1.65	0.03	1.68
11.15	2.22	0.41	5.00	1.65	0.03	1.68
11.20	2.22	0.41	5.00	1.65	0.03	1.68
11.25	2.22	0.41	5.00	1.65	0.03	1.68
11.30	2.22	0.41	5.00	1.65	0.03	1.68
11.35	2.22	0.41	5.00	1.65	0.03	1.68
11.40	2.22	0.41	5.00	1.65	0.03	1.68
11.45	2.22	0.41	5.00	1.65	0.03	1.68
11.50	2.22	0.41	5.00	1.65	0.03	1.68
11.55	2.22	0.41	5.00	1.65	0.03	1.68
11.60	2.22	0.41	5.00	1.65	0.03	1.68
11.65	2.22	0.41	5.00	1.65	0.02	1.68
11.70	2.22	0.41	5.00	1.65	0.02	1.68
11.75	2.22	0.41	5.00	1.65	0.02	1.68
11.80	2.22	0.41	5.00	1.65	0.02	1.68
11.85	2.22	0.41	5.00	1.65	0.02	1.68
11.90	2.22	0.41	5.00	1.65	0.02	1.68
11.95	2.22	0.41	5.00	1.65	0.02	1.68
12.00	2.22	0.41	5.00	1.65	0.02	1.68
12.05	2.22	0.41	5.00	1.65	0.02	1.68

12.10	2.22	0.41	5.00	1.65	0.02	1.68
12.15	2.22	0.41	5.00	1.65	0.02	1.68
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12.45	2.22	0.41	5.00	1.65	0.02	1.67
12.50	2.22	0.41	5.00	1.65	0.02	1.67
12.55	2.22	0.41	5.00	1.65	0.02	1.67
12.60	2.22	0.41	5.00	1.65	0.02	1.67
12.65	2.22	0.41	5.00	1.65	0.02	1.67
12.70	2.22	0.41	5.00	1.65	0.02	1.67
12.75	2.22	0.41	5.00	1.65	0.02	1.67
12.80	2.22	0.41	5.00	1.65	0.02	1.67
12.85	2.22	0.41	5.00	1.65	0.02	1.67
12.90	2.22	0.41	5.00	1.65	0.02	1.67
12.95	2.22	0.41	5.00	1.65	0.02	1.67
13.00	2.22	0.41	5.00	1.65	0.02	1.67
13.05	2.22	0.41	5.00	1.65	0.02	1.67
13.10	2.22	0.41	5.00	1.65	0.02	1.67
13.15	2.22	0.41	5.00	1.65	0.02	1.67
13.20	2.22	0.41	5.00	1.65	0.02	1.67
13.25	2.22	0.41	5.00	1.65	0.01	1.67
13.30	2.22	0.41	5.00	1.65	0.01	1.67
13.35	2.22	0.41	5.00	1.65	0.01	1.67
13.40	2.22	0.41	5.00	1.65	0.01	1.67
13.45	2.22	0.41	5.00	1.65	0.01	1.67
13.50	2.22	0.41	5.00	1.65	0.01	1.67
13.55	2.22	0.41	5.00	1.65	0.01	1.67
13.60	2.22	0.41	5.00	1.65	0.01	1.67
13.65	2.22	0.41	5.00	1.65	0.01	1.67
13.70	2.22	0.41	5.00	1.65	0.01	1.67
13.75	2.22	0.41	5.00	1.65	0.01	1.67
13.80	2.22	0.41	5.00	1.65	0.01	1.66
13.85	2.22	0.41	5.00	1.65	0.01	1.66
13.90	2.22	0.41	5.00	1.65	0.01	1.66
13.95	2.22	0.41	5.00	1.65	0.01	1.66
14.00	2.22	0.41	5.00	1.65	0.01	1.66
14.05	2.22	0.41	5.00	1.65	0.01	1.66
14.10	2.22	0.41	5.00	1.65	0.01	1.66
14.15	2.22	0.41	5.00	1.65	0.01	1.66
14.20	2.22	0.41	5.00	1.65	0.01	1.66
14.25	2.22	0.41	5.00	1.65	0.01	1.66
14.30	2.22	0.41	5.00	1.65	0.01	1.66
14.35	2.22	0.41	5.00	1.65	0.01	1.66
14.40	2.22	0.41	5.00	1.65	0.01	1.66
14.45	2.22	0.41	5.00	1.65	0.00	1.66
14.50	2.22	0.41	5.00	1.65	0.00	1.66
14.55	2.22	0.41	5.00	1.65	0.00	1.66
14.60	2.22	0.41	5.00	1.65	0.00	1.66
14.65	2.22	0.41	5.00	1.65	0.00	1.66
14.70	2.22	0.41	5.00	1.65	0.00	1.66
14.75	2.22	0.41	5.00	1.65	0.00	1.66
14.80	2.22	0.41	5.00	1.65	0.00	1.66
14.85	2.22	0.41	5.00	1.65	0.00	1.66
14.90	2.22	0.41	5.00	1.65	0.00	1.66
14.95	2.22	0.41	5.00	1.65	0.00	1.65
15.00	2.22	0.41	5.00	1.65	0.00	1.65
15.05	2.22	0.41	5.00	1.65	0.00	1.65
15.10	2.22	0.41	5.00	1.65	0.00	1.65
15.15	2.22	0.41	5.00	1.65	0.00	1.65
15.20	2.22	0.41	5.00	1.65	0.00	1.65

15.25	2.22	0.41	5.00	1.65	0.00	1.65
15.30	2.22	0.41	5.00	1.65	0.00	1.65
15.35	2.22	0.41	5.00	1.65	0.00	1.65
15.40	2.22	0.41	5.00	1.65	0.00	1.65
15.45	2.22	0.41	5.00	1.65	0.00	1.65
15.50	2.22	0.41	5.00	1.65	0.00	1.65
15.55	2.22	0.41	5.00	1.65	0.00	1.65
15.60	2.22	0.41	5.00	1.65	0.00	1.65
15.65	2.22	0.41	5.00	1.65	0.00	1.65
15.70	2.22	0.42	5.00	1.65	0.00	1.65
15.75	2.22	0.42	5.00	1.65	0.00	1.65
15.80	2.22	0.42	5.00	1.65	0.00	1.65
15.85	2.22	0.42	5.00	1.65	0.00	1.65
15.90	2.22	0.42	5.00	1.65	0.00	1.65
15.95	2.22	0.42	5.00	1.65	0.00	1.65
16.00	2.22	0.42	5.00	1.65	0.00	1.65
16.05	2.22	0.42	5.00	1.65	0.00	1.65
16.10	2.22	0.42	5.00	1.65	0.00	1.65
16.15	2.22	0.42	5.00	1.65	0.00	1.65
16.20	2.22	0.42	5.00	1.65	0.00	1.65
16.25	2.22	0.42	5.00	1.65	0.00	1.65
16.30	2.22	0.42	5.00	1.65	0.00	1.65
16.35	2.22	0.42	5.00	1.65	0.00	1.65
16.40	2.22	0.42	5.00	1.65	0.00	1.65
16.45	2.22	0.42	5.00	1.65	0.00	1.65
16.50	2.22	0.42	5.00	1.65	0.00	1.65
16.55	2.22	0.43	5.00	1.65	0.00	1.65
16.60	2.22	0.43	5.00	1.65	0.00	1.65
16.65	2.22	0.43	5.00	1.65	0.00	1.65
16.70	2.22	0.43	5.00	1.65	0.00	1.65
16.75	2.22	0.43	5.00	1.65	0.00	1.65
16.80	2.22	0.43	5.00	1.65	0.00	1.65
16.85	2.22	0.43	5.00	1.65	0.00	1.65
16.90	2.22	0.43	5.00	1.65	0.00	1.65
16.95	2.22	0.43	5.00	1.65	0.00	1.65
17.00	2.22	0.43	5.00	1.65	0.00	1.65
17.05	2.22	0.43	5.00	1.65	0.00	1.65
17.10	2.22	0.43	5.00	1.65	0.00	1.65
17.15	2.22	0.43	5.00	1.65	0.00	1.65
17.20	2.22	0.43	5.00	1.65	0.00	1.65
17.25	2.22	0.43	5.00	1.65	0.00	1.65
17.30	2.22	0.43	5.00	1.65	0.00	1.65
17.35	2.22	0.43	5.00	1.65	0.00	1.65
17.40	2.22	0.43	5.00	1.65	0.00	1.65
17.45	2.22	0.44	5.00	1.65	0.00	1.65
17.50	2.22	0.44	5.00	1.65	0.00	1.65
17.55	2.22	0.44	5.00	1.65	0.00	1.65
17.60	2.22	0.44	5.00	1.65	0.00	1.65
17.65	2.22	0.44	5.00	1.65	0.00	1.65
17.70	2.22	0.44	5.00	1.65	0.00	1.65
17.75	2.22	0.44	5.00	1.65	0.00	1.65
17.80	2.22	0.44	5.00	1.65	0.00	1.65
17.85	2.22	0.44	5.00	1.65	0.00	1.65
17.90	2.22	0.44	5.00	1.65	0.00	1.65
17.95	2.22	0.44	5.00	1.65	0.00	1.65
18.00	2.22	0.44	5.00	1.65	0.00	1.65
18.05	2.22	0.44	5.00	1.65	0.00	1.65
18.10	2.22	0.44	5.00	1.65	0.00	1.65
18.15	2.22	0.44	5.00	1.65	0.00	1.65
18.20	2.22	0.44	5.00	1.65	0.00	1.65
18.25	2.22	0.44	5.00	1.65	0.00	1.65
18.30	2.22	0.44	5.00	1.65	0.00	1.65
18.35	2.22	0.44	4.99	1.65	0.00	1.65

18.40	2.22	0.45	4.99	1.65	0.00	1.65
18.45	2.22	0.45	4.98	1.65	0.00	1.65
18.50	2.22	0.45	4.98	1.65	0.00	1.65
18.55	2.22	0.45	4.97	1.65	0.00	1.65
18.60	2.22	0.45	4.97	1.65	0.00	1.65
18.65	2.22	0.45	4.96	1.65	0.00	1.65
18.70	2.22	0.45	4.95	1.65	0.00	1.65
18.75	2.22	0.45	4.95	1.65	0.00	1.65
18.80	2.22	0.45	4.94	1.65	0.00	1.65
18.85	2.22	0.45	4.94	1.65	0.00	1.65
18.90	2.22	0.45	4.93	1.65	0.00	1.65
18.95	2.22	0.45	4.93	1.65	0.00	1.65
19.00	2.22	0.45	4.92	1.65	0.00	1.65
19.05	2.22	0.45	4.92	1.65	0.00	1.65
19.10	2.22	0.45	4.91	1.65	0.00	1.65
19.15	2.22	0.45	4.91	1.65	0.00	1.65
19.20	2.22	0.45	4.90	1.65	0.00	1.65
19.25	2.22	0.45	4.90	1.65	0.00	1.65
19.30	2.22	0.45	4.89	1.65	0.00	1.65
19.35	2.22	0.45	4.89	1.65	0.00	1.65
19.40	2.22	0.45	4.88	1.65	0.00	1.65
19.45	2.22	0.46	4.88	1.65	0.00	1.65
19.50	2.22	0.46	4.87	1.65	0.00	1.65
19.55	2.22	0.46	4.87	1.65	0.00	1.65
19.60	2.22	0.46	4.86	1.65	0.00	1.65
19.65	2.22	0.46	4.86	1.65	0.00	1.65
19.70	2.22	0.46	4.85	1.65	0.00	1.65
19.75	2.22	0.46	4.85	1.65	0.00	1.65
19.80	2.22	0.46	4.84	1.65	0.00	1.65
19.85	2.22	0.46	4.84	1.65	0.00	1.65
19.90	2.22	0.46	4.83	1.65	0.00	1.65
19.95	2.22	0.46	4.83	1.65	0.00	1.65
20.00	2.22	0.46	4.83	1.65	0.00	1.65
20.05	2.22	0.46	4.82	1.65	0.00	1.65
20.10	2.22	0.46	4.82	1.65	0.00	1.65
20.15	2.22	0.46	4.81	1.65	0.00	1.65
20.20	2.22	0.46	4.81	1.65	0.00	1.65
20.25	2.22	0.46	4.80	1.65	0.00	1.65
20.30	2.22	0.46	4.80	1.65	0.00	1.65
20.35	2.22	0.46	4.79	1.65	0.00	1.65
20.40	2.22	0.46	4.79	1.65	0.00	1.65
20.45	2.22	0.46	4.78	1.65	0.00	1.65
20.50	2.22	0.46	4.78	1.65	0.00	1.65
20.55	2.22	0.46	4.78	1.65	0.00	1.65
20.60	2.22	0.47	4.77	1.65	0.00	1.65
20.65	2.22	0.47	4.77	1.65	0.00	1.65
20.70	2.22	0.47	4.76	1.65	0.00	1.65
20.75	2.22	0.47	4.76	1.65	0.00	1.65
20.80	2.22	0.47	4.75	1.65	0.00	1.65
20.85	2.22	0.47	4.75	1.65	0.00	1.65
20.90	2.22	0.47	4.75	1.65	0.00	1.65
20.95	2.22	0.47	4.74	1.65	0.00	1.65
21.00	2.22	0.47	4.74	1.65	0.00	1.65
21.05	2.22	0.47	4.73	1.65	0.00	1.65
21.10	2.22	0.47	4.73	1.65	0.00	1.65
21.15	2.22	0.47	4.73	1.65	0.00	1.65
21.20	2.22	0.47	4.72	1.65	0.00	1.65
21.25	2.22	0.47	4.72	1.65	0.00	1.65
21.30	2.22	0.47	4.71	1.65	0.00	1.65
21.35	2.22	0.47	4.71	1.65	0.00	1.65
21.40	2.22	0.47	4.71	1.65	0.00	1.65
21.45	2.22	0.47	4.70	1.65	0.00	1.65
21.50	2.22	0.47	4.70	1.65	0.00	1.65

21.55	2.22	0.47	4.69	1.65	0.00	1.65
21.60	2.22	0.47	4.69	1.65	0.00	1.65
21.65	2.22	0.47	4.69	1.65	0.00	1.65
21.70	2.22	0.47	4.68	1.65	0.00	1.65
21.75	2.22	0.47	4.68	1.65	0.00	1.65
21.80	2.22	0.47	4.67	1.65	0.00	1.65
21.85	2.22	0.48	4.67	1.65	0.00	1.65
21.90	2.22	0.48	4.67	1.65	0.00	1.65
21.95	2.22	0.48	4.66	1.65	0.00	1.65
22.00	2.22	0.48	4.66	1.65	0.00	1.65
22.05	2.22	0.48	4.66	1.65	0.00	1.65
22.10	2.22	0.48	4.65	1.65	0.00	1.65
22.15	2.22	0.48	4.65	1.65	0.00	1.65
22.20	2.22	0.48	4.64	1.65	0.00	1.65
22.25	2.22	0.48	4.64	1.65	0.00	1.65
22.30	2.22	0.48	4.64	1.65	0.00	1.65
22.35	2.22	0.48	4.63	1.65	0.00	1.65
22.40	2.22	0.48	4.63	1.65	0.00	1.65
22.45	2.22	0.48	4.63	1.65	0.00	1.65
22.50	2.22	0.48	4.62	1.65	0.00	1.65
22.55	2.22	0.48	4.62	1.65	0.00	1.65
22.60	2.22	0.48	4.62	1.65	0.00	1.65
22.65	2.22	0.48	4.61	1.65	0.00	1.65
22.70	2.22	0.48	4.61	1.65	0.00	1.65
22.75	2.22	0.48	4.61	1.65	0.00	1.65
22.80	2.22	0.48	4.60	1.65	0.00	1.65
22.85	2.22	0.48	4.60	1.65	0.00	1.65
22.90	2.22	0.48	4.59	1.65	0.00	1.65
22.95	2.22	0.48	4.59	1.65	0.00	1.65
23.00	2.22	0.48	4.59	1.65	0.00	1.65
23.05	2.22	0.48	4.58	1.65	0.00	1.65
23.10	2.22	0.48	4.58	1.65	0.00	1.65
23.15	2.22	0.48	4.58	1.65	0.00	1.65
23.20	2.22	0.49	4.57	1.65	0.00	1.65
23.25	2.22	0.49	4.57	1.65	0.00	1.65
23.30	2.22	0.49	4.57	1.65	0.00	1.65
23.35	2.22	0.49	4.56	1.65	0.00	1.65
23.40	2.22	0.49	4.56	1.65	0.00	1.65
23.45	2.22	0.49	4.56	1.65	0.00	1.65
23.50	2.22	0.49	4.55	1.65	0.00	1.65
23.55	2.22	0.49	4.55	1.65	0.00	1.65
23.60	2.22	0.49	4.55	1.65	0.00	1.65
23.65	2.22	0.49	4.55	1.65	0.00	1.65
23.70	2.22	0.49	4.54	1.65	0.00	1.65
23.75	2.22	0.49	4.54	1.65	0.00	1.65
23.80	2.22	0.49	4.54	1.65	0.00	1.65
23.85	2.22	0.49	4.53	1.65	0.00	1.65
23.90	2.22	0.49	4.53	1.65	0.00	1.65
23.95	2.22	0.49	4.53	1.65	0.00	1.65
24.00	2.22	0.49	4.52	1.65	0.00	1.65
24.05	2.22	0.49	4.52	1.65	0.00	1.65
24.10	2.22	0.49	4.52	1.65	0.00	1.65
24.15	2.22	0.49	4.51	1.65	0.00	1.65
24.20	2.22	0.49	4.51	1.65	0.00	1.65
24.25	2.22	0.49	4.51	1.65	0.00	1.65
24.30	2.22	0.49	4.51	1.65	0.00	1.65
24.35	2.22	0.49	4.50	1.65	0.00	1.65
24.40	2.22	0.49	4.50	1.65	0.00	1.65
24.45	2.22	0.49	4.50	1.65	0.00	1.65
24.50	2.22	0.49	4.49	1.65	0.00	1.65
24.55	2.22	0.49	4.49	1.65	0.00	1.65
24.60	2.22	0.49	4.49	1.65	0.00	1.65
24.65	2.22	0.49	4.48	1.65	0.00	1.65

24.70	2.22	0.50	4.48	1.65	0.00	1.65
24.75	2.22	0.50	4.48	1.65	0.00	1.65
24.80	2.22	0.50	4.48	1.65	0.00	1.65
24.85	2.22	0.50	4.47	1.65	0.00	1.65
24.90	2.22	0.50	4.47	1.65	0.00	1.65
24.95	2.22	0.50	4.47	1.65	0.00	1.65
25.00	2.22	0.50	4.46	1.65	0.00	1.65
25.05	2.22	0.50	4.46	1.65	0.00	1.65
25.10	2.22	0.50	4.46	1.65	0.00	1.65
25.15	2.22	0.50	4.46	1.65	0.00	1.65
25.20	2.22	0.50	4.45	1.65	0.00	1.65
25.25	2.22	0.50	4.45	1.65	0.00	1.65
25.30	2.22	0.50	4.45	1.65	0.00	1.65
25.35	2.22	0.50	4.45	1.65	0.00	1.65
25.40	2.22	0.50	4.44	1.65	0.00	1.65
25.45	2.22	0.50	4.44	1.65	0.00	1.65
25.50	2.22	0.50	4.44	1.65	0.00	1.65
25.55	2.22	0.50	4.43	1.65	0.00	1.65
25.60	2.22	0.50	4.43	1.65	0.00	1.65
25.65	2.22	0.50	4.43	1.65	0.00	1.65
25.70	2.22	0.50	4.43	1.65	0.00	1.65
25.75	2.22	0.50	4.42	1.65	0.00	1.65
25.80	2.22	0.50	4.42	1.65	0.00	1.65
25.85	2.22	0.50	4.42	1.65	0.00	1.65
25.90	2.22	0.50	4.42	1.65	0.00	1.65
25.95	2.22	0.50	4.41	1.65	0.00	1.65
26.00	2.22	0.50	4.41	1.65	0.00	1.65
26.05	2.22	0.50	4.41	1.65	0.00	1.65
26.10	2.22	0.50	4.41	1.65	0.00	1.65
26.15	2.22	0.50	4.40	1.65	0.00	1.65
26.20	2.22	0.50	4.40	1.65	0.00	1.65
26.25	2.22	0.50	4.40	1.65	0.00	1.65
26.30	2.22	0.50	4.40	1.65	0.00	1.65
26.35	2.22	0.51	4.39	1.65	0.00	1.65
26.40	2.22	0.51	4.39	1.65	0.00	1.65
26.45	2.22	0.51	4.39	1.65	0.00	1.65
26.50	2.22	0.51	4.39	1.65	0.00	1.65
26.55	2.22	0.51	4.38	1.65	0.00	1.65
26.60	0.49	0.51	0.96*	1.65	0.00	1.65
26.65	0.45	0.51	0.89*	1.65	0.00	1.65
26.70	0.43	0.51	0.84*	1.65	0.00	1.65
26.75	0.41	0.51	0.81*	1.64	0.00	1.64
26.80	0.40	0.51	0.79*	1.64	0.00	1.64
26.85	0.39	0.51	0.77*	1.63	0.00	1.63
26.90	0.38	0.51	0.75*	1.63	0.00	1.63
26.95	0.37	0.51	0.73*	1.62	0.00	1.62
27.00	0.36	0.51	0.71*	1.61	0.00	1.61
27.05	0.35	0.51	0.70*	1.61	0.00	1.61
27.10	0.35	0.51	0.68*	1.60	0.00	1.60
27.15	0.34	0.51	0.67*	1.59	0.00	1.59
27.20	0.33	0.51	0.65*	1.58	0.00	1.58
27.25	0.33	0.51	0.64*	1.57	0.00	1.57
27.30	0.32	0.51	0.63*	1.56	0.00	1.56
27.35	0.31	0.51	0.62*	1.55	0.00	1.55
27.40	0.31	0.51	0.60*	1.54	0.00	1.54
27.45	0.30	0.51	0.59*	1.53	0.00	1.53
27.50	0.30	0.51	0.58*	1.52	0.00	1.52
27.55	0.29	0.51	0.57*	1.51	0.00	1.51
27.60	0.29	0.51	0.56*	1.50	0.00	1.50
27.65	0.28	0.51	0.55*	1.49	0.00	1.49
27.70	0.28	0.51	0.54*	1.48	0.00	1.48
27.75	0.27	0.51	0.53*	1.47	0.00	1.47
27.80	0.27	0.51	0.52*	1.46	0.00	1.46

27.85	0.26	0.51	0.52*	1.44	0.00	1.44
27.90	0.28	0.51	0.54*	1.43	0.00	1.43
27.95	0.27	0.51	0.53*	1.42	0.00	1.42
28.00	0.27	0.51	0.52*	1.41	0.00	1.41
28.05	0.26	0.51	0.51*	1.40	0.00	1.40
28.10	0.26	0.51	0.50*	1.38	0.00	1.38
28.15	0.25	0.51	0.49*	1.37	0.00	1.37
28.20	0.25	0.52	0.48*	1.36	0.00	1.36
28.25	0.24	0.52	0.47*	1.35	0.00	1.35
28.30	0.24	0.52	0.46*	1.33	0.00	1.33
28.35	0.24	0.52	0.46*	1.32	0.00	1.32
28.40	0.23	0.52	0.45*	1.31	0.00	1.31
28.45	0.23	0.52	0.44*	1.29	0.00	1.29
28.50	0.22	0.52	0.43*	1.28	0.00	1.28
28.55	0.22	0.52	0.42*	1.27	0.00	1.27
28.60	0.22	0.52	0.42*	1.25	0.00	1.25
28.65	0.21	0.52	0.41*	1.24	0.00	1.24
28.70	0.21	0.52	0.40*	1.22	0.00	1.22
28.75	0.20	0.52	0.39*	1.21	0.00	1.21
28.80	0.20	0.52	0.39*	1.19	0.00	1.19
28.85	0.20	0.52	0.38*	1.18	0.00	1.18
28.90	0.19	0.52	0.37*	1.16	0.00	1.16
28.95	0.19	0.52	0.36*	1.15	0.00	1.15
29.00	0.18	0.52	0.36*	1.13	0.00	1.13
29.05	0.18	0.52	0.35*	1.12	0.00	1.12
29.10	0.18	0.52	0.34*	1.10	0.00	1.10
29.15	0.17	0.52	0.33*	1.08	0.00	1.08
29.20	0.17	0.52	0.33*	1.07	0.00	1.07
29.25	0.17	0.52	0.32*	1.05	0.00	1.05
29.30	0.16	0.52	0.31*	1.03	0.00	1.03
29.35	0.16	0.52	0.30*	1.01	0.00	1.01
29.40	0.15	0.52	0.30*	1.00	0.00	1.00
29.45	0.15	0.52	0.29*	0.98	0.00	0.98
29.50	0.15	0.52	0.28*	0.96	0.00	0.96
29.55	0.14	0.52	0.27*	0.94	0.00	0.94
29.60	0.14	0.52	0.27*	0.92	0.00	0.92
29.65	0.14	0.52	0.26*	0.90	0.00	0.90
29.70	0.13	0.52	0.25*	0.88	0.00	0.88
29.75	0.13	0.52	0.24*	0.86	0.00	0.86
29.80	0.12	0.52	0.24*	0.84	0.00	0.84
29.85	0.12	0.52	0.23*	0.82	0.00	0.82
29.90	0.12	0.52	0.22*	0.80	0.00	0.80
29.95	0.11	0.52	0.22*	0.78	0.00	0.78
30.00	0.11	0.52	0.21*	0.76	0.00	0.76
30.05	0.11	0.52	0.22*	0.74	0.00	0.74
30.10	0.12	0.52	0.22*	0.71	0.00	0.71
30.15	0.12	0.52	0.23*	0.69	0.00	0.69
30.20	0.13	0.52	0.24*	0.67	0.00	0.67
30.25	0.13	0.52	0.25*	0.65	0.00	0.65
30.30	0.14	0.52	0.26*	0.63	0.00	0.63
30.35	0.14	0.52	0.27*	0.61	0.00	0.61
30.40	0.14	0.52	0.28*	0.59	0.00	0.59
30.45	0.15	0.52	0.29*	0.58	0.00	0.58
30.50	0.15	0.52	0.29*	0.56	0.00	0.56
30.55	0.16	0.52	0.30*	0.54	0.00	0.54
30.60	0.16	0.52	0.31*	0.52	0.00	0.52
30.65	0.17	0.52	0.32*	0.50	0.00	0.50
30.70	0.17	0.52	0.33*	0.49	0.00	0.49
30.75	0.18	0.52	0.34*	0.47	0.00	0.47
30.80	0.18	0.52	0.35*	0.45	0.00	0.45
30.85	0.19	0.52	0.35*	0.44	0.00	0.44
30.90	0.19	0.52	0.36*	0.42	0.00	0.42
30.95	0.19	0.52	0.37*	0.40	0.00	0.40

31.00	0.20	0.52	0.38*	0.39	0.00	0.39
31.05	0.20	0.52	0.39*	0.37	0.00	0.37
31.10	0.21	0.52	0.40*	0.36	0.00	0.36
31.15	0.21	0.52	0.40*	0.34	0.00	0.34
31.20	0.22	0.52	0.41*	0.33	0.00	0.33
31.25	0.22	0.52	0.42*	0.32	0.00	0.32
31.30	0.23	0.52	0.43*	0.30	0.00	0.30
31.35	0.23	0.53	0.44*	0.29	0.00	0.29
31.40	0.24	0.53	0.45*	0.27	0.00	0.27
31.45	0.24	0.53	0.46*	0.26	0.00	0.26
31.50	0.24	0.53	0.47*	0.25	0.00	0.25
31.55	0.25	0.53	0.48*	0.24	0.00	0.24
31.60	0.25	0.53	0.48*	0.22	0.00	0.22
31.65	0.26	0.53	0.49*	0.21	0.00	0.21
31.70	0.26	0.53	0.50*	0.20	0.00	0.20
31.75	0.27	0.53	0.51*	0.19	0.00	0.19
31.80	0.28	0.53	0.52*	0.17	0.00	0.17
31.85	0.28	0.53	0.53*	0.16	0.00	0.16
31.90	0.29	0.53	0.55*	0.15	0.00	0.15
31.95	0.29	0.53	0.56*	0.14	0.00	0.14
32.00	0.30	0.53	0.57*	0.13	0.00	0.13
32.05	0.30	0.53	0.58*	0.12	0.00	0.12
32.10	0.31	0.53	0.59*	0.11	0.00	0.11
32.15	0.32	0.53	0.60*	0.10	0.00	0.10
32.20	0.32	0.53	0.62*	0.09	0.00	0.09
32.25	0.33	0.53	0.63*	0.08	0.00	0.08
32.30	0.34	0.53	0.65*	0.07	0.00	0.07
32.35	0.35	0.53	0.66*	0.06	0.00	0.06
32.40	0.36	0.53	0.68*	0.05	0.00	0.05
32.45	0.37	0.53	0.69*	0.04	0.00	0.04
32.50	0.37	0.53	0.71*	0.04	0.00	0.04
32.55	0.39	0.53	0.73*	0.03	0.00	0.03
32.60	0.40	0.53	0.76*	0.02	0.00	0.02
32.65	0.41	0.53	0.79*	0.02	0.00	0.02
32.70	0.43	0.53	0.82*	0.01	0.00	0.01
32.75	0.46	0.53	0.87*	0.01	0.00	0.01
32.80	0.51	0.53	0.98*	0.00	0.00	0.00
32.85	2.23	0.53	4.24	0.00	0.00	0.00
32.90	2.23	0.53	4.24	0.00	0.00	0.00
32.95	2.23	0.53	4.24	0.00	0.00	0.00
33.00	2.23	0.53	4.24	0.00	0.00	0.00
33.05	2.23	0.53	4.24	0.00	0.00	0.00
33.10	2.23	0.53	4.24	0.00	0.00	0.00
33.15	2.23	0.53	4.24	0.00	0.00	0.00
33.20	2.23	0.53	4.24	0.00	0.00	0.00
33.25	2.23	0.53	4.24	0.00	0.00	0.00
33.30	2.23	0.53	4.24	0.00	0.00	0.00
33.35	2.23	0.53	4.24	0.00	0.00	0.00
33.40	2.23	0.53	4.24	0.00	0.00	0.00
33.45	2.23	0.53	4.23	0.00	0.00	0.00
33.50	2.23	0.53	4.23	0.00	0.00	0.00
33.55	2.23	0.53	4.23	0.00	0.00	0.00
33.60	2.23	0.53	4.23	0.00	0.00	0.00
33.65	2.23	0.53	4.23	0.00	0.00	0.00
33.70	2.23	0.53	4.23	0.00	0.00	0.00
33.75	2.23	0.53	4.23	0.00	0.00	0.00
33.80	2.22	0.53	4.23	0.00	0.00	0.00
33.85	2.22	0.53	4.23	0.00	0.00	0.00
33.90	2.22	0.53	4.23	0.00	0.00	0.00
33.95	2.22	0.53	4.23	0.00	0.00	0.00
34.00	2.22	0.53	4.23	0.00	0.00	0.00
34.05	2.22	0.53	4.23	0.00	0.00	0.00
34.10	2.22	0.53	4.23	0.00	0.00	0.00

34.15	2.22	0.53	4.23	0.00	0.00	0.00
34.20	2.22	0.53	4.22	0.00	0.00	0.00
34.25	2.22	0.53	4.22	0.00	0.00	0.00
34.30	2.22	0.53	4.22	0.00	0.00	0.00
34.35	2.22	0.53	4.22	0.00	0.00	0.00
34.40	2.22	0.53	4.22	0.00	0.00	0.00
34.45	2.22	0.53	4.22	0.00	0.00	0.00
34.50	2.22	0.53	4.22	0.00	0.00	0.00
34.55	2.22	0.53	4.22	0.00	0.00	0.00
34.60	2.22	0.53	4.22	0.00	0.00	0.00
34.65	2.22	0.53	4.22	0.00	0.00	0.00
34.70	2.22	0.53	4.22	0.00	0.00	0.00
34.75	2.22	0.53	4.22	0.00	0.00	0.00
34.80	2.22	0.53	4.22	0.00	0.00	0.00
34.85	2.22	0.53	4.22	0.00	0.00	0.00
34.90	2.22	0.53	4.22	0.00	0.00	0.00
34.95	2.22	0.53	4.22	0.00	0.00	0.00
35.00	2.22	0.53	4.22	0.00	0.00	0.00
35.05	2.22	0.53	4.21	0.00	0.00	0.00
35.10	2.22	0.53	4.21	0.00	0.00	0.00
35.15	2.22	0.53	4.21	0.00	0.00	0.00
35.20	2.21	0.53	4.21	0.00	0.00	0.00
35.25	2.21	0.53	4.21	0.00	0.00	0.00
35.30	2.21	0.53	4.21	0.00	0.00	0.00
35.35	2.21	0.53	4.21	0.00	0.00	0.00
35.40	2.21	0.53	4.21	0.00	0.00	0.00
35.45	2.21	0.53	4.21	0.00	0.00	0.00
35.50	2.21	0.53	4.21	0.00	0.00	0.00
35.55	2.21	0.53	4.21	0.00	0.00	0.00
35.60	2.21	0.53	4.21	0.00	0.00	0.00
35.65	2.21	0.53	4.21	0.00	0.00	0.00
35.70	2.21	0.53	4.21	0.00	0.00	0.00
35.75	2.21	0.53	4.21	0.00	0.00	0.00
35.80	2.21	0.53	4.21	0.00	0.00	0.00
35.85	2.21	0.53	4.21	0.00	0.00	0.00
35.90	2.21	0.53	4.21	0.00	0.00	0.00
35.95	2.21	0.53	4.21	0.00	0.00	0.00
36.00	2.21	0.53	4.21	0.00	0.00	0.00
36.05	2.21	0.53	4.20	0.00	0.00	0.00
36.10	2.21	0.53	4.20	0.00	0.00	0.00
36.15	2.21	0.53	4.20	0.00	0.00	0.00
36.20	2.21	0.53	4.20	0.00	0.00	0.00
36.25	2.21	0.53	4.20	0.00	0.00	0.00
36.30	2.21	0.53	4.20	0.00	0.00	0.00
36.35	2.21	0.53	4.20	0.00	0.00	0.00
36.40	2.21	0.53	4.20	0.00	0.00	0.00
36.45	2.21	0.52	4.20	0.00	0.00	0.00
36.50	2.21	0.52	4.20	0.00	0.00	0.00
36.55	2.21	0.52	4.20	0.00	0.00	0.00
36.60	2.20	0.52	4.20	0.00	0.00	0.00
36.65	2.20	0.52	4.20	0.00	0.00	0.00
36.70	2.20	0.52	4.20	0.00	0.00	0.00
36.75	2.20	0.52	4.20	0.00	0.00	0.00
36.80	2.20	0.52	4.20	0.00	0.00	0.00
36.85	2.20	0.52	4.20	0.00	0.00	0.00
36.90	2.20	0.52	4.20	0.00	0.00	0.00
36.95	2.20	0.52	4.20	0.00	0.00	0.00
37.00	2.20	0.52	4.20	0.00	0.00	0.00
37.05	2.20	0.52	4.20	0.00	0.00	0.00
37.10	2.20	0.52	4.20	0.00	0.00	0.00
37.15	2.20	0.52	4.20	0.00	0.00	0.00
37.20	2.20	0.52	4.20	0.00	0.00	0.00
37.25	2.20	0.52	4.20	0.00	0.00	0.00

37.30	2.20	0.52	4.20	0.00	0.00	0.00
37.35	2.20	0.52	4.20	0.00	0.00	0.00
37.40	2.20	0.52	4.20	0.00	0.00	0.00
37.45	2.20	0.52	4.19	0.00	0.00	0.00
37.50	2.20	0.52	4.19	0.00	0.00	0.00
37.55	2.20	0.52	4.19	0.00	0.00	0.00
37.60	2.20	0.52	4.19	0.00	0.00	0.00
37.65	2.20	0.52	4.19	0.00	0.00	0.00
37.70	2.20	0.52	4.19	0.00	0.00	0.00
37.75	2.20	0.52	4.19	0.00	0.00	0.00
37.80	2.20	0.52	4.19	0.00	0.00	0.00
37.85	2.20	0.52	4.19	0.00	0.00	0.00
37.90	2.20	0.52	4.19	0.00	0.00	0.00
37.95	2.19	0.52	4.19	0.00	0.00	0.00
38.00	2.19	0.52	4.19	0.00	0.00	0.00
38.05	2.19	0.52	4.19	0.00	0.00	0.00
38.10	2.19	0.52	4.19	0.00	0.00	0.00
38.15	2.19	0.52	4.19	0.00	0.00	0.00
38.20	2.19	0.52	4.19	0.00	0.00	0.00
38.25	2.19	0.52	4.19	0.00	0.00	0.00
38.30	2.19	0.52	4.19	0.00	0.00	0.00
38.35	2.19	0.52	4.19	0.00	0.00	0.00
38.40	2.19	0.52	4.19	0.00	0.00	0.00
38.45	2.19	0.52	4.19	0.00	0.00	0.00
38.50	2.19	0.52	4.19	0.00	0.00	0.00
38.55	2.19	0.52	4.19	0.00	0.00	0.00
38.60	2.19	0.52	4.19	0.00	0.00	0.00
38.65	2.19	0.52	4.19	0.00	0.00	0.00
38.70	2.19	0.52	4.19	0.00	0.00	0.00
38.75	2.19	0.52	4.19	0.00	0.00	0.00
38.80	2.19	0.52	4.19	0.00	0.00	0.00
38.85	2.19	0.52	4.19	0.00	0.00	0.00
38.90	2.19	0.52	4.19	0.00	0.00	0.00
38.95	2.19	0.52	4.19	0.00	0.00	0.00
39.00	2.19	0.52	4.19	0.00	0.00	0.00
39.05	2.19	0.52	4.19	0.00	0.00	0.00
39.10	2.19	0.52	4.19	0.00	0.00	0.00
39.15	2.19	0.52	4.19	0.00	0.00	0.00
39.20	2.19	0.52	4.19	0.00	0.00	0.00
39.25	2.19	0.52	4.19	0.00	0.00	0.00
39.30	2.19	0.52	4.19	0.00	0.00	0.00
39.35	2.18	0.52	4.19	0.00	0.00	0.00
39.40	2.18	0.52	4.19	0.00	0.00	0.00
39.45	2.18	0.52	4.19	0.00	0.00	0.00
39.50	2.18	0.52	4.19	0.00	0.00	0.00
39.55	2.18	0.52	4.19	0.00	0.00	0.00
39.60	2.18	0.52	4.19	0.00	0.00	0.00
39.65	2.18	0.52	4.19	0.00	0.00	0.00
39.70	2.18	0.52	4.19	0.00	0.00	0.00
39.75	2.18	0.52	4.19	0.00	0.00	0.00
39.80	2.18	0.52	4.19	0.00	0.00	0.00
39.85	2.18	0.52	4.19	0.00	0.00	0.00
39.90	2.18	0.52	4.19	0.00	0.00	0.00
39.95	2.18	0.52	4.19	0.00	0.00	0.00
40.00	2.18	0.52	4.19	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.

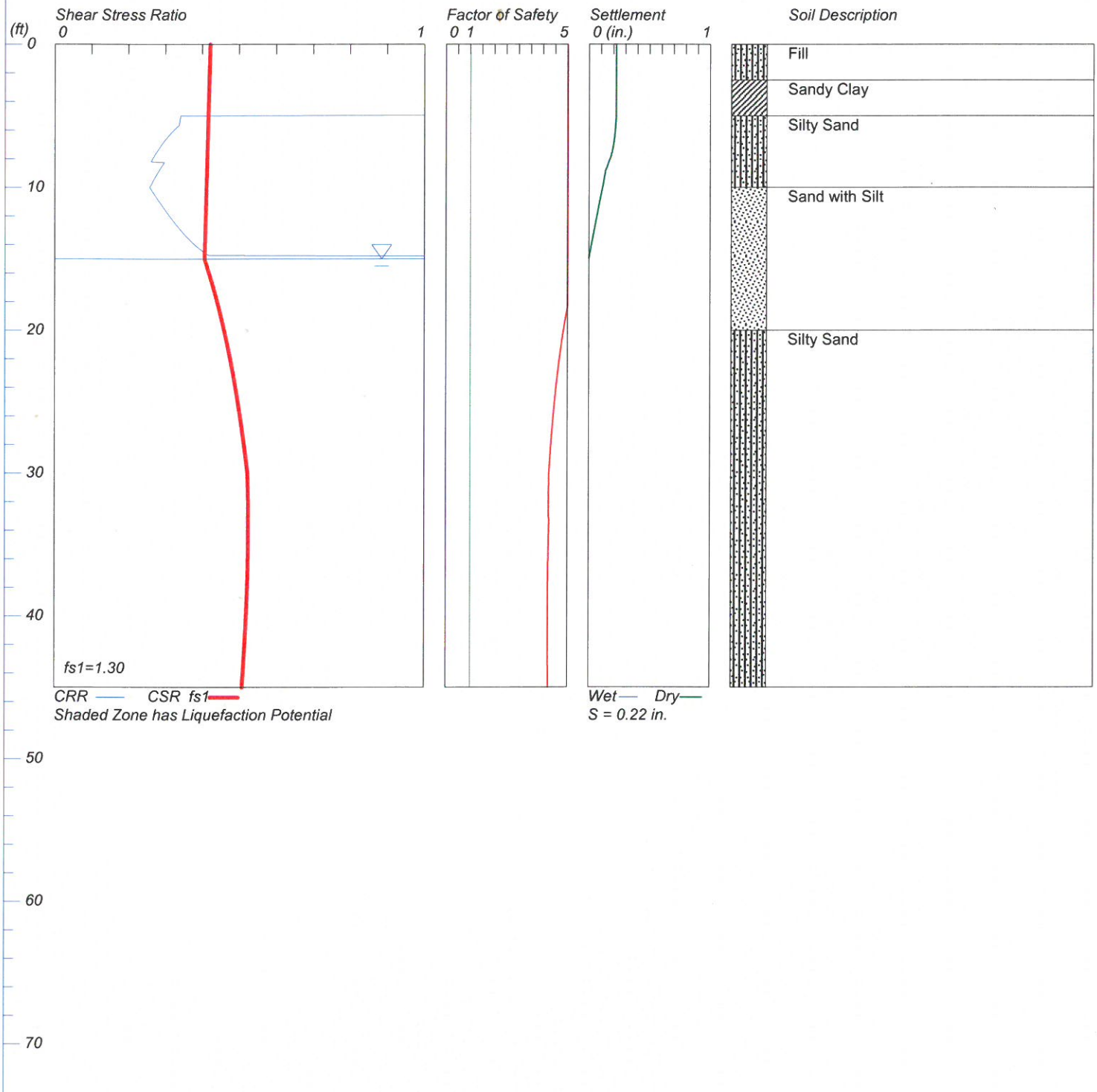
CRRm	Cyclic resistance ratio from soils
CSRfs	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRfs
S_sat	Settlement from saturated sands
S_dry	Settlement from dry sands
S_all	Total settlement from saturated and dry sands
NoLiq	No-Liquefy Soils

LIQUEFACTION ANALYSIS

Blue Wave Hotel & Residences

Hole No.=B-2 Water Depth=15 ft Surface Elev.=18

Magnitude=7.2
Acceleration=0.499g



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LIQUEFACTION ANALYSIS CALCULATION SHEET

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Input File Name: \\Server\projects\40-3618G Imperial Beach Hotel and Residential\B-2.liq
Title: Blue Wave Hotel & Residences
Subtitle: 40-3618G

Surface Elev.=18
Hole No.=B-2
Depth of Hole= 45.0 ft
Water Table during Earthquake= 15.0 ft
Water Table during In-Situ Testing= 16.5 ft
Max. Acceleration= 0.5 g
Earthquake Magnitude= 7.2

Input Data:
Surface Elev.=18
Hole No.=B-2
Depth of Hole=45.0 ft
Water Table during Earthquake= 15.0 ft
Water Table during In-Situ Testing= 16.5 ft
Max. Acceleration=0.5 g
Earthquake Magnitude=7.2

Earthquake Magnitude=7.2
2. Settlement Analysis Method: Ishihara / Yoshimine*
3. Fines Correction for Liquefaction: Stark/Olson et al.*
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= 1.3
Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.0	20.0	125.0	NoLiq
5.0	16.0	120.0	30.0
10.0	19.0	125.0	8.0
15.0	33.0	125.0	6.0
20.0	61.0	125.0	15.0
25.0	59.0	125.0	19.0
30.0	37.0	125.0	30.0
35.0	85.0	125.0	30.0
40.0	44.0	130.0	16.0
45.0	67.0	130.0	16.0

Output Results:

Settlement of saturated sands=0.00 in.
Settlement of dry sands=0.22 in.
Total settlement of saturated and dry sands=0.22 in.
Differential Settlement=0.111 to 0.147 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.42	5.00	0.00	0.22	0.22
0.05	2.00	0.42	5.00	0.00	0.22	0.22
0.10	2.00	0.42	5.00	0.00	0.22	0.22
0.15	2.00	0.42	5.00	0.00	0.22	0.22
0.20	2.00	0.42	5.00	0.00	0.22	0.22
0.25	2.00	0.42	5.00	0.00	0.22	0.22
0.30	2.00	0.42	5.00	0.00	0.22	0.22
0.35	2.00	0.42	5.00	0.00	0.22	0.22
0.40	2.00	0.42	5.00	0.00	0.22	0.22
0.45	2.00	0.42	5.00	0.00	0.22	0.22
0.50	2.00	0.42	5.00	0.00	0.22	0.22
0.55	2.00	0.42	5.00	0.00	0.22	0.22
0.60	2.00	0.42	5.00	0.00	0.22	0.22
0.65	2.00	0.42	5.00	0.00	0.22	0.22
0.70	2.00	0.42	5.00	0.00	0.22	0.22
0.75	2.00	0.42	5.00	0.00	0.22	0.22
0.80	2.00	0.42	5.00	0.00	0.22	0.22
0.85	2.00	0.42	5.00	0.00	0.22	0.22
0.90	2.00	0.42	5.00	0.00	0.22	0.22
0.95	2.00	0.42	5.00	0.00	0.22	0.22
1.00	2.00	0.42	5.00	0.00	0.22	0.22
1.05	2.00	0.42	5.00	0.00	0.22	0.22
1.10	2.00	0.42	5.00	0.00	0.22	0.22
1.15	2.00	0.42	5.00	0.00	0.22	0.22
1.20	2.00	0.42	5.00	0.00	0.22	0.22
1.25	2.00	0.42	5.00	0.00	0.22	0.22
1.30	2.00	0.42	5.00	0.00	0.22	0.22
1.35	2.00	0.42	5.00	0.00	0.22	0.22
1.40	2.00	0.42	5.00	0.00	0.22	0.22
1.45	2.00	0.42	5.00	0.00	0.22	0.22
1.50	2.00	0.42	5.00	0.00	0.22	0.22
1.55	2.00	0.42	5.00	0.00	0.22	0.22
1.60	2.00	0.42	5.00	0.00	0.22	0.22
1.65	2.00	0.42	5.00	0.00	0.22	0.22
1.70	2.00	0.42	5.00	0.00	0.22	0.22
1.75	2.00	0.42	5.00	0.00	0.22	0.22
1.80	2.00	0.42	5.00	0.00	0.22	0.22
1.85	2.00	0.42	5.00	0.00	0.22	0.22
1.90	2.00	0.42	5.00	0.00	0.22	0.22
1.95	2.00	0.42	5.00	0.00	0.22	0.22
2.00	2.00	0.42	5.00	0.00	0.22	0.22
2.05	2.00	0.42	5.00	0.00	0.22	0.22
2.10	2.00	0.42	5.00	0.00	0.22	0.22
2.15	2.00	0.42	5.00	0.00	0.22	0.22
2.20	2.00	0.42	5.00	0.00	0.22	0.22
2.25	2.00	0.42	5.00	0.00	0.22	0.22
2.30	2.00	0.42	5.00	0.00	0.22	0.22
2.35	2.00	0.42	5.00	0.00	0.22	0.22
2.40	2.00	0.42	5.00	0.00	0.22	0.22
2.45	2.00	0.42	5.00	0.00	0.22	0.22
2.50	2.00	0.42	5.00	0.00	0.22	0.22
2.55	2.00	0.42	5.00	0.00	0.22	0.22

2.60	2.00	0.42	5.00	0.00	0.22	0.22
2.65	2.00	0.42	5.00	0.00	0.22	0.22
2.70	2.00	0.42	5.00	0.00	0.22	0.22
2.75	2.00	0.42	5.00	0.00	0.22	0.22
2.80	2.00	0.42	5.00	0.00	0.22	0.22
2.85	2.00	0.42	5.00	0.00	0.22	0.22
2.90	2.00	0.42	5.00	0.00	0.22	0.22
2.95	2.00	0.42	5.00	0.00	0.22	0.22
3.00	2.00	0.42	5.00	0.00	0.22	0.22
3.05	2.00	0.42	5.00	0.00	0.22	0.22
3.10	2.00	0.42	5.00	0.00	0.22	0.22
3.15	2.00	0.42	5.00	0.00	0.22	0.22
3.20	2.00	0.42	5.00	0.00	0.22	0.22
3.25	2.00	0.42	5.00	0.00	0.22	0.22
3.30	2.00	0.42	5.00	0.00	0.22	0.22
3.35	2.00	0.42	5.00	0.00	0.22	0.22
3.40	2.00	0.42	5.00	0.00	0.22	0.22
3.45	2.00	0.42	5.00	0.00	0.22	0.22
3.50	2.00	0.42	5.00	0.00	0.22	0.22
3.55	2.00	0.42	5.00	0.00	0.22	0.22
3.60	2.00	0.42	5.00	0.00	0.22	0.22
3.65	2.00	0.42	5.00	0.00	0.22	0.22
3.70	2.00	0.42	5.00	0.00	0.22	0.22
3.75	2.00	0.42	5.00	0.00	0.22	0.22
3.80	2.00	0.42	5.00	0.00	0.22	0.22
3.85	2.00	0.42	5.00	0.00	0.22	0.22
3.90	2.00	0.42	5.00	0.00	0.22	0.22
3.95	2.00	0.42	5.00	0.00	0.22	0.22
4.00	2.00	0.42	5.00	0.00	0.22	0.22
4.05	2.00	0.42	5.00	0.00	0.22	0.22
4.10	2.00	0.42	5.00	0.00	0.22	0.22
4.15	2.00	0.42	5.00	0.00	0.22	0.22
4.20	2.00	0.42	5.00	0.00	0.22	0.22
4.25	2.00	0.42	5.00	0.00	0.22	0.22
4.30	2.00	0.42	5.00	0.00	0.22	0.22
4.35	2.00	0.42	5.00	0.00	0.22	0.22
4.40	2.00	0.42	5.00	0.00	0.22	0.22
4.45	2.00	0.42	5.00	0.00	0.22	0.22
4.50	2.00	0.42	5.00	0.00	0.22	0.22
4.55	2.00	0.42	5.00	0.00	0.22	0.22
4.60	2.00	0.42	5.00	0.00	0.22	0.22
4.65	2.00	0.42	5.00	0.00	0.22	0.22
4.70	2.00	0.42	5.00	0.00	0.22	0.22
4.75	2.00	0.42	5.00	0.00	0.22	0.22
4.80	2.00	0.42	5.00	0.00	0.22	0.22
4.85	2.00	0.42	5.00	0.00	0.22	0.22
4.90	2.00	0.42	5.00	0.00	0.22	0.22
4.95	2.00	0.42	5.00	0.00	0.22	0.22
5.00	0.34	0.42	5.00	0.00	0.22	0.22
5.05	0.34	0.42	5.00	0.00	0.22	0.22
5.10	0.34	0.42	5.00	0.00	0.22	0.22
5.15	0.34	0.42	5.00	0.00	0.22	0.22
5.20	0.34	0.42	5.00	0.00	0.22	0.22
5.25	0.34	0.42	5.00	0.00	0.22	0.22
5.30	0.34	0.42	5.00	0.00	0.22	0.22
5.35	0.34	0.42	5.00	0.00	0.22	0.22
5.40	0.34	0.42	5.00	0.00	0.22	0.22
5.45	0.34	0.42	5.00	0.00	0.22	0.22
5.50	0.34	0.42	5.00	0.00	0.22	0.22
5.55	0.34	0.42	5.00	0.00	0.22	0.22
5.60	0.34	0.42	5.00	0.00	0.22	0.22
5.65	0.34	0.42	5.00	0.00	0.22	0.22
5.70	0.34	0.42	5.00	0.00	0.22	0.22

5.75	0.33	0.42	5.00	0.00	0.22	0.22
5.80	0.33	0.42	5.00	0.00	0.22	0.22
5.85	0.33	0.42	5.00	0.00	0.22	0.22
5.90	0.33	0.42	5.00	0.00	0.21	0.21
5.95	0.33	0.42	5.00	0.00	0.21	0.21
6.00	0.32	0.42	5.00	0.00	0.21	0.21
6.05	0.32	0.42	5.00	0.00	0.21	0.21
6.10	0.32	0.42	5.00	0.00	0.21	0.21
6.15	0.32	0.42	5.00	0.00	0.21	0.21
6.20	0.32	0.42	5.00	0.00	0.21	0.21
6.25	0.31	0.42	5.00	0.00	0.21	0.21
6.30	0.31	0.42	5.00	0.00	0.21	0.21
6.35	0.31	0.42	5.00	0.00	0.21	0.21
6.40	0.31	0.42	5.00	0.00	0.21	0.21
6.45	0.31	0.42	5.00	0.00	0.21	0.21
6.50	0.31	0.42	5.00	0.00	0.21	0.21
6.55	0.30	0.42	5.00	0.00	0.21	0.21
6.60	0.30	0.42	5.00	0.00	0.21	0.21
6.65	0.30	0.42	5.00	0.00	0.21	0.21
6.70	0.30	0.42	5.00	0.00	0.21	0.21
6.75	0.30	0.42	5.00	0.00	0.20	0.20
6.80	0.30	0.41	5.00	0.00	0.20	0.20
6.85	0.29	0.41	5.00	0.00	0.20	0.20
6.90	0.29	0.41	5.00	0.00	0.20	0.20
6.95	0.29	0.41	5.00	0.00	0.20	0.20
7.00	0.29	0.41	5.00	0.00	0.20	0.20
7.05	0.29	0.41	5.00	0.00	0.20	0.20
7.10	0.29	0.41	5.00	0.00	0.20	0.20
7.15	0.29	0.41	5.00	0.00	0.20	0.20
7.20	0.29	0.41	5.00	0.00	0.20	0.20
7.25	0.28	0.41	5.00	0.00	0.20	0.20
7.30	0.28	0.41	5.00	0.00	0.19	0.19
7.35	0.28	0.41	5.00	0.00	0.19	0.19
7.40	0.28	0.41	5.00	0.00	0.19	0.19
7.45	0.28	0.41	5.00	0.00	0.19	0.19
7.50	0.28	0.41	5.00	0.00	0.19	0.19
7.55	0.28	0.41	5.00	0.00	0.19	0.19
7.60	0.27	0.41	5.00	0.00	0.19	0.19
7.65	0.27	0.41	5.00	0.00	0.18	0.18
7.70	0.27	0.41	5.00	0.00	0.18	0.18
7.75	0.27	0.41	5.00	0.00	0.18	0.18
7.80	0.27	0.41	5.00	0.00	0.18	0.18
7.85	0.27	0.41	5.00	0.00	0.18	0.18
7.90	0.27	0.41	5.00	0.00	0.18	0.18
7.95	0.27	0.41	5.00	0.00	0.17	0.17
8.00	0.27	0.41	5.00	0.00	0.17	0.17
8.05	0.26	0.41	5.00	0.00	0.17	0.17
8.10	0.26	0.41	5.00	0.00	0.17	0.17
8.15	0.26	0.41	5.00	0.00	0.17	0.17
8.20	0.26	0.41	5.00	0.00	0.16	0.16
8.25	0.30	0.41	5.00	0.00	0.16	0.16
8.30	0.30	0.41	5.00	0.00	0.16	0.16
8.35	0.29	0.41	5.00	0.00	0.16	0.16
8.40	0.29	0.41	5.00	0.00	0.15	0.15
8.45	0.29	0.41	5.00	0.00	0.15	0.15
8.50	0.29	0.41	5.00	0.00	0.15	0.15
8.55	0.29	0.41	5.00	0.00	0.15	0.15
8.60	0.29	0.41	5.00	0.00	0.15	0.15
8.65	0.29	0.41	5.00	0.00	0.14	0.14
8.70	0.29	0.41	5.00	0.00	0.14	0.14
8.75	0.28	0.41	5.00	0.00	0.14	0.14
8.80	0.28	0.41	5.00	0.00	0.14	0.14
8.85	0.28	0.41	5.00	0.00	0.13	0.13

8.90	0.28	0.41	5.00	0.00	0.13	0.13
8.95	0.28	0.41	5.00	0.00	0.13	0.13
9.00	0.28	0.41	5.00	0.00	0.13	0.13
9.05	0.28	0.41	5.00	0.00	0.13	0.13
9.10	0.28	0.41	5.00	0.00	0.13	0.13
9.15	0.28	0.41	5.00	0.00	0.13	0.13
9.20	0.27	0.41	5.00	0.00	0.13	0.13
9.25	0.27	0.41	5.00	0.00	0.13	0.13
9.30	0.27	0.41	5.00	0.00	0.13	0.13
9.35	0.27	0.41	5.00	0.00	0.13	0.13
9.40	0.27	0.41	5.00	0.00	0.12	0.12
9.45	0.27	0.41	5.00	0.00	0.12	0.12
9.50	0.27	0.41	5.00	0.00	0.12	0.12
9.55	0.27	0.41	5.00	0.00	0.12	0.12
9.60	0.27	0.41	5.00	0.00	0.12	0.12
9.65	0.26	0.41	5.00	0.00	0.12	0.12
9.70	0.26	0.41	5.00	0.00	0.12	0.12
9.75	0.26	0.41	5.00	0.00	0.12	0.12
9.80	0.26	0.41	5.00	0.00	0.12	0.12
9.85	0.26	0.41	5.00	0.00	0.12	0.12
9.90	0.26	0.41	5.00	0.00	0.11	0.11
9.95	0.26	0.41	5.00	0.00	0.11	0.11
10.00	0.26	0.41	5.00	0.00	0.11	0.11
10.05	0.26	0.41	5.00	0.00	0.11	0.11
10.10	0.26	0.41	5.00	0.00	0.11	0.11
10.15	0.26	0.41	5.00	0.00	0.11	0.11
10.20	0.26	0.41	5.00	0.00	0.11	0.11
10.25	0.26	0.41	5.00	0.00	0.11	0.11
10.30	0.27	0.41	5.00	0.00	0.10	0.10
10.35	0.27	0.41	5.00	0.00	0.10	0.10
10.40	0.27	0.41	5.00	0.00	0.10	0.10
10.45	0.27	0.41	5.00	0.00	0.10	0.10
10.50	0.27	0.41	5.00	0.00	0.10	0.10
10.55	0.27	0.41	5.00	0.00	0.10	0.10
10.60	0.27	0.41	5.00	0.00	0.10	0.10
10.65	0.27	0.41	5.00	0.00	0.10	0.10
10.70	0.28	0.41	5.00	0.00	0.09	0.09
10.75	0.28	0.41	5.00	0.00	0.09	0.09
10.80	0.28	0.41	5.00	0.00	0.09	0.09
10.85	0.28	0.41	5.00	0.00	0.09	0.09
10.90	0.28	0.41	5.00	0.00	0.09	0.09
10.95	0.28	0.41	5.00	0.00	0.09	0.09
11.00	0.28	0.41	5.00	0.00	0.09	0.09
11.05	0.28	0.41	5.00	0.00	0.09	0.09
11.10	0.29	0.41	5.00	0.00	0.09	0.09
11.15	0.29	0.41	5.00	0.00	0.08	0.08
11.20	0.29	0.41	5.00	0.00	0.08	0.08
11.25	0.29	0.41	5.00	0.00	0.08	0.08
11.30	0.29	0.41	5.00	0.00	0.08	0.08
11.35	0.29	0.41	5.00	0.00	0.08	0.08
11.40	0.29	0.41	5.00	0.00	0.08	0.08
11.45	0.30	0.41	5.00	0.00	0.08	0.08
11.50	0.30	0.41	5.00	0.00	0.08	0.08
11.55	0.30	0.41	5.00	0.00	0.08	0.08
11.60	0.30	0.41	5.00	0.00	0.07	0.07
11.65	0.30	0.41	5.00	0.00	0.07	0.07
11.70	0.30	0.41	5.00	0.00	0.07	0.07
11.75	0.30	0.41	5.00	0.00	0.07	0.07
11.80	0.31	0.41	5.00	0.00	0.07	0.07
11.85	0.31	0.41	5.00	0.00	0.07	0.07
11.90	0.31	0.41	5.00	0.00	0.07	0.07
11.95	0.31	0.41	5.00	0.00	0.07	0.07
12.00	0.31	0.41	5.00	0.00	0.07	0.07

12.05	0.31	0.41	5.00	0.00	0.06	0.06
12.10	0.31	0.41	5.00	0.00	0.06	0.06
12.15	0.32	0.41	5.00	0.00	0.06	0.06
12.20	0.32	0.41	5.00	0.00	0.06	0.06
12.25	0.32	0.41	5.00	0.00	0.06	0.06
12.30	0.32	0.41	5.00	0.00	0.06	0.06
12.35	0.32	0.41	5.00	0.00	0.06	0.06
12.40	0.32	0.41	5.00	0.00	0.06	0.06
12.45	0.32	0.41	5.00	0.00	0.06	0.06
12.50	0.33	0.41	5.00	0.00	0.05	0.05
12.55	0.33	0.41	5.00	0.00	0.05	0.05
12.60	0.33	0.41	5.00	0.00	0.05	0.05
12.65	0.33	0.41	5.00	0.00	0.05	0.05
12.70	0.33	0.41	5.00	0.00	0.05	0.05
12.75	0.33	0.41	5.00	0.00	0.05	0.05
12.80	0.34	0.41	5.00	0.00	0.05	0.05
12.85	0.34	0.41	5.00	0.00	0.05	0.05
12.90	0.34	0.41	5.00	0.00	0.05	0.05
12.95	0.34	0.41	5.00	0.00	0.04	0.04
13.00	0.34	0.41	5.00	0.00	0.04	0.04
13.05	0.34	0.41	5.00	0.00	0.04	0.04
13.10	0.35	0.41	5.00	0.00	0.04	0.04
13.15	0.35	0.41	5.00	0.00	0.04	0.04
13.20	0.35	0.41	5.00	0.00	0.04	0.04
13.25	0.35	0.41	5.00	0.00	0.04	0.04
13.30	0.35	0.41	5.00	0.00	0.04	0.04
13.35	0.35	0.41	5.00	0.00	0.04	0.04
13.40	0.36	0.41	5.00	0.00	0.03	0.03
13.45	0.36	0.41	5.00	0.00	0.03	0.03
13.50	0.36	0.41	5.00	0.00	0.03	0.03
13.55	0.36	0.41	5.00	0.00	0.03	0.03
13.60	0.36	0.41	5.00	0.00	0.03	0.03
13.65	0.37	0.41	5.00	0.00	0.03	0.03
13.70	0.37	0.41	5.00	0.00	0.03	0.03
13.75	0.37	0.41	5.00	0.00	0.03	0.03
13.80	0.37	0.41	5.00	0.00	0.03	0.03
13.85	0.37	0.41	5.00	0.00	0.02	0.02
13.90	0.38	0.41	5.00	0.00	0.02	0.02
13.95	0.38	0.41	5.00	0.00	0.02	0.02
14.00	0.38	0.41	5.00	0.00	0.02	0.02
14.05	0.38	0.41	5.00	0.00	0.02	0.02
14.10	0.38	0.41	5.00	0.00	0.02	0.02
14.15	0.39	0.41	5.00	0.00	0.02	0.02
14.20	0.39	0.41	5.00	0.00	0.02	0.02
14.25	0.39	0.41	5.00	0.00	0.02	0.02
14.30	0.39	0.41	5.00	0.00	0.01	0.01
14.35	0.40	0.41	5.00	0.00	0.01	0.01
14.40	0.40	0.41	5.00	0.00	0.01	0.01
14.45	0.40	0.41	5.00	0.00	0.01	0.01
14.50	0.40	0.41	5.00	0.00	0.01	0.01
14.55	0.41	0.41	5.00	0.00	0.01	0.01
14.60	0.41	0.41	5.00	0.00	0.01	0.01
14.65	0.41	0.41	5.00	0.00	0.01	0.01
14.70	0.42	0.41	5.00	0.00	0.01	0.01
14.75	0.42	0.41	5.00	0.00	0.00	0.00
14.80	2.22	0.41	5.00	0.00	0.00	0.00
14.85	2.22	0.41	5.00	0.00	0.00	0.00
14.90	2.22	0.41	5.00	0.00	0.00	0.00
14.95	2.22	0.41	5.00	0.00	0.00	0.00
15.00	2.22	0.41	5.00	0.00	0.00	0.00
15.05	2.22	0.41	5.00	0.00	0.00	0.00
15.10	2.22	0.41	5.00	0.00	0.00	0.00
15.15	2.22	0.41	5.00	0.00	0.00	0.00

15.20	2.22	0.41	5.00	0.00	0.00	0.00
15.25	2.22	0.41	5.00	0.00	0.00	0.00
15.30	2.22	0.41	5.00	0.00	0.00	0.00
15.35	2.22	0.41	5.00	0.00	0.00	0.00
15.40	2.22	0.41	5.00	0.00	0.00	0.00
15.45	2.22	0.41	5.00	0.00	0.00	0.00
15.50	2.22	0.41	5.00	0.00	0.00	0.00
15.55	2.22	0.41	5.00	0.00	0.00	0.00
15.60	2.22	0.41	5.00	0.00	0.00	0.00
15.65	2.22	0.41	5.00	0.00	0.00	0.00
15.70	2.22	0.42	5.00	0.00	0.00	0.00
15.75	2.22	0.42	5.00	0.00	0.00	0.00
15.80	2.22	0.42	5.00	0.00	0.00	0.00
15.85	2.22	0.42	5.00	0.00	0.00	0.00
15.90	2.22	0.42	5.00	0.00	0.00	0.00
15.95	2.22	0.42	5.00	0.00	0.00	0.00
16.00	2.22	0.42	5.00	0.00	0.00	0.00
16.05	2.22	0.42	5.00	0.00	0.00	0.00
16.10	2.22	0.42	5.00	0.00	0.00	0.00
16.15	2.22	0.42	5.00	0.00	0.00	0.00
16.20	2.22	0.42	5.00	0.00	0.00	0.00
16.25	2.22	0.42	5.00	0.00	0.00	0.00
16.30	2.22	0.42	5.00	0.00	0.00	0.00
16.35	2.22	0.42	5.00	0.00	0.00	0.00
16.40	2.22	0.42	5.00	0.00	0.00	0.00
16.45	2.22	0.42	5.00	0.00	0.00	0.00
16.50	2.22	0.42	5.00	0.00	0.00	0.00
16.55	2.22	0.43	5.00	0.00	0.00	0.00
16.60	2.22	0.43	5.00	0.00	0.00	0.00
16.65	2.22	0.43	5.00	0.00	0.00	0.00
16.70	2.22	0.43	5.00	0.00	0.00	0.00
16.75	2.22	0.43	5.00	0.00	0.00	0.00
16.80	2.22	0.43	5.00	0.00	0.00	0.00
16.85	2.22	0.43	5.00	0.00	0.00	0.00
16.90	2.22	0.43	5.00	0.00	0.00	0.00
16.95	2.22	0.43	5.00	0.00	0.00	0.00
17.00	2.22	0.43	5.00	0.00	0.00	0.00
17.05	2.22	0.43	5.00	0.00	0.00	0.00
17.10	2.22	0.43	5.00	0.00	0.00	0.00
17.15	2.22	0.43	5.00	0.00	0.00	0.00
17.20	2.22	0.43	5.00	0.00	0.00	0.00
17.25	2.22	0.43	5.00	0.00	0.00	0.00
17.30	2.22	0.43	5.00	0.00	0.00	0.00
17.35	2.22	0.43	5.00	0.00	0.00	0.00
17.40	2.22	0.43	5.00	0.00	0.00	0.00
17.45	2.22	0.44	5.00	0.00	0.00	0.00
17.50	2.22	0.44	5.00	0.00	0.00	0.00
17.55	2.22	0.44	5.00	0.00	0.00	0.00
17.60	2.22	0.44	5.00	0.00	0.00	0.00
17.65	2.22	0.44	5.00	0.00	0.00	0.00
17.70	2.22	0.44	5.00	0.00	0.00	0.00
17.75	2.22	0.44	5.00	0.00	0.00	0.00
17.80	2.22	0.44	5.00	0.00	0.00	0.00
17.85	2.22	0.44	5.00	0.00	0.00	0.00
17.90	2.22	0.44	5.00	0.00	0.00	0.00
17.95	2.22	0.44	5.00	0.00	0.00	0.00
18.00	2.22	0.44	5.00	0.00	0.00	0.00
18.05	2.22	0.44	5.00	0.00	0.00	0.00
18.10	2.22	0.44	5.00	0.00	0.00	0.00
18.15	2.22	0.44	5.00	0.00	0.00	0.00
18.20	2.22	0.44	5.00	0.00	0.00	0.00
18.25	2.22	0.44	5.00	0.00	0.00	0.00
18.30	2.22	0.44	5.00	0.00	0.00	0.00

18.35	2.22	0.44	4.99	0.00	0.00	0.00
18.40	2.22	0.45	4.99	0.00	0.00	0.00
18.45	2.22	0.45	4.98	0.00	0.00	0.00
18.50	2.22	0.45	4.98	0.00	0.00	0.00
18.55	2.22	0.45	4.97	0.00	0.00	0.00
18.60	2.22	0.45	4.97	0.00	0.00	0.00
18.65	2.22	0.45	4.96	0.00	0.00	0.00
18.70	2.22	0.45	4.95	0.00	0.00	0.00
18.75	2.22	0.45	4.95	0.00	0.00	0.00
18.80	2.22	0.45	4.94	0.00	0.00	0.00
18.85	2.22	0.45	4.94	0.00	0.00	0.00
18.90	2.22	0.45	4.93	0.00	0.00	0.00
18.95	2.22	0.45	4.93	0.00	0.00	0.00
19.00	2.22	0.45	4.92	0.00	0.00	0.00
19.05	2.22	0.45	4.92	0.00	0.00	0.00
19.10	2.22	0.45	4.91	0.00	0.00	0.00
19.15	2.22	0.45	4.91	0.00	0.00	0.00
19.20	2.22	0.45	4.90	0.00	0.00	0.00
19.25	2.22	0.45	4.90	0.00	0.00	0.00
19.30	2.22	0.45	4.89	0.00	0.00	0.00
19.35	2.22	0.45	4.89	0.00	0.00	0.00
19.40	2.22	0.45	4.88	0.00	0.00	0.00
19.45	2.22	0.46	4.88	0.00	0.00	0.00
19.50	2.22	0.46	4.87	0.00	0.00	0.00
19.55	2.22	0.46	4.87	0.00	0.00	0.00
19.60	2.22	0.46	4.86	0.00	0.00	0.00
19.65	2.22	0.46	4.86	0.00	0.00	0.00
19.70	2.22	0.46	4.85	0.00	0.00	0.00
19.75	2.22	0.46	4.85	0.00	0.00	0.00
19.80	2.22	0.46	4.84	0.00	0.00	0.00
19.85	2.22	0.46	4.84	0.00	0.00	0.00
19.90	2.22	0.46	4.83	0.00	0.00	0.00
19.95	2.22	0.46	4.83	0.00	0.00	0.00
20.00	2.22	0.46	4.83	0.00	0.00	0.00
20.05	2.22	0.46	4.82	0.00	0.00	0.00
20.10	2.22	0.46	4.82	0.00	0.00	0.00
20.15	2.22	0.46	4.81	0.00	0.00	0.00
20.20	2.22	0.46	4.81	0.00	0.00	0.00
20.25	2.22	0.46	4.80	0.00	0.00	0.00
20.30	2.22	0.46	4.80	0.00	0.00	0.00
20.35	2.22	0.46	4.79	0.00	0.00	0.00
20.40	2.22	0.46	4.79	0.00	0.00	0.00
20.45	2.22	0.46	4.78	0.00	0.00	0.00
20.50	2.22	0.46	4.78	0.00	0.00	0.00
20.55	2.22	0.46	4.78	0.00	0.00	0.00
20.60	2.22	0.47	4.77	0.00	0.00	0.00
20.65	2.22	0.47	4.77	0.00	0.00	0.00
20.70	2.22	0.47	4.76	0.00	0.00	0.00
20.75	2.22	0.47	4.76	0.00	0.00	0.00
20.80	2.22	0.47	4.75	0.00	0.00	0.00
20.85	2.22	0.47	4.75	0.00	0.00	0.00
20.90	2.22	0.47	4.75	0.00	0.00	0.00
20.95	2.22	0.47	4.74	0.00	0.00	0.00
21.00	2.22	0.47	4.74	0.00	0.00	0.00
21.05	2.22	0.47	4.73	0.00	0.00	0.00
21.10	2.22	0.47	4.73	0.00	0.00	0.00
21.15	2.22	0.47	4.73	0.00	0.00	0.00
21.20	2.22	0.47	4.72	0.00	0.00	0.00
21.25	2.22	0.47	4.72	0.00	0.00	0.00
21.30	2.22	0.47	4.71	0.00	0.00	0.00
21.35	2.22	0.47	4.71	0.00	0.00	0.00
21.40	2.22	0.47	4.71	0.00	0.00	0.00
21.45	2.22	0.47	4.70	0.00	0.00	0.00

21.50	2.22	0.47	4.70	0.00	0.00	0.00
21.55	2.22	0.47	4.69	0.00	0.00	0.00
21.60	2.22	0.47	4.69	0.00	0.00	0.00
21.65	2.22	0.47	4.69	0.00	0.00	0.00
21.70	2.22	0.47	4.68	0.00	0.00	0.00
21.75	2.22	0.47	4.68	0.00	0.00	0.00
21.80	2.22	0.47	4.67	0.00	0.00	0.00
21.85	2.22	0.48	4.67	0.00	0.00	0.00
21.90	2.22	0.48	4.67	0.00	0.00	0.00
21.95	2.22	0.48	4.66	0.00	0.00	0.00
22.00	2.22	0.48	4.66	0.00	0.00	0.00
22.05	2.22	0.48	4.66	0.00	0.00	0.00
22.10	2.22	0.48	4.65	0.00	0.00	0.00
22.15	2.22	0.48	4.65	0.00	0.00	0.00
22.20	2.22	0.48	4.64	0.00	0.00	0.00
22.25	2.22	0.48	4.64	0.00	0.00	0.00
22.30	2.22	0.48	4.64	0.00	0.00	0.00
22.35	2.22	0.48	4.63	0.00	0.00	0.00
22.40	2.22	0.48	4.63	0.00	0.00	0.00
22.45	2.22	0.48	4.63	0.00	0.00	0.00
22.50	2.22	0.48	4.62	0.00	0.00	0.00
22.55	2.22	0.48	4.62	0.00	0.00	0.00
22.60	2.22	0.48	4.62	0.00	0.00	0.00
22.65	2.22	0.48	4.61	0.00	0.00	0.00
22.70	2.22	0.48	4.61	0.00	0.00	0.00
22.75	2.22	0.48	4.61	0.00	0.00	0.00
22.80	2.22	0.48	4.60	0.00	0.00	0.00
22.85	2.22	0.48	4.60	0.00	0.00	0.00
22.90	2.22	0.48	4.59	0.00	0.00	0.00
22.95	2.22	0.48	4.59	0.00	0.00	0.00
23.00	2.22	0.48	4.59	0.00	0.00	0.00
23.05	2.22	0.48	4.58	0.00	0.00	0.00
23.10	2.22	0.48	4.58	0.00	0.00	0.00
23.15	2.22	0.48	4.58	0.00	0.00	0.00
23.20	2.22	0.49	4.57	0.00	0.00	0.00
23.25	2.22	0.49	4.57	0.00	0.00	0.00
23.30	2.22	0.49	4.57	0.00	0.00	0.00
23.35	2.22	0.49	4.56	0.00	0.00	0.00
23.40	2.22	0.49	4.56	0.00	0.00	0.00
23.45	2.22	0.49	4.56	0.00	0.00	0.00
23.50	2.22	0.49	4.55	0.00	0.00	0.00
23.55	2.22	0.49	4.55	0.00	0.00	0.00
23.60	2.22	0.49	4.55	0.00	0.00	0.00
23.65	2.22	0.49	4.55	0.00	0.00	0.00
23.70	2.22	0.49	4.54	0.00	0.00	0.00
23.75	2.22	0.49	4.54	0.00	0.00	0.00
23.80	2.22	0.49	4.54	0.00	0.00	0.00
23.85	2.22	0.49	4.53	0.00	0.00	0.00
23.90	2.22	0.49	4.53	0.00	0.00	0.00
23.95	2.22	0.49	4.53	0.00	0.00	0.00
24.00	2.22	0.49	4.52	0.00	0.00	0.00
24.05	2.22	0.49	4.52	0.00	0.00	0.00
24.10	2.22	0.49	4.52	0.00	0.00	0.00
24.15	2.22	0.49	4.51	0.00	0.00	0.00
24.20	2.22	0.49	4.51	0.00	0.00	0.00
24.25	2.22	0.49	4.51	0.00	0.00	0.00
24.30	2.22	0.49	4.51	0.00	0.00	0.00
24.35	2.22	0.49	4.50	0.00	0.00	0.00
24.40	2.22	0.49	4.50	0.00	0.00	0.00
24.45	2.22	0.49	4.50	0.00	0.00	0.00
24.50	2.22	0.49	4.49	0.00	0.00	0.00
24.55	2.22	0.49	4.49	0.00	0.00	0.00
24.60	2.22	0.49	4.49	0.00	0.00	0.00

24.65	2.22	0.49	4.48	0.00	0.00	0.00
24.70	2.22	0.50	4.48	0.00	0.00	0.00
24.75	2.22	0.50	4.48	0.00	0.00	0.00
24.80	2.22	0.50	4.48	0.00	0.00	0.00
24.85	2.22	0.50	4.47	0.00	0.00	0.00
24.90	2.22	0.50	4.47	0.00	0.00	0.00
24.95	2.22	0.50	4.47	0.00	0.00	0.00
25.00	2.22	0.50	4.46	0.00	0.00	0.00
25.05	2.22	0.50	4.46	0.00	0.00	0.00
25.10	2.22	0.50	4.46	0.00	0.00	0.00
25.15	2.22	0.50	4.46	0.00	0.00	0.00
25.20	2.22	0.50	4.45	0.00	0.00	0.00
25.25	2.22	0.50	4.45	0.00	0.00	0.00
25.30	2.22	0.50	4.45	0.00	0.00	0.00
25.35	2.22	0.50	4.45	0.00	0.00	0.00
25.40	2.22	0.50	4.44	0.00	0.00	0.00
25.45	2.22	0.50	4.44	0.00	0.00	0.00
25.50	2.22	0.50	4.44	0.00	0.00	0.00
25.55	2.22	0.50	4.43	0.00	0.00	0.00
25.60	2.22	0.50	4.43	0.00	0.00	0.00
25.65	2.22	0.50	4.43	0.00	0.00	0.00
25.70	2.22	0.50	4.43	0.00	0.00	0.00
25.75	2.22	0.50	4.42	0.00	0.00	0.00
25.80	2.22	0.50	4.42	0.00	0.00	0.00
25.85	2.22	0.50	4.42	0.00	0.00	0.00
25.90	2.22	0.50	4.42	0.00	0.00	0.00
25.95	2.22	0.50	4.41	0.00	0.00	0.00
26.00	2.22	0.50	4.41	0.00	0.00	0.00
26.05	2.22	0.50	4.41	0.00	0.00	0.00
26.10	2.22	0.50	4.41	0.00	0.00	0.00
26.15	2.22	0.50	4.40	0.00	0.00	0.00
26.20	2.22	0.50	4.40	0.00	0.00	0.00
26.25	2.22	0.50	4.40	0.00	0.00	0.00
26.30	2.22	0.50	4.40	0.00	0.00	0.00
26.35	2.22	0.51	4.39	0.00	0.00	0.00
26.40	2.22	0.51	4.39	0.00	0.00	0.00
26.45	2.22	0.51	4.39	0.00	0.00	0.00
26.50	2.22	0.51	4.39	0.00	0.00	0.00
26.55	2.22	0.51	4.38	0.00	0.00	0.00
26.60	2.22	0.51	4.38	0.00	0.00	0.00
26.65	2.22	0.51	4.38	0.00	0.00	0.00
26.70	2.22	0.51	4.38	0.00	0.00	0.00
26.75	2.22	0.51	4.37	0.00	0.00	0.00
26.80	2.22	0.51	4.37	0.00	0.00	0.00
26.85	2.22	0.51	4.37	0.00	0.00	0.00
26.90	2.22	0.51	4.37	0.00	0.00	0.00
26.95	2.22	0.51	4.36	0.00	0.00	0.00
27.00	2.22	0.51	4.36	0.00	0.00	0.00
27.05	2.22	0.51	4.36	0.00	0.00	0.00
27.10	2.22	0.51	4.36	0.00	0.00	0.00
27.15	2.22	0.51	4.35	0.00	0.00	0.00
27.20	2.22	0.51	4.35	0.00	0.00	0.00
27.25	2.22	0.51	4.35	0.00	0.00	0.00
27.30	2.22	0.51	4.35	0.00	0.00	0.00
27.35	2.22	0.51	4.35	0.00	0.00	0.00
27.40	2.22	0.51	4.34	0.00	0.00	0.00
27.45	2.22	0.51	4.34	0.00	0.00	0.00
27.50	2.22	0.51	4.34	0.00	0.00	0.00
27.55	2.22	0.51	4.34	0.00	0.00	0.00
27.60	2.22	0.51	4.33	0.00	0.00	0.00
27.65	2.22	0.51	4.33	0.00	0.00	0.00
27.70	2.22	0.51	4.33	0.00	0.00	0.00
27.75	2.22	0.51	4.33	0.00	0.00	0.00

27.80	2.22	0.51	4.33	0.00	0.00	0.00
27.85	2.22	0.51	4.32	0.00	0.00	0.00
27.90	2.22	0.51	4.32	0.00	0.00	0.00
27.95	2.22	0.51	4.32	0.00	0.00	0.00
28.00	2.22	0.51	4.32	0.00	0.00	0.00
28.05	2.22	0.51	4.31	0.00	0.00	0.00
28.10	2.22	0.51	4.31	0.00	0.00	0.00
28.15	2.22	0.51	4.31	0.00	0.00	0.00
28.20	2.22	0.52	4.31	0.00	0.00	0.00
28.25	2.22	0.52	4.31	0.00	0.00	0.00
28.30	2.22	0.52	4.30	0.00	0.00	0.00
28.35	2.22	0.52	4.30	0.00	0.00	0.00
28.40	2.22	0.52	4.30	0.00	0.00	0.00
28.45	2.22	0.52	4.30	0.00	0.00	0.00
28.50	2.22	0.52	4.30	0.00	0.00	0.00
28.55	2.22	0.52	4.29	0.00	0.00	0.00
28.60	2.22	0.52	4.29	0.00	0.00	0.00
28.65	2.22	0.52	4.29	0.00	0.00	0.00
28.70	2.22	0.52	4.29	0.00	0.00	0.00
28.75	2.22	0.52	4.29	0.00	0.00	0.00
28.80	2.22	0.52	4.28	0.00	0.00	0.00
28.85	2.22	0.52	4.28	0.00	0.00	0.00
28.90	2.22	0.52	4.28	0.00	0.00	0.00
28.95	2.22	0.52	4.28	0.00	0.00	0.00
29.00	2.22	0.52	4.28	0.00	0.00	0.00
29.05	2.22	0.52	4.27	0.00	0.00	0.00
29.10	2.22	0.52	4.27	0.00	0.00	0.00
29.15	2.22	0.52	4.27	0.00	0.00	0.00
29.20	2.22	0.52	4.27	0.00	0.00	0.00
29.25	2.22	0.52	4.27	0.00	0.00	0.00
29.30	2.22	0.52	4.26	0.00	0.00	0.00
29.35	2.22	0.52	4.26	0.00	0.00	0.00
29.40	2.22	0.52	4.26	0.00	0.00	0.00
29.45	2.22	0.52	4.26	0.00	0.00	0.00
29.50	2.22	0.52	4.26	0.00	0.00	0.00
29.55	2.22	0.52	4.25	0.00	0.00	0.00
29.60	2.22	0.52	4.25	0.00	0.00	0.00
29.65	2.22	0.52	4.25	0.00	0.00	0.00
29.70	2.22	0.52	4.25	0.00	0.00	0.00
29.75	2.22	0.52	4.25	0.00	0.00	0.00
29.80	2.22	0.52	4.24	0.00	0.00	0.00
29.85	2.22	0.52	4.24	0.00	0.00	0.00
29.90	2.22	0.52	4.24	0.00	0.00	0.00
29.95	2.22	0.52	4.24	0.00	0.00	0.00
30.00	2.22	0.52	4.24	0.00	0.00	0.00
30.05	2.22	0.52	4.24	0.00	0.00	0.00
30.10	2.22	0.52	4.24	0.00	0.00	0.00
30.15	2.22	0.52	4.24	0.00	0.00	0.00
30.20	2.22	0.52	4.24	0.00	0.00	0.00
30.25	2.22	0.52	4.24	0.00	0.00	0.00
30.30	2.22	0.52	4.24	0.00	0.00	0.00
30.35	2.22	0.52	4.24	0.00	0.00	0.00
30.40	2.22	0.52	4.23	0.00	0.00	0.00
30.45	2.22	0.52	4.23	0.00	0.00	0.00
30.50	2.22	0.52	4.23	0.00	0.00	0.00
30.55	2.22	0.52	4.23	0.00	0.00	0.00
30.60	2.22	0.52	4.23	0.00	0.00	0.00
30.65	2.22	0.52	4.23	0.00	0.00	0.00
30.70	2.22	0.52	4.23	0.00	0.00	0.00
30.75	2.22	0.52	4.23	0.00	0.00	0.00
30.80	2.22	0.52	4.23	0.00	0.00	0.00
30.85	2.22	0.52	4.23	0.00	0.00	0.00
30.90	2.22	0.52	4.23	0.00	0.00	0.00

30.95	2.22	0.52	4.23	0.00	0.00	0.00
31.00	2.22	0.52	4.23	0.00	0.00	0.00
31.05	2.22	0.52	4.23	0.00	0.00	0.00
31.10	2.22	0.52	4.23	0.00	0.00	0.00
31.15	2.22	0.52	4.23	0.00	0.00	0.00
31.20	2.22	0.52	4.23	0.00	0.00	0.00
31.25	2.22	0.52	4.23	0.00	0.00	0.00
31.30	2.22	0.52	4.23	0.00	0.00	0.00
31.35	2.22	0.53	4.23	0.00	0.00	0.00
31.40	2.22	0.53	4.23	0.00	0.00	0.00
31.45	2.22	0.53	4.23	0.00	0.00	0.00
31.50	2.22	0.53	4.23	0.00	0.00	0.00
31.55	2.22	0.53	4.23	0.00	0.00	0.00
31.60	2.22	0.53	4.23	0.00	0.00	0.00
31.65	2.22	0.53	4.23	0.00	0.00	0.00
31.70	2.22	0.53	4.23	0.00	0.00	0.00
31.75	2.22	0.53	4.23	0.00	0.00	0.00
31.80	2.22	0.53	4.23	0.00	0.00	0.00
31.85	2.22	0.53	4.22	0.00	0.00	0.00
31.90	2.22	0.53	4.22	0.00	0.00	0.00
31.95	2.22	0.53	4.22	0.00	0.00	0.00
32.00	2.22	0.53	4.22	0.00	0.00	0.00
32.05	2.22	0.53	4.22	0.00	0.00	0.00
32.10	2.22	0.53	4.22	0.00	0.00	0.00
32.15	2.22	0.53	4.22	0.00	0.00	0.00
32.20	2.22	0.53	4.22	0.00	0.00	0.00
32.25	2.22	0.53	4.22	0.00	0.00	0.00
32.30	2.22	0.53	4.22	0.00	0.00	0.00
32.35	2.22	0.53	4.22	0.00	0.00	0.00
32.40	2.22	0.53	4.22	0.00	0.00	0.00
32.45	2.22	0.53	4.22	0.00	0.00	0.00
32.50	2.22	0.53	4.22	0.00	0.00	0.00
32.55	2.22	0.53	4.22	0.00	0.00	0.00
32.60	2.22	0.53	4.22	0.00	0.00	0.00
32.65	2.22	0.53	4.22	0.00	0.00	0.00
32.70	2.22	0.53	4.22	0.00	0.00	0.00
32.75	2.22	0.53	4.22	0.00	0.00	0.00
32.80	2.22	0.53	4.22	0.00	0.00	0.00
32.85	2.22	0.53	4.22	0.00	0.00	0.00
32.90	2.22	0.53	4.22	0.00	0.00	0.00
32.95	2.22	0.53	4.22	0.00	0.00	0.00
33.00	2.22	0.53	4.22	0.00	0.00	0.00
33.05	2.22	0.53	4.22	0.00	0.00	0.00
33.10	2.22	0.53	4.22	0.00	0.00	0.00
33.15	2.23	0.53	4.25	0.00	0.00	0.00
33.20	2.23	0.53	4.25	0.00	0.00	0.00
33.25	2.23	0.53	4.24	0.00	0.00	0.00
33.30	2.23	0.53	4.24	0.00	0.00	0.00
33.35	2.23	0.53	4.24	0.00	0.00	0.00
33.40	2.23	0.53	4.24	0.00	0.00	0.00
33.45	2.23	0.53	4.24	0.00	0.00	0.00
33.50	2.23	0.53	4.24	0.00	0.00	0.00
33.55	2.23	0.53	4.24	0.00	0.00	0.00
33.60	2.23	0.53	4.24	0.00	0.00	0.00
33.65	2.23	0.53	4.24	0.00	0.00	0.00
33.70	2.23	0.53	4.24	0.00	0.00	0.00
33.75	2.23	0.53	4.24	0.00	0.00	0.00
33.80	2.23	0.53	4.24	0.00	0.00	0.00
33.85	2.23	0.53	4.24	0.00	0.00	0.00
33.90	2.23	0.53	4.24	0.00	0.00	0.00
33.95	2.23	0.53	4.23	0.00	0.00	0.00
34.00	2.23	0.53	4.23	0.00	0.00	0.00
34.05	2.23	0.53	4.23	0.00	0.00	0.00

34.10	2.23	0.53	4.23	0.00	0.00	0.00
34.15	2.23	0.53	4.23	0.00	0.00	0.00
34.20	2.23	0.53	4.23	0.00	0.00	0.00
34.25	2.23	0.53	4.23	0.00	0.00	0.00
34.30	2.22	0.53	4.23	0.00	0.00	0.00
34.35	2.22	0.53	4.23	0.00	0.00	0.00
34.40	2.22	0.53	4.23	0.00	0.00	0.00
34.45	2.22	0.53	4.23	0.00	0.00	0.00
34.50	2.22	0.53	4.23	0.00	0.00	0.00
34.55	2.22	0.53	4.23	0.00	0.00	0.00
34.60	2.22	0.53	4.23	0.00	0.00	0.00
34.65	2.22	0.53	4.23	0.00	0.00	0.00
34.70	2.22	0.53	4.23	0.00	0.00	0.00
34.75	2.22	0.53	4.22	0.00	0.00	0.00
34.80	2.22	0.53	4.22	0.00	0.00	0.00
34.85	2.22	0.53	4.22	0.00	0.00	0.00
34.90	2.22	0.53	4.22	0.00	0.00	0.00
34.95	2.22	0.53	4.22	0.00	0.00	0.00
35.00	2.22	0.53	4.22	0.00	0.00	0.00
35.05	2.22	0.53	4.22	0.00	0.00	0.00
35.10	2.22	0.53	4.22	0.00	0.00	0.00
35.15	2.22	0.53	4.22	0.00	0.00	0.00
35.20	2.22	0.53	4.22	0.00	0.00	0.00
35.25	2.22	0.53	4.22	0.00	0.00	0.00
35.30	2.22	0.53	4.22	0.00	0.00	0.00
35.35	2.22	0.53	4.22	0.00	0.00	0.00
35.40	2.22	0.53	4.22	0.00	0.00	0.00
35.45	2.22	0.53	4.22	0.00	0.00	0.00
35.50	2.22	0.53	4.22	0.00	0.00	0.00
35.55	2.22	0.53	4.22	0.00	0.00	0.00
35.60	2.22	0.53	4.22	0.00	0.00	0.00
35.65	2.22	0.53	4.22	0.00	0.00	0.00
35.70	2.21	0.53	4.21	0.00	0.00	0.00
35.75	2.21	0.53	4.21	0.00	0.00	0.00
35.80	2.21	0.53	4.21	0.00	0.00	0.00
35.85	2.21	0.53	4.21	0.00	0.00	0.00
35.90	2.21	0.53	4.21	0.00	0.00	0.00
35.95	2.21	0.53	4.21	0.00	0.00	0.00
36.00	2.21	0.53	4.21	0.00	0.00	0.00
36.05	2.21	0.53	4.21	0.00	0.00	0.00
36.10	2.21	0.53	4.21	0.00	0.00	0.00
36.15	2.21	0.53	4.21	0.00	0.00	0.00
36.20	2.21	0.53	4.21	0.00	0.00	0.00
36.25	2.21	0.53	4.21	0.00	0.00	0.00
36.30	2.21	0.53	4.21	0.00	0.00	0.00
36.35	2.21	0.53	4.21	0.00	0.00	0.00
36.40	2.21	0.53	4.21	0.00	0.00	0.00
36.45	2.21	0.52	4.21	0.00	0.00	0.00
36.50	2.21	0.52	4.21	0.00	0.00	0.00
36.55	2.21	0.52	4.21	0.00	0.00	0.00
36.60	2.21	0.52	4.21	0.00	0.00	0.00
36.65	2.21	0.52	4.21	0.00	0.00	0.00
36.70	2.21	0.52	4.21	0.00	0.00	0.00
36.75	2.21	0.52	4.21	0.00	0.00	0.00
36.80	2.21	0.52	4.21	0.00	0.00	0.00
36.85	2.21	0.52	4.21	0.00	0.00	0.00
36.90	2.21	0.52	4.20	0.00	0.00	0.00
36.95	2.21	0.52	4.20	0.00	0.00	0.00
37.00	2.21	0.52	4.20	0.00	0.00	0.00
37.05	2.20	0.52	4.20	0.00	0.00	0.00
37.10	2.20	0.52	4.20	0.00	0.00	0.00
37.15	2.20	0.52	4.20	0.00	0.00	0.00
37.20	2.20	0.52	4.20	0.00	0.00	0.00

37.25	2.20	0.52	4.20	0.00	0.00	0.00
37.30	2.20	0.52	4.20	0.00	0.00	0.00
37.35	2.20	0.52	4.20	0.00	0.00	0.00
37.40	2.20	0.52	4.20	0.00	0.00	0.00
37.45	2.20	0.52	4.20	0.00	0.00	0.00
37.50	2.20	0.52	4.20	0.00	0.00	0.00
37.55	2.20	0.52	4.20	0.00	0.00	0.00
37.60	2.20	0.52	4.20	0.00	0.00	0.00
37.65	2.20	0.52	4.20	0.00	0.00	0.00
37.70	2.20	0.52	4.20	0.00	0.00	0.00
37.75	2.20	0.52	4.20	0.00	0.00	0.00
37.80	2.20	0.52	4.20	0.00	0.00	0.00
37.85	2.20	0.52	4.20	0.00	0.00	0.00
37.90	2.20	0.52	4.20	0.00	0.00	0.00
37.95	2.20	0.52	4.20	0.00	0.00	0.00
38.00	2.20	0.52	4.20	0.00	0.00	0.00
38.05	2.20	0.52	4.20	0.00	0.00	0.00
38.10	2.20	0.52	4.20	0.00	0.00	0.00
38.15	2.20	0.52	4.20	0.00	0.00	0.00
38.20	2.20	0.52	4.20	0.00	0.00	0.00
38.25	2.20	0.52	4.20	0.00	0.00	0.00
38.30	2.20	0.52	4.20	0.00	0.00	0.00
38.35	2.20	0.52	4.20	0.00	0.00	0.00
38.40	2.20	0.52	4.20	0.00	0.00	0.00
38.45	2.19	0.52	4.20	0.00	0.00	0.00
38.50	2.19	0.52	4.20	0.00	0.00	0.00
38.55	2.19	0.52	4.20	0.00	0.00	0.00
38.60	2.19	0.52	4.20	0.00	0.00	0.00
38.65	2.19	0.52	4.20	0.00	0.00	0.00
38.70	2.19	0.52	4.20	0.00	0.00	0.00
38.75	2.19	0.52	4.20	0.00	0.00	0.00
38.80	2.19	0.52	4.20	0.00	0.00	0.00
38.85	2.19	0.52	4.20	0.00	0.00	0.00
38.90	2.19	0.52	4.20	0.00	0.00	0.00
38.95	2.19	0.52	4.20	0.00	0.00	0.00
39.00	2.19	0.52	4.20	0.00	0.00	0.00
39.05	2.19	0.52	4.20	0.00	0.00	0.00
39.10	2.19	0.52	4.20	0.00	0.00	0.00
39.15	2.19	0.52	4.19	0.00	0.00	0.00
39.20	2.19	0.52	4.19	0.00	0.00	0.00
39.25	2.19	0.52	4.19	0.00	0.00	0.00
39.30	2.19	0.52	4.19	0.00	0.00	0.00
39.35	2.19	0.52	4.19	0.00	0.00	0.00
39.40	2.19	0.52	4.19	0.00	0.00	0.00
39.45	2.19	0.52	4.19	0.00	0.00	0.00
39.50	2.19	0.52	4.19	0.00	0.00	0.00
39.55	2.19	0.52	4.19	0.00	0.00	0.00
39.60	2.19	0.52	4.19	0.00	0.00	0.00
39.65	2.19	0.52	4.19	0.00	0.00	0.00
39.70	2.19	0.52	4.19	0.00	0.00	0.00
39.75	2.19	0.52	4.19	0.00	0.00	0.00
39.80	2.18	0.52	4.19	0.00	0.00	0.00
39.85	2.18	0.52	4.19	0.00	0.00	0.00
39.90	2.18	0.52	4.19	0.00	0.00	0.00
39.95	2.18	0.52	4.19	0.00	0.00	0.00
40.00	2.18	0.52	4.19	0.00	0.00	0.00
40.05	2.18	0.52	4.19	0.00	0.00	0.00
40.10	2.18	0.52	4.19	0.00	0.00	0.00
40.15	2.18	0.52	4.19	0.00	0.00	0.00
40.20	2.18	0.52	4.19	0.00	0.00	0.00
40.25	2.18	0.52	4.19	0.00	0.00	0.00
40.30	2.18	0.52	4.19	0.00	0.00	0.00
40.35	2.18	0.52	4.19	0.00	0.00	0.00

40.40	2.18	0.52	4.19	0.00	0.00	0.00
40.45	2.18	0.52	4.19	0.00	0.00	0.00
40.50	2.18	0.52	4.19	0.00	0.00	0.00
40.55	2.18	0.52	4.19	0.00	0.00	0.00
40.60	2.18	0.52	4.19	0.00	0.00	0.00
40.65	2.18	0.52	4.19	0.00	0.00	0.00
40.70	2.18	0.52	4.19	0.00	0.00	0.00
40.75	2.18	0.52	4.19	0.00	0.00	0.00
40.80	2.18	0.52	4.19	0.00	0.00	0.00
40.85	2.18	0.52	4.19	0.00	0.00	0.00
40.90	2.18	0.52	4.19	0.00	0.00	0.00
40.95	2.18	0.52	4.19	0.00	0.00	0.00
41.00	2.18	0.52	4.19	0.00	0.00	0.00
41.05	2.18	0.52	4.19	0.00	0.00	0.00
41.10	2.18	0.52	4.19	0.00	0.00	0.00
41.15	2.17	0.52	4.19	0.00	0.00	0.00
41.20	2.17	0.52	4.19	0.00	0.00	0.00
41.25	2.17	0.52	4.19	0.00	0.00	0.00
41.30	2.17	0.52	4.19	0.00	0.00	0.00
41.35	2.17	0.52	4.19	0.00	0.00	0.00
41.40	2.17	0.52	4.19	0.00	0.00	0.00
41.45	2.17	0.52	4.19	0.00	0.00	0.00
41.50	2.17	0.52	4.19	0.00	0.00	0.00
41.55	2.17	0.52	4.19	0.00	0.00	0.00
41.60	2.17	0.52	4.19	0.00	0.00	0.00
41.65	2.17	0.52	4.19	0.00	0.00	0.00
41.70	2.17	0.52	4.19	0.00	0.00	0.00
41.75	2.17	0.52	4.20	0.00	0.00	0.00
41.80	2.17	0.52	4.20	0.00	0.00	0.00
41.85	2.17	0.52	4.20	0.00	0.00	0.00
41.90	2.17	0.52	4.20	0.00	0.00	0.00
41.95	2.17	0.52	4.20	0.00	0.00	0.00
42.00	2.17	0.52	4.20	0.00	0.00	0.00
42.05	2.17	0.52	4.20	0.00	0.00	0.00
42.10	2.17	0.52	4.20	0.00	0.00	0.00
42.15	2.17	0.52	4.20	0.00	0.00	0.00
42.20	2.17	0.52	4.20	0.00	0.00	0.00
42.25	2.17	0.52	4.20	0.00	0.00	0.00
42.30	2.17	0.52	4.20	0.00	0.00	0.00
42.35	2.17	0.52	4.20	0.00	0.00	0.00
42.40	2.17	0.52	4.20	0.00	0.00	0.00
42.45	2.17	0.52	4.20	0.00	0.00	0.00
42.50	2.16	0.52	4.20	0.00	0.00	0.00
42.55	2.16	0.52	4.20	0.00	0.00	0.00
42.60	2.16	0.52	4.20	0.00	0.00	0.00
42.65	2.16	0.52	4.20	0.00	0.00	0.00
42.70	2.16	0.52	4.20	0.00	0.00	0.00
42.75	2.16	0.52	4.20	0.00	0.00	0.00
42.80	2.16	0.52	4.20	0.00	0.00	0.00
42.85	2.16	0.52	4.20	0.00	0.00	0.00
42.90	2.16	0.51	4.20	0.00	0.00	0.00
42.95	2.16	0.51	4.20	0.00	0.00	0.00
43.00	2.16	0.51	4.20	0.00	0.00	0.00
43.05	2.16	0.51	4.20	0.00	0.00	0.00
43.10	2.16	0.51	4.20	0.00	0.00	0.00
43.15	2.16	0.51	4.20	0.00	0.00	0.00
43.20	2.16	0.51	4.20	0.00	0.00	0.00
43.25	2.16	0.51	4.20	0.00	0.00	0.00
43.30	2.16	0.51	4.20	0.00	0.00	0.00
43.35	2.16	0.51	4.20	0.00	0.00	0.00
43.40	2.16	0.51	4.20	0.00	0.00	0.00
43.45	2.16	0.51	4.20	0.00	0.00	0.00
43.50	2.16	0.51	4.20	0.00	0.00	0.00

43.55	2.16	0.51	4.20	0.00	0.00	0.00
43.60	2.16	0.51	4.20	0.00	0.00	0.00
43.65	2.16	0.51	4.20	0.00	0.00	0.00
43.70	2.16	0.51	4.20	0.00	0.00	0.00
43.75	2.16	0.51	4.20	0.00	0.00	0.00
43.80	2.16	0.51	4.20	0.00	0.00	0.00
43.85	2.16	0.51	4.20	0.00	0.00	0.00
43.90	2.15	0.51	4.20	0.00	0.00	0.00
43.95	2.15	0.51	4.20	0.00	0.00	0.00
44.00	2.15	0.51	4.20	0.00	0.00	0.00
44.05	2.15	0.51	4.20	0.00	0.00	0.00
44.10	2.15	0.51	4.20	0.00	0.00	0.00
44.15	2.15	0.51	4.20	0.00	0.00	0.00
44.20	2.15	0.51	4.20	0.00	0.00	0.00
44.25	2.15	0.51	4.21	0.00	0.00	0.00
44.30	2.15	0.51	4.21	0.00	0.00	0.00
44.35	2.15	0.51	4.21	0.00	0.00	0.00
44.40	2.15	0.51	4.21	0.00	0.00	0.00
44.45	2.15	0.51	4.21	0.00	0.00	0.00
44.50	2.15	0.51	4.21	0.00	0.00	0.00
44.55	2.15	0.51	4.21	0.00	0.00	0.00
44.60	2.15	0.51	4.21	0.00	0.00	0.00
44.65	2.15	0.51	4.21	0.00	0.00	0.00
44.70	2.15	0.51	4.21	0.00	0.00	0.00
44.75	2.15	0.51	4.21	0.00	0.00	0.00
44.80	2.15	0.51	4.21	0.00	0.00	0.00
44.85	2.15	0.51	4.21	0.00	0.00	0.00
44.90	2.15	0.51	4.21	0.00	0.00	0.00
44.95	2.15	0.51	4.21	0.00	0.00	0.00
45.00	2.15	0.51	4.21	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

ATTACHMENT 1e
POLLUTION CONTROL BMP DESIGN WORKSHEETS

BLUE WAVE
DCV CALCULATION

DMA#1 : MWS-1: Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.52	inches
2	Area tributary to BMP (s)	A=	1.05	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.80	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	1,590	cubic-feet

DMA#2: MWS-2: Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.52	inches
2	Area tributary to BMP (s)	A=	0.27	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.67	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	345	cubic-feet

DMA # 1

B.6.3 Sizing Flow-Thru Treatment Control BMPs:

Flow-thru treatment control BMPs shall be sized to filter or treat the maximum flow rate of runoff produced from a rainfall intensity of 0.2 inch of rainfall per hour, for each hour of every storm event. The required flow-thru treatment rate should be adjusted for the portion of the DCV already retained or biofiltered onsite as described in Worksheet B.6-1. The following hydrologic method shall be used to calculate the flow rate to be filtered or treated:

$$Q = C \times i \times A$$

Where:

Q = Design flow rate in cubic feet per second

C = Runoff factor, area-weighted estimate using Table B.1-1.

i = Rainfall intensity of 0.2 in/hr.

A = Tributary area (acres) which includes the total area draining to the BMP, including any offsite or onsite areas that comingle with project runoff and drain to the BMP. Refer to Section 3.3.3 for additional guidance. Street projects consult Section 1.4.3.

Worksheet B.6-1: Flow-Thru Design Flows

Flow-thru Design Flows		Worksheet B.6-1		
1	DCV	DCV	1590	cubic-feet
2	DCV retained	$DCV_{retained}$	0	cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$	0	cubic-feet
4	DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3)	$DCV_{flow\text{-}thru}$	1590	cubic-feet
5	Adjustment factor (Line 4 / Line 1)*	AF=	1.0	unitless
6	Design rainfall intensity	i=	0.20	in/hr
7	Area tributary to BMP (s)	A=	1.05	acres
8	Area-weighted runoff factor (estimate using Appendix B.2)	C=	0.8	unitless
9	Calculate Flow Rate = AF x (C x i x A)	Q=	0.168	cfs

$Q_{treat} = Q \times 1.5 = 0.252$ cfs

1) Adjustment factor shall be estimated considering only retention and biofiltration BMPs located upstream of flow-thru BMPs. That is, if the flow-thru BMP is upstream of the project's retention and biofiltration BMPs then the flow-thru BMP shall be sized using an adjustment factor of 1.
2) Volume based (e.g., dry extended detention basin) flow-thru treatment control BMPs shall be sized to the volume in Line 4 and flow based (e.g., vegetated swales) shall be sized to flow rate in Line 9. Sand filter and media filter can be designed either by volume in Line 4 or flow rate in Line 9.
3) Proprietary BMPs, if used, shall provide certified treatment capacity equal to or greater than the calculated flow rate in Line 9; certified treatment capacity per unit shall be consistent with third party certifications.

∴ use MWS L-4-21
(treatment capacity = 0.268 cfs)

DMA # 2

B.6.3 Sizing Flow-Thru Treatment Control BMPs:

Flow-thru treatment control BMPs shall be sized to filter or treat the maximum flow rate of runoff produced from a rainfall intensity of 0.2 inch of rainfall per hour, for each hour of every storm event. The required flow-thru treatment rate should be adjusted for the portion of the DCV already retained or biofiltered onsite as described in Worksheet B.6-1. The following hydrologic method shall be used to calculate the flow rate to be filtered or treated:

$$Q = C \times i \times A$$

Where:

Q = Design flow rate in cubic feet per second

C = Runoff factor, area-weighted estimate using Table B.1-1.

i = Rainfall intensity of 0.2 in/hr.

A = Tributary area (acres) which includes the total area draining to the BMP, including any offsite or onsite areas that comingle with project runoff and drain to the BMP. Refer to Section 3.3.3 for additional guidance. Street projects consult Section 1.4.3.

Worksheet B.6-1: Flow-Thru Design Flows

Flow-thru Design Flows		Worksheet B.6-1		
1	DCV	DCV	345	cubic-feet
2	DCV retained	$DCV_{retained}$	0	cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$	0	cubic-feet
4	DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3)	$DCV_{flow\text{-}thru}$	345	cubic-feet
5	Adjustment factor (Line 4 / Line 1)*	AF=	1.0	unitless
6	Design rainfall intensity	i=	0.20	in/hr
7	Area tributary to BMP (s)	A=	0.27	acres
8	Area-weighted runoff factor (estimate using Appendix B.2)	C=	0.67	unitless
9	Calculate Flow Rate = AF x (C x i x A)	Q=	0.036	cfs

$Q_{treat} = Q \times 1.5 = 0.054$ cfs

1) Adjustment factor shall be estimated considering only retention and biofiltration BMPs located upstream of flow-thru BMPs. That is, if the flow-thru BMP is upstream of the project's retention and biofiltration BMPs then the flow-thru BMP shall be sized using an adjustment factor of 1.
2) Volume based (e.g., dry extended detention basin) flow-thru treatment control BMPs shall be sized to the volume in Line 4 and flow based (e.g., vegetated swales) shall be sized to flow rate in Line 9. Sand filter and media filter can be designed either by volume in Line 4 or flow rate in Line 9.
3) Proprietary BMPs, if used, shall provide certified treatment capacity equal to or greater than the calculated flow rate in Line 9; certified treatment capacity per unit shall be consistent with third party certifications.

∴ use MW L-4-6
(treatment capacity = 0.073 cfs)

ATTACHMENT 2
BACKUP FOR PDP HYDROMODIFICATION CONTROL MEASURES

This is the cover sheet for Attachment 2.

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

Indicate which Items are Included behind this cover sheet:

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

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

The Hydromodification Management Exhibit must identify:

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

ATTACHMENT 2a
HYDROMODIFICATION MANAGEMENT EXHIBITS

ATTACHMENT 2b

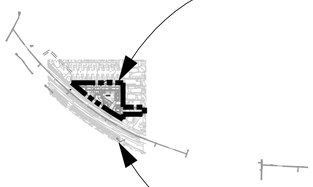
MANAGEMENT OF CRITICAL COARSE SEDIMENT YIELD AREAS

LEGEND

PROJECT BOUNDARY

PCCSYA PER WMAA

PROJECT SITE



SILVER STRAND BLVD

CLOSEST
CRITICAL COURSE
SEDIMENT YIELD AREA

H&A

0 500 1000 1500

SCALE 1" =500'

WMAA MAP FOR POTENTIAL CRITICAL COURSE SEDIMENT YIELD AREA ANALYSIS

BLUE WAVE MIXED USE

550 HIGHWAY 75

CITY OF IMPERIAL BEACH, CALIFORNIA

SHEET 1 OF 1

W.O.# 107-275

ATTACHMENT 2c
GEOMORPHIC ASSESSMENT OF RECEIVING CHANNELS

ATTACHMENT 2d
FLOW CONTROL FACILITY DESIGN

ATTACHMENT 2e
VECTOR CONTROL PLAN

NO VECTOR PLAN IS NECESSARY SINCE BMPS WILL DRAIN IN LESS THAN 96 HRS.

ATTACHMENT 3
Structural BMP Maintenance Information

This is the cover sheet for Attachment 3.

Indicate which Items are Included behind this cover sheet:

Attachment Sequence	**Contents**	**Checklist**
Attachment 3a	Structural BMP Maintenance Thresholds and Actions (Required)	☑ Included See Structural BMP Maintenance Information Checklist on the back of this Attachment cover sheet.
Attachment 3b	Draft Maintenance Agreement (when applicable)	☐ Included ☑ Not Applicable

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

☑ **Preliminary Design / Planning / CEQA level submittal:**

Attachment 3a must identify:

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

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

☐ **Final Design level submittal:**

Attachment 3a must identify:

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

Attachment 3b: For private entity operation and maintenance, Attachment 3b shall include a draft maintenance agreement in the local jurisdiction's standard format (PDP applicant to contact the [City Engineer] to obtain the current maintenance agreement forms).

ATTACHMENT 3a
STRUCTURAL BMP MAINTENANCE THRESHOLDS

The following inspection and maintenance activities shall be performed and completed as indicated.

Maintenance Program for Inlet Stenciling

Inspection Frequency/Indications:	Regular Maintenance Inspections q Before wet season begins (September); q After wet season (April).
Maintenance Indications	**Maintenance Activities**
q Inlet stenciling/signage begins to weather or fade	q Re-stamp signage
q Broken or damaged structure	q Repair or replace signage structure

Maintenance Program for Modular Wetland Biofiltration Units

Inspection Frequency/Indications:	Regular Maintenance Inspections q Monthly during wet season q Annually before wet season (September) Performance Inspection q 72 hrs after rainfall events greater than 0.5 in.
Maintenance Indications	**Maintenance Activities**
q Excessive trash, debris, or sediment in unit. (i.e., sump is 85 percent full or sump is 50 percent full during two consecutive monthly inspections)	q Remove trash and debris within 15 days. Empty unit when the unit is 85 percent full or 50 percent full during two consecutive monthly inspections, or annually in May.
q Presence of trash and debris in weir box.	q Remove trash and debris while onsite conducting inspection
q When standing water in sump is observed during annual and performance inspection.	q If standing water cannot be removed or remains through the wet season, notify vector control.
q Minor structural damage (i.e., screen becomes clogged, damaged or loose)	q Clean screen, re-fasten screen if appropriate.
q Cracked or fatigued neoprene vector seals	q Replace damaged seal
q Major damage to structures (i.e., holes in screen, large debris, damage to housing or weir box)	q Immediately consult with engineer and manufacturer=s representative to develop a course of action and effect repairs prior to the wet season.
Waste Disposal	Sediment, other pollutants, and all other waste shall be properly disposed of in a licensed landfill or by another appropriate disposal method in accordance with local, state, and federal regulations.

Maintenance Program for Detention Vault

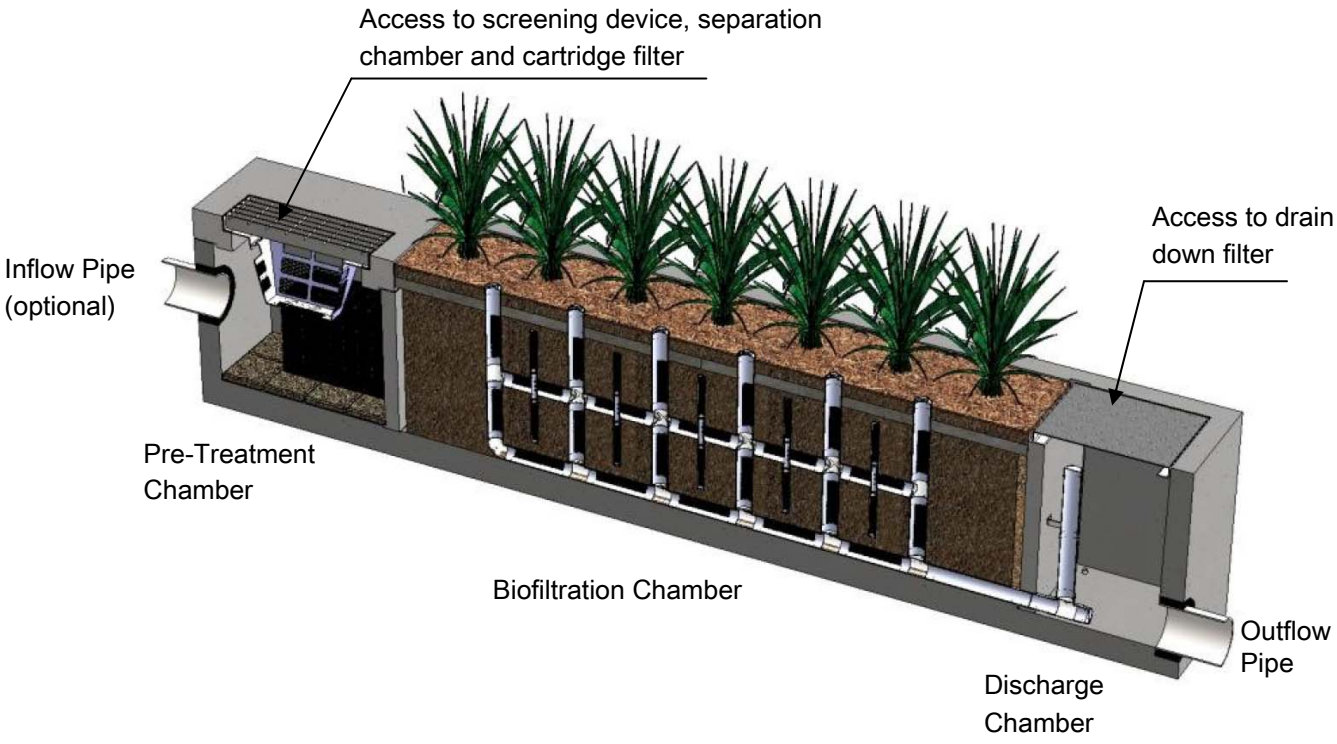
Inspection Frequency/Indications:	Regular Inspections q Before wet season begins (September); q After wet season (April). Performance Inspections q After rainfall events greater than 0.5 inches, or any rainfall that fills the basin.
Maintenance Indications	**Maintenance Activities**
q Standing water in vault during dry weather; basin does not drain within 72 hours after runoff event.	q Drain basin. Determine and resolve problems that are causing the basin to drain improperly. If basin cannot be drained, or if standing water persists, notify vector control.
q Evidence of rodent infestation	q Abate and control rodents as necessary to maintain the performance of the facility.
q Trash, debris, or litter present in basin	q Remove trash, debris, and litter
Waste Disposal	Sediment, other pollutants, and all other waste shall be properly disposed of in a licensed landfill or by another appropriate disposal method in accordance with local, state, and federal regulations.

Maintenance Guidelines for Modular Wetland System - Linear

Maintenance Summary

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

System Diagram



Maintenance Procedures

Screening Device

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

Separation Chamber

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

Cartridge Filters

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

Drain Down Filter

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

Maintenance Notes

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

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

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

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

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

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

Maintenance Procedure Illustration

Screening Device

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

Separation Chamber

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

Cartridge Filters

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

Drain Down Filter

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

Trim Vegetation

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

Inspection Form

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

www.modularwetlands.com

Inspection Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

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

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:

2972 San Luis Rey Road, Oceanside, CA 92058 P (760) 433-7640 F (760) 433-3176

Maintenance Report

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

www.modularwetlands.com

Cleaning and Maintenance Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

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

Weather Condition _____ Additional Notes _____

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

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

Comments:

2972 San Luis Rey Road, Oceanside, CA 92058 P. 760.433.7640 F. 760.433.3176

FocalPoint

BIOFILTRATION SYSTEMS

HIGH PERFORMANCE MODULAR BIOFILTRATION SYSTEM (HPMBS)

Operations & Maintenance

CFS
CALIFORNIA FILTRATION SPECIALISTS

ACF ENVIRONMENTAL
Customer Focused, Environmentally Committed

GENERAL DESCRIPTION

The following general specifications describe the general operations and maintenance requirements for the FocalPoint® High Performance Modular Biofiltration System (HPMBS). The system utilizes physical, chemical and biological mechanisms of a soil, plant and microbe complex to remove pollutants typically found in urban stormwater runoff. The treatment system is a fully equipped, modular, constructed in place system designed to treat contaminated runoff.

Stormwater enters the FocalPoint® HPMBS, is filtered by the High Flow Biofiltration Media and passes through to the underdrain/storage system where the treated water is detained, retained or infiltrated to sub-soils, prior to discharge to the storm sewer system of any remaining flow.

Higher flows bypass the FocalPoint® HPMBS via a downstream inlet or other overflow conveyance. Maintenance is a simple, inexpensive and safe operation that does not require confined space entry, pumping or vacuum equipment, or specialized tools. Properly trained landscape personnel can effectively maintain FocalPoint® HPMBS by following instructions in this manual.

BASIC OPERATIONS

FocalPoint® is a modular, high performance biofiltration system that often works in tandem with other integrated management practices (IMP). Contaminated stormwater runoff enters the biofiltration bed through a conveyance swale, planter box, or directly through a curb cut or false inlet. Energy is dissipated by a rock or vegetative dissipation device and is absorbed by a 3-inch layer of aged, double shredded hardwood mulch, with fines removed, (when specified) on the surface of the biofiltration media.

As the water passes through the mulch layer, most of the larger sediment particles and heavy metals are removed through sedimentation and chemical reactions with the organic material in the mulch. Water passes through the biofiltration media where the finer particles are removed and numerous chemical reactions take place to immobilize and capture pollutants in the soil media.

The cleansed water passes into the underdrain/storage system and remaining flows are directed to a storm sewer system or other appropriate discharge point. Once the pollutants are in the soil, bacteria begin to break down and metabolize the materials and the plants begin to uptake and metabolize the pollutants. Some pollutants such as heavy metals, which are chemically bound to organic particles in the mulch, are released over time as the organic matter decomposes to release the metals to the feeder roots of the plants and the cells of the bacteria in the soil where they remain and are recycled. Other pollutants such as phosphorus are chemically bound to the soil particles and released slowly back to the plants and bacteria and used in their metabolic processes. Nitrogen goes through a variety of very complex biochemical processes where it can ultimately end up in the plant/bacteria biomass, turned to nitrogen gas or dissolves back into the water column as nitrates depending on soil temperature, pH and the availability of oxygen. The pollutants ultimately are retained in the mulch, soil and biomass with some passing out of the system into the air or back into the water.

DESIGN AND INSTALLATION

Each project presents different scopes for the use of FocalPoint® HPMBS. To ensure the safe and specified function of this stormwater BMP, Convergent Water Technologies and/or its Value Added Resellers (VAR) review each application before supply. Information and design assistance is available to the design engineer during the planning process. Correct FocalPoint® sizing is essential to optimum performance. The engineer shall submit calculations for approval by the local jurisdiction when required. The contractor and/or VAR is responsible for the correct installation of FocalPoint® HPMBS units as described in approved plans. A comprehensive installation manual is available at www.convergentwater.com.

FocalPoint
BIOFILTRATION SYSTEMS

MAINTENANCE

Why Maintain?

All stormwater treatment systems require maintenance for effective operation. This necessity is often incorporated in your property's permitting process as a legally binding BMP maintenance agreement. Other reasons for maintenance include:

- Avoid legal challenges from your jurisdiction's maintenance enforcement program.
- Prolong the lifespan of your FocalPoint® HPMBS.
- Avoid costly repairs.
- Help reduce pollutant loads leaving your property.

Simple maintenance of the FocalPoint® HPMBS is required to continue effective pollutant removal from stormwater runoff before any discharge into downstream waters. This procedure will also extend the longevity of the living biofiltration system. The unit will recycle and accumulate pollutants within the biomass, but may also subjected to other materials entering the surface of the system. This may include trash, silt and leaves etc. which will be contained above the mulch and/or biofiltration media layer. Too much silt may inhibit the FocalPoint's® HPMBS flow rate, which is a primary reason for system maintenance. Removal of accumulated silt/sediment and/or replacement of the mulch layer (when specified), is an important activity that prevents over accumulation of such silt/sediment.

When to Maintain?

Convergent Water Technologies and/or its VAR includes a 1-year maintenance plan with each system purchased. Annual included maintenance consists of two (2) scheduled maintenance visits. Additional maintenance may be necessary depending on sediment and trash loading (by Owner or at additional cost). The start of the maintenance plan begins when the system is activated for full operation. Full operation is defined as when the site is appropriately stabilized, the unit is installed and activated (by VAR), i.e., when mulch (if specified) and plantings are added.

Activation should be avoided until the site is fully stabilized (full landscaping, grass cover, final paving and street sweeping completed). Maintenance visits are scheduled seasonally; the spring visit aims to clean up after winter loads including salts and sands. The fall visit helps the system by removing excessive leaf litter.

A first inspection to determine if maintenance is necessary should be performed at least twice annually after storm events of greater than (1) one inch total depth (subject to regional climate). Please refer to the maintenance checklist for specific conditions that indicate if maintenance is necessary.

It has been found that in regions which receive between 30-50 inches of annual rainfall, (2) two visits are generally required. Regions with less rainfall often only require (1) one visit per annum. Varying land uses can affect maintenance frequency.

Some sites may be subjected to extreme sediment or trash loads, requiring more frequent maintenance visits. This is the reason for detailed notes of maintenance actions per unit, helping the VAR/Maintenance contractor and Owner predict future maintenance frequencies, reflecting individual site conditions.

Owners must promptly notify the VAR/Maintenance contractor of any damage to the plant(s), which constitute(s) an integral part of the biofiltration technology. Owners should also advise other landscape or maintenance contractors to leave all maintenance of the FocalPoint® HPMBS to the VAR/Maintenance contractor (i.e. no pruning or fertilizing).

EXCLUSION OF SERVICES

It is the responsibility of the owner to provide adequate irrigation when necessary to the plant(s) in the FocalPoint® HPMBS.

Clean up due to major contamination such as oils, chemicals, toxic spills, etc. will result in additional costs and are not covered under the VAR/Maintenance contractor maintenance contract. Should a major contamination event occur, the Owner must block off the outlet pipe of the FocalPoint® (where the cleaned runoff drains to, such as drop-inlet) and block off the point where water enters of the FocalPoint® HPMBS. The VAR/Maintenance contractor should be informed immediately.

MAINTENANCE VISIT SUMMARY

Each maintenance visit consists of the following simple tasks (detailed instructions below).

1. Inspection of FocalPoint® HPMBS and surrounding area
2. Removal of debris, trash and mulch
3. Mulch replacement
4. Plant health evaluation (including measurements) and pruning or replacement as necessary
5. Clean area around FocalPoint® HPMBS
6. Complete paperwork, including date stamped photos of the tasks listed above.

MAINTENANCE TOOLS, SAFETY EQUIPMENT AND SUPPLIES

Ideal tools include: camera, bucket, shovel, broom, pruners, hoe/rake, and tape measure. Appropriate Personal Protective Equipment (PPE) should be used in accordance with local or company procedures. This may include impervious gloves where the type of trash is unknown, high visibility clothing and barricades when working in close proximity to traffic and also safety hats and shoes.

MAINTENANCE VISIT PROCEDURE

Inspection of FocalPoint® HPMBS and surrounding area

Record individual unit before maintenance with photograph (numbered). Record on Maintenance Report (see example in this document) the following:

- Standing Water yes | no
- Is Bypass Inlet Clear? yes | no
- Damage to HPMBS System yes | no
- to Overflow conveyance yes | no

Removal of Silt / Sediment / Clay

Dig out silt (if any) and mulch and remove trash & foreign items.

- Silt / Clay Found? yes | no
- Cups / Bags Found? yes | no
- Leaves? yes | no
- Volume of material removed _____ (volume or weight)

Removal of debris, trash and mulch

After removal of mulch and debris, measure distance from the top of the FocalPoint® HPMBS engineered media soil to the flow line elevation of the adjacent overflow conveyance. If this distance is greater than that specified on the plans (typ. 6" - 12"), add media (not top soil or other) to recharge to the distance specified.

- Distance to media surface to flow line of overflow conveyance (inches) _____
- # of Buckets of Media Added _____

Mulch Replacement

Most maintenance visits require only replacement mulch (if utilized) which must be, aged, double shredded hardwood mulch with fines removed. For smaller projects, one cubic foot of mulch will cover four square feet of biofiltration bed, and for larger projects, one cubic yard of mulch will cover 108 square feet of biofiltration bed. Some visits may require additional FocalPoint® HPMBS engineered soil media available from the VAR/Contractor.

- Add double shredded, aged hardwood mulch which has been screened to remove fines, evenly across the entire biofiltration media bed to a depth of 3".
- Clean accumulated sediment from energy dissipation system at the inlet to the FocalPoint® HPMBS to allow for entry of trash during a storm event.

Plant health evaluation and pruning or replacement as necessary

Examine the plant's health and replace if dead or dying.
Prune as necessary to encourage growth in the correct directions

- Height above Grate (feet) _____
- Width at Widest point (feet) _____
- Health alive | dead
- Damage to Plant yes | no

Clean area around FocalPoint® HPMBS

- Clean area around unit and remove all refuse to be disposed of appropriately.

Complete paperwork

- Deliver Maintenance Report and photographs as appropriate.
- Some jurisdictions may require submission of maintenance reports in accordance with approvals.
- It is the responsibility of the Owner to comply with local regulations.

FocalPoint Warranty

Seller warrants goods sold hereunder against defects in materials and workmanship only, for a period of (1) year from date the Seller activates the system into service. Seller makes no other warranties, express or implied.

Seller's liability hereunder shall be conditioned upon the Buyer's installation, maintenance, and service of the goods in strict compliance with the written instructions and specifications provided by the Seller. Any deviation from Seller's instructions and specifications or any abuse or neglect shall void warranties.

In the event of any claim upon Seller's warranty, the burden shall be upon the Buyer to prove strict compliance with all instructions and specifications provided by the Seller.

Seller's liability hereunder shall be limited only to the cost or replacement of the goods. Buyer agrees that Seller shall not be liable for any consequential losses arising from the purchase, installation, and/or use of the goods.

Maintenance Checklist

Element	Problem	What To Check	Should Exist	Action
Inlet	Excessive sediment or trash accumulation	Accumulation of sediment or trash impair free flow of water into FocalPoint	Inlet free of obstructions allowing free flow into FocalPoint System	Sediments or trash should be removed
Mulch Cover	Trash and floatable debris accumulation	Excessive trash or debris accumulation.	Minimal trash or other debris on mulch cover	Trash and debris should be removed and mulch cover raked level. Ensure that bark nugget
Mulch Cover	Ponding of water on mulch cover	Ponding in unit could be indicative of clogging due to excessive fine sediment accumulation or spill of petroleum oils	Stormwater should drain freely and evenly over mulch cover.	Contact VAR for advice.
Plants	Plants not growing, or in poor condition	Soil/mulch too wet, evidence of spill. Pest infestation. Vandalism to plants.	Plants should be healthy and pest free.	Contact VAR for advice.
Plants	Plant growth excessive	Plants should be appropriate to the species and location of FocalPoint		Trim/prune plants in accordance with typical landscaping and

ATTACHMENT 4
Copy of Plan Sheets Showing Permanent Storm Water BMPs

This is the cover sheet for Attachment 4.

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

The plans must identify:

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

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