CORAL MOUNTAIN RESORT

DRAFT EIR

SCH# 2021020310

TECHNICAL APPENDICES

Water Quality Management Plan
Appendix J.2

June 2021

Project Specific
Preliminary Water Quality Management Plan

For: **The Wave at Coral Mountain – Tentative Tract Map No. 37815**

South of Avenue 58; West of Madison Street, in the City of La Quinta

DEVELOPMENT NO. **TTM 2019-0005 (TTM 37815)**

Prepared for:
CM Wave Development, L.L.C.
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Original Date Prepared: June 1, 2020

Revision Date(s): N/A

OWNER'S CERTIFICATION

This project-specific Preliminary Water Quality Management Plan (M-WQMP) has been prepared for:

CM Wave Development, L.L.C. by MSA Consulting, Inc. for the project known as **The Wave at Coral Mountain** in the City of La Quinta.

This WQMP is intended to comply with the requirements of the City of La Quinta for **The Wave at Coral Mountain TTM 2019-0005 (TTM 37815),** which includes the requirement for the preparation and implementation of a project-specific WQMP.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity.

The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under City of La Quinta Water Quality Ordinance 493 (La Quinta Municipal Code Municipal Code Section 8.70).

If the undersigned transfers its interest in the subject property/project, the undersigned shall notify the successor in interest of its responsibility to implement this WQMP.

"I, the undersigned, certify under penalty of law that I am the owner of the property that is the subject of this WQMP, and that the provisions of this WQMP have been reviewed and accepted and that the WQMP will be transferred to future successors in interest."

_____
Owner's Signature

_____
Owner's Printed Name

_____
Owner's Title/Position

_____
Date

2440 Junction Place, Suite 200
Boulder, CO 80301

ATTEST

_____
Notary Signature

_____
Printed Name

_____
Title/Position

_____
Date

THIS FORM SHALL BE NOTARIZED BEFORE ACCEPTANCE OF THE FINAL PROJECT SPECIFIC WQMP

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APPENDICES

I. Project Description

Project Owner: CM Wave Development, L.L.C.
2440 Junction Place, Suite 200
Boulder, CO 80301

WQMP Preparer: Under the Direct Supervision of Michael Rowe, PE
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34200 Bob Hope Drive
Rancho Mirage, CA 92270
Telephone: (760) 323-7893
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Project Site Address:	**South of Avenue 58; West of Madison Street in the City of La Quinta**
Planning Area:	**City of La Quinta Specific Plan 03-067**
Community Name:	**City of La Quinta**
Development Name:	**The Wave at Coral Mountain – TTM No. 37815**
APN Number(s):	**764-200-076, 764-210-007, 764-210-028, 764-210-029, 766-070-003, 766-070-006, 766-070-012, 766-070-014, 766-080-001, 766-080-002, 766-080-004 & 766-080-005**
Latitude & Longitude:	**33°37'6.7399" North, 116°15'24.7324" West**
Receiving Water:	**Coachella Valley Stormwater Channel**

Preliminary WQMP Coverage Area: **304.727 Acres (Drainage Areas A – E)**

Standard Industrial Classification (SIC) Code(s):

- SIC not applicable to residential development
- 7999: Amusement and Recreation
- 7011: Hotels (Resort Hotels)
- 5399: Miscellaneous General Merchandise Stores

Formation of Home Owners' Association (HOA)
or Property Owners Association (POA): Y ☒ N ☐

Additional Permits/Approvals required for the Project:

AGENCY	Permit required
State Department of Fish and Wildlife, Fish and Game Code §1602 Streambed Alteration Agreement	Y ☐ N☒
State Water Resources Control Board, Clean Water Act (CWA) Section 401 Water Quality Certification	Y ☐ N☒
US Army Corps of Engineers, CWA Section 404 permit	Y ☐ N☒
US Fish and Wildlife, Endangered Species Act Section 7 biological opinion	Y ☐ N☒
Statewide Construction General Permit Coverage	Y ☒ N☐
Statewide Industrial General Permit Coverage	Y ☐ N☒
Other: City of La Quinta Grading Permit City of La Quinta Building Permit	 Y ☒ N☐ Y ☒ N☐

- The proposed project activity will not divert or obstruct the natural flow or change the bed, channel, or bank of any stream, river or lake. Therefore, a State Department of Fish and Game, 1601 Streambed Alteration Agreement is not required.
- The proposed project activity will not result in discharge into navigable waters or other impacts; therefore, a Clean Water Act Section 401 Water Quality Certification permit is not required.
- The proposed facility will not result in the discharge of dredged or fill materials into the Waters of the United States. A Clean Water Act Section 404 Permit is not required for this project.
- The proposed project site is not recognized as a habitat of an endangered species nor does it form part of a Conservation Area under the Coachella Valley Multiple Species Habitat Conservation Plan. A U.S. Fish and Wildlife, Endangered Species Act Section 7 biological opinion is not required for this project.
- The proposed project is not industrial in nature. Therefore, coverage under the General Permit for Storm Water Discharges Associated with Industrial Activities is not required. This project will obtain coverage under the State Water Board NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities.

Project Introduction and Existing Conditions

The level of detail provided in this Preliminary WQMP is consistent with the corresponding Preliminary Hydrology Report prepared for Tentative Tract Map 37815. As the site plan and engineering plans progress toward a final design, additional detail will be provided per the City's Final WQMP Scope of Work.

As presently observed, the terrain across most of the project area is relatively level with scattered vegetation coverage due to the past agricultural operations and site clearing activities that occurred over multiple decades. Only the hillside portions of Coral Mountain on the west edge of the project have retained a relatively undisturbed condition, which will not be modified by the project. In addition to the prior modifications from agricultural uses, the site has also been altered dirt roads, hiking paths, and various underground irrigation lines. The project site has also been subject to instances of trespassing and off-road vehicular circulation. As such, site drainage appears to be controlled via sheet flow generally from west to east. Per the Preliminary Hydrology Report for this site, no groundwater was encountered in any of the exploratory borings to a depth of 51 feet.

Description of Proposed Improvements

Based on the amended specific plan, the project site that is the subject of this Preliminary WQMP includes a surf resort (hotel complex), residential units (attached and detached), a wave pool feature, and other resort-related amenities largely occurring in the form of recreational open space. The wave pool is an artificial wave basin designed to generate ocean-like waves for recreational uses by resort guests and residents, as well as providing a venue for competitive and professional surfing events. The wave pool has also been incorporated into the preliminary hydrology design to serve as a stormwater retention basin for properly treated runoff.

Hydrologically, the proposed development and preliminary WQMP coverage is divided into five primary drainage management areas totaling 304.727 acres. This area calculation includes off-site tributary flows from hillside rock outcropping and open brush areas west of the project limits.

Drainage Area A covers approximately 162.745 acres, occupying a western portion of the project site, where the proposed land uses include residential units, the resort hotel, the corresponding interior drive aisles, the proposed wave pool, and recreational open space. Of the 162.745 acres making up this drainage area, approximately 70.893 acres are off-site tributaries with rock out-cropping and open brush conditions. These areas occur generally west of the project boundary corresponding to easterly portions of the Coral Mountain natural feature. Based on the current preliminary engineering design, the existing conditions and proposed improvements will result in 38.874 acres (24%) of impervious cover consisting of interior drive aisles, residential structures, hotel-related structures, and the corresponding hardscape. The remaining 123.297 acres (76%) will consist of pervious cover, largely being made up of open space.

Based on these conditions and using the *Whitewater Watershed BMP Design Volume Worksheet*, the Design Storage Volume (Vbmp) for Drainage Area A (as a whole) is 45,337 cubic feet. Runoff from throughout Drainage Area A will be carried to a system of three retention facilities. Two of these retention facilities will be designed to accept the 10-year storm volumes from mentioned off-site areas to the west, while the third retention facility will be the wave pool feature designed to accept stormwater flows from the interior (on-site) portions. The combined retention capacity provided in Drainage Area A is 3,178,217, which is sufficiently sized to

contain the flood volume resulting from the controlling 100-year storm, as well as the smaller Vbmp volume for water quality purposes. During the final design process, a more detailed description will be provided of the sub-areas in Drainage Area A.

Drainage Area B covers approximately 41.586 acres, occupying a northwest portion of the project site, where the proposed land uses include low-density residential units, recreational open space, interior streets, and an artificial lake feature. Of the 41.586 acres making up this drainage area, approximately 17.512 acres (42%) are expected to be impervious cover consisting of residential structures, interior roads, and the corresponding hardscape. The remaining 24.074 (58%) will consist of pervious cover (open space).

Based on these conditions and using the Whitewater Watershed BMP Design Volume Worksheet, the Design Storage Volume (Vbmp) for Drainage Area B is 17,613 cubic feet. Runoff from throughout Drainage Area B will be carried to the centralized artificial lake feature, which will provide a retention capacity of 292,016 cubic feet to handle the controlling 100-year storm event and the previously mentioned Vbmp volume for water quality purposes. During the Final Design, a more detailed description will be provided for this drainage area.

Drainage Area C covers approximately 10.191 acres, occupying a central portion of the project site, where the proposed land uses residential units, surf resort units, recreational open space, and interior streets. Of the 10.191 acres making up this drainage area, approximately 4.419 acres (43%) are expected to be impervious cover consisting of residential structures, resort structures, interior roads, and the corresponding hardscape. The remaining 5.772 acres (57%) will consist of pervious cover (open space).

Based on these conditions and using the Whitewater Watershed BMP Design Volume Worksheet, the Design Storage Volume (Vbmp) for Drainage Area C is 4,423 cubic feet. Runoff from throughout Drainage Area C will be carried to a temporary retention basin with a capacity of 57,966 cubic feet to handle the controlling 100-year storm event and the previously mentioned Vbmp volume for water quality purposes. During the Final Design, a more detailed description will be provided for this drainage area.

Drainage Area D covers approximately 28.403 acres, occupying a central portion of the project site, where the proposed land uses residential units, surf resort units, a portion of the hotel, recreational open space, interior streets, and an artificial lake feature. Of the 28.403 acres making up this drainage area, approximately 14.177 acres (49%) are expected to be impervious cover. The remaining 14.799 acres (51%) will consist of pervious cover (open space).

Based on these conditions and using the *Whitewater Watershed BMP Design Volume Worksheet*, the Design Storage Volume (Vbmp) for Drainage Area D is 13,988 cubic feet. Runoff from throughout Drainage Area C will be carried to a proposed artificial lake feature with a retention capacity of 168,719 cubic feet to handle the controlling 100-year storm event and the previously mentioned Vbmp volume for water quality purposes. During the Final Design, a more detailed description will be provided for this drainage area.

Drainage Area E covers approximately 61.802 acres, occupying an eastern portion of the project site where the expected land uses will be future low-density residential units. Of the 61.802 acres making up this drainage area, approximately 19.414 acres (31%) are expected to be impervious cover. The remaining 43.489 acres (69%) will consist of pervious cover (open space).

Based on these conditions and using the Whitewater Watershed BMP Design Volume Worksheet, the Design Storage Volume (Vbmp) for Drainage Area E is 20,990 cubic feet. Runoff from throughout Drainage Area C will be carried to a temporary retention basin with a capacity of 1,216,389 cubic feet to handle the controlling 100-year storm event and the previously mentioned Vbmp volume for water quality purposes. During the Final Design, a more detailed description will be provided for this drainage area.

Runoff from throughout the primary project entry driveway will be conveyed to adjacent landscaped swales sized to contain the corresponding runoff volumes.

Future development within the Specific Plan area is expected to occur in Drainage Areas F, G, H and I, which have a combined area of 145.728 acres. Based on estimates found in the Preliminary Hydrology Report, these drainage areas are expected to require a combined 13.7 acre-feet of retention capacity to handle their corresponding runoff volumes. The identification and area-specific retention sizing will be a function of the site designed to be determined for these areas. As such, Drainage Areas F, G, H, and I are not covered in the scope of this Preliminary or subsequent Final WQMP. A separate site design, preliminary engineering and WQMP will be necessary to cover these areas.

Location of Activities:

The project does not have a specific area where heightened activities would warrant additional site design, source control or treatment measures other than those identified for each drainage area. Final WQMP documentation is expected to provide additional detail based on a final site design and engineering.

Waste Generation:

The proposed project is expected to generate non-hazardous solid waste typical of most residential and commercial land uses. The project's waste will be collected and managed by Burrtec Waste Industries on a typical schedule. Pollution prevention, waste reduction, and recycling practices will be implemented on-site.

II. Site Characterization

Land Use Designation or Zoning:	Existing General Plan and Zoning: Specific Plan 03-067 Proposed General Plan & Zoning: Specific Plan 03-067
Current Property Use:	Vacant
Proposed Property Use:	Residential, Resort Hotel, Recreational
Availability of Soils Report:	Y ☒ N ☐
Phase 1 Site Assessment:	Y ☐ N ☒

Receiving Waters for Urban Runoff from Site

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use Designated Receiving Waters
Coachella Valley Stormwater Channel	DDT (Dichlorodiphenyltrichloroethane), Dieldrin, Indicator Bacteria, PCBs (Polychlorinated Biphenyls), Toxaphene, Toxicity, Nitrogen, ammonia (Total Ammonia)	FRSH, REC I *c*, REC II *c*, WARM, WILD, RARE *d*	Approximately 7.1 miles

The preceding table is based on the **2014 and 2016 Integrated Report (Clean Water Act Section 303(d) List/305(b) Report.** All impairments listed for Coachella Valley Stormwater Channel are under Category 5, which apply to water segments where standards are not met and a Total Maximum Daily Load (TMDL) is required, but not yet completed. All pollutant sources for this segment are unknown.

Abbreviations:
I – Intermittent Beneficial Use
FRSH – Freshwater Replenishment
REC I – Water Contact Recreation
REC II – Non-Contact Water Recreation
WARM – Warm Freshwater Habitat
WILD – Wildlife Habitat
RARE – Preservation of Rare, Threatened, or Endangered Species
MUN – Municipal & Domestic Supply
AGR – Agricultural Supply
GWR – Groundwater Recharge
AQUA – Acuaculture
COLD – Cold Freshwater Habitat
POW – Hydropower Generation

a. Although it is not encouraged, children play in the water infrequently on the wildlife reserve
b. Section of perennial flow from approximately Indio to the Salton Sea.
c. Unauthorized use.
d. Rare, endangered, or threatened wildlife exists in or utilizes some of this waterway.

III. Pollutants of Concern

Table 1. Pollutant of Concern Summary

Pollutant Category	Potential for Project	Causing Receiving Water Impairment
Bacteria/Virus (Pathogens)	Yes	Yes (Pathogens)
Heavy Metals	Yes	No
Nutrients	Yes	No
Toxic Organic Compounds	Yes	No
Total Ammonia (Nitrogen, ammonia)	No	Yes
Toxicity	No	Yes
Sediment/Turbidity	Yes	No
Trash & Debris	Yes	No
Oil & Grease	Yes	No

The Coachella Valley Stormwater Channel is impaired by **DDT (Dichlorodiphenyltrichloroethane), Dieldrin, Indicator Bacteria, PCBs (Polychlorinated Biphenyls), Toxaphene, Toxicity** and **Total Ammonia (Nitrogen, ammonia)**.

- The project is not anticipated to generate DDT contamination because the use of this substance (synthetic organic compound) has been banned since 1972; therefore, it will not be handled or form part of the proposed development.
- The project is not anticipated to generate Dieldrin contamination because the use of this substance (synthetic organic compound) was related to agricultural operations (found in pesticides for crops) and it has been illegal since 1987; therefore, it will not be handled or form part of the proposed development.
- The project is not anticipated to produce polychlorinated biphenyls (PCBs) because manufacturing this substance (synthetic organic compound) stopped in 1977 and its application was banned in 1979; therefore, it will not be handled or form part of the proposed development.
- The proposed development is not anticipated to produce toxaphene because the use of this substance (synthetic organic compound) has been illegal since 1990; therefore, it will not be handled or form part of the proposed development.
- The proposed office development is not anticipated to produce Nitrogen, ammonia (Total Ammonia). Ammonia is a nutrient typically associated with commercial fertilizers utilized in agricultural operations. The project's retention facilities will contain runoff, such that it will not reach the impaired receiving waters.
- The project has the potential to generate small amounts of pathogens (bacteria/virus). These pollutants are generally associated with various human activities, but pathogens are also present in natural environments. Moreover, pathogens can be associated with wild and domesticated animal waste. Source control measures to address this potential pollutant are discussed in the subsequent sections of this report. Runoff from the project will be conveyed to proposed retention facilities sized to capture and infiltrate the controlling 100-year storm event and the design capture volume for water

quality purposes (Vbmp). Therefore, no discharge of pathogens in runoff is expected as part of the standard operating condition.

- The project is not expected to generate or discharge toxicants, such as toxic metals and synthetic organic compounds that would result in detrimental physiological responses in human, plant, animal, or indigenous aquatic life in the Coachella Valley Storm Water Channel. Due to the project's location and proposed improvements, the project will not involve direct or indirect discharges into the Coachella Valley Storm Water Channel. All project runoff will be conveyed to on-site retention facilities.

Table 1 (*Potential Pollutants Generated by Land Use Type*) of the *Riverside County Whitewater River Region Stormwater Quality Best Management Practice Design Handbook for Low Impact Development* identifies eight (8) land use categories with their corresponding potential pollutants that may be generated. Based on the allowable land uses under the governing Specific Plan, here are the comparable land use types pertaining to the mentioned list.

Type of Development (Land Use)	Sediment/ Turbidity	Nutrients	Toxic Organic Compounds	Trash & Debris	Bacteria & Viruses (*Also: Pathogens*)	Oil & Grease	Heavy Metals
Detached Residential Development	P	P	N	P	P	P	N
Attached Residential Development	P	P	N	P	P	P(2)	N
Restaurants	N	N	N	P	P	P	N
Parking Lots	P	P(1)	P(4)	P	P	P	P
Commercial Development	P	P(1)	P(5)	P	P(3)	P	P(6)

Abbreviations:

P = Potential **N** = Not potential

Notes:

(1) A potential Pollutant if non-native landscaping exists or is proposed onsite; otherwise not expected.
(2) A potential Pollutant if the project includes uncovered parking areas; otherwise not expected.
(3) A potential Pollutant if land use involves food or animal waste products.
(4) Specifically, petroleum hydrocarbons.
(5) Specifically, solvents; however, this Pollutant is not expected at commercial office or commercial retail sites, unless said retail is vehicle related.
(6) A potential Pollutant if the project includes outdoor storage or metal roofs; otherwise not expected.

Potential Project Pollutants: The project's land uses have the generalized potential to produce sediment/turbidity; nutrients; toxic organic compounds; trash and debris; bacteria and viruses (including pathogens); oil and grease; and heavy metals.

Legacy Pollutants: There is no evidence or other known information of legacy pollutants on-site.

Pollutants of Concern: Based on the comparison of potential project pollutants with the pollutant categories causing receiving water impairments, the pollutants of concern include **bacteria/virus**. The project's proposed storm drain improvements are designed to intercept and retain the flood volume resulting from the 100-year storm event. Therefore, the project will not produce pollutants that could affect off-site or downstream resources, such as the proximate receiving waters.

IV. Hydrologic Conditions of Concern

Local Jurisdiction Requires On-Site Retention of Urban Runoff:

Yes ☒ The project will be required to retain urban runoff onsite in conformance with local ordinance (See Table 6 of the WQMP Guidance document, "Local Land use Authorities Requiring Onsite Retention of Stormwater"). This section does not need to be completed; however, retention facility design details and sizing calculations must be included in Appendix F.

Note: The Preliminary WQMP and corresponding Preliminary Hydrology Report for this project have identified five (5) drainage management areas (A through E) with the respective required capacity for retaining the flood volume resulting from the 100-year controlling storm event for the corresponding on-site and off-site tributary conditions. The necessary retention capacity will be met through retention facilities at each drainage management area, the details of which will be demonstrated in the Final WQMP and Final Hydrology Report. As a result, the project will not result in changes to the hydrologic regime that will permanently impact downstream channels, receiving waters, or habitat integrity. No Hydrologic Conditions of Concern are expected to result from the project. The local jurisdiction requirements for on-site retention of urban runoff will be met.

No ☐ This section must be completed.

This Project meets the following condition:

☐ **Condition A**: 1) Runoff from the Project is discharged directly to a publicly-owned, operated and maintained MS4 or engineered and maintained channel, 2) the discharge is in full compliance with local land use authority requirements for connections and discharges to the MS4 (including both quality and quantity requirements), 3) the discharge would not significantly impact stream habitat in proximate Receiving Waters, **and** 4) the discharge is authorized by the local land use authority.

☐ **Condition B**: The project disturbs less than 1 acre and is not part of a larger common plan of development that exceeds 1 acre of disturbance. The disturbed area calculation must include all disturbances associated with larger plans of development.

☐ **Condition C**: The project's runoff flow rate, volume, velocity and duration for the post-development condition do not exceed the pre-development condition for the 2-year, 24-hour and 10-year 24-hour rainfall events. This condition can be achieved by, where applicable, complying with the local land use authority's on-site retention ordinance, or minimizing impervious area on a site and incorporating other Site-Design BMP concepts and LID/Site Design BMPs that assure non-exceedance of pre-development conditions. This condition must be substantiated by hydrologic modeling methods acceptable to the local land use authority.

☐ **None:** Refer to Section 3.4 of the Whitewater River Region WQMP Guidance document for additional requirements.

Supporting engineering studies, calculations, and reports are included in Appendix C.

V. Best Management Practices

This project implements Best Management Practices (BMPs) to address the Pollutants of Concern that may potentially be generated from the use of the project site. These BMPs have been selected and implemented to comply with Section 3.5 of the WQMP Guidance document, and consist of Site Design BMP concepts, Source Control, LID/Site Design and, if/where necessary, Treatment Control BMPs as described herein.

V.1 Site Design BMP Concepts, LID/Site Design and Treatment Control BMPs

Local Jurisdiction Requires On-Site Retention of Urban Runoff:

Yes ☒ The project will be required to retain Urban Runoff onsite in conformance with local ordinance (See Table 6 of the WQMP Guidance document, "Local Land use Authorities Requiring Onsite Retention of Stormwater). **The LID/Site Design measurable goal has thus been met (100%), and Sections V.1.A and V.1.B do not need to be completed**; however, retention facility design details and sizing calculations must be included in Appendix F, and '100%' should be entered into Column 3 of Table 6 below.

Note: The Preliminary WQMP and corresponding Preliminary Hydrology Report for this project have identified five (5) drainage management areas (A through E) with the respective required capacity for retaining the flood volume resulting from the 100-year controlling storm event for the corresponding on-site and off-site tributary conditions. The necessary retention capacity will be met through retention facilities at each drainage management area, the details of which will be demonstrated in the Final WQMP and Final Hydrology Report. As a result, the project will not result in changes to the hydrologic regime that will permanently impact downstream channels, receiving waters, or habitat integrity. No Hydrologic Conditions of Concern are expected to result from the project. The local jurisdiction requirements for on-site retention of urban runoff will be met.

No ☐ Section V.1 must be completed.

This section of the Project-Specific WQMP documents the LID/Site Design BMPs and, if/where necessary, the Treatment Control BMPs that will be implemented on the project to meet the requirements detailed within Section 3.5.1 of the WQMP Guidance document. Section 3.5.1 includes requirements to implement Site Design Concepts and BMPs, and includes requirements to address Pollutants of Concern with BMPs. Further, sub-section 3.5.1.1 specifically requires that Pollutants of Concern be addressed with LID/Site Design BMPs to the extent feasible.

LID/Site Design BMPs are those BMPs listed within Table 2 below which promote retention and/or feature a natural treatment mechanism; off-site and regionally-based BMPs are also LID/Site Design BMPs, and therefore count towards the measurable goal, if they fit these criteria. This project incorporates LID/Site Design BMPs to fully address the Treatment Control BMP requirement where and to the extent feasible. If and where it has been acceptably demonstrated to the local land use authority that it is infeasible to fully meet this requirement with LID/Site Design BMPs, Section V.1.B (below) includes a description of the conventional Treatment Control BMPs that will be substituted to meet the same requirements. In addressing Pollutants of Concern, BMPs are selected using Table 2 below.

Table 2. BMP Selection Matrix Based Upon Pollutant of Concern Removal Efficiency (1)

(Sources: Riverside County Flood Control & Water Conservation District Design Handbook for Low Impact Development Best Management Practices, dated September 2011, the Orange County Technical Guidance Document for Water Quality Management Plans, dated May 19, 2011, and the Caltrans Treatment BMP Technology Report, dated April 2010 and April 2008)

Pollutant of Concern	Landscape Swale[2, 3]	Landscape Strip[2, 3]	Biofiltration (with underdrain)[2, 3]	Extended Detention Basin[2]	Sand Filter Basin[2]	Infiltration Basin[2]	Infiltration Trench[2]	Permeable Pavement[2]	Bioretention (w/o underdrain)[2, 3]	Other BMPs Including Proprietary BMPs[4, 6]
Sediment & Turbidity	M	M	H	M	H	H	H	H	H	Varies by Product[5]
Nutrients	L/M	L/M	M	L/M	L/M	H	H	H	H	
Toxic Organic Compounds	M/H	M/H	M/H	L	L/M	H	H	H	H	
Trash & Debris	L	L	H	H	H	H	H	L	H	
Bacteria & Viruses (also: Pathogens)	L	M	H	L	M	H	H	H	H	
Oil & Grease	M	M	H	M	H	H	H	H	H	
Heavy Metals	M	M/H	M/H	L/M	M	H	H	H	H	

Abbreviations:

L: Low removal efficiency M: Medium removal efficiency H: High removal efficiency

Notes:

(1) Periodic performance assessment and updating of the guidance provided by this table may be necessary.

(2) Expected performance when designed in accordance with the most current edition of the document, "Riverside County, Whitewater River Region Stormwater Quality Best Management Practice Design Handbook".

(3) Performance dependent upon design which includes implementation of thick vegetative cover. Local water conservation and/or landscaping requirements should be considered; approval is based on the discretion of the local land use authority.

(4) Includes proprietary stormwater treatment devices as listed in the CASQA Stormwater Best Management Practices Handbooks, other stormwater treatment BMPs not specifically listed in this WQMP (including proprietary filters, hydrodynamic separators, inserts, etc.), or newly developed/emerging stormwater treatment technologies.

(5) Expected performance should be based on evaluation of unit processes provided by BMP and available testing data. Approval is based on the discretion of the local land use authority.

(6) When used for primary treatment as opposed to pre-treatment, requires site-specific approval by the local land use authority.

V.1.A SITE DESIGN BMP CONCEPTS AND LID/SITE DESIGN BMPS

Note: This section is not applicable Due to conformance with local retention ordinance per Section 3.5.1.2 of Whitewater River Region WQMP Guidance Document.

This section documents the Site Design BMP concepts and LID/Site Design BMPs that will be implemented on this project to comply with the requirements detailed in Section 3.5.1 of the WQMP Guidance document.

- Table 3 herein documents the implementation of the Site Design BMP Concepts described in sub-sections 3.5.1.3 and 3.5.1.4.
- Table 4 herein documents the extent to which this project has implemented the LID/Site Design goals described in sub-section 3.5.1.1.

Table 3. Implementation of Site Design BMP Concepts

Note: Completion of this sub-section is not required since the project retains urban runoff on-site in conformance with the local ordinances.

Design Concept	Technique	Specific BMP	Included			Brief Reason for BMPs Indicated as No or N/A
			Yes	No	N/A	
Site Design BMP Concept 1	**Minimize Urban Runoff, Minimize Impervious Footprint, and Conserve Natural Areas** **(See WQMP Section 3.5.1.3)**	Conserve natural areas by concentrating or clustering development on the least environmentally sensitive portions of a site while leaving the remaining land in a natural, undisturbed condition.	☐	☐	☐	
		Conserve natural areas by incorporating the goals of the Multi-Species Habitat Conservation Plan or other natural resource plans.	☐	☐	☐	
		Preserve natural drainage features and natural depressional storage areas on the site.	☐	☐	☐	
		Maximize canopy interception and water conservation by preserving existing native trees and shrubs, and planting additional native or drought tolerant trees and large shrubs.	☐	☐	☐	
		Use natural drainage systems.	☐	☐	☐	
		Where applicable, incorporate Self-Treating Areas	☐	☐	☐	
		Where applicable, incorporate Self-Retaining Areas	☐	☐	☐	
		Increase the building floor to area ratio (i.e., number of stories above or below ground).	☐	☐	☐	
		Construct streets, sidewalks and parking lot aisles to minimum widths necessary, provided that public safety and a walkable environment for pedestrians are not compromised.	☐	☐	☐	
		Reduce widths of streets where off-street parking is available.	☐	☐	☐	
		Minimize the use of impervious surfaces, such as decorative concrete, in the landscape design.	☐	☐	☐	
		Other comparable and equally effective Site Design BMP concept(s) as approved by the local land use authority (Note: Additional narrative required to describe BMP and how it addresses site design concept).	☐	☐	☐	

Table 3. Site Design BMP Concepts (continued)

Note: Completion of this sub-section is not required since the project retains urban runoff on-site in conformance with the local ordinances.

Design Concept	Technique	Specific BMP	Included			Brief Reason for Each BMP Indicated as No or N/A
			Yes	No	N/A	
Site Design BMP Concept 2	**Minimize Directly Connected Impervious Area** **(See WQMP Section 3.5.1.4)**	Design residential and commercial sites to contain and infiltrate roof runoff, or direct roof runoff to landscaped swales or buffer areas.	☐	☐	☐	
		Drain impervious sidewalks, walkways, trails, and patios into adjacent landscaping.	☐	☐	☐	
		Incorporate landscaped buffer areas between sidewalks and streets.	☐	☐	☐	
		Use natural or landscaped drainage swales in lieu of underground piping or imperviously lined swales.	☐	☐	☐	
		Where soil conditions are suitable, use perforated pipe or gravel filtration pits for low flow infiltration.	☐	☐	☐	
		Maximize the permeable area by constructing walkways, trails, patios, overflow parking, alleys, driveways, low-traffic streets, and other low-traffic areas with open-jointed paving materials or permeable surfaces such as pervious concrete, porous asphalt, unit pavers, and granular materials.	☐	☐	☐	
		Use one or more of the following:				
		Rural swale system: street sheet flows to landscaped swale or gravel shoulder, curbs used at street corners, and culverts used under driveways and street crossings.	☐	☐	☐	
		Urban curb/swale system: street slopes to curb; periodic swale inlets drain to landscaped swale or biofilter.	☐	☐	☐	
		Dual drainage system: first flush captured in street catch basins and discharged to adjacent vegetated swale or gravel shoulder; high flows connect directly to MS4s.	☐	☐	☐	
		Other comparable and equally effective Site Design BMP concept(s) as approved by the local land use authority (Note: Additional narrative required to describe BMP and how it addresses site design concept).	☐	☐	☐	
		Use one or more of the following for design of driveways and private residential parking areas:				
		Design driveways with shared access, flared (single lane at street), or wheel strips (paving only under the tires).	☐	☐	☐	
		Uncovered temporary or guest parking on residential lots paved with a permeable surface, or designed to drain into landscaping.	☐	☐	☐	

Table 3. Site Design BMP Concepts (continued)

Note: Completion of this sub-section is not required since the project retains urban runoff on-site in conformance with the local ordinances.

Design Concept	Technique	Specific BMP	Included: Yes	Included: No	Included: N/A	Brief Reason for Each BMP Indicated as No or N/A
Site Design BMP Concept 2 (cont'd)	**Minimize Directly Connected Impervious Area (See WQMP Section 3.5.1.4)**	Other comparable and equally effective Site Design BMP concept(s) as approved by the local land use authority (Note: Additional narrative required to describe BMP and how it addresses site design concept).	☐	☐	☐	
		Use one or more of the following for design of parking areas:				
		Where landscaping is proposed in parking areas, incorporate parking area landscaping into the drainage design.	☐	☐	☐	
		Overflow parking (parking stalls provided in excess of the Permittee's minimum parking requirements) may be constructed with permeable pavement.	☐	☐	☐	
		Other comparable and equally effective Site Design BMP (or BMPs) as approved by the local land use authority (Note: Additional narrative required describing BMP and how it addresses site design concept).	☐	☐	☐	

Project Site Design BMP Concepts:

Note: This section is not applicable Due to conformance with local retention ordinance per Section 3.5.1.2 of Whitewater River Region WQMP Guidance Document.

Alternative Project Site Design BMP Concepts:

Not Applicable

Table 4. LID/Site Design BMPs Meeting the LID/Site Design Measurable Goal

(1) DRAINAGE SUB-AREA ID OR NO.	(2) LID/SITE DESIGN BMP TYPE* (See Table 2)	(3) POTENTIAL POLLUTANTS OF CONCERN WITHIN DRAINAGE SUB-AREA (Refer to Table 1)	(4) POTENTIAL POLLUTANTS WITHIN SUB-AREA CAUSING RECEIVING WATER IMPAIRMENTS (Refer to Table 1)	(5) EFFECTIVENESS OF LID/SITE DESIGN BMP AT ADDRESSING IDENTIFIED POTENTIAL POLLUTANTS (U, L, M, H/M, H; see Table 2)	(6) BMP MEETS WHICH DESIGN CRITERIA? (Identify as V_{BMP} OR Q_{BMP})	(7) TOTAL AREA WITHIN DRAINAGE SUB-AREA (Nearest 0.1 acre)
Area A	Infiltration BMP (Retention Basin)	Bacteria/virus	Bacteria/virus	H	45,337 CU. FT. (V_{BMP}) **Retention Capacity Provided: 3,178,217 CU. FT.**	162.745
Area B	Artificial Lake Retention	Bacteria/virus	Bacteria/virus	H	17,613 CU. FT. (V_{BMP}) **Retention Capacity Provided: 292,016 CU. FT.**	41.586
Area C	Infiltration BMP (Retention Basin)	Bacteria/virus	Bacteria/virus	H	4,423 CU. FT. (V_{BMP}) **Retention Capacity Provided: 57,966 CU. FT.**	10.191
Area D	Artificial Lake Retention	Bacteria/virus	Bacteria/virus	H	13,988 CU. FT. (V_{BMP}) **Retention Capacity Provided: 168,719 CU. FT.**	28.403
Area E	Infiltration BMP (Retention Basin)	Bacteria/virus	Bacteria/virus	H	20,990 CU. FT. (V_{BMP}) **Retention Capacity Provided: 1,216,389 CU. FT.**	61.802
TOTAL PROJECT AREA TREATED WITH LID/SITE DESIGN BMPs (NEAREST 0.1 ACRE)						**304.727**

*** LID/Site Design BMPs listed in this table are those that completely address the 'Treatment Control BMP requirement' for their drainage sub-area.**

Note: This Preliminary WQMP covers drainage areas A through E. The development of drainage areas F through I will be covered by a separate WQMP based on a corresponding future site design. Conformance with the local retention requirements will be satisfied by conveying project runoff into proposed on-site retention facilities.

Justification of infeasibility for sub-areas not addressed with LID/Site Design BMPs

Not applicable.

V.1.B TREATMENT CONTROL BMPS

Conventional Treatment Control BMPs shall be implemented to address the project's Pollutants of Concern as required in WQMP Section 3.5.1 where, and to the extent that, Section V.1.A has demonstrated that it is infeasible to meet these requirements through implementation of LID/Site Design BMPs.

☒ The LID/Site Design BMPs described in Section V.1.A of this project-specific WQMP completely address the 'Treatment Control BMP requirement' for the entire project site (and where applicable, entire existing site) as required in Section 3.5.1.1 of the WQMP Guidance document. Supporting documentation for the sizing of these LID/Site Design BMPs is included in Appendix F. ***Section V.1.B does not need to be completed**.

Note: The project includes a system of on-site retention basins sized to retain/infiltrate the volume resulting from the 100-year controlling storm event at each on-site tributary area. As such, the proposed on-site retention capacity will also be sufficient to handled the corresponding Vbmp volume for water quality purposes.

☐ The LID/Site Design BMPs described in Section V.1.A of this project-specific WQMP do **NOT** completely address the 'Treatment Control BMP requirement' for the entire project site (or where applicable, entire existing site) as required in Section 3.5.1.1 of the WQMP. ***Section V.1.B must be completed.**

The Treatment Control BMPs identified in this section are selected, sized and implemented to treat the design criteria of V_{BMP} and/or Q_{BMP} for all project (and if required, existing site) drainage sub-areas which were not fully addressed using LID/Site Design BMPs. Supporting documentation for the sizing of these Treatment Control BMPs is included in Appendix F.

Table 5: Treatment Control BMP Summary

(1) DRAINAGE SUB-AREA ID OR NO.	(2) TREATMENT CONTROL BMP TYPE* (See Table 2)	(3) POTENTIAL POLLUTANTS OF CONCERN WITHIN DRAINAGE SUB-AREA (Refer to Table 1)	(4) POTENTIAL POLLUTANTS WITHIN SUB-AREA CAUSING RECEIVING WATER IMPAIRMENTS (Refer to Table 1)	(5) EFFECTIVENESS OF TREATMENT CONTROL BMP AT ADDRESSING IDENTIFIED POTENTIAL POLLUTANTS (U, L, M, H/M, H; see Table 2)	(6) BMP MEETS WHICH DESIGN CRITERIA? (Identify as V_{BMP} OR Q_{BMP})	(7) TOTAL AREA WITHIN DRAINAGE SUB-AREA (Nearest 0.1 acre)
N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TOTAL PROJECT AREA TREATED WITH TREATMENT CONTROL BMPs (NEAREST 0.1 ACRE)					N/A

Note: Conformance with the local retention requirements will be satisfied by conveying project runoff into proposed on-site retention facilities.

V.1.C MEASURABLE GOAL SUMMARY

This section documents the extent to which this project has met the measurable goal described in WQMP Section 3.5.1.1 of addressing 100% of the project's 'Treatment Control BMP requirement' with LID/Site Design BMPs. Projects required to retain Urban Runoff onsite in conformance with local ordinance are considered to have met the measurable goal; for these instances, '100%' is entered into Column 3 of the Table.

Table 6: Measurable Goal Summary

(1) **Total Area Treated with <u>LID/Site Design</u> BMPs** **(Last row of Table 4)**	(2) **Total Area Treated with <u>Treatment Control</u> BMPs** **(Last row of Table 5)**	(3) **% of Treatment Control BMP Requirement addressed with LID/Site Design BMPs**
304.727 (Drainage Areas A through E)	**N/A** *Due to conformance with local retention ordinance per Section 3.5.1.2 of Whitewater River Region WQMP Guidance Document.*	**100**

Note: This Preliminary WQMP covers drainage areas A through E. The development of drainage areas F through I will be covered by a separate WQMP based on a corresponding future site design. Conformance with the local retention requirements will be satisfied by conveying project runoff into proposed on-site retention facilities.

V.2 SOURCE CONTROL BMPS

This section identifies and describes the Source Control BMPs applicable and implemented on this project.

Table 7. Source Control BMPs

BMP Name	Check One		If not applicable, state brief reason
	Included	Not Applicable	
Non-Structural Source Control BMPs			
Education for Property Owners, Operators, Tenants, Occupants, or Employees	☒	☐	
Activity Restrictions	☒	☐	
Irrigation System and Landscape Maintenance	☒	☐	
Common Area Litter Control	☒	☐	
Street Sweeping Private Streets and Parking Lots	☒	☐	
Drainage Facility Inspection and Maintenance	☒	☐	
Structural Source Control BMPs			
Storm Drain Inlet Stenciling and Signage	☒	☐	
Landscape and Irrigation System Design	☒	☐	
Protect Slopes and Channels	☒	☐	
Provide Community Car Wash Racks	☐	☒	Not part of the proposed project.
Properly Design*:			
Fueling Areas	☐	☒	
Air/Water Supply Area Drainage	☐	☒	
Trash Storage Areas	☒	☐	
Loading Docks	☐	☒	Not part of the proposed project.
Maintenance Bays	☐	☒	Not part of the proposed project.
Vehicle and Equipment Wash Areas	☐	☒	Not part of the proposed project.
Outdoor Material Storage Areas	☐	☒	Not part of the proposed project.
Outdoor Work Areas or Processing Areas	☐	☒	Not part of the proposed project.
Provide Wash Water Controls for Food Preparation Areas	☐	☒	Pursuant to Section E.4.b.v of the Whitewater River Region MS4, discharges from food-related wastes into the storm drain system or MS4 are prohibited.

*Details demonstrating proper design must be included in Appendix F.

Non-Structural Source Control BMPs

Education Program: (Property management/operator)

Employees, maintenance staff, and residents should be informed on topics related to stormwater pollution and prevention through various means, which can include the distribution of printed materials or public posting of rules or activity restrictions. A series of guidelines should be formulated and promoted to communicate beneficial habits and restricting activities which could impact the storm drain system. Appendix D includes samples of the educational materials that can be used in implementing this project-specific WQMP.

Activity Restrictions: (Property management/operator)

The following activities should be prevented or prohibited on-site: littering; discharge and waste dumping into parking storm drain inlets; blowing, sweeping or hosing of debris into streets or parking lots; nuisance water flows from irrigation.

Irrigation System and Landscape Maintenance: (Property management/operator)

Operation and Maintenance responsibilities and scheduling should be adhered to throughout the life of the project. The irrigation and landscape maintenance will help increase the effectiveness of these systems and minimize the amount of runoff that enters the storm drain system. Erosion and the conveyance of pesticides/fertilizers in runoff should also be prevented through proper routine maintenance. Routine irrigation system and landscape maintenance will also serve as a vector control measure due to the minimization of nuisance water runoff and stagnation.

Common Area Litter Control: (Property management/operator)

Common area litter control should be implemented to reduce pollution in runoff. Routine or scheduled monitoring should be performed in the common areas, landscaped areas, parking lots, in and around the trash enclosures, and along the perimeter walls of the project. Any observed accumulated trash, vegetation debris or improper disposal should be addressed promptly by the designated staff. Common area litter control measures can be coordinated and improved by the landscaping maintenance that will take place at the site. The raking or sweeping of trash shall only be performed in manner that avoids trash from entering the storm drain system. All landscape-related debris or maintenance deficiencies are to be corrected promptly.

Paved Area Sweeping and Cleaning: (Property management/operator)

Paved area sweeping and cleaning should be performed on-site on a routine basis to prevent trash, sediment, and other debris from being conveyed into the on-site storm drain system. Paved area sweeping should be performed during dry weather and the frequency should be flexible to accommodate climate conditions and areas of concern. Street sweeping equipment must be operated only by trained personnel based on the manufacturer's specifications. Street sweeping equipment should be properly maintained off-site by the operator. All collected debris must be taken to an approved permanent disposal site.

Structural Source Control BMPs

The project will incorporate measures to discourage illegal dumping in the proposed private storm drain system.

- **MS4 Stenciling: (Property management/operator)**

  At each storm drain inlet, a stencil or fixed sign (including medallions) should contain a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. The legibility of markers and signs should be maintained throughout the life of the project.

- **Rules and Regulations: (Property management/operator)**

  The management should establish and implement rules that prohibit improper non-stormwater discharge into the storm drain system. This measure may also be considered non-structural and form part of the activity restrictions associated with the site's standard operating procedures.

- **Signage at the Trash Enclosures: (Property management/operator)**

  Language prohibiting illegal dumping into the storm drain system should be integrated in the signage posted on the side of trash enclosures with the intent to discourage trash and waste misplacement that could ultimately impact the on-site storm drain system.

Landscape and Irrigation System Design: (Property management/operator)

The site's structural source control BMP involves an efficient landscape irrigation design. The system will include native or drought-tolerant plants and mechanisms to minimize excess irrigation and nuisance water into the stormwater conveyance system while working to reduce soil amendments and irrigation frequency. The system should also minimize the conveyance of landscape related chemicals, including pesticides.

Trash Containers: (Property management/operator)

Trash containers shall be leak proof and have attached covers or lids. Connection of trash to the MS4 shall be prohibited.

Storm Drain System Facilities: (Property management/operator)

Storm drain inlets and storm drainage facilities on-site should be inspected, cleaned, and maintained routinely. Maintenance staff should take prompt action to correct or repair malfunctioning facilities.

Safer Alternative Products (CASQA SC-35): (Property management/operator)

The use of less harmful products as alternatives to chemical fertilizers, pesticides, cleaning solutions, janitorial chemicals, and consumables will be pursued under the guidance of SC-35 primarily aimed at the commercial portions of the project. The objective of this Source Control BMP will be to integrate the measures as much as possible with the future programs at this facility.

Building and Grounds Maintenance (CASQA SC-41): (Property management/operator)

A series of maintenance practices can be implemented to prevent or reduce the discharge of potential pollutants into the storm drain system resulting from building and grounds maintenance activities. The BMP implementation will be achieved with the following guidelines under SC-41:

washing and cleaning up with as little water as possible; following good landscape management practices; preventing and cleaning up spills immediately; keeping debris from entering the storm drains; and properly maintaining the stormwater collection system.

Protection of Slopes and Channels: (Property management/operator)

Landscaping improvements will help stabilize the proposed landscaped areas and prevent erosion. These areas will be subject to routine maintenance to address potential instances of soil erosion. Basin slopes should be visually inspected on a quarterly basis and after major rainfall events. Physical obstructions caused by vegetation debris or littering should be cleared to ensure that the slopes continue to function as designed. Any material collected (e.g. landscape debris or trash) should be properly handled and disposed of.

Note about Wash Water Controls for Food Preparation Areas: Pursuant to Section E.4.b.v of the Whitewater River Region MS4, illicit discharges to the MS4 of food-related wastes (e.g. grease, fish processing, and restaurant kitchen mat and trash bin water, etc.) are prohibited. Food preparation areas (per State Health & Safety Code 27520) shall have either contained areas or sinks, each with connections to the sanitary sewer for disposal of wash waters containing kitchen and food wastes. The entry of wash water controls into urban runoff or the proposed storm drain system is prohibited.

V.3 EQUIVALENT TREATMENT CONTROL BMP ALTERNATIVES

Not applicable.

V.4 REGIONALLY-BASED BMPS

Not Applicable

VI. Operation and Maintenance Responsibility for BMPs

The Final WQMP shall include the applicable copies of the mechanisms used to ensure the ongoing operation, maintenance, funding, transfer and implementation of the project-specific WQMP requirements.

TABLE 8 -OPERATIONS AND MAINTENANCE

BMP Requiring Maintenance	Party Responsibility	Recommended Inspection and Maintenance Frequency	Recommended Self-Inspection and Record Keeping	Implementation Period	Recommended O & M Activities and Process
Landscaped Areas	Property Owner, Operator, Hired Management, Home Owner's Association	At least twice monthly or according to a maintenance schedule.	Quarterly summaries of inspection and maintenance activities should be appended to the WQMP.	Post-Construction	(See the following page)
Irrigation System	Property Owner, Operator, Hired Management, Home Owner's Association	At least twice monthly or according to a maintenance schedule.			
Trash Enclosures and Common Area Litter Control	Property Owner, Operator, Hired Management, Home Owner's Association	Based on trash pick-up intervals and according to a maintenance schedule.			
Paved Area Sweeping	Property Owner, Operator, Hired Management, Home Owner's Association	Twice monthly or according to a maintenance schedule			
Storm Drain System	Property Owner, Operator, Hired Management, Home Owner's Association	Quarterly and after storm events or according to a maintenance schedule			
Retention Basins	Property Owner, Operator, Hired Management, Home Owner's Association	Quarterly and after storm events or according to an established maintenance schedule			
*Note: "Storm events" refer to precipitation events producing 0.5 inches of rain or greater within a 48-hour period. The occurrence of these events may be confirmed against the local rain event summaries published in the National Weather Service or National Oceanic and Atmospheric Administration web site (www.noaa.gov). The recommended inspection, maintenance, and recordkeeping practices in this WQMP may be addressed by a formal schedule, operations manual, and other standard operating procedures which may be developed for this site.					

Note: The maintenance recommendations, including responsible parties, inspection intervals, and maintenance intervals, and activities are not intended to be exhaustive in nature and should not serve as the sole source of on-site operating procedures. As the Final WQMP documentation is produced for City review and approval, additional maintenance procedures may be necessary to implement. Where applicable, refer to the equipment manufacturer's recommendations.

Description of Maintenance Requirements:

Landscaped Areas: All trimming, pruning, and removal of fallen organic material from plants, shrubs, and trees should be collected per an approved or adopted landscape maintenance plan, stored in an appropriate location and transported to an approved green-waste collection facility. Any equipment or material temporarily staged during maintenance activities should be placed away from drainage courses and storm drain inlets. Contracted maintenance staff should haul collected material promptly following the maintenance activities to avoid prolonged on-site storage. The planting materials are to remain as indicated on the approved set of landscape planting plans. In conjunction with the routine activities, maintenance staff should verify that the landscape design continues to function properly by adjusting to eliminate overspray to hardscape areas and to verify that irrigation timing and cycle lengths are adjusted in accordance with water demands, given the time of year, weather and day or nighttime temperatures.

Irrigation Systems: Water conservation is to be maintained at all times per the approved irrigation plans. Monitoring of the irrigation system should be provided as necessary to ensure that appropriate watering levels are maintained and to verify that no piping or irrigation heads are leaking. Any debris, sediment, mineral and grit deposits should be removed from the irrigation system at regular intervals to provide consistent watering levels.

The irrigation and landscape maintenance will help increase the effectiveness of these systems and minimize the amount of runoff that enters the storm drain system. Erosion and the conveyance of pesticides/fertilizers in runoff will also be prevented through routine maintenance. Routine irrigation system and landscape maintenance will also serve as a vector control measure due to the minimization of nuisance water runoff and stagnation.

Trash Management and Common Area Litter Control: Common area litter control should be implemented to reduce pollution in runoff. Routine or scheduled monitoring should be performed in the common areas, landscaped areas, parking lots, in and around the trash enclosures, and along the perimeter walls of the project. Any observed accumulated trash, vegetation debris or improper disposal should be addressed promptly by the designated staff. Common area litter control measures can be coordinated and improved by the landscaping maintenance that will take place at the site. All landscape-related debris or maintenance deficiencies are to be corrected immediately. No trash should be allowed to be stored at the base of the containers. Pick-up intervals are to be determined so that the containers are not overfilled. Only approved materials and chemicals should be allowed in the dumpsters.

Storm Drain System: Storm water conveyance systems, including inlets, outlets, cleanouts, manholes and pipelines within the project are to be inspected quarterly and after each major storm event or according to a maintenance schedule. All parts of the system are to be periodically cleaned to ensure that the system works properly during any storm event. Any waste collected from the cleaning activities is to be stored and properly disposed of.

Paved Area Sweeping and Cleaning

Paved area sweeping and cleaning should be performed on-site, specifically in the parking areas, to prevent sediment, litter and other debris from being washed by runoff into the on-site storm drain system. Paved area sweeping should be performed during dry weather if possible and the frequency should be flexible to accommodate climate conditions and areas of concern. Street sweeping equipment must be operated only by trained personnel based on the manufacturer's specifications. Street sweeping equipment should be properly maintained off-site by the operator.

Sweeping equipment should not be maintained or washed off on-site. All collected debris must be taken to an approved permanent disposal site.

Retention Basins: Retention basins should be visually inspected on a quarterly basis or according to a landscaping maintenance schedule. Physical obstructions caused by vegetation debris or littering should be promptly cleared to ensure that the basins continue to function as designed. Any material collected (e.g. landscape debris or trash) should be properly handled and disposed of. Basin outlets must be inspected for signs of erosion or obstruction. The condition and effectiveness of the basin infiltration will depend in part on the maintenance procedures, such as those outlined below.

Before annual storm seasons and following rainfall events producing precipitation of 0.5 inches or more:

- Maintain landscaping and irrigation system as needed.
- Remove debris and litter from the entire basin to minimize clogging and improve aesthetics.
- Inspect for obvious problems and repair as needed. Address odor, insects, and overgrowth issues associated with stagnant or standing water in the basin bottom. No standing water should be present longer than 72 hours.
- Check for erosion and sediment laden areas in the basin. Repair as needed.
- Re-stabilize the basin slopes as needed.

Perform the following inspection procedures within 72 hours after a rainfall event producing precipitation of 0.5 inches or greater:

- Examine the tributary inlet for blockage, the embankment and spillway integrity, as well as damage to any structural element.
- Check for erosion, slumping and overgrowth. Repair as needed.
- Check basin depth for sediment build up and reduced total capacity. Scrape bottom as needed and remove sediment. Restore to original cross-section and infiltration rate. Replant basin vegetation.
- No water should be present 72 hours after a rainfall event. No long-term standing water should be present at all. No algae formation should be visible.

Record Keeping: A copy of this project-specific WQMP shall be maintained on-site or remotely by the project owner or operator (Property Manager). Records of maintenance shall be appended to this WQMP based on the information provided by the contracted management.

VII. Funding

The funding source for operation and maintenance of each BMP identified in the Project Specific Preliminary Water Quality Management Plan shall be the responsibility of CM Wave Development, L.L.C. The owner recognizes that a source of funding is required to support the on-going operation and maintenance of BMPs, and that funding will continue for the life of the project.

By certifying the final project specific WQMP, the Project applicant is certifying that the funding responsibilities have been addressed and will be transferred to future owners. One example of how to adhere to the requirement to transfer operation and maintenance responsibilities is to record the project specific WQMP against the title to the property.

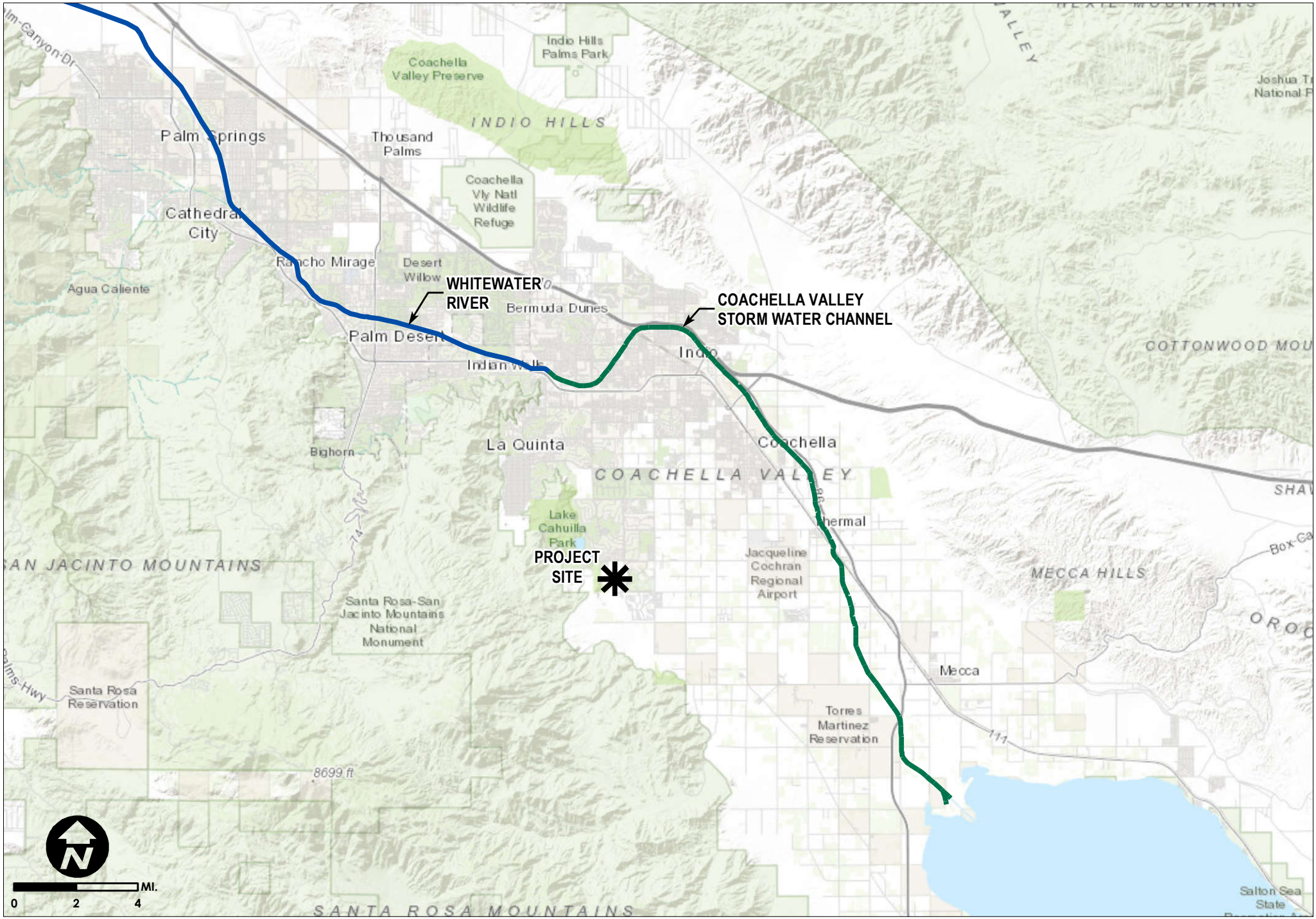
Appendix A

CONDITIONS OF APPROVAL

(TO BE PROVIDED)

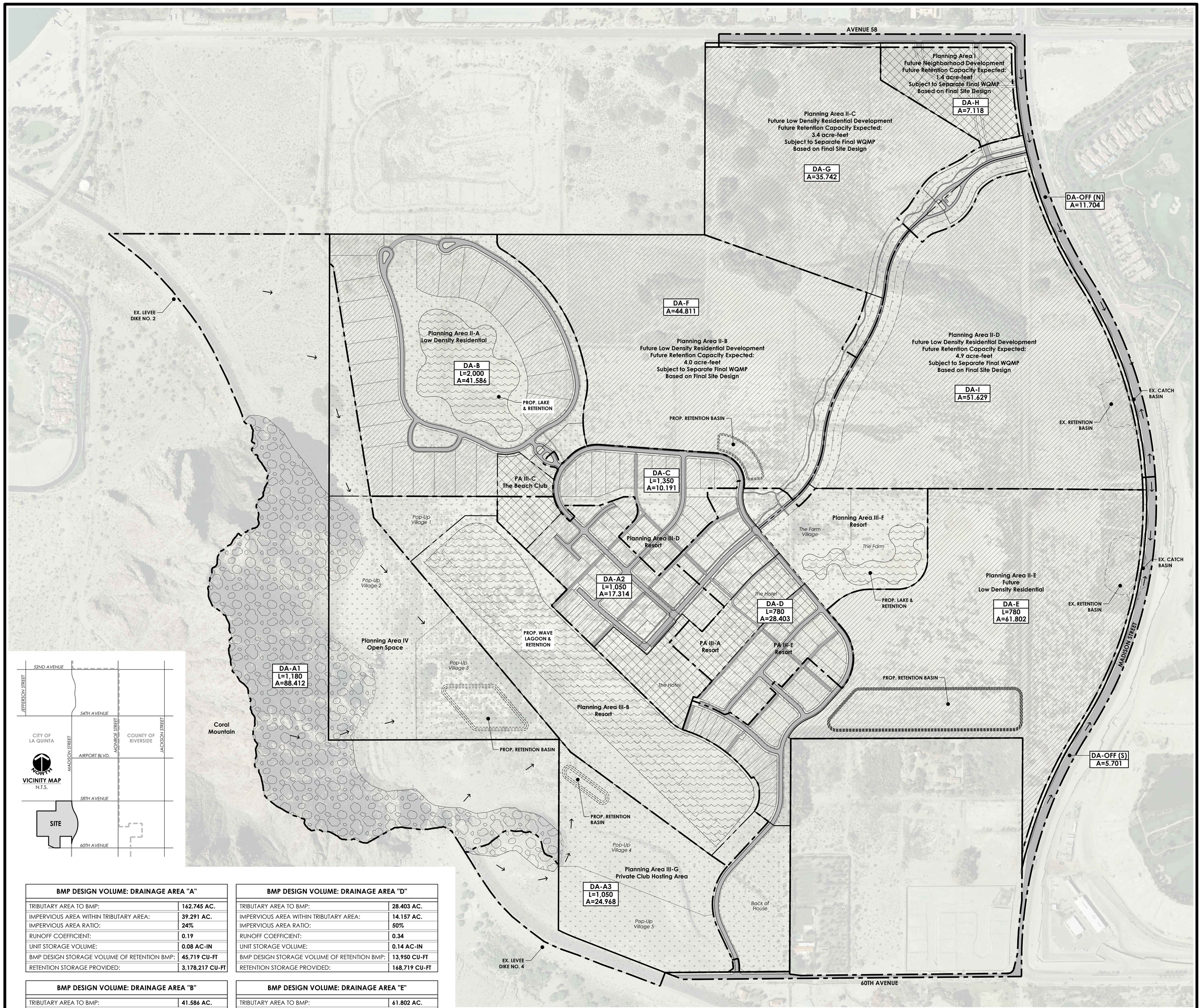
Appendix B

VICINITY MAP, WQMP SITE PLAN, AND RECEIVING WATERS MAP



MSA CONSULTING, INC.
> PLANNING > CIVIL ENGINEERING > LAND SURVEYING

MAP OF RECEIVING WATERS



BMP DESIGN VOLUME: DRAINAGE AREA "A"	
TRIBUTARY AREA TO BMP:	162.745 AC.
IMPERVIOUS AREA WITHIN TRIBUTARY AREA:	39.291 AC.
IMPERVIOUS AREA RATIO:	24%
RUNOFF COEFFICIENT:	0.19
UNIT STORAGE VOLUME:	0.08 AC-IN
BMP DESIGN STORAGE VOLUME OF RETENTION BMP:	45,719 CU-FT
RETENTION STORAGE PROVIDED:	3,178,217 CU-FT

BMP DESIGN VOLUME: DRAINAGE AREA "D"	
TRIBUTARY AREA TO BMP:	28.403 AC.
IMPERVIOUS AREA WITHIN TRIBUTARY AREA:	14.157 AC.
IMPERVIOUS AREA RATIO:	50%
RUNOFF COEFFICIENT:	0.34
UNIT STORAGE VOLUME:	0.14 AC-IN
BMP DESIGN STORAGE VOLUME OF RETENTION BMP:	13,950 CU-FT
RETENTION STORAGE PROVIDED:	168,719 CU-FT

BMP DESIGN VOLUME: DRAINAGE AREA "B"	
TRIBUTARY AREA TO BMP:	41.586 AC.
IMPERVIOUS AREA WITHIN TRIBUTARY AREA:	17.518 AC.
IMPERVIOUS AREA RATIO:	42%
RUNOFF COEFFICIENT:	0.29
UNIT STORAGE VOLUME:	0.12 AC-IN
BMP DESIGN STORAGE VOLUME OF RETENTION BMP:	17,618 CU-FT
RETENTION STORAGE PROVIDED:	292,016 CU-FT

BMP DESIGN VOLUME: DRAINAGE AREA "E"	
TRIBUTARY AREA TO BMP:	61.802 AC.
IMPERVIOUS AREA WITHIN TRIBUTARY AREA:	19.059 AC.
IMPERVIOUS AREA RATIO:	31%
RUNOFF COEFFICIENT:	0.23
UNIT STORAGE VOLUME:	0.09 AC-IN
BMP DESIGN STORAGE VOLUME OF RETENTION BMP:	20,610 CU-FT
RETENTION STORAGE PROVIDED:	1,216,389 CU-FT

BMP DESIGN VOLUME: DRAINAGE AREA "C"	
TRIBUTARY AREA TO BMP:	10.191 AC.
IMPERVIOUS AREA WITHIN TRIBUTARY AREA:	4.420 AC.
IMPERVIOUS AREA RATIO:	43%
RUNOFF COEFFICIENT:	0.30
UNIT STORAGE VOLUME:	0.12 AC-IN
BMP DESIGN STORAGE VOLUME OF RETENTION BMP:	4,424 CU-FT
RETENTION STORAGE PROVIDED:	57,966 CU-FT

PRELIMINARY WQMP SUMMARY

DRAINAGE AREA	TOTAL AREA (acres)	IMPERVIOUS AREA (acres)	DESIGN VOLUME (cu-ft)	DESIGN FLOW (cfs)	STORAGE PROVIDED (cu-ft)
DA-A	162.745	39.291	45,719	6.30	3,178,217
DA-B	41.586	17.518	17,618	2.43	292,016
DA-C	10.191	4.420	4,424	0.61	57,966
DA-D	28.403	14.157	13,950	1.92	168,719
DA-E	61.802	19.059	20,610	2.84	1,216,389

HYDROLOGIC AREA RECONCILIATION

ROCK OUT-OUTCROPPING	35.652 AC.
EXISTING OPEN BRUSH - POOR	35.233 AC.
IMPERVIOUS (STREETS/WALKS)	11.552 AC.
IMPERVIOUS (WATER FEATURE)	27.445 AC.
SFR - LOW DENSITY	193.047 AC.
SFR - MEDIUM DENSITY	4.092 AC.
SFR - HIGH DENSITY	22.208 AC.
OPEN SPACE (LANDSCAPE)	95.642 AC.
TOTAL ON-SITE HYDROLOGIC AREA	444.027 AC.
OFF-SITE	
IMPERVIOUS (STREETS/WALKS)	9.768 AC.
OPEN SPACE (LANDSCAPE)	5.701 AC.
TOTAL OFF-SITE HYDROLOGIC AREA	17.405 AC.
TOTAL HYDROLOGIC AREA	461.432 AC.
SURVEY BOUNDARY	384.389 AC.
AREA ADD:	77.080 AC. OFF-SITE TRIBUTARY
AREA SUBTRACT:	0.037 AC.
TOTAL AREA - RECONCILED	461.432 AC.

LEGEND

- PROJECT BOUNDARY
- PROPOSED DRAINAGE AREA BOUNDARIES
- PROPOSED STORM DRAIN LINES
- PROPOSED STORM DRAIN INLETS (WITH MS4 STENCILING OR SIGNAGE)
- PROPOSED DRAINAGE DIRECTION
- DA / L = / A = : DRAINAGE SUB-AREA ID, FLOW TRAVEL LENGTH (FT), AREA (AC)

AC. ACREAGE
DA DRAINAGE AREA
ELEV. ELEVATION
EX. EXISTING
PROP. PROPOSED
RET. RETENTION

- ROCK OUTCROPPING
- EXISTING OPEN BRUSH - POOR
- IMPERVIOUS (PAVING/HARDSCAPE)
- IMPERVIOUS (WATER FEATURE)
- COMMERCIAL
- SINGLE FAMILY RESIDENTIAL
- PERVIOUS AREA (LANDSCAPE & RETENTION BASINS)

NORTH
0' 200' 400' 600' 800'
SCALE 1"=200'

PROJECT NAME:	THE WAVE
MAP NUMBER:	TRACT MAP NO. 37815
PLAN:	PRELIMINARY WATER QUALITY MANAGEMENT PLAN
EXHIBIT DATE:	JUNE 2020

MSA CONSULTING, INC.
> PLANNING > CIVIL ENGINEERING > LAND SURVEYING
34200 Bob Hope Drive, Rancho Mirage, CA 92270
760.320.9811 msaconsultinginc.com

DESIGN BY JHC
DRAWN BY DG
CHECK BY JHC

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Appendix C

SUPPORTING DETAIL RELATED TO HYDROLOGIC CONDITIONS OF CONCERN

(NOT APPLICABLE – SEE APPENDIX F FOR HYDROLOGY REPORT SUMMARY)

Appendix D

EDUCATIONAL MATERIALS

CHECKLIST FOR MINIMIZING VECTOR PRODUCTION IN STORMWATER MANAGEMENT STRUCTURES

OUTDOOR CLEANING ACTIVITIES AND PROFESSIONAL MOBILE SERVICE PROVIDERS

CALIFORNIA STORMWATER BMP HANDBOOK - MUNICIPAL

SC-35: Safer Alternative Products

SC-41: Building and Grounds Maintenance

SC-43: Parking/Storage Area Maintenance

SC-70: Road and Street Maintenance

SC-71: Plaza and Sidewalk Cleaning

SC-73: Landscape Maintenance

SC-74: Drainage System Maintenance

SD-12: Efficient Irrigation

SD-13: Storm Drain Signage

TC-11: Infiltration Basin

Helpful telephone numbers and links:

WATER AGENCY LIST in Riverside County

City of Banning	(951) 922-3130
City of Beaumont	(951) 769-8520
City of Blythe	(760) 922-6161
City of Coachella	(760) 398-3502
Coachella Valley Water District	(760) 398-2651
City of Corona	(951) 736-2259
Desert Center, CSA #51	(760) 227-3203
Eastern Municipal Water District	(951) 928-3777
Elsinore Valley MWD	(951) 674-3146
Farm Mutual Water Company	(951) 244-4198
City of Hemet	(951) 765-3712
Idyllwild Water District	(951) 659-2143
Jurupa Community Services District	(951) 360-8795
Lake Hemet MWD	(951) 658-3241
Lee Lake Water District	(951) 277-1414
March Air Force Base	(951) 656-7000
Mission Springs Water District	(760) 329-6448
City of Palm Springs	(760) 323-8253
Rancho Caballero	(951) 780-9272
Rancho California Water District	(951) 296-6900
Ripley, CSA #62	(760) 922-4951
City of Riverside	(951) 351-6170
Rubidoux Services District	(951) 684-7580
Silent Valley Club, Inc	(951) 849-4501
Valley Sanitary District	(760) 347-2356
Western Municipal Water District	(951) 789-5000
Yucaipa Valley Water District	(909) 797-5117

REPORT ILLEGAL STORM DRAIN DISPOSAL
1-800-506-2555 or online at
www.rcflood.org

Online resources include:

- Riverside County Flood Control and Water Conservation District **www.rcflood.org**
- California Storm Water Quality Association **www.casqa.org**
- State Water Resources Control Board **www.swrcb.ca.gov/**
- Power Washers of North America **www.thepwna.org**

StormWater Pollution

What you should know for...

OUTDOOR CLEANING ACTIVITIES AND PROFESSIONAL MOBILE SERVICE PROVIDERS

Storm drain pollution prevention information for:

- Car Washing / Mobile Detailers
- Window and Carpet Cleaners
- Power Washers
- Waterproofers / Street Sweepers
- Equipment cleaners or degreasers and all mobile service providers

Do you know where street flows actually go?

Storm Drains are NOT connected to sanitary sewer systems and treatment plants!

The primary purpose of storm drains is to carry rain water away from developed areas to prevent flooding. Pollutants discharged to storm drains are transported directly into rivers, lakes and streams. Soaps, degreasers, automotive fluids, litter and a host of materials are washed off buildings, sidewalks, plazas and parking areas. Vehicles and equipment must be properly managed to prevent the pollution of local waterways.

Unintentional spills by mobile service operators can flow into storm drains and pollute our waterways. **Avoid mishaps.** *Always* have a **Spill Response Kit** on hand to clean up unintentional spills. Only emergency **Mechanical** repairs should be done in City streets and use drip pans for spills. **Plumbing** should be done on private property. Always store chemicals in a leak-proof container and keep covered when not in use. **Window/Power Washing** waste water shouldn't be released into the streets, but should be disposed of in a sanitary sewer, landscaped area or in the soil. Soiled **Carpet Cleaning** wash water should be filtered before being discharged into the sanitary sewer. Dispose of all filter debris properly. **Car Washing/Detailing** operators should wash cars on private property and use a regulated hose nozzle for water flow control and runoff prevention. Capture and dispose of waste water and chemicals properly. Always prevent runoff water from entering storm drains.

REPORT ILLEGAL STORM DRAIN DISPOSAL
1-800-506-2555

Help Protect Our Waterways!

Use These Guidelines For Outdoor Cleaning Activities and Wash Water Disposal

Did you know that disposing of pollutants into the street, gutter, storm drain or nearest body of water is ***PROHIBITED*** by law and can bring about stiff penalties.

Best Management Practices

Waste wash water from Mechanics, Plumbers, Window/Power Washers, Carpet Cleaners, Car Washing and Mobile Detailing activities may contain significant quantities of motor oil, grease, chemicals, dirt, detergents, brake pad dust, litter and other materials.

Best Management Practices, or BMPs as they are known, are guides to prevent pollutants from entering the storm drains. *Each of us* can do our part to keep storm water clean by using the suggested BMPs below:

Simple solutions for both light and heavy duty jobs:

Do...consider dry cleaning methods first such as a mop, broom, rag or wire brush. Always keep a spill response kit on site.

Do...prepare the work area before power cleaning by using sand bags, rubber mats, vacuum booms, containment pads or temporary berms to keep wash water away from the gutters and storm drains.

Do...use vacuums or other machines to remove and collect loose debris or litter before applying water.

Do...obtain the property owner's permission to dispose *small amounts* of power washing waste water to landscaped, gravel or unpaved surfaces.

Do...check with your local sanitary sewer agency's policies on wash water disposal regulations. (See list on reverse side).

Do...be aware that if discharging to landscape areas, soapy wash water may damage landscaping. Residual wash water may remain on paved surfaces to evaporate. Sweep up solid residuals and dispose of properly. Vacuum booms are another option for capturing and collecting wash water.

Do not let...wash or waste water from sidewalk, plaza or building cleaning go into a street or storm drain.

Report illegal storm drain disposal, Call Toll Free
1-800-506-2555

Using Cleaning Agents

Try using biodegradable/phosphate-free products. They are easier on the environment, but don't confuse them for being toxic free. Soapy water entering the storm drain system can impact the delicate aquatic environment.

When cleaning surfaces with a *high-pressure washer* or *steam cleaner*, additional precautions should be taken to prevent the discharge of pollutants into the storm drain system. These two methods of surface cleaning can loosen additional material that can contaminate local waterways.

Think Water Conservation

Minimize water use by using high pressure, low volume nozzles. Be sure to check all hoses for leaks.

Screening Wash Water

A thorough dry cleanup before washing exterior surfaces, such as buildings and decks *without loose paint*, sidewalks, or plaza areas should be sufficient to protect receiving waters. Keep debris from entering the storm drain after cleaning by first passing the wash water first through a "20 mesh" or finer screen to catch the solid materials, then disposing the mesh in a refuse container.

Drain Inlet Protection & Collection of Wash Water

- Prior to any washing, block all storm drains with an impervious barrier such as sandbags or berms, or seal the storm drain with plugs or rubber mats.
- Create a containment area with berms and traps or take advantage of a low spot to keep wash water contained.
- Wash vehicles and equipment on grassy or gravel areas so that the wash water can seep into the ground.
- Pump or vacuum up all wash water in the contained area.

Equipment and Supplies

For special materials, equipment and supplies:

- New Pig — (800) 468-4647
- Lab Safety Supply — (800) 356-0783
- C&H — (800) 558-90966
- W.W. Grainger — (800) 994-9174
- Cleaning Equipment Trade Association — (800) 441-0111

Adopt a pet from your local animal shelter or adoption centers at pet stores. A variety of animals, from purebred to mixed breed are waiting for loving arms and good homes. Consider volunteering at your local animal shelters. Volunteers, donations, food, newspapers, old towels and linens are needed to help the animals.

RIVERSIDE COUNTY ANIMAL SHELTER LOCATIONS:

BLYTHE
16450 West Hobson Way
Blythe, CA 92225
760-921-7857

HEMET
800 South Sanderson
Hemet, CA 92545
909 925-8025

INDIO
45-355 Van Buren
Indio, CA 92201
760-347-2319

RIVERSIDE
5950 Wilderness Avenue
Riverside, CA 92504
909-358-7387

FOR ALL OTHER AREAS
CALL 1-888-636-7387

Riverside County gratefully acknowledges the City of Los Angeles Stormwater Program for the design concept of this brochure.

What's the Scoop?

TIPS FOR A HEALTHY PET AND A HEALTHIER ENVIRONMENT

CREATE A HEALTHY ENVIRONMENT in and around your home by following these simple pet practices. Your pet, family and neighbors will appreciate their clean comfortable surroundings.

HOUSEHOLD PETS

We all love our pets, but pet waste is a subject everyone likes to avoid. Pet waste left on trails, sidewalks, streets, and grassy areas is immediately flushed into the nearest waterway when it rains. Even if you can't see water near you, the rain or waste water WASHES all that PET WASTE and BACTERIA INTO THE STORMDRAIN, where it travels to your neighborhood creek or lake untreated. These animal droppings also contain nutrients that can promote the growth of algae, if they enter our streams and lakes. The risk of STORMWATER CONTAMINATION INCREASES, if pet wastes is allowed to accumulate in animal pen areas or left on sidewalks, streets, or driveways where runoff can carry them to storm sewers.

Some of the DISEASES THAT CAN SPREAD from pet waste are:
Campylobacteriosis — a bacterial infection that causes diarrhea in humans.
Salmonellosis — the most common bacterial infection transmitted to humans from animals.
Toxocarisis — roundworms transmitted from animals to humans.

Flies and other pest insects can also increase when pet waste is disposed of improperly, becoming a nuisance and adding yet another vector for disease transmission.

WHAT CAN YOU DO?

- SCOOP up pet waste and flush it down the toilet.
- NEVER DUMP pet waste into a storm drain or catch basin.
- USE the complimentary BAGS or mutt mitts offered in dispensers at local parks.
- CARRY EXTRA BAGS when walking your dog and make them available to other pet owners who are without.
- TEACH CHILDREN how to properly clean up after a pet.
- TELL FRIENDS AND NEIGHBORS about the ill effects of animal waste on the environment. Encourage them to clean up after pets.

Did You Know ...
that Californians illegally dump about 80 million gallons of motor oil each year?

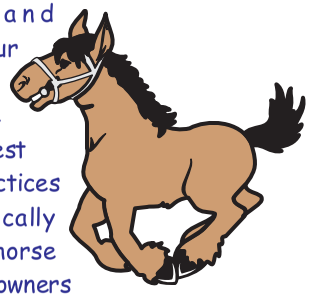
Many communities have "Scoop the Poop" laws that govern pet waste cleanup. Some of these laws specifically require anyone who walks an animal off of their property to carry a bag, shovel, or scooper. Any waste left by the animal must be cleaned up immediately. CALL YOUR LOCAL CODE ENFORCEMENT OFFICER to find out more about pet waste regulations.

Pets are only one of the many fixtures of suburban America that add to water pollution. Lawn fertilizers, rinse water from driveways and motor oil commonly end up in streams and lakes. **CALL 1-800-506-2555 FOR HOUSEHOLD HAZARDOUS WASTE COLLECTION LOCATION AND DATES.** Maintain your automobile to avoid leaks. Dispose of used vehicle fluids properly. Your pets can be poisoned if they ingest gas, oil or antifreeze that drips onto the pavement or is stored in open containers.

NEVER HOSE VEHICLE FLUIDS into the street or gutter. USE ABSORBENT MATERIALS such as cat litter to clean-up spills. SWEEP UP used absorbent materials and place in the trash.

HORSES AND LIVESTOCK

Fortunate enough to own a horse or livestock? You, too, can play a part in protecting and cleaning up our water resources. The following are a few simple Best Management Practices (BMPs) specifically designed for horse owners and landowners with horses.



- STORE your manure properly. Do not store unprotected piles of manure in places where runoff may enter streams, or flood waters may wash the manure away. Place a cover or tarp over the pile to keep rainwater out.
- CHECK with your local conservation district to design manure storage facilities to protect water quality. These structures usually consist of a concrete pad to protect ground water and a short wall on one or two sides to make manure handling easier.
- TRY composting – A vegetative cover placed around buildings or on steeper slopes can help minimize erosion and absorb nutrients while improving the appearance of your property. In addition, avoid costlier erosion controls, vegetative covers will provide animals with better traction during wet or icy conditions.

- KEEP animals out of steams – Designed stream crossings provide a safe, easy way for horses and livestock to ford streams. Fencing encourages the use of the crossing instead of the streambed to navigate streams. This will allow vegetation to stabilize stream banks and reduce sediment pollution.
- MOW pastures to proper height, six inches is typically recommended.
- Material STORAGE SAFETY TIPS – Many of the chemicals found in barns require careful handling and proper disposal. When using these chemicals, be certain to follow these common sense guidelines:
  - Buy only what you need.
  - Treat spills of hoof oils like fuel spill. Use kitty litter to soak up the oil and dispose in a tightly sealed plastic bag.
  - Store pesticides in a locked, dry, well-ventilated area.
  - Protect stored fertilizer and pesticides from rain and surface water.

Call 1-800-506-2555 to locate your local conservation district to find out what to do with your current backyard manure pile, how to re-establish a healthy pasture, what to do about weeds, and what grasses grow best in your soils.

Thank you for doing your part to protect your watershed, the environment, and the equestrian way of life in your community!

Helpful telephone numbers and links:

RIVERSIDE COUNTY WATER AGENCIES:

City of Banning	(951) 922-3130
City of Beaumont	(951) 769-8520
City of Blythe	(760) 922-6161
City of Coachella	(760) 398-3502
Coachella Valley Water District	(760) 398-2651
City of Corona	(951) 736-2259
Desert Center, CSA #51	(760) 227-3203
Eastern Municipal Water District	(951) 928-3777
Elsinore Valley MWD	(951) 674-3146
Farm Mutual Water Company	(951) 244-4196
City of Hemet	(951) 765-3712
Idyllwild Water District	(951) 659-2143
Jurupa Community Services District	(951) 360-8795
Lake Hemet MWD	(951) 658-3241
Lee Lake Water District	(951) 277-1414
March Air Force Base	(951) 656-7000
Mission Springs Water District	(760) 329-6448
City of Palm Springs	(760) 323-8253
Rancho Caballero	(951) 780-9272
Rancho California Water District	(951) 296-6900
Ripley, CSA #62	(760) 922-4951
City of Riverside	(951) 351-6170
Ruhidoux Community Services District	(951) 684-7580
Silent Valley Club, Inc	(951) 849-4501
Valley Sanitary District	(760) 347-2356
Western Municipal Water District	(951) 789-5000
Yucaipa Valley Water District	(909) 797-5117

CALL 1-800-506-2555 to:

- Report clogged storm drains or illegal storm drain disposal from residential, industrial, construction and commercial sites into public streets, storm drains and/or water bodies.
- Find out about our various storm drain pollution prevention materials.
- Locate the dates and times of Household Hazardous Waste (HHW) Collection Event.
- Request adult, neighborhood, or classroom presentations.
- Locate other County environmental services.
- Receive grasscycling information and composting workshop information.

Or visit our (Riverside County Flood Control District website at:
www.floodcontrol.co.riverside.ca.us

Other links to additional storm drain pollution information:

- County of Riverside Environmental Health:
  www.rivcoeh.org
- California State Water Resource Conservation Board:
  www.swrcb.ca.gov/stormwtr/links.html
- California Water Quality Task Force:
  www.cabmphandbooks.com/
- United State Environmental Protection Agency (EPA):
  www.epa.gov/opptintr/p2home/programs/busprc.htm
  (compliance assistance information)

Riverside County Only Rain in the Storm Drain Pollution Protection Program gratefully acknowledges the Bay Area Stormwater Management Agencies Association and the Cleaning Equipment Trade Association for information provided in this brochure.

StormWater Pollution

What you should know for...

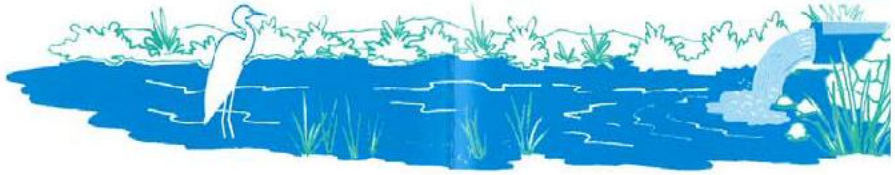
Swimming Pool, Jacuzzi and Fountain Maintenance

Do you know . . . where the water actually goes?

Storm Drains are not connected to sanitary sewer systems and treatment plants!

The primary purpose of storm drains is to carry rain water away from developed areas to prevent flooding. Untreated storm water and the pollutants it carries flow directly into rivers, lakes, and streams. Wastewater from residential swimming pools, jacuzzis, fishponds, and fountains often contain chemicals used for sanitizing or cleansing purposes. Toxic chemicals (such as chlorine or copper-based algaecides) can damage the environment when wastewater is allowed to flow into our local rivers, lakes, and streams by way of the storm drain system. Each of us can do our part to help clean our water, and that adds up to a pollution solution.

The Cities and County of Riverside have adopted ordinances for storm drain pollution management to maintain discharge control and prevent illegal storm drain discharge. In accordance with state and federal law, these local storm water ordinances prohibit the discharge of pollutants into the storm drain system or local surface waters. The Only Rain in the Storm Drain Pollution Program informs residents and businesses of storm drain pollution prevention activities such as those described in this brochure.



PLEASE NOTE: The discharge of pollutants into the street, gutters, storm drain system, or waterways – without a Regional Water Quality Control board permit or waiver – is strictly prohibited by local ordinances and state and federal law.

Do Your Part to Protect Our Waterways!

Use These Guidelines For Proper Draining of Your Swimming Pool, Jacuzzi and Fountain Water

Discharge Regulations

Requirements for pool draining may differ from city to city. Check with your water agency to see if disposal to the sanitary sewer line is allowed for pool discharges (see reverse side for Riverside County water purveyors).

If sewer discharge is allowed, a hose can be run from your swimming pool pump to the washing machine drain or a sink or bathtub. If sewer discharge is not allowed, or if your house is served by a septic tank, review the options presented below.

Discharge Options

If your local sewer agency will not accept pool water into their system, or if you are on a septic tank system, follow these guidelines:

1. Reduce or eliminate solids (e.g., debris, leaves or dirt) in the pool water.
2. Allow the chemicals in the pool water to dissipate. This could take up to seven (7) days depending on the time of year. Create a co-op; let your neighbor share your pool while theirs is being prepared for draining, then use their pool while yours is being drained. Chlorinated water should not be discharged into the storm drain or surface waters. This includes large pools such as community swimming pools or spas.
3. When the pool water is free of all chemicals (verify by a home pool water test kit) drain pool water to landscaped areas, lawns, yards, or any areas that will absorb the water.
4. You may have to drain the pool water over a period of a few days to allow the landscape areas to absorb most of the water.
5. Control the flow of the draining pool water to prevent soil erosion. Do not allow sediment to enter the street, gutter or storm drain.
6. Avoid discharging pool water into the street and storm drain system. Water runoff that enters the street can pick up motor oil, pet waste, trash and other pollutants, eventually carrying them into the storm drain system and local surface waters.

Refinishing Pool Surfaces

If you are resurfacing your pool, or resurfacing the pool patio area, be sure to hose down mixers, tools and trailers in a dirt area where rinse water won't flow into the street, gutter or storm drain. Local storm water ordinances strictly prohibit the discharge of pollutants into the storm drain system.

Residues from acid washing and similar activities require special handling. Never discharge low or high pH wastewater into the street, gutter or storm drain.

Cleaning Filters

Discharge of pool filter rinse water and backflush to a stream, ditch, or storm drain is prohibited. Backflush from pool filters must be discharged to the sanitary sewer, on-site septic tank and drainfield system (if properly designed and adequately sized), or a seepage pit. Alternatively, pool filter rinse water and backwash may be diverted to dirt or landscaped areas. Filter media and other solids should be picked up and disposed of in the trash.

Algaecides

Avoid using copper-based algaecides unless absolutely necessary. Control algae with chlorine, organic polymers or other alternatives to copper-based pool chemicals. Copper is a heavy metal that can be toxic to aquatic life.

Chemical Storage and Handling

- Use only the amount indicated on product labels.
- Store chlorine and other chemicals in a covered area to prevent runoff. Keep out of reach of children and pets.
- Chlorine kits, available at retail swimming pool equipment and supply stores, should be used to monitor the chlorine and pH levels.
- Chlorine and other pool chemicals should never be allowed to flow into the gutter or the storm drain system.

Proper Disposal of Pool Chemicals

If you need to dispose of unwanted pool chemicals, first try giving them to a neighbor with a pool. If that doesn't work, bring unwanted pool chemicals to a Household Hazardous Waste (HHW) Collection Event. There's no cost for bringing HHW items to collection events - it's FREE! Call **1-800-506-2555** for a schedule of HHW events in your community.

NEVER put unused chemicals into the trash, onto the ground or down a storm drain.

Safer Alternative Products SC-35

Description

Promote the use of less harmful products and products that contain little or no TMDL pollutants. Alternatives exist for most product classes including chemical fertilizers, pesticides, cleaning solutions, janitorial chemicals, automotive and paint products, and consumables (batteries, fluorescent lamps).

Approach

Pattern a new program after the many established programs around the state and country. Integrate this best management practice as much as possible with existing programs at your facility.

Develop a comprehensive program based on:

- The "Precautionary Principle," which is an alternative to the "Risk Assessment" model that says it's acceptable to use a potentially harmful product until physical evidence of its harmful effects are established and deemed too costly from an environmental or public health perspective. For instance, a risk assessment approach might say it's acceptable to use a pesticide until there is direct proof of an environmental impact. The Precautionary Principle approach is used to evaluate whether a given product is safe, whether it is really necessary, and whether alternative products would perform just as well.
- Environmentally Preferable Purchasing Program to minimize the purchase of products containing hazardous ingredients used in the facility's custodial services, fleet maintenance, and facility maintenance in favor of using alternate products that pose less risk to employees and to the environment.
- Integrated Pest Management (IPM) or Less-Toxic Pesticide Program, which uses a pest management approach that minimizes the use of toxic chemicals and gets rid of pests by methods that pose a lower risk to employees, the public, and the environment.
- Energy Efficiency Program including no-cost and low-cost energy conservation and efficiency actions that can reduce both energy consumption and electricity bills, along with long-term energy efficiency investments.

Consider the following mechanisms for developing and implementing a comprehensive program:

- Policies

Objectives

- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

CASQA California Stormwater Quality Association

- Procedures
  - Standard operating procedures (SOPs)
  - Purchasing guidelines and procedures
  - Bid packages (services and supplies)
- Materials
  - Preferred or approved product and supplier lists
  - Product and supplier evaluation criteria
  - Training sessions and manuals
  - Fact sheets for employees

Implement this BMP in conjunction with the Vehicle and Equipment Management fact sheets (SC20 – SC22) and SC41, Building and Grounds Maintenance.

Training

- Employees who handle potentially harmful materials in the use of safer alternatives.
- Purchasing departments should be encouraged to procure less hazardous materials and products that contain little or no harmful substances or TMDL pollutants.

Regulations

This BMP has no regulatory requirements. Existing regulations already encourage facilities to reduce the use of hazardous materials through incentives such as reduced:

- Specialized equipment storage and handling requirements,
- Storm water runoff sampling requirements,
- Training and licensing requirements, and
- Record keeping and reporting requirements.

Equipment

- There are no major equipment requirements to this BMP.

Limitations

- Alternative products may not be available, suitable, or effective in every case.

Requirements

Cost Considerations

- The primary cost is for staff time to: 1) develop new policies and procedures and 2) educate purchasing departments and employees who handle potentially harmful materials about the availability, procurement, and use of safer alternatives.

- Some alternative products may be slightly more expensive than conventional products.

Supplemental Information

Employees and contractors / service providers can both be educated about safer alternatives by using information developed by a number of organizations including the references and resources listed below.

The following discussion provides some general information on safer alternatives. More specific information on particular hazardous materials and the available alternatives may be found in the references and resources listed below.

- Automotive products – Less toxic alternatives are not available for many automotive products, especially engine fluids. But there are alternatives to grease lubricants, car polishes, degreasers, and windshield washer solution. Rerefined motor oil is also available.
- Vehicle/Trailer lubrication – Fifth wheel bearings on trucks require routine lubrication. Adhesive lubricants are available to replace typical chassis grease.
- Cleaners – Vegetables-based or citrus-based soaps are available to replace petroleum-based soaps/detergents.
- Paint products – Water-based paints, wood preservatives, stains, and finishes are available.
- Pesticides – Specific alternative products or methods exist to control most insects, fungi, and weeds.
- Chemical Fertilizers – Compost and soil amendments are natural alternatives.
- Consumables – Manufacturers have either reduced or are in the process of reducing the amount of heavy metals in consumables such as batteries and fluorescent lamps. All fluorescent lamps contain mercury, however low-mercury containing lamps are now available from most hardware and lighting stores. Fluorescent lamps are also more energy efficient than the average incandescent lamp.
- Janitorial chemicals – Even biodegradable soap can harm fish and wildlife before it biodegrades. Biodegradable does not mean non-toxic. Safer products and procedures are available for floor stripping and cleaning, as well as carpet, glass, metal, and restroom cleaning and disinfecting.

Examples

There are a number of business and trade associations, and communities with effective programs. Some of the more prominent are listed below in the references and resources section.

References and Resources

Note: Many of these references provide alternative products for materials that typically are used inside and disposed to the sanitary sewer as well as alternatives to products that usually end up in the storm drain.

General Sustainable Practices and Pollution Prevention Including Pollutant-Specific Information

California Department of Toxic Substances Control (www.dtsc.ca.gov)

California Integrated Waste Management Board (www.ciwmb.ca.gov)

City of Santa Monica (www.santa-monica.org/environment)

City of Palo Alto (www.city.palo-alto.ca.us/cleanbay)

City and County of San Francisco, Department of the Environment (www.ci.sf.ca.us/sfenvironment)

Earth 911 (www.earth911.org/master.asp)

Environmental Finance Center Region IX (www.greenstart.org/efc9)

Flex Your Power (www.flexyourpower.ca.gov)

GreenBiz.com (www.greenbiz.com)

Green Business Program (www.abag.org/bayarea/enviro/gbus/gb.html)

Pacific Industrial and Business Association (www.piba.org)

Sacramento Clean Water Business Partners (www.sacstormwater.org)

USEPA BMP fact sheet – Alternative products (http://cfpub.epa.gov/npdes/stormwater/menuofbmps/poll_2.cfm)

USEPA Region IX Pollution Prevention Program (www.epa.gov/region09/p2)

Western Regional Pollution Prevention Network (www.westp2net.org)

Metals (mercury, copper)

National Electrical Manufacturers Association - Environment, Health and Safety (www.nema.org)

Sustainable Conservation (www.suscon.org)

- Auto Recycling Project
- Brake Pad Partnership

Pesticides and Chemical Fertilizers

Bio-Integral Resource Center (www.birc.org)

California Department of Pesticide Regulation (www.cdpr.ca.gov)

University of California Statewide IPM Program (www.ipm.ucdavis.edu/default.html)

Dioxins

Bay Area Dioxins Project (http://dioxin.abag.ca.gov/)

Building & Grounds Maintenance SC-41

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Switch to non-toxic chemicals for maintenance to the maximum extent possible.
- ☐ Choose cleaning agents that can be recycled.
- ☐ Encourage proper lawn management and landscaping, including use of native vegetation.
- ☐ Encourage use of Integrated Pest Management techniques for pest control.
- ☐ Encourage proper onsite recycling of yard trimmings.
- ☐ Recycle residual paints, solvents, lumber, and other material as much as possible.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

Targeted Constituents	
Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	
Organics	

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Clean work areas at the end of each work shift using dry cleaning methods such as sweeping and vacuuming.

Good Housekeeping

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.

- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.

- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Use mulch or other erosion control measures on exposed soils. See also SC-40, Contaminated and Erodible Areas, for more information.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.

- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.

- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.

- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.

- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and

solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.
- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- Apply pesticides only when wind speeds are low.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering and repair leaks in the irrigation system as soon as they are observed.

Building & Grounds Maintenance SC-41

Spill Response and Prevention Procedures

- ☐ Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- ☐ Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.
- ☐ Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.
- ☐ Familiarize employees with the Spill Prevention Control and Countermeasure Plan.
- ☐ Clean up spills immediately.

Material Handling and Waste Management

- ☐ Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- ☐ Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- ☐ Dispose of empty pesticide containers according to the instructions on the container label.
- ☐ Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- ☐ Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Employee Training Program

- ☐ Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.
- ☐ Train employees and contractors in proper techniques for spill containment and cleanup.
- ☐ Be sure the frequency of training takes into account the complexity of the operations and the needs of individual staff.

Quality Assurance and Record Keeping

- ☐ Keep accurate logs that document maintenance activities performed and minimum BMP measures implemented.
- ☐ Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- ☐ Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Additional capital costs are not anticipated for building and grounds maintenance. Implementation of the minimum BMPs described above should be conducted as part of regular site operations.

Maintenance

- Maintenance activities for the BMPs described above will be minimal, and no additional cost is anticipated.

Supplemental Information

Fire Sprinkler Line Flushing

Site fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual.*

Kennedy/Jenks Consultants, 2007. *The Truckee Meadows Industrial and Commercial Storm Water Best Management Practices Handbook*. Available online at: http://www.cityofsparks.us/sites/default/files/assets/documents/env-control/construction/TM-I-C_BMP_Handbook_2-07-final.pdf.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities.

Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at:

http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

US EPA, 1997. *Best Management Practices Handbook for Hazardous Waste Containers*. Available online at: http://www.epa.gov/region6/6en/h/handbk4.pdf.

Ventura Countywide Stormwater Management Program Clean Business Fact Sheets. Available online at: http://www.vcstormwater.org/documents/programs_business/building.pdf.

Parking/Storage Area Maintenance SC-43

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓
Oxygen Demanding	✓

Description

Parking lots and storage areas can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The following protocols are intended to prevent or reduce the discharge of pollutants from parking/storage areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

Approach

Pollution Prevention

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook).
- Keep accurate maintenance logs to evaluate BMP implementation.

Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low concentrations.

- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel and dispose of litter in the trash.

Surface cleaning

- Use dry cleaning methods (e.g. sweeping or vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- If water is used follow the procedures below:
  - Block the storm drain or contain runoff.
  - Wash water should be collected and pumped to the sanitary sewer or discharged to a pervious surface, do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- When cleaning heavy oily deposits:
  - Use absorbent materials on oily spots prior to sweeping or washing.
  - Dispose of used absorbents appropriately.

Surface Repair

- Pre-heat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination form contacting stormwater runoff.
- Cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc., where applicable. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.

- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

- Have designated personnel conduct inspections of the parking facilities and stormwater conveyance systems associated with them on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

Training

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
- Train employees and contractors in proper techniques for spill containment and cleanup.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, nad implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

Requirements

Costs

Cleaning/sweeping costs can be quite large, construction and maintenance of stormwater structural controls can be quite expensive as well.

Maintenance

- Sweep parking lot to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities on a regular basis to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

SC-43 Parking/Storage Area Maintenance

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination form contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Use only as much water as necessary for dust control, to avoid runoff.

References and Resources

http://www.stormwatercenter.net/

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality control Board. July 1998 (Revised February 2002 by the California Coastal Commission).

Orange County Stormwater Program
http://www.ocwatersheds.com/StormWater/swp_introduction.asp

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA) http://www.basma.org

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP)
http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf

Road and Street Maintenance SC-70

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Description

Streets, roads, and highways are significant sources of pollutants in stormwater discharges, and operation and maintenance (O&M) practices, if not conducted properly, can contribute to the problem. Stormwater pollution from roadway and bridge maintenance should be addressed on a site-specific basis. Use of the procedures outlined below, that address street sweeping and repair, bridge and structure maintenance, and unpaved roads will reduce pollutants in stormwater.

Approach

Pollution Prevention

- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal)
- Recycle paint and other materials whenever possible.
- Enlist the help of citizens to keep yard waste, used oil, and other wastes out of the gutter.

Suggested Protocols

Street Sweeping and Cleaning

- Maintain a consistent sweeping schedule. Provide minimum monthly sweeping of curbed streets.
- Perform street cleaning during dry weather if possible.

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- Avoid wet cleaning or flushing of street, and utilize dry methods where possible.
- Consider increasing sweeping frequency based on factors such as traffic volume, land use, field observations of sediment and trash accumulation, proximity to water courses, etc. For example:
  - Increase the sweeping frequency for streets with high pollutant loadings, especially in high traffic and industrial areas.
  - Increase the sweeping frequency just before the wet season to remove sediments accumulated during the summer.
  - Increase the sweeping frequency for streets in special problem areas such as special events, high litter or erosion zones.
- Maintain cleaning equipment in good working condition and purchase replacement equipment as needed. Old sweepers should be replaced with new technologically advanced sweepers (preferably regenerative air sweepers) that maximize pollutant removal.
- Operate sweepers at manufacturer requested optimal speed levels to increase effectiveness.
- To increase sweeping effectiveness consider the following:
  - Institute a parking policy to restrict parking in problematic areas during periods of street sweeping.
  - Post permanent street sweeping signs in problematic areas; use temporary signs if installation of permanent signs is not possible.
  - Develop and distribute flyers notifying residents of street sweeping schedules.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- If available use vacuum or regenerative air sweepers in the high sediment and trash areas (typically industrial/commercial).
- Keep accurate logs of the number of curb-miles swept and the amount of waste collected.
- Dispose of street sweeping debris and dirt at a landfill.
- Do not store swept material along the side of the street or near a storm drain inlet.
- Keep debris storage to a minimum during the wet season or make sure debris piles are contained (e.g. by berming the area) or covered (e.g. with tarps or permanent covers).

Street Repair and Maintenance

Pavement marking

- Schedule pavement marking activities for dry weather.

- Develop paint handling procedures for proper use, storage, and disposal of paints.
- Transfer and load paint and hot thermoplastic away from storm drain inlets.
- Provide drop cloths and drip pans in paint mixing areas.
- Properly maintain application equipment.
- Street sweep thermoplastic grindings. Yellow thermoplastic grindings may require special handling as they may contain lead.
- Paints containing lead or tributyltin are considered a hazardous waste and must be disposed of properly.
- Use water based paints whenever possible. If using water based paints, clean the application equipment in a sink that is connected to the sanitary sewer.
- Properly store leftover paints if they are to be kept for the next job, or dispose of properly.

Concrete installation and repair

- Schedule asphalt and concrete activities for dry weather.
- Take measures to protect any nearby storm drain inlets and adjacent watercourses, prior to breaking up asphalt or concrete (e.g. place san bags around inlets or work areas).
- Limit the amount of fresh concrete or cement mortar mixed, mix only what is needed for the job.
- Store concrete materials under cover, away from drainage areas. Secure bags of cement after they are open. Be sure to keep wind-blown cement powder away from streets, gutters, storm drains, rainfall, and runoff.
- Return leftover materials to the transit mixer. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.
- When making saw cuts in pavement, use as little water as possible and perform during dry weather. Cover each storm drain inlet completely with filter fabric or plastic during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site. Alternatively, a small onsite vacuum may be used to pick up the slurry as this will prohibit slurry from reaching storm drain inlets.
- Wash concrete trucks off site or in designated areas on site designed to preclude discharge of wash water to drainage system.

Patching, resurfacing, and surface sealing

- Schedule patching, resurfacing and surface sealing for dry weather.
- Stockpile materials away from streets, gutter areas, storm drain inlets or watercourses. During wet weather, cover stockpiles with plastic tarps or berm around them if necessary to prevent transport of materials in runoff.
- Pre-heat, transfer or load hot bituminous material away from drainage systems or watercourses.
- Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and maintenance holes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from covered maintenance holes and storm drain inlets when the job is complete.
- Prevent excess material from exposed aggregate concrete or similar treatments from entering streets or storm drain inlets. Designate an area for clean up and proper disposal of excess materials.
- Use only as much water as necessary for dust control, to avoid runoff.
- Sweep, never hose down streets to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Equipment cleaning maintenance and storage

- Inspect equipment daily and repair any leaks. Place drip pans or absorbent materials under heavy equipment when not in use.
- Perform major equipment repairs at the corporation yard, when practical.
- If refueling or repairing vehicles and equipment must be done onsite, use a location away from storm drain inlets and watercourses.
- Clean equipment including sprayers, sprayer paint supply lines, patch and paving equipment, and mud jacking equipment at the end of each day. Clean in a sink or other area (e.g. vehicle wash area) that is connected to the sanitary sewer.

Bridge and Structure Maintenance

Paint and Paint Removal

- Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.
- Do not transfer or load paint near storm drain inlets or watercourses.

- Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint container.
- Plug nearby storm drain inlets prior to starting painting where there is significant risk of a spill reaching storm drains. Remove plugs when job is completed.
- If sand blasting is used to remove paint, cover nearby storm drain inlets prior to starting work.
- Perform work on a maintenance traveler or platform, or use suspended netting or tarps to capture paint, rust, paint removing agents, or other materials, to prevent discharge of materials to surface waters if the bridge crosses a watercourse. If sanding, use a sander with a vacuum filter bag.
- Capture all clean-up water, and dispose of properly.
- Recycle paint when possible (e.g. paint may be used for graffiti removal activities). Dispose of unused paint at an appropriate household hazardous waste facility.

Graffiti Removal

- Schedule graffiti removal activities for dry weather.
- Protect nearby storm drain inlets prior to removing graffiti from walls, signs, sidewalks, or other structures needing graffiti abatement. Clean up afterwards by sweeping or vacuuming thoroughly, and/or by using absorbent and properly disposing of the absorbent.
- When graffiti is removed by painting over, implement the procedures under Painting and Paint Removal above.
- Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a landscaped or dirt area. If such an area is not available, filter runoff through an appropriate filtering device (e.g. filter fabric) to keep sand, particles, and debris out of storm drains.
- If a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound), plug nearby storm drains and vacuum/pump wash water to the sanitary sewer.
- Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds).

Repair Work

- Prevent concrete, steel, wood, metal parts, tools, or other work materials from entering storm drains or watercourses.
- Thoroughly clean up the job site when the repair work is completed.
- When cleaning guardrails or fences follow the appropriate surface cleaning methods (depending on the type of surface) outlined in SC-71 Plaza & Sidewalk Cleaning fact sheet.

- If painting is conducted, follow the painting and paint removal procedures above.
- If graffiti removal is conducted, follow the graffiti removal procedures above.
- If construction takes place, see the Construction Activity BMP Handbook.
- Recycle materials whenever possible.

Unpaved Roads and Trails

- Stabilize exposed soil areas to prevent soil from eroding during rain events. This is particularly important on steep slopes.
- For roadside areas with exposed soils, the most cost-effective choice is to vegetate the area, preferably with a mulch or binder that will hold the soils in place while the vegetation is establishing. Native vegetation should be used if possible.
- If vegetation cannot be established immediately, apply temporary erosion control mats/blankets; a comma straw, or gravel as appropriate.
- If sediment is already eroded and mobilized in roadside areas, temporary controls should be installed. These may include: sediment control fences, fabric-covered triangular dikes, gravel-filled burlap bags, biobags, or hay bales staked in place.

Non-Stormwater Discharges

Field crews should be aware of non-stormwater discharges as part of their ongoing street maintenance efforts.

- Refer to SC-10 Non-Stormwater Discharges
- Identify location, time and estimated quantity of discharges.
- Notify appropriate personnel.

Training

- Train employees regarding proper street sweeping operation and street repair and maintenance.
- Instruct employees and subcontractors to ensure that measures to reduce the stormwater impacts of roadway/bridge maintenance are being followed.
- Require engineering staff and/or consulting A/E firms to address stormwater quality in new bridge designs or existing bridge retrofits.
- Use a training log or similar method to document training.
- Train employees on proper spill containment and clean up, and in identifying non-stormwater discharges.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Densely populated areas or heavily used streets may require parking regulations to clear streets for cleaning.
- No currently available conventional sweeper is effective at removing oil and grease. Mechanical sweepers are not effective at removing finer sediments.
- Limitations may arise in the location of new bridges. The availability and cost of land and other economic and political factors may dictate where the placement of a new bridge will occur. Better design of the bridge to control runoff is required if it is being placed near sensitive waters.

Requirements

Costs

- The maintenance of local roads and bridges is already a consideration of most community public works or transportation departments. Therefore, the cost of pollutant reducing management practices will involve the training and equipment required to implement these new practices.
- The largest expenditures for street sweeping programs are in staffing and equipment. The capital cost for a conventional street sweeper is between $60,000 and $120,000. Newer technologies might have prices approaching $180,000. The average useful life of a conventional sweeper is about four years, and programs must budget for equipment replacement. Sweeping frequencies will determine equipment life, so programs that sweep more often should expect to have a higher cost of replacement.
- A street sweeping program may require the following.
  - Sweeper operators, maintenance, supervisory, and administrative personnel are required.
  - Traffic control officers may be required to enforce parking restrictions.
  - Skillful design of cleaning routes is required for program to be productive.
  - Arrangements must be made for disposal of collected wastes.

- If investing in newer technologies, training for operators must be included in operation and maintenance budgets. Costs for public education are small, and mostly deal with the need to obey parking restrictions and litter control. Parking tickets are an effective reminder to obey parking rules, as well as being a source of revenue.

Maintenance

- Not applicable

Supplemental Information

Further Detail of the BMP

Street sweeping

There are advantages and disadvantages to the two common types of sweepers. The best choice depends on your specific conditions. Many communities find it useful to have a compliment of both types in their fleet.

Mechanical Broom Sweepers - More effective at picking up large debris and cleaning wet streets. Less costly to purchase and operate. Create more airborne dust.

Vacuum Sweepers - More effective at removing fine particles and associated heavy metals. Ineffective at cleaning wet streets. Noisier than mechanical broom sweepers which may restrict areas or times of operation. May require an advance vehicle to remove large debris.

Street Flushers - Not affected by biggest interference to cleaning, parked cars. May remove finer sediments, moving them toward the gutter and stormwater inlets. For this reason, flushing fell out of favor and is now used primarily after sweeping. Flushing may be effective for combined sewer systems. Presently street flushing is not allowed under most NPDES permits.

Cross-Media Transfer of Pollutants

The California Air Resources Board (ARB) has established state ambient air quality standards including a standard for respirable particulate matter (less than or equal to 10 microns in diameter, symbolized as PM10). In the effort to sweep up finer sediments to remove attached heavy metals, municipalities should be aware that fine dust, that cannot be captured by the sweeping equipment and becomes airborne, could lead to issues of worker and public safety.

Bridges

Bridges that carry vehicular traffic generate some of the more direct discharges of runoff to surface waters. Bridge scupper drains cause a direct discharge of stormwater into receiving waters and have been shown to carry relatively high concentrations of pollutants. Bridge maintenance also generates wastes that may be either directly deposited to the water below or carried to the receiving water by stormwater. The following steps will help reduce the stormwater impacts of bridge maintenance:

- Site new bridges so that significant adverse impacts to wetlands, sensitive areas, critical habitat, and riparian vegetation are minimized.

- Design new bridges to avoid the use of scupper drains and route runoff to land for treatment control. Existing scupper drains should be cleaned on a regular basis to avoid sediment/debris accumulation.
- Reduce the discharge of pollutants to surface waters during maintenance by using suspended traps, vacuums, or booms in the water to capture paint, rust, and paint removing agents. Many of these wastes may be hazardous. Properly dispose of this waste by referring to CA21 (Hazardous Waste Management) in the Construction Handbook.
- Train employees and subcontractors to reduce the discharge of wastes during bridge maintenance.

De-icing

- Do not over-apply deicing salt and sand, and routinely calibrate spreaders.
- Near reservoirs, restrict the application of deicing salt and redirect any runoff away from reservoirs.
- Consider using alternative deicing agents (less toxic, biodegradable, etc.).

References and Resources

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

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Plaza and Sidewalk Cleaning SC-71

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Description

Pollutants on sidewalks and other pedestrian traffic areas and plazas are typically due to littering and vehicle use. This fact sheet describes good housekeeping practices that can be incorporated into the municipality's existing cleaning and maintenance program.

Approach

Pollution Prevention

- Use dry cleaning methods whenever practical for surface cleaning activities.
- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal).

Suggested Protocols

Surface Cleaning

- Regularly broom (dry) sweep sidewalk, plaza and parking lot areas to minimize cleaning with water.
- Dry cleanup first (sweep, collect, and dispose of debris and trash) when cleaning sidewalks or plazas, then wash with or without soap.
- Block the storm drain or contain runoff when cleaning with water. Discharge wash water to landscaping or collect water and pump to a tank or discharge to sanitary sewer if allowed. (Permission may be required from local sanitation district.)

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- Block the storm drain or contain runoff when washing parking areas, driveways or drive-throughs. Use absorbents to pick up oil; then dry sweep. Clean with or without soap. Collect water and pump to a tank or discharge to sanitary sewer if allowed. Street Repair and Maintenance.

Graffiti Removal

- Avoid graffiti abatement activities during rain events.
- Implement the procedures under Painting and Paint Removal in SC-70 Roads, Streets, and Highway Operation and Maintenance fact sheet when graffiti is removed by painting over.
- Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a dirt or landscaped area after treating with an appropriate filtering device.
- Plug nearby storm drain inlets and vacuum/pump wash water to the sanitary sewer if authorized to do so if a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound). Ensure that a non-hazardous cleaning compound is used or dispose as hazardous waste, as appropriate.

Surface Removal and Repair

- Schedule surface removal activities for dry weather if possible.
- Avoid creating excess dust when breaking asphalt or concrete.
- Take measures to protect nearby storm drain inlets prior to breaking up asphalt or concrete (e.g. place hay bales or sand bags around inlets). Clean afterwards by sweeping up as much material as possible.
- Designate an area for clean up and proper disposal of excess materials.
- Remove and recycle as much of the broken pavement as possible to avoid contact with rainfall and stormwater runoff.
- When making saw cuts in pavement, use as little water as possible. Cover each storm drain inlet completely with filter fabric during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site.
- Always dry sweep first to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains. Once dry sweeping is complete, the area may be hosed down if needed. Wash water should be directed to landscaping or collected and pumped to the sanitary sewer if allowed.

Concrete Installation and Repair

- Schedule asphalt and concrete activities for dry weather.

- Take measures to protect any nearby storm drain inlets and adjacent watercourses, prior to breaking up asphalt or concrete (e.g. place san bags around inlets or work areas).
- Limit the amount of fresh concrete or cement mortar mixed, mix only what is needed for the job.
- Store concrete materials under cover, away from drainage areas. Secure bags of cement after they are open. Be sure to keep wind-blown cement powder away from streets, gutters, storm drains, rainfall, and runoff.
- Return leftover materials to the transit mixer. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.
- Protect applications of fresh concrete from rainfall and runoff until the material has dried.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- Wash concrete trucks off site or in designated areas on site designed to preclude discharge of wash water to drainage system.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide litter receptacles in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events.
- Cover litter receptacles and clean out frequently to prevent leaking/spillage or overflow.
- Clean parking lots on a regular basis with a street sweeper.

Training

- Provide regular training to field employees and/or contractors regarding surface cleaning and proper operation of equipment.
- Train employee and contractors in proper techniques for spill containment and cleanup.
- Use a training log or similar method to document training.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Limitations related to sweeping activities at large parking facilities may include current sweeper technology to remove oil and grease.
- Surface cleaning activities that require discharges to the local sewering agency will require coordination with the agency.
- Arrangements for disposal of the swept material collected must be made, as well as accurate tracking of the areas swept and the frequency of sweeping.

Requirements

Costs

- The largest expenditures for sweeping and cleaning of sidewalks, plazas, and parking lots are in staffing and equipment. Sweeping of these areas should be incorporated into street sweeping programs to reduce costs.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Community education, such as informing residents about their options for recycling and waste disposal, as well as the consequences of littering, can instill a sense of citizen responsibility and potentially reduce the amount of maintenance required by the municipality.

Additional BMPs that should be considered for parking lot areas include:

- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low concentrations.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Structural BMPs such as storm drain inlet filters can be very effective in reducing the amount of pollutants discharged from parking facilities during periods of rain.

References and Resources

Bay Area Stormwater Management Agencies Association (BASMAA). 1996. Pollution From Surface Cleaning Folder http://www.basmaa.org

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

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Santa Clara Valley Urban Runoff Pollution Prevention Program. Maintenance Best Management Practices for the Construction Industry. Brochures: Landscaping, Gardening, and Pool; Roadwork and Paving; and Fresh Concrete and Mortar Application. June 2001.

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Landscape Maintenance SC-73

Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	
Oxygen Demanding	☑

Description

Landscape maintenance activities include vegetation removal; herbicide and insecticide application; fertilizer application; watering; and other gardening and lawn care practices. Vegetation control typically involves a combination of chemical (herbicide) application and mechanical methods. All of these maintenance practices have the potential to contribute pollutants to the storm drain system. The major objectives of this BMP are to minimize the discharge of pesticides, herbicides and fertilizers to the storm drain system and receiving waters; prevent the disposal of landscape waste into the storm drain system by collecting and properly disposing of clippings and cuttings, and educating employees and the public.

Approach

Pollution Prevention

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Consider alternative landscaping techniques such as naturescaping and xeriscaping.
- Conduct appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) to help preserve the landscapes water efficiency.

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- Consider grass cycling (grass cycling is the natural recycling of grass by leaving the clippings on the lawn when mowing. Grass clippings decompose quickly and release valuable nutrients back into the lawn).

Suggested Protocols

Mowing, Trimming, and Weeding

- Whenever possible use mechanical methods of vegetation removal (e.g mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.
- Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.
- Performing mowing at optimal times. Mowing should not be performed if significant rain events are predicted.
- Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs.
- Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this fact sheet).
- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- Determine existing native vegetation features (location, species, size, function, importance) and consider the feasibility of protecting them. Consider elements such as their effect on drainage and erosion, hardiness, maintenance requirements, and possible conflicts between preserving vegetation and the resulting maintenance needs.
- Retain and/or plant selected native vegetation whose features are determined to be beneficial, where feasible. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.
- Consider using low water use groundcovers when planting or replanting.

Waste Management

- Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.

- Avoid landscape wastes in and around storm drain inlets by either using bagging equipment or by manually picking up the material.

Irrigation

- Where practical, use automatic timers to minimize runoff.
- Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.
- Ensure that there is no runoff from the landscaped area(s) if re-claimed water is used for irrigation.
- If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.
- Irrigate slowly or pulse irrigate to prevent runoff and then only irrigate as much as is needed.
- Apply water at rates that do not exceed the infiltration rate of the soil.

Fertilizer and Pesticide Management

- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques. There are many methods and types of IPM, including the following:
  - Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.
  - Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.
  - Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.
  - Slugs can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.
  - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).
  - Small mammals and birds can be excluded using fences, netting, tree trunk guards.
  - Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seed head weevils, and spiders that prey on detrimental pest species can be promoted.
- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule).
- Do not use pesticides if rain is expected. Apply pesticides only when wind speeds are low (less than 5 mph).
- Do not mix or prepare pesticides for application near storm drains.
- Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- Periodically test soils for determining proper fertilizer use.
- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Dispose of empty pesticide containers according to the instructions on the container label.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.
- Inspect pesticide/fertilizer equipment and transportation vehicles daily.

Training

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution. Pesticide application must be under the supervision of a California qualified pesticide applicator.
- Train/encourage municipal maintenance crews to use IPM techniques for managing public green areas.
- Annually train employees within departments responsible for pesticide application on the appropriate portions of the agency's IPM Policy, SOPs, and BMPs, and the latest IPM techniques.

- Employees who are not authorized and trained to apply pesticides should be periodically (at least annually) informed that they cannot use over-the-counter pesticides in or around the workplace.
- Use a training log or similar method to document training.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a know in location
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- The Federal Pesticide, Fungicide, and Rodenticide Act and California Title 3, Division 6, Pesticides and Pest Control Operations place strict controls over pesticide application and handling and specify training, annual refresher, and testing requirements. The regulations generally cover: a list of approved pesticides and selected uses, updated regularly; general application information; equipment use and maintenance procedures; and record keeping. The California Department of Pesticide Regulations and the County Agricultural Commission coordinate and maintain the licensing and certification programs. All public agency employees who apply pesticides and herbicides in "agricultural use" areas such as parks, golf courses, rights-of-way and recreation areas should be properly certified in accordance with state regulations. Contracts for landscape maintenance should include similar requirements.
- All employees who handle pesticides should be familiar with the most recent material safety data sheet (MSDS) files.
- Municipalities do not have the authority to regulate the use of pesticides by school districts, however the California Healthy Schools Act of 2000 (AB 2260) has imposed requirements on California school districts regarding pesticide use in schools. Posting of notification prior to the application of pesticides is now required, and IPM is stated as the preferred approach to pest management in schools.

Requirements

Costs

Additional training of municipal employees will be required to address IPM techniques and BMPs. IPM methods will likely increase labor cost for pest control which may be offset by lower chemical costs.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Waste Management

Composting is one of the better disposal alternatives if locally available. Most municipalities either have or are planning yard waste composting facilities as a means of reducing the amount of waste going to the landfill. Lawn clippings from municipal maintenance programs as well as private sources would probably be compatible with most composting facilities

Contractors and Other Pesticide Users

Municipal agencies should develop and implement a process to ensure that any contractor employed to conduct pest control and pesticide application on municipal property engages in pest control methods consistent with the IPM Policy adopted by the agency. Specifically, municipalities should require contractors to follow the agency's IPM policy, SOPs, and BMPs; provide evidence to the agency of having received training on current IPM techniques when feasible; provide documentation of pesticide use on agency property to the agency in a timely manner.

References and Resources

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Los Angeles County Stormwater Quality Model Programs. Public Agency Activities http://ladpw.org/wmd/npdes/model_links.cfm

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Drainage System Maintenance SC-74

Photo Credit: Geoff Brosseau

Objectives

- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff that may contain certain pollutants. Maintaining catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis will remove pollutants, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Approach

Suggested Protocols

Catch Basins/Inlet Structures

- Municipal staff should regularly inspect facilities to ensure the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC-75 Waste Handling and Disposal).
- Clean catch basins, storm drain inlets, and other conveyance structures in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.

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- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Record the amount of waste collected.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed of. Do not dewater near a storm drain or stream.
- Except for small communities with relatively few catch basins that may be cleaned manually, most municipalities will require mechanical cleaners such as eductors, vacuums, or bucket loaders.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect flushed effluent and pump to the sanitary sewer for treatment.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge from cleaning a storm drain pump station or other facility to reach the storm drain system.
- Conduct quarterly routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.
- Sample collected sediments to determine if landfill disposal is possible, or illegal discharges in the watershed are occurring.

Open Channel

- Consider modification of storm channel characteristics to improve channel hydraulics, to increase pollutant removals, and to enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies

(SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS

Illicit Connections and Discharges

- During routine maintenance of conveyance system and drainage structures field staff should look for evidence of illegal discharges or illicit connections:
  - Is there evidence of spills such as paints, discoloring, etc.
  - Are there any odors associated with the drainage system
  - Record locations of apparent illegal discharges/illicit connections
  - Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of up gradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
  - Once the origin of flow is established, require illicit discharger to eliminate the discharge.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties
- Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

- The State Department of Fish and Game has a hotline for reporting violations called Cal TIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).
- The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Only properly trained individuals are allowed to handle hazardous materials/wastes.
- Train municipal employees from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report illegal dumping.
- Train municipal employees and educate businesses, contractors, and the general public in proper and consistent methods for disposal.
- Train municipal staff regarding non-stormwater discharges (See SC-10 Non-Stormwater Discharges).

Spill Response and Prevention

- Refer to SC-11, Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Cleanup activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and disposal of flushed effluent to sanitary sewer may be prohibited in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Private property access rights may be needed to track illegal discharges up gradient.

- Requirements of municipal ordinance authority for suspected source verification testing for illicit connections necessary for guaranteed rights of entry.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget. A careful study of cleaning effectiveness should be undertaken before increased cleaning is implemented. Catch basin cleaning costs are less expensive if vacuum street sweepers are available; cleaning catch basins manually can cost approximately twice as much as cleaning the basins with a vacuum attached to a sweeper.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary. Encouraging reporting of illicit discharges by employees can offset costs by saving expense on inspectors and directing resources more efficiently. Some programs have used funds available from "environmental fees" or special assessment districts to fund their illicit connection elimination programs.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.

- Identifying illicit discharges requires teams of at least two people (volunteers can be used), plus administrative personnel, depending on the complexity of the storm sewer system.

- Arrangements must be made for proper disposal of collected wastes.

- Requires technical staff to detect and investigate illegal dumping violations, and to coordinate public education.

Supplemental Information

Further Detail of the BMP

Storm Drain flushing

Sanitary sewer flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in sanitary sewer systems. The same principles that make sanitary sewer flushing effective can be used to flush storm drains. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as to an open channel, to another point where flushing will be initiated, or over to the sanitary sewer and on to the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. The deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to

cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce the impacts of stormwater pollution, a second inflatable device, placed well downstream, may be used to re-collect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to re-collect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75 percent for organics and 55-65 percent for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm drain flushing.

Flow Management

Flow management has been one of the principal motivations for designing urban stream corridors in the past. Such needs may or may not be compatible with the stormwater quality goals in the stream corridor.

Downstream flood peaks can be suppressed by reducing through flow velocity. This can be accomplished by reducing gradient with grade control structures or increasing roughness with boulders, dense vegetation, or complex banks forms. Reducing velocity correspondingly increases flood height, so all such measures have a natural association with floodplain open space. Flood elevations laterally adjacent to the stream can be lowered by increasing through flow velocity.

However, increasing velocity increases flooding downstream and inherently conflicts with channel stability and human safety. Where topography permits, another way to lower flood elevation is to lower the level of the floodway with drop structures into a large but subtly excavated bowl where flood flows we allowed to spread out.

Stream Corridor Planning

Urban streams receive and convey stormwater flows from developed or developing watersheds. Planning of stream corridors thus interacts with urban stormwater management programs. If local programs are intended to control or protect downstream environments by managing flows delivered to the channels, then it is logical that such programs should be supplemented by management of the materials, forms, and uses of the downstream riparian corridor. Any proposal for steam alteration or management should be investigated for its potential flow and stability effects on upstream, downstream, and laterally adjacent areas. The timing and rate of flow from various tributaries can combine in complex ways to alter flood hazards. Each section of channel is unique, influenced by its own distribution of roughness elements, management activities, and stream responses.

Flexibility to adapt to stream features and behaviors as they evolve must be included in stream reclamation planning. The amenity and ecology of streams may be enhanced through the landscape design options of 1) corridor reservation, 2) bank treatment, 3) geomorphic restoration, and 4) grade control.

Corridor reservation - Reserving stream corridors and valleys to accommodate natural stream meandering, aggradation, degradation, and over bank flows allows streams to find their own form and generate less ongoing erosion. In California, open stream corridors in recent urban developments have produced recreational open space, irrigation of streamside plantings, and the aesthetic amenity of flowing water.

Bank treatment - The use of armoring, vegetative cover, and flow deflection may be used to influence a channel's form, stability, and biotic habitat. To prevent bank erosion, armoring can be done with rigid construction materials, such as concrete, masonry, wood planks and logs, riprap, and gabions. Concrete linings have been criticized because of their lack of provision of biotic habitat. In contrast, riprap and gabions make relatively porous and flexible linings. Boulders, placed in the bed reduce velocity and erosive power.

Riparian vegetation can stabilize the banks of streams that are at or near a condition of equilibrium. Binding networks of roots increase bank shear strength. During flood flows, resilient vegetation is forced into erosion-inhibiting mats. The roughness of vegetation leads to lower velocity, further reducing erosive effects. Structural flow deflection can protect banks from erosion or alter fish habitat. By concentrating flow, a deflector causes a pool to be scoured in the bed.

Geomorphic restoration – Restoration refers to alteration of disturbed streams so their form and behavior emulate those of undisturbed streams. Natural meanders are retained, with grading to gentle slopes on the inside of curves to allow point bars and riffle-pool sequences to develop. Trees are retained to provide scenic quality, biotic productivity, and roots for bank stabilization, supplemented by plantings where necessary.

A restorative approach can be successful where the stream is already approaching equilibrium. However, if upstream urbanization continues new flow regimes will be generated that could disrupt the equilibrium of the treated system.

Grade Control - A grade control structure is a level shelf of a permanent material, such as stone, masonry, or concrete, over which stream water flows. A grade control structure is called a sill, weir, or drop structure, depending on the relation of its invert elevation to upstream and downstream channels.

A sill is installed at the preexisting channel bed elevation to prevent upstream migration of nick points. It establishes a firm base level below which the upstream channel can not erode.

A weir or check dam is installed with invert above the preexisting bed elevation. A weir raises the local base level of the stream and causes aggradation upstream. The gradient, velocity, and erosive potential of the stream channel are reduced. A drop structure lowers the downstream invert below its preexisting elevation, reducing downstream gradient and velocity. Weirs and drop structure control erosion by dissipating energy and reducing slope velocity.

When carefully applied, grade control structures can be highly versatile in establishing human and environmental benefits in stabilized channels. To be successful, application of grade control structures should be guided by analysis of the stream system both upstream and downstream from the area to he reclaimed.

Examples

The California Department of Water Resources began the Urban Stream Restoration Program in 1985. The program provides grant funds to municipalities and community groups to implement stream restoration projects. The projects reduce damages from streambank aid watershed instability arid floods while restoring streams' aesthetic, recreational, and fish and wildlife values.

In Buena Vista Park, upper floodway slopes are gentle and grassed to achieve continuity of usable park land across the channel of small boulders at the base of the slopes.

The San Diego River is a large, vegetative lined channel, which was planted in a variety of species to support riparian wildlife while stabilizing the steep banks of the floodway.

References and Resources

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Efficient Irrigation SD-12

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

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– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Infiltration Basin TC-11

Maintenance Concerns, Objectives, and Goals

- Vector Control
- Clogged soil or outlet structures
- Vegetation/Landscape Maintenance
- Groundwater contamination
- Accumulation of metals
- Aesthetics

Targeted Constituents

✓	Sediment	■
✓	Nutrients	■
✓	Trash	■
✓	Metals	■
✓	Bacteria	■
✓	Oil and Grease	■
✓	Organics	■
✓	Oxygen Demanding	■

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

General Description

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually infiltrates into the soil and eventually into the water table. This practice has high pollutant removal efficiency and can also help recharge groundwater, thus helping to maintain low flows in stream systems. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices.

Inspection/Maintenance Considerations

Infiltration basins perform better in well-drained permeable soils. Infiltration basins in areas of low permeability can clog within a couple years, and require more frequent inspections and maintenance. The use and regular maintenance of pretreatment BMPs will significantly minimize maintenance requirements for the basin. Spill response procedures and controls should be implemented to prevent spills from reaching the infiltration system.

Scarification or other disturbance should only be performed when there are actual signs of clogging or significant loss of infiltrative capacity, rather than on a routine basis. Always remove deposited sediments before scarification, and use a hand-guided rotary tiller, if possible, or a disc harrow pulled by a light tractor. This BMP may require groundwater monitoring. Basins cannot be put into operation until the upstream tributary area stabilized.

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TC-11 Infiltration Basin

Clogged infiltration basins with surface standing water can become a breeding area for mosquitoes and midges. Maintenance efforts associated with infiltration basins should include frequent inspections to ensure that water infiltrates into the subsurface completely (recommended infiltration rate of 72 hours or less) and that vegetation is carefully managed to prevent creating mosquito and other vector habitats.

Inspection Activities	Suggested Frequency
■ Observe drain time for a storm after completion or modification of the facility to confirm that the desired drain time has been obtained. ■ Newly established vegetation should be inspected several times to determine if any landscape maintenance (reseeding, irrigation, etc.) is necessary.	Post construction
■ Inspect for the following issues: differential accumulation of sediment, signs of wetness or damage to structures, erosion of the basin floor, dead or dying grass on the bottom, condition of riprap, drain time, signs of petroleum hydrocarbon contamination, standing water, trash and debris, sediment accumulation, slope stability, pretreatment device condition	Semi-annual and after extreme events
Maintenance Activities	**Suggested Frequency**
■ Factors responsible for clogging should be repaired immediately. ■ Weed once monthly during the first two growing seasons.	Post construction
■ Stabilize eroded banks. ■ Repair undercut and eroded areas at inflow and outflow structures. ■ Maintain access to the basin for regular maintenance activities. ■ Mow as appropriate for vegetative cover species. ■ Monitor health of vegetation and replace as necessary. ■ Control mosquitoes as necessary. ■ Remove litter and debris from infiltration basin area as required.	Standard maintenance (as needed)
■ Mow and remove grass clippings, litter, and debris. ■ Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons. ■ Replant eroded or barren spots to prevent erosion and accumulation of sediment.	Semi-annual
■ Scrape bottom and remove sediment when accumulated sediment reduces original infiltration rate by 25-50%. Restore original cross-section and infiltration rate. Properly dispose of sediment. ■ Seed or sod to restore ground cover. ■ Disc or otherwise aerate bottom. ■ Dethatch basin bottom.	3-5 year maintenance

Additional Information

In most cases, sediment from an infiltration basin does not contain toxins at levels posing a hazardous concern. Studies to date indicate that pond sediments are generally below toxicity limits and can be safely landfilled or disposed onsite. Onsite sediment disposal is always preferable (if local authorities permit) as long as the sediments are deposited away from the shoreline to prevent their reentry into the pond and away from recreation areas, where they could possibly be ingested by young children. Sediments should be tested for toxicants in compliance with current disposal requirements if land uses in the catchment include commercial or industrial zones, or if visual or olfactory indications of pollution are noticed. Sediments containing high levels of pollutants should be disposed of properly.

Light equipment, which will not compact the underlying soil, should be used to remove the top layer of sediment. The remaining soil should be tilled and revegetated as soon as possible.

Sediment removal within the basin should be performed when the sediment is dry enough so that it is cracked and readily separates from the basin floor. This also prevents smearing of the basin floor.

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King County, Stormwater Pollution Control Manual – Best Management Practices for Businesses. July, 1995 Available at: ftp://dnr metrokc.gov/wlr/dss/spcm/SPCM.HTM

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Appendix E

SOILS REPORT

GEOTECHNICAL INVESTIGATION
ANDALUSIA WEST SIDE DEVELOPMENT
WEST OF MADISON STREET
BETWEEN AVENUE 58 & AVENUE 60
LA QUINTA, CALIFORNIA

-Prepared By-

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February 26, 2019

Project No. 544-19025
19-01-049

Meriwether Companies
2440 Junction Place, Suite 200
Boulder, Colorado 80301

Subject: Geotechnical Investigation

Project: Andalusia West Side Development
West of Madison Street Between Avenue 58 & Avenue 60
La Quinta, California

Sladden Engineering is pleased to present the results of the geotechnical investigation performed for the Andalusia West Side development in the City of La Quinta, California. Our services were completed in accordance with our proposal for geotechnical engineering services dated December 12, 2018 and your authorization to proceed with the work. The purpose of our investigation was to explore the subsurface conditions at the site to provide recommendations for foundation design and site preparation relative to the development of the project. Evaluation of environmental issues and hazardous wastes was not included within the scope of services provided.

The opinions, recommendations and design criteria presented in this report are based on our field exploration program, laboratory testing and engineering analyses. Based on the results of our investigation, it is our professional opinion that the remainder of the project remains feasible.

We appreciate the opportunity to provide service to you on this project. If you have any questions regarding this report, please contact the undersigned.

Respectfully submitted,
SLADDEN ENGINEERING

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GEOTECHNICAL INVESTIGATION
ANDALUSIA WEST SIDE DEVELOPMENT
LA QUINTA, CALIFORNIA

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INTRODUCTION

This report presents the results of the geotechnical investigation performed by Sladden Engineering (Sladden) for the Andalusia West Side mixed-use resort/residential development proposed for the project site located on the southwest corner of Avenue 58 and Madison Street in the City of La Quinta, California. The central portion of the site development is located at approximately 33.6212 degrees north latitude and 116.2570 degrees west longitude. The approximate location of the site is indicated on the Site Location Map (Figure 1).

Our investigation was conducted in order to evaluate the engineering properties of the near surface and subsurface materials throughout the currently undeveloped site to evaluate their *in-situ* characteristics in order to provide recommendations for site preparation and design criteria for foundation design as well as the design of various site improvements. This study also includes a review of published and unpublished geotechnical reports and geological literature regarding seismicity and potential geologic hazards that may impact the subject site.

PROJECT DESCRIPTION

Based on the preliminary site plans (Vita, 2018), it is our understanding that the proposed project will consist of constructing new residential structures, a multi-story hotel complex, a wave lagoon and various outdoor amenities. Sladden anticipates that the project will also include new concrete flatwork, swimming pools, underground utilities, landscape areas, access roadways, parking areas and various surface improvements. For our analyses we expect that the proposed new residential structures and hotel structures will consist of relatively lightweight one (1) or two (2) story wood-frame structures supported on conventional spread footings and concrete slabs-on-grade or post-tensioned slabs.

Sladden anticipates that grading will consist of generally minor cuts and fills in order to accomplish the desired pad elevations and to provide adequate gradients for site drainage. Significant excavation is expected to accomplish wave lagoon and lake construction. This does not include the removal and re-compaction of loosely placed stockpiled soil that exists within portions of the site. Upon completion of the foundation plans and precise grading plans, Sladden should be retained to verify that the recommendations presented within in this report are incorporated into the design of the proposed project.

Structural foundation loads were not available at the time of this report. Based on our experience with relatively lightweight wood-frame structures, we expect that isolated column loads will be less than 30 kips and continuous wall loads will be less than 3.0 kips per linear foot. If these assumed loads vary significantly from the actual loads, we should be consulted to verify the applicability of the recommendations provided.

SCOPE OF SERVICES

The purpose of our investigation was to determine specific engineering characteristics of the surface and near surface soil and evaluate potential geologic and seismic hazards in order to develop foundation design criteria and recommendations for site preparation. Exploration of the site was achieved by drilling ten (10) exploratory boreholes to depths of between approximately 21 and 51 feet below the existing ground surface (bgs). Specifically, our site characterization consisted of the following tasks:

- Site reconnaissance to assess the existing surface conditions on and adjacent to the site.
- Advancing ten (10) exploratory boreholes to depths between approximately 21 and 51 feet bgs in order to characterize the subsurface soil conditions. Representative samples of the soil were classified in the field and retained for laboratory testing and engineering analyses.
- Advancing five (5) exploratory trenches to depths of approximately 5 feet bgs in order evaluate the subsurface conditions along previously identified vegetation linaments.
- The performance of laboratory testing on selected samples to evaluate their engineering characteristics.
- The review of available geologic literature and the discussion of potential geologic hazards.
- The review of various geotechnical reports previously prepared for the project site.
- The performance of engineering analyses to develop recommendations for foundation design and site preparation.
- The preparation of this report summarizing our work at the site.

SITE CONDITIONS

The Andalusia-Westside development occupies a total area of approximately 377.20 acres. At the time of our investigation, the site was vacant and generally undeveloped with the exception of an old dilapidated farm house located in the central portion of the property. In addition, CVWD (Coachella Valley Water District) irrigation mains were observed on the site along with numerous dirt roads and hiking trails. Various desert vegetation is found throughout the site. The site is located on the west side of Madison Street between Avenue 58 and Avenue 60 in the City of La Quinta, California.

According to the USGS 7.5' Valeria, Martinez Mountain, La Quinta and Indio Quadrangle maps (USGS, 2015), the site is situated at an elevation of between 30 feet and 50 feet below mean sea level (MSL).

No natural ponding water or surface seepage was observed at or near the site during our field investigations. Site drainage appears to be controlled via sheet flow and surface infiltration.

GEOLOGIC SETTING

The project site is located within the Colorado Desert Physiographic Province (also referred to as the Salton Trough) that is characterized as a northwest-southeast trending structural depression extending from the Gulf of California to the Banning Pass. The Salton Trough is dominated by several northwest trending faults, most notably the San Andreas Fault system. The Salton Trough is bounded by the Santa Rosa – San Jacinto Mountains on the southwest, the San Bernardino Mountains on the north, the Little San Bernardino - Chocolate – Orocopia Mountains on the east and extends through the Imperial Valley into the Gulf of California on the south.

A relatively thick sequence (20,000 feet) of sediment has been deposited in the Coachella Valley portion of the Salton Trough from Miocene to present times. These sediments are predominately terrestrial in nature with some lacustrian (lake) and minor marine deposits. The major contributor of these sediments has been the Colorado River. The mountains surrounding the Coachella Valley are composed primarily of Precambrian metamorphic and Mesozoic "granitic" rock.

The Salton Trough is an internally draining area with no readily available outlet to Gulf of California and with portions well below sea level (-253' msl). The region is intermittently blocked from the Gulf of California by the damming effects of the Colorado River delta (current elevation +30'msl). Between about 300AD and 1600 AD (to 1700) the Salton Trough has been inundated by the River's water, forming ancient Lake Cahuilla (max. elevation +58' msl). Since that time the floor of the Trough has been repeatedly flooded with other "fresh" water lakes (1849, 1861, and 1891), the most recent and historically long lived being the current Salton Sea (1905). The sole outlet for these waters is evaporation, leaving behind vast amounts of terrestrial sediment materials and evaporite minerals.

The site has been mapped by Rogers (1965) to be immediately underlain by undifferentiated Quaternary-age lake deposits (Ql), alluvium (Qal) and Mesozoic granitic rocks (gr). The regional geologic setting for the site vicinity is presented on the Regional Geologic Map (Figure 2).

SUBSURFACE CONDITIONS

The subsurface conditions at the site were investigated by drilling ten (10) exploratory boreholes on-site. The approximate locations of the boreholes are illustrated on the Borehole Location Plan (Figure 3). The boreholes were advanced using a truck-mounted Mobile B-61 drill rig equipped with 8-inch outside diameter (O.D.) hollow stem augers. A representative of Sladden was present to log the materials encountered and retrieve samples for laboratory testing and engineering analysis.

During our field investigation a thin mantle of disturbed soil was encountered to a depth of approximately one (1) to two (2) feet below existing grade in the area of our bores. The disturbed soil consisted of silty sand (SM) and sandy silt (ML). Underlying the fill soil and extending to the maximum depth explored, native alluvium was encountered. Native materials consisted primarily of silty sand (SM) and sandy silt (ML) with minor portions of clay (CL/CH). Generally, granualar materials appeared grayish brown, slightly moist to moist, loose to dense and fine-grained. Cohesive layers appeared grayish to olive brown, slightly moist to wet and exhibited low to high plasticity characteristics.

The final logs represent our interpretation of the contents of the field logs, and the results of the laboratory observations and tests of the field samples. The final logs are included in Appendix A of this report. The stratification lines represent the approximate boundaries between soil types although the transitions may be gradual and variable across the site.

Groundwater was encountered at depths of approximately 47 feet below existing grade for BH-2 and BH-6 during our field investigation on February 6, 2019. Currently, ongoing aquifer recharge operations are being conducted by Coachella Valley Water District (CVWD). Based on potential impacts to existing nearby developments (including inundation of low-lying improvements), we do not expect that recharging operations will allow groundwater to reach historical high depths in the site vicinity. We anticipate a high groundwater depth of 20 feet or more below existing grade.

Sladden's trench investigation of the site commenced on February 5, 2019 with the excavation of exploratory trenches T-1, T-2 and T-3. Exploratory trenches T-4 and T-5 were excavated on February 6, 2019 (Figures 3 & 4). All five (5) exploratory trenches were excavated to a total depth of approximately five (5) feet bgs. Exploratory trenches were excavated by Sladden Engineering utilizing a track mounted mini excavator equipped with a 2.0-foot wide bucket. The exploratory trenches were excavated to expose the near surface soil in an effort to locate and observe any discontinuities of the soil profile indicative of surface rupture or ground fissures. Geologic logging of all the exploratory trenches was provided by Sladden's Project Geologist working with or under the direction of a State of California Certified Engineering Geologist.

As part of the actual geologic logging process of the trenches, the trench walls were first evaluated to identify the soil stratigraphy and to group soil units. The identified contacts between soil units within the trenches were based on their stratigraphic position, soil type, and the nature of bounding contacts. Once all the preparation was completed, the actual geologic logging was performed by or under the direction of a California Certified Engineering Geologist utilizing the trench wall profiles at a scale of 1 inch equals 5 feet. The trench logs are presented within Appendix A (Plates 1-5).

As a result of Sladden's lineament trench investigation, features indicative of active surface faulting were not encountered within the exploratory trenches excavated.

SEISMICITY AND FAULTING

The southwestern United States is a tectonically active and structurally complex region, dominated by northwest trending dextral faults. Faults in the region are often part of complex fault systems composed of numerous subparallel faults that splay or step from main fault traces. Strong seismic shaking could be produced by any of these faults during the design life of the proposed project.

Sladden considers the most significant geologic hazard to the project to be the potential for moderate to severe seismic shaking that is likely to occur during the design life of the project. The proposed project is located in the highly seismic Southern California region within the influence of several fault systems that are considered to be active or potentially active. An active fault is defined by the State of California as a "sufficiently active and well defined fault" that has exhibited surface displacement within the Holocene epoch (about the last 11,000 years). A potentially active fault is defined by the State as a fault with a history of movement within Pleistocene time (between 11,000 and 1.6 million years ago).

Based on our research, the site is not currently located within any State of California or County of Riverside designated fault zone (CGS, 2015; RCPR, 2019). Table 1 lists the closest known potentially active faults that was generated in part using the EQFAULT computer program (Blake, 2000), as modified using the fault parameters from The Revised 2002 California Probabilistic Seismic Hazard Maps (Cao et al, 2003). This table does not identify the probability of reactivation or the on-site effects from earthquakes occurring on any other faults in the region.

TABLE 1
CLOSEST KNOWN ACTIVE FAULTS

Fault Name	Distance (Km)	Maximum Event
San Andreas - Coachella	13.9	7.2
San Andreas - Southern	13.9	7.2
San Jacinto - Anza	27.3	7.2
San Jacinto - Coyote Creek	29.3	6.8
Burnt Mountain	37.7	6.5
Eureka Peak	39.2	6.4
San Andreas - San Bernardino	39.3	7.5

2016 CBC SEISMIC DESIGN PARAMETERS

Sladden has reviewed the 2016 California Building Code (CBC) and summarized the current seismic design parameters for the proposed structures. The seismic design category for a structure may be determined in accordance with Section 1613 of the 2016 CBC or ASCE7. According to the 2016 CBC, Site Class D may be used to estimate design seismic loading for the proposed structure. The 2016 CBC Seismic Design Parameters are summarized below. The project Design Map Reports are included within Appendix C (SEAC, 2019).

Risk Category (Table 1.5-1): II
Site Class (Table 1613.3.2): D
S_S (Figure 1613.3.1): 1.5g
S_1 (Figure 1613.3.1): 0.6g
F_a (Table 1613.3.3(1)): 1.0
F_v (Table 1613.5.3(2)): 1.5
S_{MS} (Equation 16-37 {F_a X S_S}): 1.5g
S_{M1} (Equation 16-38 {F_v X S_1}): 0.901g
S_{DS} (Equation 16-39 {2/3 X S_{MS}}): 1.0g
S_{D1} (Equation 16-40 {2/3 X S_{M1}}): 0.6g
Seismic Design Category: D

GEOLOGIC HAZARDS

The subject site is located in an active seismic zone and will likely experience strong seismic shaking during the design life of the proposed project. In general, the intensity of ground shaking will depend on several factors including: the distance to the earthquake focus, the earthquake magnitude, the response characteristics of the underlying materials, and the quality and type of construction. Geologic hazards and their relationship to the site are discussed below.

I. Surface Rupture. Surface rupture is expected to occur along preexisting, known active fault traces. However, surface rupture could potentially splay or step from known active faults or rupture along unidentified traces. Based on our review of Jennings (1994), CGS (2015), Rodgers (1965) and RCPR (2019) known faults are not mapped on or projecting towards the site. In addition, no signs of active surface faulting were observed during our review of non-stereo digitized photographs of the site and site vicinity (Google, 2019). Finally, no signs of active surface fault rupture or secondary seismic effects (lateral spreading, lurching etc.) were identified on-site during our field investigation. Therefore, it is our opinion that risks associated with primary surface ground rupture should be considered "low".

II. Ground Shaking. The site has been subjected to past ground shaking by faults that traverse through the region. Strong seismic shaking from nearby active faults is expected to produce strong seismic shaking during the design life of the proposed project. A probabilistic approach was employed to the estimate the peak ground acceleration (a_{max}) that could be experienced at the site. Based on the USGS Unified Hazard Tool (USGS, 2019) shear wave velocity (Vs30) of 259 m/s, the site could be subjected to ground motions on the order of 0.53g. The peak ground acceleration at the site is judged to have a 475 year return period and a 10 percent chance of exceedence in 50 years.

III. Liquefaction/ Dry Sand Settlement. Liquefaction is the process in which loose, saturated granular soil loses strength as a result of cyclic loading. The strength loss is a result of a decrease in granular sand volume and a positive increase in pore pressures. Generally, liquefaction can occur if all of the following conditions apply: liquefaction-susceptible soil, groundwater within a depth of 50 feet or less, and strong seismic shaking.

We have performed seismic settlement calculations utilizing a magnitude of 7.34 (USGS, 2019). Anticipated high groundwater depths were selected at 20 feet bgs.

Calculations indicate potential total seismic settlements of up to 2.10 inches and 1.03 inches for BH-2 and BH-6, respectively. The potential seismically related differential settlements are expected to be less than 1.0 inches. Based upon the general uniformity of the soil and groundwater conditions underlying the site, we expect the maximum differential settlement to occur over a horizontal distance of approximately 50 feet. Accordingly, risks associated with seismic settlements should be considered "low". Our seismic settlement calculations are summarized below and included within Appendix D.

BOREHOLE	PGAm*	Mag.**	F.O.S.	Settlement (in.)	Differential Settlement (in.)
BH-2	0.513g	7.34	1.3	2.10	< 1.0
BH-6	0.513g	7.34	1.3	1.03	< 1.0

IV. Tsunamis and Seiches. Because the site is situated at an elevated inland location and is not immediately adjacent to any impounded bodies of water, risk associated with tsunamis and seiches is considered negligible.

V. Slope Failure. The site is located on relatively flat ground except for the ascending slope is located on the west side of the subject site. It is our professional opinion that risks associated with slope instability should not be a controlling factor is project design

VI. Expansive Soil. Expansion Index testing of select samples was performed to evaluate expansive potential of the materials underlying the site. Based the results of our laboratory testing (EI = 1 & 66) the materials underlying the site are considered to have "very low" to "medium" expansion potential for the sandy and silty soil layers, respectively. Because significant grading is expected the expansion potential should be re-evaluated after grading.

VII. Settlement. Static settlement resulting from the anticipated foundation loads should be minimal provided that the recommendations included in this report are considered in foundation design and construction. The ultimate static settlement is estimated to be less than one inch when using the recommended foundation bearing pressures. As a practical matter, differential static settlement between footings can be assumed as one-half of the total static settlement.

VIII. Subsidence. Land subsidence can occur in valleys where aquifer systems have been subjected to extensive groundwater pumping, such that groundwater pumping exceeds groundwater recharge. Generally, pore water reduction can result in a rearrangement of skeletal grains and could result in elastic (recoverable) or inelastic (unrecoverable) deformation of an aquifer system.

Previous studies by ESSW (2012) were conducted to evaluate existing distress to structures, roadways and improvements within the existing Andalusia development (SEC Madison and Avenue 58) and to evaluate the potential for areal subsidence to affect current and future development. ESSW (2012) did not find conclusive evidence of observed distress that could be directed attributed to areal subsidence.

The lineament evaluation performed as a part of this investigation indicates that the previously identified surface lineaments do not appear to be the result of subsidence.

IX. Flooding and Erosion. Surface erosion was observed along the southwestern portion of our site during our field investigation conducted on February 1, 2019. Risks associated with flooding and erosion should be evaluated and mitigated by the project design Civil Engineer.

X. Debris Flows. Debris flows are viscous flows consisting of poorly sorted mixtures of sediment and water and are generally initiated on slopes steeper than approximately six horizontal to one vertical (6H:1V), Subject: Concrete Mix Designs

CONCLUSIONS

Based on the results of our investigation and our review of the previous geotechnical reports prepared for the property, it is our professional opinion that the project remains feasible from a geotechnical perspective provided that the recommendations included in this report are incorporated into foundation design and carried out through construction. The main geotechnical concerns are the presence of potentially compressible and expansive near-surface native soil and potential seismic settlements.

We recommend that remedial grading within the proposed new building areas include the removal and re-compaction of any loose surface soil. Specific recommendations for site preparation are presented in the Earthwork and Grading section of this report.

Groundwater was encountered at a depth of approximately 47 feet bgs within BH-2 and BH-6. Based on the current depth and anticipated high groundwater depth, we do not expect that groundwater will impact grading operations or construction.

Caving did occur to varying degrees within each of our exploratory bores and the surface soil may be susceptible to caving within deeper excavations. All excavations should be constructed in accordance with the normal CalOSHA excavation criteria. On the basis of our observations of the materials encountered, we anticipate that the subsoil will conform to that described by CalOSHA as Type B or C. Soil conditions should be verified in the field by a "Competent person" employed by the Contractor.

The following preliminary design recommendations present more detailed design criteria that have been developed on the basis of our field and laboratory investigation.

EARTHWORK AND GRADING

All earthwork including excavation, backfill and preparation of the subgrade soil, should be performed in accordance with the geotechnical recommendations presented in this report and portions of the local regulatory requirements, as applicable. All earthwork should be performed under the observation and testing of a qualified soil engineer. The following geotechnical engineering recommendations for the proposed project are based on observations from the field investigation program, laboratory testing and geotechnical engineering analyses.

a. Stripping. Areas to be graded should be cleared of the vegetation, associated root systems and debris. All areas scheduled to receive fill should be cleared of old fills and any irreducible matter. The strippings should be removed off-site, or stockpiled for later use in landscape areas. Undocumented fill soil or loose soil should be removed in its entirety and replaced as engineered fill. Voids left by obstructions should be properly backfilled in accordance with the compaction recommendations of this report.

b. Preparation of the Residential Building Areas: In order to provide firm and uniform foundation bearing conditions, the primary foundation bearing soil should be over-excavated and re-compacted. Over-excavation should extend to a minimum depth of 3 feet below existing grade or 3 feet below the bottom of the footings, whichever is deeper. Once adequate removals have been verified, the exposed native soil should be scarified, moisture-conditioned and compacted to a minimum of 90 percent relative compaction.

c. Preparation of the Hotel Building Areas. In order to provide firm and uniform bearing foundation bearing conditions, we recommend over-excavation and re-compaction throughout the building and foundation areas. All artificial fill soil and low density near surface native soil should be removed to a depth of at least 4 feet below existing grade or 4 feet below the bottom of the footings, whichever is greater. Remedial grading should extend laterally, a minimum of five feet beyond the building perimeter. The exposed surface should then be scarified, moisture conditioned to within two percent of optimum moisture content, and compacted to at least 90 percent relative compaction.

d. Compaction. Soil to be used as engineered fill should be free of organic material, debris, and other deleterious substances, and should not contain irreducible matter greater than six (6) inches in maximum dimension. All fill materials should be placed in thin lifts not exceeding six inches in a loose condition. If import fill is required, the material should be of a non-expansive nature and should meet the following criteria:

Plastic Index	Less than 12
Liquid Limit	Less than 35
Percent Soil Passing #200 Sieve	Between 15% and 35%
Maximum Aggregate Size	3 inches

The subgrade and all fill material should be compacted with acceptable compaction equipment, to at least 90 percent relative compaction. The bottom of the exposed subgrade should be observed by a representative of Sladden Engineering prior to fill placement. Compaction testing should be performed on all lifts in order to verify proper placement of the fill materials. Table 2 provides a summary of the excavation and compaction recommendations.

TABLE 2
SUMMARY OF RECOMMENDATIONS

*Remedial Grading	Over-excavation and re-compaction within the residential building areas and extending laterally for 5 feet beyond the building limits and to a minimum of 3 feet below existing grade or 3 feet below the bottom of the footings, whichever is deeper. Over-excavation and re-compaction within the hotel building areas and extending laterally for 5 feet beyond the building limits and to a minimum of 4 feet below existing grade or 4 feet below the bottom of the footings, whichever is deeper.
Native / Import Engineered Fill	Place in thin lifts not exceeding 6 inches in a loose condition, compact to a minimum of 90 percent relative compaction.
Asphalt Concrete Sections	Compact the top 12 inches to at least 95 percent compaction within 2 percent of optimum moisture content.

*Actual depth may vary and should be determined by a representative of Sladden Engineering in the field during construction.

d. Shrinkage and Subsidence. Volumetric shrinkage of the material that is excavated and replaced as controlled compacted fill should be anticipated. We estimate that the shrinkage could vary from 10 to 25 percent. Subsidence of the surfaces that are scarified and compacted should be between 1 and 3 tenths of a foot. This will vary depending upon the type of equipment used, the moisture content of the soil at the time of grading and the actual degree of compaction attained.

FOUNDATIONS: CONVENTIONAL SHALLOW SPREAD FOOTINGS

Conventional shallow spread footings may be used for building support provided that the potential seismic settlements are accommodated in design. Load bearing walls may be supported on continuous spread footings and interior columns may be supported on isolated pad footings. All footings should be founded upon properly engineered fill and should have a minimum embedment depth of 18 inches measured from the lowest adjacent finished grade. Continuous and isolated footings should have minimum widths of 18 inches and 24 inches, respectively. Continuous and isolated footings placed on compact engineered fill soil may be designed using allowable (net) bearing pressures of 1800 and 2000 pounds per square foot (psf), respectively. Allowable increases of 250 psf for each additional 1 foot in width and 250 psf for each additional 6 inches in depth may be utilized, if desired. The maximum allowable bearing pressure should be 3,000 psf. The allowable bearing pressures apply to combined dead and sustained live loads.

The allowable bearing pressure may be increased by one-third when considering transient live loads, including seismic and wind forces. All footings should be reinforced in accordance with the project structural engineer's recommendations.

Based on the allowable bearing pressures recommended above, total static settlement of the shallow footings is anticipated to be less than one-inch, provided that foundation area preparation conforms to the recommendations described in this report. Differential static settlement is anticipated to be approximately one-half of the total settlement for similarly loaded footings spaced up to approximately 50 feet apart. The previously discussed seismic settlement should also be considered in design.

Lateral load resistance for the spread footings will be developed by passive soil pressure against the sides of the footings below grade and by friction acting at the base of the concrete footings bearing on compacted fill. An allowable passive pressure of 250 psf per foot of depth may be used for design purposes. An allowable coefficient of friction 0.40 may be used for dead and sustained live loads to compute the frictional resistance of the footing placed directly on compacted fill. Under seismic and wind loading conditions, the passive pressure or the frictional resistance may be increased by one-third.

All footing excavations should be observed by a representative of the project geotechnical consultant to verify adequate embedment depths prior to placement of forms, steel reinforcement or concrete. The excavations should be trimmed neat, level and square. All loose, disturbed, sloughed or moisture-softened soils and/or any construction debris should be removed prior to concrete placement. Excavated soil generated from footing and/or utility trenches should not be stockpiled within the building envelope or in areas of exterior concrete flatwork.

POST-TENSIONED SLABS

Post-tensioned slabs may be considered for the proposed structures. We have evaluated the on-site soil for construction of post-tensioned foundation systems in general accordance with design specifications of the Post Tensioning Institute. Post-tensioned slabs should be designed to be rigid and capable of spanning areas of non-uniform support and meet the following criteria:

1. Bearing Capacity = 1500 psf
2. Potential Liquefaction Induced Differential Settlement = 1.00 inches (over a horizontal distance of 50 feet)
3. Coefficient of Friction = 0.40

SLABS-ON-GRADE

In order to reduce the risk of heave, cracking and settlement, concrete slabs-on-grade should be placed on properly compacted soil as outlined in the previous sections of this report. The slab subgrades should remain near optimum moisture content and should not be permitted to dry prior to concrete placement. All slab subgrades should be firm and unyielding. Disturbed soil should be removed and then replaced and compacted to a minimum of 90 percent relative compaction.

Slab thickness and reinforcement should be determined by the Structural Engineer. All slab reinforcement should be supported on concrete chairs to ensure that reinforcement is placed at slab mid-height. Final slab-on-grade designs should be in accordance with the structural engineer's recommendations.

Slabs with moisture sensitive surfaces should be underlain with a moisture vapor retarder consisting of a polyvinyl chloride (pvc) membrane such as 10-mil Visqueen, or equivalent. All laps within the membrane should be sealed and at least 2 inches of clean sand should be placed over the membrane to promote uniform curing of the concrete. To reduce the potential for punctures, the membrane should be placed on a pad surface that has been graded smooth without any sharp protrusions. If a smooth surface can not be achieved by grading, consideration should be given to placing a 1-inch thick leveling course of sand across the pad surface prior to placement of the membrane.

RETAINING WALLS

Cantilever retaining walls may be designed using "active" pressures. Active pressures may be estimated using an equivalent fluid weight of 35 pcf for native backfill soil with level free-draining backfill conditions. The active pressure should be increased to 55 pcf equivalent fluid pressure where sloping backfill conditions (up to 2 to 1 H:V) are expected. At rest pressures should be used for retaining walls that are restrained from movement. At rest pressures may be estimated using an equivalent fluid weight of 55 pcf for native backfill soil with level drained conditions. Seismic pressures must be considered in the design of retaining walls in excess of 6 feet in height. Seismic pressures can be provided once specific wall heights and configurations are known.

PRELIMINARY PAVEMENT DESIGN

Asphalt concrete pavements should be designed in accordance with Topic 608 of the Caltrans Highway Design Manual based on R-Value and Traffic Index. R-Values of 10 for silty soil and 66 for sandy soil were determined by testing. A design R-Value of 50 was assumed to develop the following preliminary pavement design sections. The subgrade soil should be tested for R-Value after grading and the final pavement design should be based upon the R-Value of subgrade soil. For Pavement design, a Traffic Index (TI) of 6.0 was used for the light duty pavements (on site residential streets and parking areas) and a Traffic Index of 7.5 was assumed for heavy duty pavements (collector streets). We assumed Asphalt Concrete (AC) over Class II Aggregate Base (AB). The preliminary flexible pavement design is as follows:

RECOMMENDED ASPHALT PAVEMENT SECTION LAYER THICKNESS		
Pavement Material	**Recommended Thickness**	
	TI=6.0	**TI=7.5**
Asphalt Concrete Surface Course	3.0 inches	4.0 inches
Class II Aggregate Base Course	4.5 inches	6.0 inches
Compacted Subgrade Soil	12.0 inches	12.0 inches

Asphalt concrete should conform to Sections 203 and 302 of the latest edition of the Standard Specifications for Public Works Construction ("Greenbook") or Caltrans Section 39. Class II aggregate base should conform to Section 26 of the Caltrans Standard Specifications, or Greenbook latest edition. The aggregate base course should be compacted to at least 95 percent of the maximum dry density and subgrade should be compacted to at least 90 percent of maximum dry density as determined by ASTM Test Method D 1557.

CORROSION SERIES

The soluble sulfate concentrations of the surface soil were determined to be 600 and 280 parts per million (ppm). The soil is considered to have a "negligible" corrosion potential with respect to concrete. However, based upon our previous experience in the project vicinity, the use of Type V cement and special sulfate resistant concrete mixes may be necessary for structural concrete. The soluble sulfate content of the surface soil should be reevaluated after grading and appropriate concrete mix designs should be established based upon post-grading test results.

The pH levels of the surface soil was determined to be 9.0. Based on soluble chloride concentration testing (180 and 90 ppm), the soil is considered to have a "low" corrosion potential with respect to normal grade steel.

The minimum resistivity of the surface soil was found to be 970 and 2600 ohm-cm, that indicates the site soil is considered to have a "severe" corrosion potential with respect to ferrous metal installations. A corrosion expert should be retained to provide appropriate corrosion protection measures for corrosion sensitive installations.

UTILITY TRENCH BACKFILL

All utility trench backfill should be compacted to a minimum of 90 percent relative compaction. Trench backfill materials should be placed in lifts no greater than six inches in a loose condition, moisture conditioned (or air-dried) as necessary to achieve near optimum moisture conditions, and then mechanically compacted in place to a minimum relative compaction of 90 percent. A representative of the project geotechnical consultant should test the backfill to verify adequate compaction.

EXTERIOR CONCRETE FLATWORK

To minimize cracking of concrete flatwork, the subgrade soil below concrete flatwork areas should first be compacted to a minimum relative compaction of 90 percent. A representative of the project geotechnical consultant should observe and verify the density and moisture content of the soil prior to pouring concrete.

DRAINAGE

All final grades should be provided with positive gradients away from foundations to provide rapid removal of surface water runoff to an adequate discharge point. No water should be allowed to be pond on or immediately adjacent to foundation elements. In order to reduce water infiltration into the subgrade soil, surface water should be directed away from building foundations to an adequate discharge point. Subgrade drainage should be evaluated upon completion of the precise grading plans and in the field during grading.

LIMITATIONS

The findings and recommendations presented in this report are based upon an interpolation of the soil conditions between the exploratory bore locations and extrapolation of these conditions throughout the proposed building areas. Should conditions encountered during grading appear different than those indicated in this report, this office should be notified.

The use of this report by other parties or for other projects is not authorized. The recommendations of this report are contingent upon monitoring of the grading operation by a representative of Sladden Engineering. All recommendations are considered to be tentative pending our review of the grading operation and additional testing, if indicated. If others are employed to perform any soil testing, this office should be notified prior to such testing in order to coordinate any required site visits by our representative and to assure indemnification of Sladden Engineering.

We recommend that a pre-job conference be held on the site prior to the initiation of site grading. The purpose of this meeting will be to assure a complete understanding of the recommendations presented in this report as they apply to the actual grading performed.

ADDITIONAL SERVICES

Once completed, final project plans and specifications should be reviewed by us prior to construction to confirm that the full intent of the recommendations presented herein have been applied to design and construction. Following the review of plans and specifications, observation should be performed by the Soil Engineer during construction to document that foundation elements are founded on/or penetrate into the recommended soil, and that suitable backfill soil is placed upon competent materials and properly compacted at the recommended moisture content.

Tests and observations should be performed during grading by the Soil Engineer or his representative in order to verify that the grading is being performed in accordance with the project specifications. Field density testing shall be performed in accordance with acceptable ASTM test methods. The minimum acceptable degree of compaction should be 90 percent for subgrade soil and 95 percent for Class II aggregate base as obtained by the ASTM Test Method D1557. Where testing indicates insufficient density, additional compactive effort shall be applied until retesting indicates satisfactory compaction.

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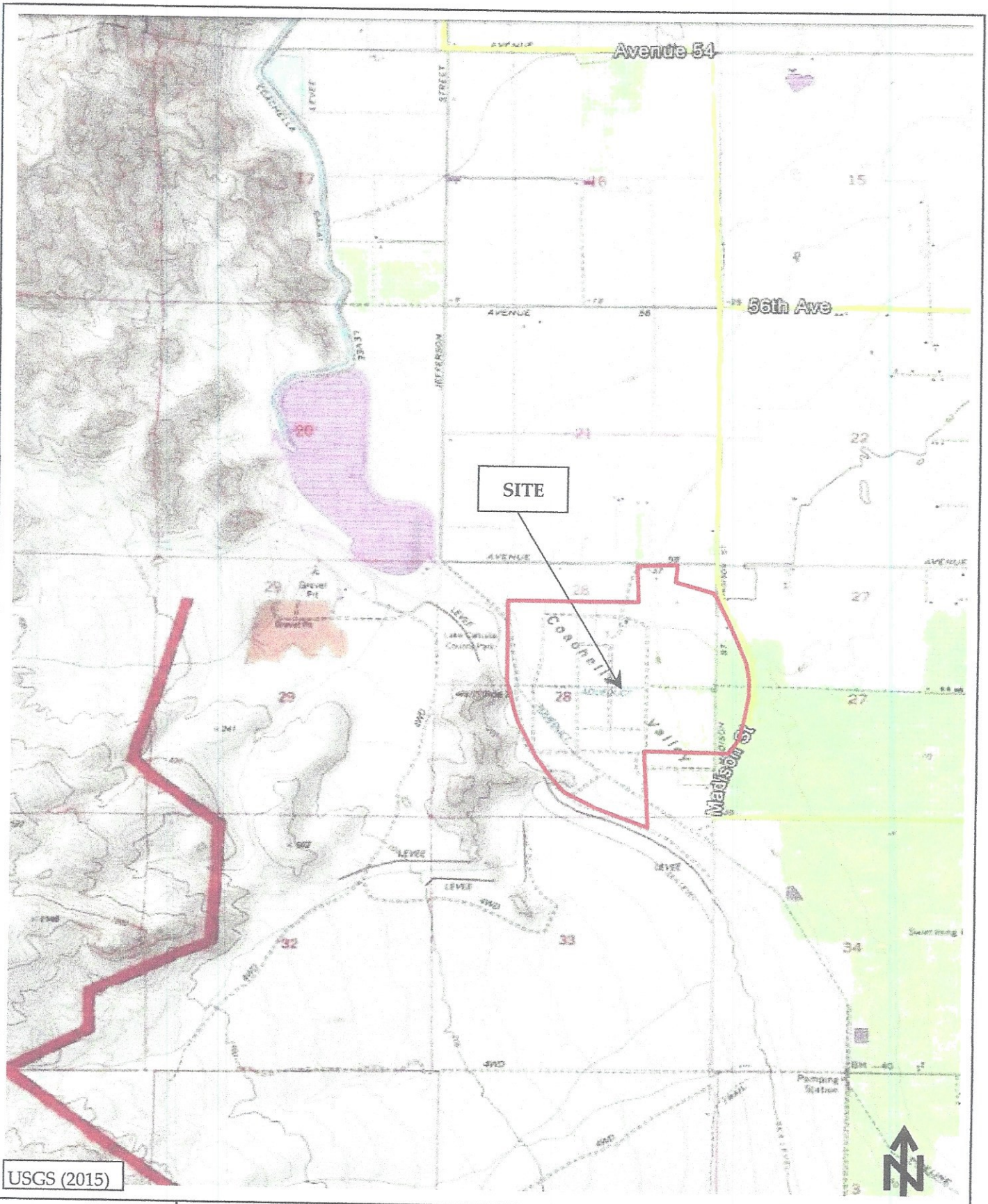
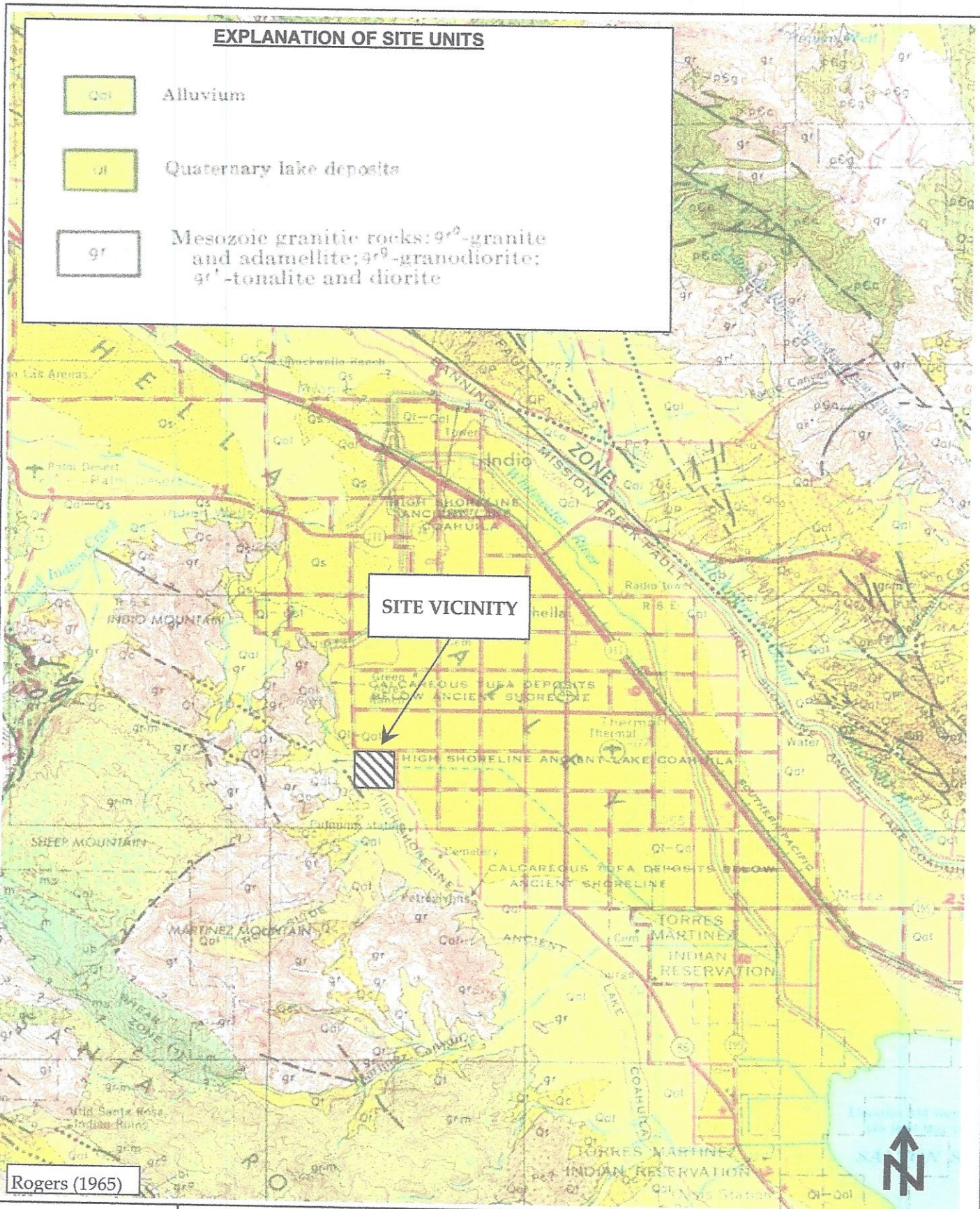
FIGURES

SITE LOCATION MAP
REGIONAL GEOLOGIC MAP
BOREHOLE LOCATION PLAN
LINEAMENT PHOTOGRAPH



Sladden Engineering	SITE LOCATION MAP	FIGURE 1
	Project Number: 544-19025	
	Report Number: 19-01-049	
	Date: February 26, 2019	



Sladden Engineering	REGIONAL GEOLOGIC MAP	FIGURE 2
	Project Number: 544-19025	
	Report Number: 19-01-049	
	Date: February 26, 2019	

Vita (2019)

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Sladden Engineering

BOREHOLE LOCATION PLAN

Project Number:	544-19025
Report Number:	19-01-049
Date:	February 26, 2019

FIGURE

3

Google Earth (2019)

Sladden Engineering	LINEAMENT PHOTOGRAPH		FIGURE 4
	Project Number:	544-19025	
	Report Number:	19-01-049	
	Date:	February 26, 2019	

APPENDIX A

FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

For our field investigation ten (10) exploratory bores were excavated on February 1, 2019 utilizing a truck mounted rig (Mobile B-61) equipped with 8-inch outside diameter (O.D.) augers. Continuous logs of the materials encountered were made by a representative of Sladden Engineering.

Sladden's linement trench investigation was conducted on February 5, 2019 with the excavation of exploratory trenches T-1, T-2 and T-3 and February 6, 2019 for T-4 and T-5. All five (5) exploratory trenches were excavated to a total depth of approximately five (5) feet bgs. Exploratory trenches were excavated by Sladden Engineering utilizing a track mounted mini excavator equipped with a 2.0-foot wide bucket.

Materials encountered in the boreholes were classified in accordance with the Unified Soil Classification System which is presented in this appendix.

Representative undisturbed samples were obtained within our borings by driving a thin-walled steel penetration sampler (California split spoon sampler) or a Standard Penetration Test (SPT) sampler with a 140 pound automatic-trip hammer dropping approximately 30 inches (ASTM D1586). The number of blows required to drive the samplers 18 inches was recorded in 6-inch increments and blowcounts are indicated on the boring logs.

The California samplers are 3.0 inches in diameter, carrying brass sample rings having inner diameters of 2.5 inches. The standard penetration samplers are 2.0 inches in diameter with an inner diameter of 1.5 inches. Undisturbed samples were removed from the sampler and placed in moisture sealed containers in order to preserve the natural soil moisture content. Bulk samples were obtained from the excavation spoils and samples were then transported to our laboratory for further observations and testing.

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			TYPICAL NAMES	
COARSE GRAINED SOILS MORE THAN HALF IS LARGER THAN No.200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN No.4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVEL-SAND MIXTURES
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, POORLY-GRADED GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN No.4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS
			SP	POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES
			SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN HALF IS SMALLER THAN No.200 SIEVE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS & VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, CLEAN CLAYS
			OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS: LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

EXPLANATION OF BORE LOG SYMBOLS


California Split-spoon Sample


Unrecovered Sample


Standard Penetration Test Sample


Groundwater depth

Note: The stratification lines on the borelogs represent the approximate boundaries between the soil types; the transitions may be gradual.

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobile B-61	Date Drilled:	1/30/2019
Elevation:	-20 Ft (MSL)	Boring No:	BH-1

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0		Sandy Silt (ML); grayish brown, dry, low plasticity with gravel (Fill/Disturbed).
							2		
							4		
	5/6/11			37.1	1.9		6		Silty Sand (SM); grayish brown, dry, medium dense, fine-grained, with gravel (Ql-Qal).
							8		
	6/6/9			26.5	1.3		10		Silty Sand (SM); grayish brown, dry, medium dense, fine-grained, with gravel (Ql-Qal).
							12		
							14		
	6/7/9			49.4	2.5		16		Silty Sand (SM); grayish brown, dry, medium dense, fine-grained, with gravel (Ql-Qal).
							18		
							20		
	7/9/15			56.4	2.8		22		Sandy Silt (ML); grayish brown, slightly moist, very stiff, low plasticity (Ql-Qal).
							24		Terminated at ~21.5 Ft. bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

ANDALUSIA - WESTSIDE DEVELOPMENT
WEST OF MADISON ST., BETWEEN AVE. 58 & AVE. 60

Project No: 544-19025
Report No: 19-01-049

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobile B-61	Date Drilled:	1/30/2019
Elevation:	-40 Ft (MSL)	Boring No:	BH-2

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0		Silt (ML); grayish brown, dry, low plasticity (Fill/Disturbed).
	8/15/20	1	66	97.8	4.4	85.4	2		Silt (ML); grayish brown, slightly moist, very stiff, medium plasticity with shells (Ql-Qal).
	8/14/19			97.7	5.8	88.5	6		Silt (ML); grayish brown, slightly moist, very stiff, medium plasticity with shells (Ql-Qal).
	5/6/9			13.4	1.6		10		Silty Sand (SM); grayish brown with orange mottling, dry, medium dense, fine-grained (Ql-Qal).
	8/10/15			90.1	10.3	96.3	16		Sandy Clay (CL); grayish brown with orange mottling, moist, very stiff, medium plasticity (Ql-Qal).
	7/8/14			64.3	10.6		20		Silt (ML); grayish brown, moist, very stiff, low plasticity with shells (Ql-Qal).
	8/14/19			64.3	5.9	132.4	26		Silt (ML); grayish brown, moist, very stiff, low plasticity with shells (Ql-Qal).
	8/10/10			35.6	5.5		30		Silty Sand (SM); grayish brown, slightly moist, medium dense, fine-grained (Ql-Qal).
	17/24/41			7.1	2.2	117.4	36		Gravelly Sand (SW); grayish brown, slightly moist, dense, fine-to coarse-grained (Ql-Qal).
	6/10/10			48.4	17.4		40		Silty Sand (SM); grayish brown, very moist, medium dense, fine-grained (Ql-Qal).
	4/5/11			81.1	30.2	92.5	46		Clayey Silt (ML); grayish brown, very moist, stiff, medium plasticity with shells (Ql-Qal).
	5/9/15			45.9	23.5		50		Silty Sand (SM); grayish brown, wet, loose, fine-grained (Ql-Qal).

Completion Notes:
Terminated at -51.5 Feet bgs.
No Bedrock Encountered.
Groundwater Encountered at -47.0 Feet bgs.

ANDALUSIA - WESTSIDE DEVELOPMENT
WEST OF MADISON ST., BETWEEN AVE. 58 & AVE. 60

Project No: 544-19025
Report No: 19-01-049

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobile B-61	Date Drilled:	1/30/2019
Elevation:	-40 Ft (MSL)	Boring No:	BH-3

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0		Silt (ML); grayish brown, dry, low plasticity with shells (Fill/Disturbed).
	4/6/8			88.0	5.1		2		Silt (ML); grayish brown, slightly moist, stiff, low plasticity with shells (Ql-Qal).
	8/16/24			96.4	9.1	90.6	10		Clayey Silt (ML); grayish brown with orange mottling, slightly moist, very stiff, friable, low to medium plasticity with shells (Ql-Qal).
	8/8/9			29.6	2.2		16		Silty Sand (SM); grayish brown, dry, medium dense, fine-grained (Ql-Qal).
	11/17/24			74.7	7.3	100.2	20		Silt (ML); grayish brown, dry, very stiff, low plasticity with shells (Ql-Qal).
							22		Terminated at ~21.5 Ft. bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

ANDALUSIA - WESTSIDE DEVELOPMENT
WEST OF MADISON ST., BETWEEN AVE. 58 & AVE. 60

Project No: 544-19025
Report No: 19-01-049

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobile B-61	Date Drilled:	1/30/2019
Elevation:	-45 Ft (MSL)	Boring No:	BH-4

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0		Silt (ML); grayish brown, dry, low plasticity with shells (Fill/Disturbed).
	12/12/18			94.7	6.3	84.2	5		Silt (ML); grayish brown, slightly moist, very stiff, low plasticity with shells (Ql-Qal).
	7/11/14			21.3	1.5		10		Silty Sand (SM); grayish brown, dry, medium dense, fine-grained (Ql-Qal).
	7/12/15			37.0	1.8	105.8	15		Silty Sand (SM); grayish brown, dry, medium dense, fine-grained (Ql-Qal).
	8/11/12			33.4	1.9		20		Silty Sand (SM); grayish brown, dry, medium dense, fine-grained (Ql-Qal).
							22		Terminated at ~21.5 Ft. bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

ANDALUSIA - WESTSIDE DEVELOPMENT
WEST OF MADISON ST., BETWEEN AVE. 58 & AVE. 60

Project No: 544-19025
Report No: 19-01-049

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobile B-61	Date Drilled:	1/30/2019
Elevation:	-40 Ft (MSL)	Boring No:	BH-5

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0		Gravelly Sand (SP); grayish brown, dry, fine-to coarse-grained (Fill).
							2		
	4/4/6			15.9	1.4		4		Silty Sand (SM); grayish brown, slightly moist, loose, fine-to coarse-grained with gravel (Ql-Qal).
							6		
	10/14/20			18.6	1.2	111.0	8		Silty Sand (SM); grayish brown, slightly moist, medium dense, fine-to coarse-grained with gravel and shells (Ql-Qal).
							10		
	5/10/9			24.5	1.7		12		Silty Sand (SM); grayish brown, slightly moist, medium dense, fine-to coarse-grained with gravel and shells (Ql-Qal).
							14		
	12/13/18			17.1	1.2	113.9	16		Silty Sand (SM); grayish brown with orange mottling, slightly moist, medium dense, fine-to coarse-grained with gravel and shells (Ql-Qal).
							18		
	8/10/13			12.9	1.2		20		Silty Sand (SM); grayish brown with orange mottling, slightly moist, medium dense, fine-to coarse-grained with gravel and shells (Ql-Qal).
							22		
	12/21/24			20.4	1.4	112.3	24		Silty Sand (SM); grayish brown with orange mottling, slightly moist, medium dense, fine-to coarse-grained with gravel and shells (Ql-Qal).
							26		
							28		
							30		
							32		
							34		Terminated at ~31.5 Ft. bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

ANDALUSIA - WESTSIDE DEVELOPMENT
WEST OF MADISON ST., BETWEEN AVE. 58 & AVE. 60

Project No: 544-19025
Report No: 19-01-049

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobile B-61	Date Drilled:	2/1/2019
Elevation:	-55 Ft (MSL)	Boring No:	BH-6

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0		Silty Sand (SM); grayish brown, dry, fine-to coarse-grained with gravel (Fill).
	8/17/23			14.6	3.8	104.3	2		Silty Sand (SM); grayish brown, slightly moist, medium dense, fine-grained (Ql-Qal).
	7/9/11			13.4	0.7		4		Silty Sand (SM); grayish brown, slightly moist, medium dense, fine-grained (Ql-Qal).
	12/23/29			78.8	6.3	98.6	10		Silt (ML); grayish brown, slightly moist, very hard, low plasticity (Ql-Qal).
	6/13/25			92.1	8.9		16		Silt (ML); grayish brown, slightly moist, very hard, low plasticity (Ql-Qal).
	8/16/20			39.9	3.5	101.8	20		Silty Sand (SM); grayish brown, slightly moist, medium dense, fine-grained (Ql-Qal).
	9/13/15			41.0	3.0		26		Silty Sand (SM); grayish brown, slightly moist, medium dense, fine-grained (Ql-Qal).
	15/21/32			11.7	1.8	107.6	30		Sand (SP); grayish brown, slightly moist, dense, fine-grained (Ql-Qal).
	5/6/10			75.3	14.9		36		Clayey Silt (ML); grayish brown , moist, stiff, friable, medium plasticity (Ql-Qal).
	6/10/25			84.9	27.7	94.0	40		Silty Clay (CL/CH); olive brown, moist, very stiff, high plasticity (Ql-Qal).
	4/4/6			95.6	34.6		46		Sandy Clay (CL/CH); olive brown, moist, stiff, high plasticity (Ql-Qal).
	5/6/12			84.6	34.4	89.2	50		Sandy Clay (CL/CH); olive brown, moist, stiff, high plasticity (Ql-Qal).

Completion Notes:
Terminated at ~51.5 Feet bgs.
No Bedrock Encountered.
Groundwater Encountered at ~47.0 Feet bgs.

ANDALUSIA - WESTSIDE DEVELOPMENT
WEST OF MADISON ST., BETWEEN AVE. 58 & AVE. 60

Project No: 544-19025
Report No: 19-01-049

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobile B-61	Date Drilled:	2/1/2019
Elevation:	-45 Ft (MSL)	Boring No:	BH-7

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0		Silty Sand (SM); grayish brown, dry, fine-grained (Fill/Disturbed).
							2		
							4		
	8/15/25			12.1	0.7	100.6	6		Silty Sand (SM); grayish brown, dry, medium dense, fine-grained (Ql-Qal).
							8		
	8/12/16			21.0	1.7		10		Silty Sand (SM); grayish brown, dry, medium dense, fine-grained (Ql-Qal).
							12		
							14		
	10/15/24			12.8	1.0	104.2	16		Silty Sand (SM); grayish brown, dry, medium dense, fine-grained (Ql-Qal).
							18		
	15/24/31			86.1	6.7		20		Silt (ML); grayish brown, dry to slightly moist, hard, low plasticity (Ql-Qal).
							22		
							24		Terminated at ~21.5 Ft. bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

ANDALUSIA - WESTSIDE DEVELOPMENT
WEST OF MADISON ST., BETWEEN AVE. 58 & AVE. 60

Project No: 544-19025
Report No: 19-01-049

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobile B-61	Date Drilled:	2/1/2019
Elevation:	-55 Ft (MSL)	Boring No:	BH-8

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0		Silty Sand (SM); grayish brown, slightly moist, fine-grained (Ql-Qal).
	5/7/11			13.8	0.9		6		Silty Sand (SM); grayish brown, dry, medium dense, fine-grained (Ql-Qal).
	8/12/16			91.8	15.2	94.1	10		Sandy Silt (ML); grayish brown, moist, very stiff, low plasticity (Ql-Qal).
	8/12/13			46.8	5.2		15		Silty Sand (SM); grayish brown, slightly moist, medium dense, fine-grained (Ql-Qal).
	8/16/20			15.2	2.6	100.6	20		Silty Sand (SM); grayish brown, slightly moist, dense, fine-grained with clay (Ql-Qal).
							22		Terminated at ~21.5 Ft. bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

ANDALUSIA - WESTSIDE DEVELOPMENT
WEST OF MADISON ST., BETWEEN AVE. 58 & AVE. 60

Project No: 544-19025
Report No: 19-01-049

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobile B-61	Date Drilled:	2/1/2019
Elevation:	-50 Ft (MSL)	Boring No:	BH-9

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0		Sandy Silt (ML); grayish brown, dry, low plasticity (Fill/Disturbed).
	9/16/20			51.8	15.3	98.3	10		Sandy Silt (ML); grayish brown, moist, very stiff, low plasticity (Ql-Qal).
	7/9/13			15.5	1.7		10		Silty Sand (SM); grayish brown, dry, medium dense, fine-grained (Ql-Qal).
	8/20/21			29.5	3.5	109.3	20		Silty Sand (SM); grayish brown, dry, medium dense, fine-grained with clay (Ql-Qal).
	4/7/8			88.1	23.3		20		Sandy Silt (ML); grayish brown, moist, stiff, low plasticity (Ql-Qal).
							22		Terminated at ~21.5 Ft. bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

ANDALUSIA - WESTSIDE DEVELOPMENT
WEST OF MADISON ST., BETWEEN AVE. 58 & AVE. 60

Project No: 544-19025
Report No: 19-01-049

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobile B-61	Date Drilled:	2/1/2019
Elevation:	-50 Ft (MSL)	Boring No:	BH-10

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0		Silt (ML); grayish brown, slightly moist, low plasticity (Fill/Disturbed).
							2		
	7/10/13			30.6	1.6		4		Silty Sand (SM); grayish brown, dry, medium dense, fine-grained (Ql-Qal).
							6		
	13/18/23			14.8	1.8	103.6	8		Silty Sand (SM); grayish brown with orange mottling, dry, medium dense, fine-grained (Ql-Qal).
							10		
	8/12/12			38.8	3.8		12		Silty Sand (SM); grayish brown with orange mottling, dry, medium dense, fine-grained (Ql-Qal).
							14		
	7/15/21			71.6	8.4	99.6	16		Sandy Silt (ML); grayish brown, slightly moist to moist, very stiff, low plasticity (Ql-Qal).
							18		
							20		Terminated at ~21.5 Ft. bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							22		
							24		
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

ANDALUSIA - WESTSIDE DEVELOPMENT
WEST OF MADISON ST., BETWEEN AVE. 58 & AVE. 60

Project No: 544-19025
Report No: 19-01-049

APPENDIX B

LABORATORY TESTING

APPENDIX B

LABORATORY TESTING

Representative bulk and relatively undisturbed soil samples were obtained in the field and returned to our laboratory for additional observations and testing. Laboratory testing was generally performed in two phases. The first phase consisted of testing in order to determine the compaction of the existing natural soil and the general engineering classifications of the soil underlying the site. This testing was performed in order to estimate the engineering characteristics of the soil and to serve as a basis for selecting samples for the second phase of testing. The second phase consisted of soil mechanics testing. This testing including consolidation, shear strength and expansion testing was performed in order to provide a means of developing specific design recommendations based on the mechanical properties of the soil.

CLASSIFICATION AND COMPACTION TESTING

Unit Weight and Moisture Content Determinations: Each undisturbed sample was weighed and measured in order to determine its unit weight. A small portion of each sample was then subjected to testing in order to determine its moisture content. This was used in order to determine the dry density of the soil in its natural condition. The results of this testing are shown on the Boring Logs.

Maximum Density-Optimum Moisture Determinations: Representative soil types were selected for maximum density determinations. This testing was performed in accordance with the ASTM Standard D1557-91, Test Method A. The results of this testing are presented graphically in this appendix. The maximum densities are compared to the field densities of the soil in order to determine the existing relative compaction to the soil.

Classification Testing: Soil samples were selected for classification testing. This testing consists of mechanical grain size analyses. This provides information for developing classifications for the soil in accordance with the Unified Soil Classification System which is presented in the preceding appendix. This classification system categorizes the soil into groups having similar engineering characteristics. The results of this testing is very useful in detecting variations in the soil and in selecting samples for further testing.

SOIL MECHANIC'S TESTING

Expansion Testing: Two (2) bulk samples were selected for Expansion testing. Expansion testing was performed in accordance with the UBC Standard 18-2. This testing consists of remolding 4-inch diameter by 1-inch thick test specimens to a moisture content and dry density corresponding to approximately 50 percent saturation. The samples are subjected to a surcharge of 144 pounds per square foot and allowed to reach equilibrium. At that point the specimens are inundated with distilled water. The linear expansion is then measured until complete.

Direct Shear Tests: Two (2) bulk samples were selected for Direct Shear testing. This test measures the shear strength of the soil under various normal pressures and is used to develop parameters for foundation design and lateral design. Tests were performed using a recompacted test specimen that was saturated prior to tests. Tests were performed using a strain controlled test apparatus with normal pressures ranging from 800 to 2300 pounds per square foot.

Consolidation Test: Four (4) relatively undisturbed samples were selected for consolidation testing. For this test, a one-inch thick test specimen was subjected to vertical loads varying from 575 psf to 11520 psf applied progressively. The consolidation at each load increment was recorded prior to placement of each subsequent load. The specimens were saturated at 575 psf or 720 psf load increment.

Corrosion Series Testing: The soluble sulfate concentrations of the surface soil were determined in accordance with California Test Method Number (CA) 417. The pH and Minimum Resistivity were determined in accordance with CA 643. The soluble chloride concentrations were determined in accordance with CA 422.

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Maximum Density/Optimum Moisture

ASTM D698/D1557

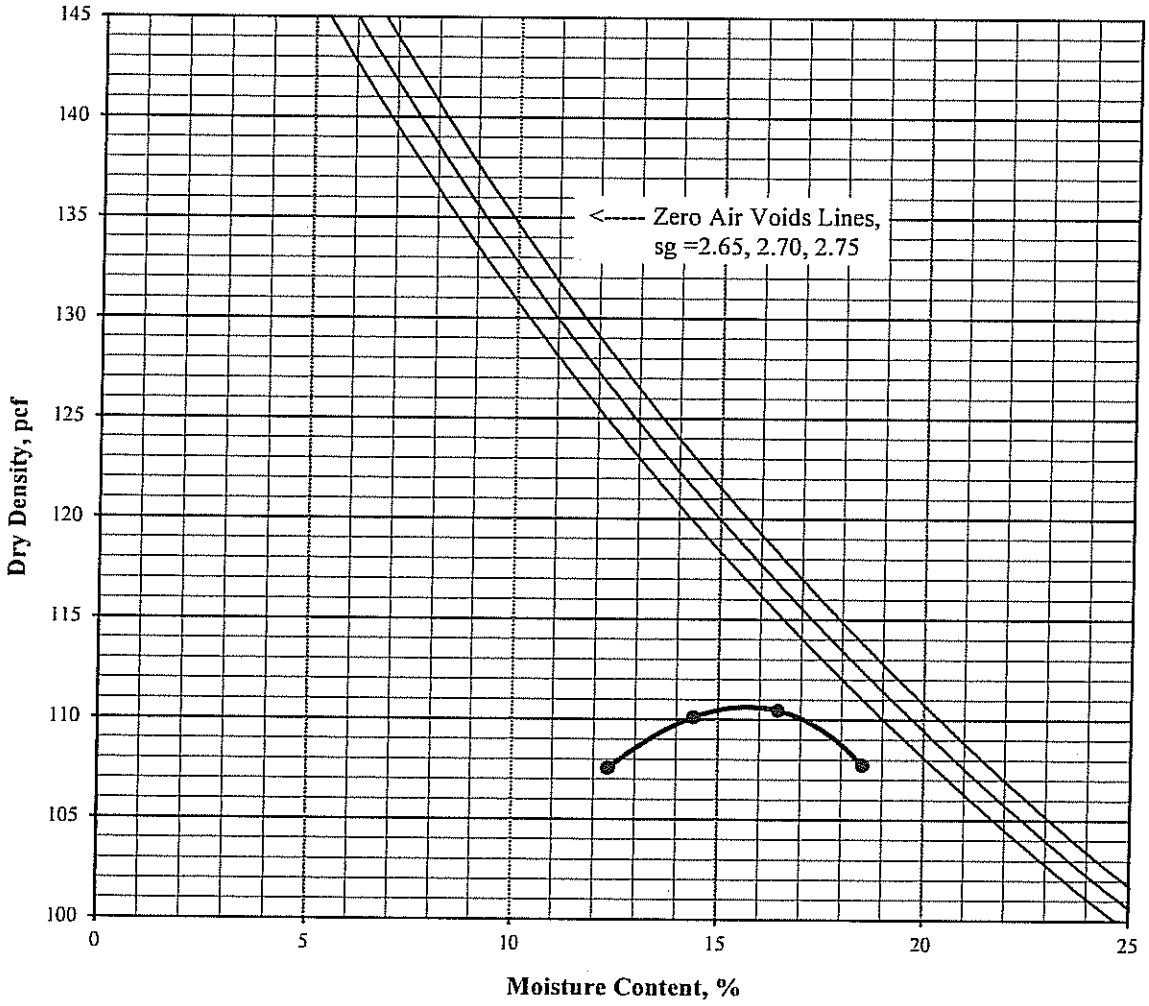
Project Number: 544-19025
Project Name: Andalusia - Westside Development
Lab ID Number: LN6-19062
Sample Location: BH-2 Bulk 1 @ 0-5'
Description: Olive Brown Silt (ML)

February 12, 2019

ASTM D-1557 A
Rammer Type: Machine

Maximum Density: 111 pcf
Optimum Moisture: 16%

Sieve Size	% Retained
3/4"	
3/8"	
#4	0.0



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Maximum Density/Optimum Moisture

ASTM D698/D1557

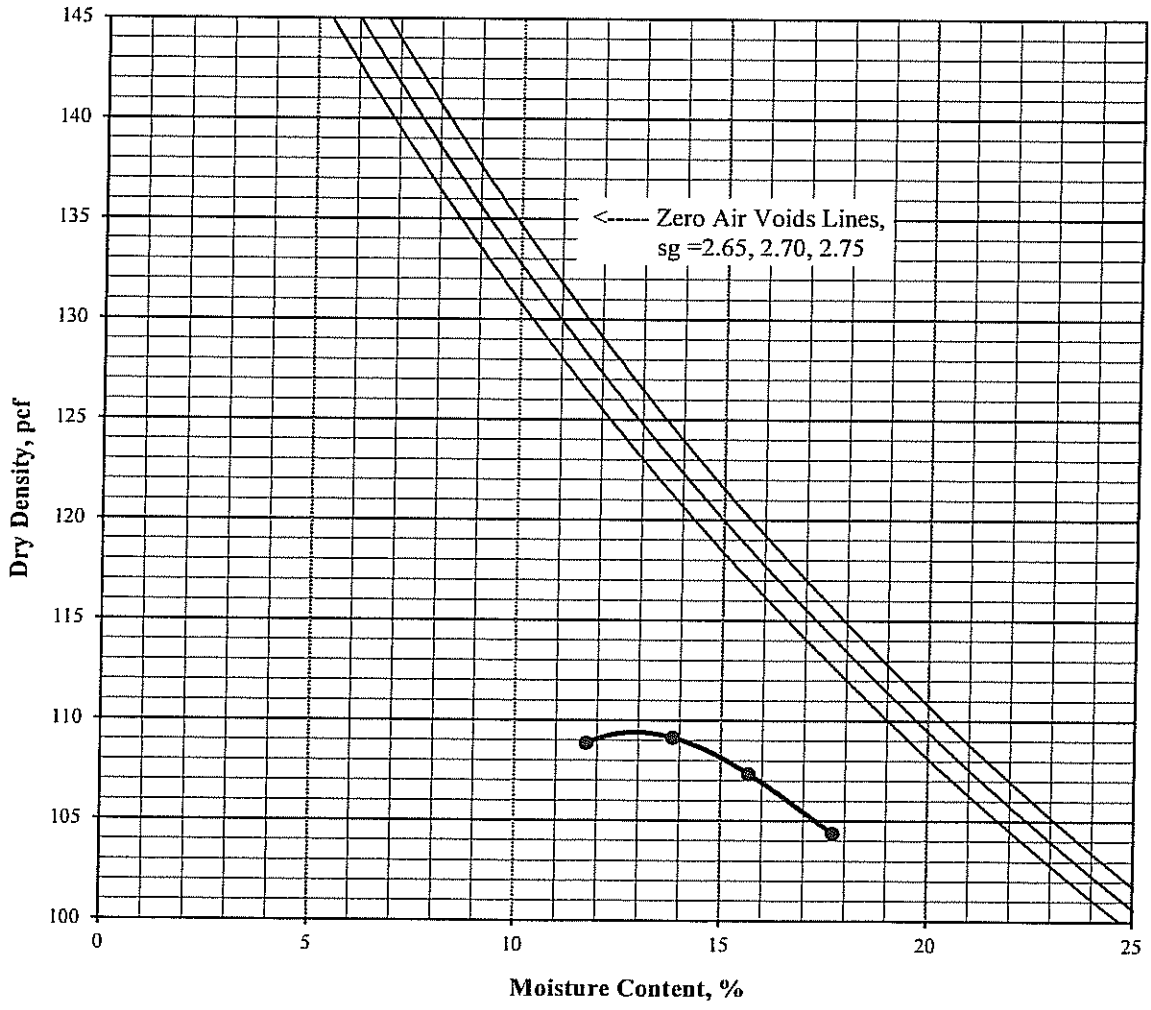
Project Number: 544-19025
Project Name: Andalusia - Westside Development
Lab ID Number: LN6-19062
Sample Location: BH-6 Bulk 2 @ 0-5'
Description: Dark Brown Silty Sand (SM)

February 12, 2019

ASTM D-1557 A
Rammer Type: Machine

Maximum Density: 109.5 pcf
Optimum Moisture: 14%

Sieve Size	% Retained
3/4"	
3/8"	
#4	0.0



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Expansion Index

ASTM D 4829

Job Number: 544-19025
Job Name: Andalusia - Westside Development
Lab ID Number: LN6-19062
Sample ID: BH-2 Bulk 1 @ 0-5'
Soil Description: Olive Brown Silt (ML)

February 12, 2019

Wt of Soil + Ring:	532.9
Weight of Ring:	194.9
Wt of Wet Soil:	338.0
Percent Moisture:	14.5%
Sample Height, in	0.95
Wet Density, pcf:	107.8
Dry Denstiy, pcf:	94.2

% Saturation:	49.6

Expansion **Rack # 1**

Date/Time	2/11/2019	2:00 PM
Initial Reading	0.0000	
Final Reading	0.0663	

Expansion Index **66**

(Final - Initial) x 1000

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Expansion Index

ASTM D 4829

February 12, 2019

Job Number: 544-19025
Job Name: Andalusia - Westside Development
Lab ID Number: LN6-19062
Sample ID: BH-6 Bulk 2 @ 0-5'
Soil Description: Dark Brown Silty Sand (SM)

Wt of Soil + Ring:	541.4
Weight of Ring:	192.0
Wt of Wet Soil:	349.4
Percent Moisture:	12.6%
Sample Height, in	0.95
Wet Density, pcf:	111.5
Dry Denstiy, pcf:	99.0

% Saturation:	48.4

Expansion **Rack # 4**

Date/Time	2/11/2019	2:20 PM
Initial Reading	0.0000	
Final Reading	0.0006	

Expansion Index **1**

(Final - Initial) x 1000

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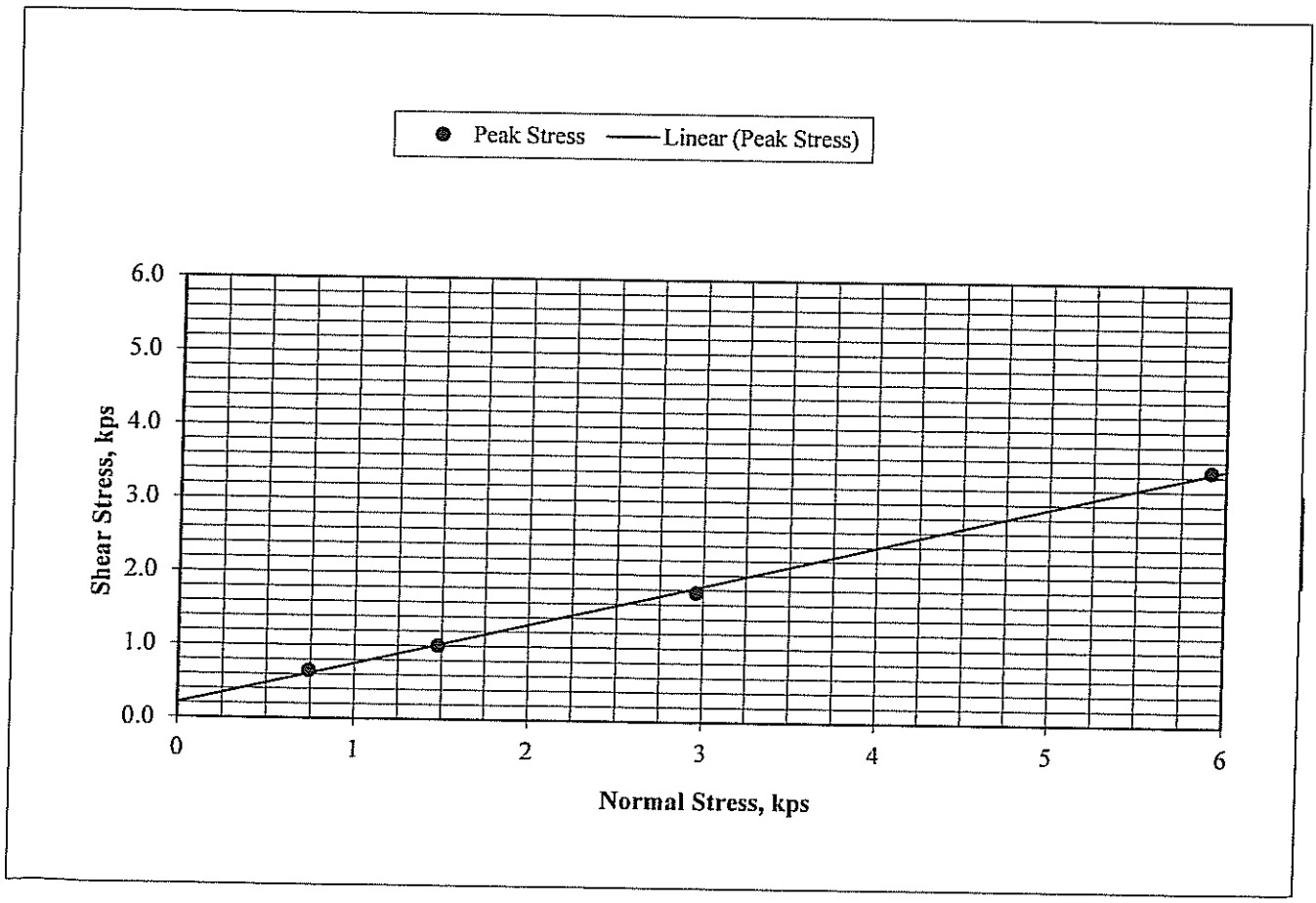
Direct Shear ASTM D 3080-04
(modified for unconsolidated condition)

Job Number: 544-19025
Job Name Andalusia - Westside Development
Lab ID No. LN6-19062
Sample ID BH-2 Bulk-1 @ 0-5'
Classification Olive Brown Silt (ML)
Sample Type Remolded @ 90% of Maximum Density

February 12, 2019
Initial Dry Density: 100.3 pcf
Initial Mosture Content: 15.8 %
Peak Friction Angle (Ø): 29°
Cohesion (c): 200 psf

Test Results	1	2	3	4	Average
Moisture Content, %	27.2	27.2	27.2	27.2	27.2
Saturation, %	107.9	107.9	107.9	107.9	107.9
Normal Stress, kps	0.739	1.479	2.958	5.916	
Peak Stress, kps	0.649	1.002	1.761	3.466	



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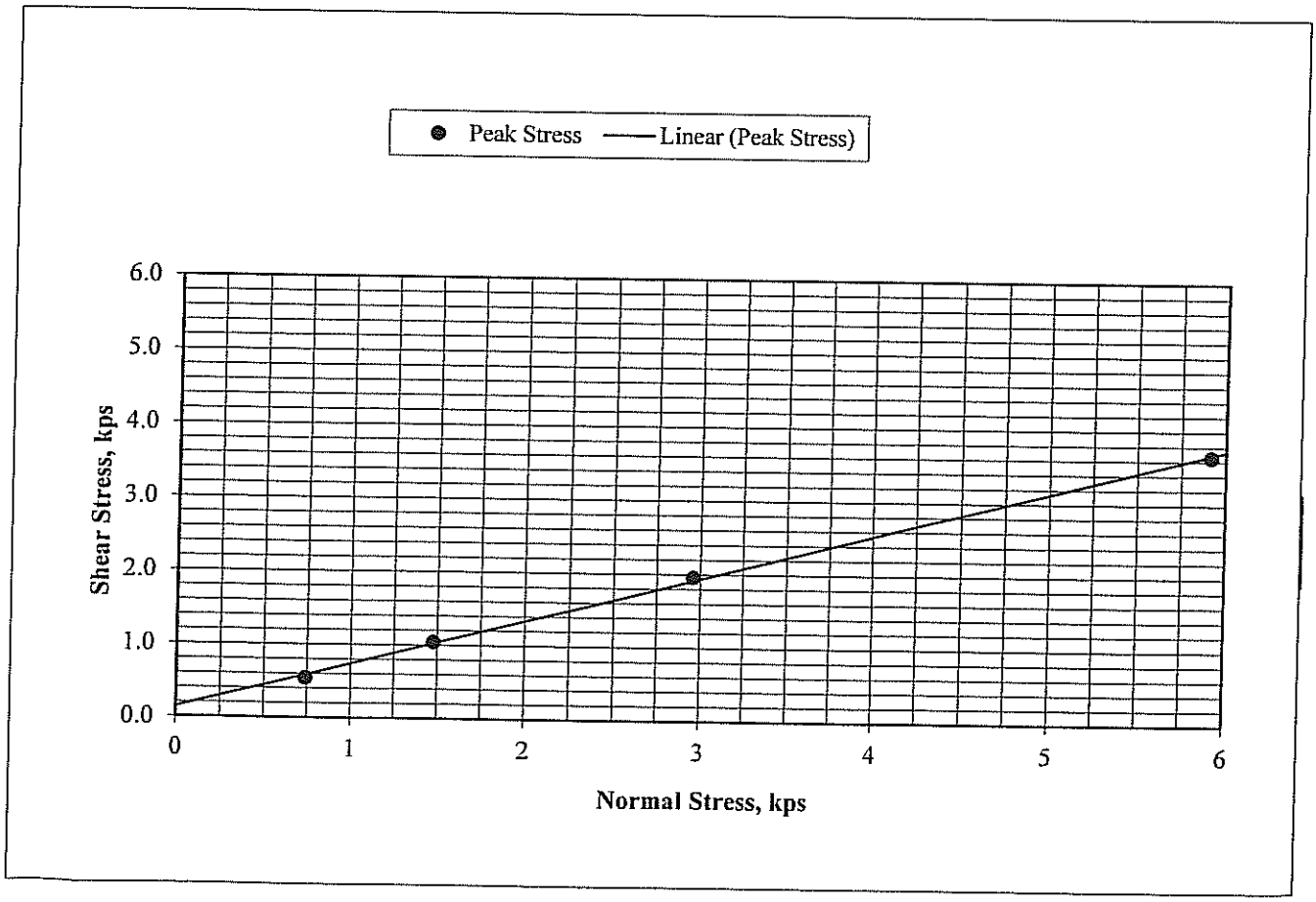
Direct Shear ASTM D 3080-04
(modified for unconsolidated condition)

Job Number: 544-19025
Job Name Andalusia - Westside Development
Lab ID No. LN6-19062
Sample ID BH-2 Bulk-1 @ 0-5'
Classification Dark Brown Silty Sand (SM)
Sample Type Remolded @ 90% of Maximum Density

February 12, 2019
Initial Dry Density: 98.4 pcf
Initial Mosture Content: 13.8 %
Peak Friction Angle (Ø): 31°
Cohesion (c): 140 psf

Test Results	1	2	3	4	Average
Moisture Content, %	23.6	23.6	23.6	23.6	23.6
Saturation, %	89.6	89.6	89.6	89.6	89.6
Normal Stress, kps	0.739	1.479	2.958	5.916	
Peak Stress, kps	0.540	1.041	1.959	3.655	



Sladden Engineering
450 Egan Avenue, Beaumont, CA 92223 (951) 845-7743 Fax (951) 845-8863

Gradation

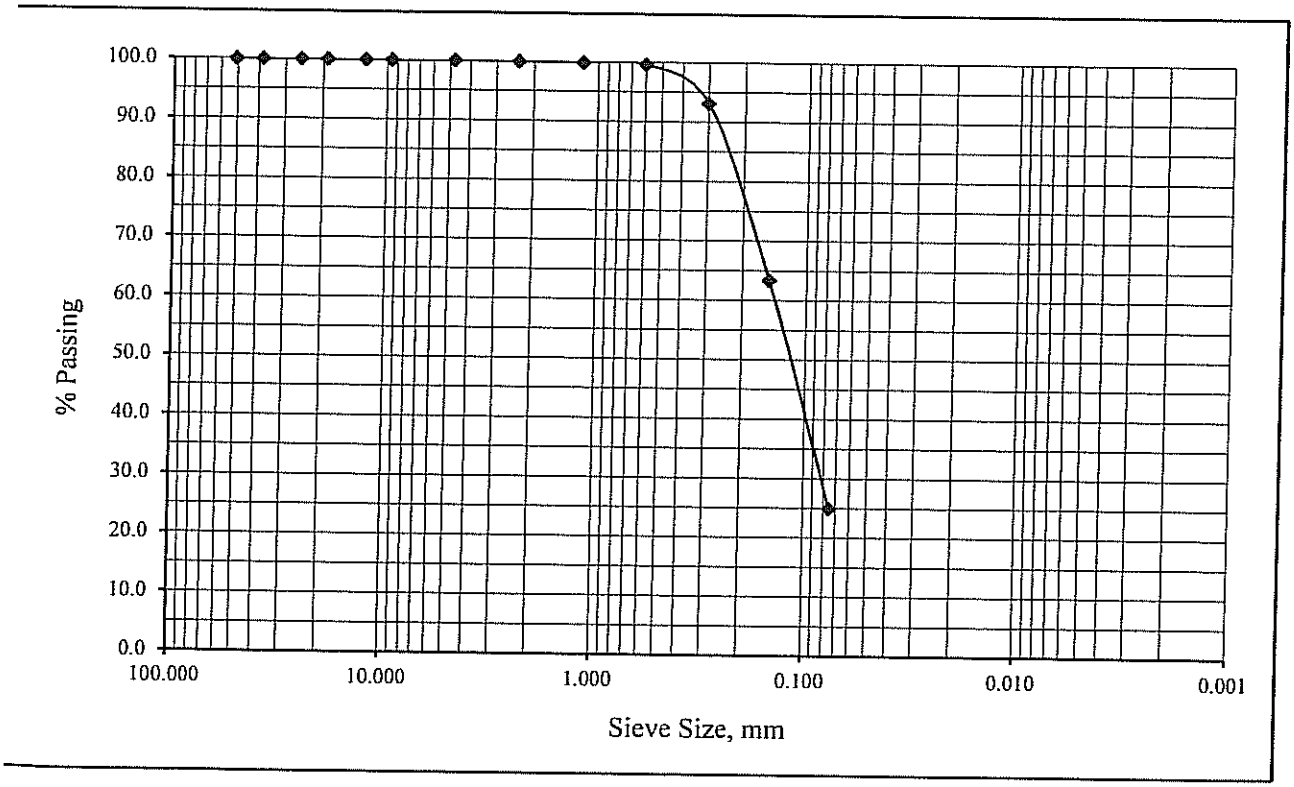
ASTM C117 & C136

Project Number: 544-19025
Project Name: Andalusia - Westside Development
Lab ID Number: LN6-19062
Sample ID: BH-6 Bulk-2 @ 0-5'

February 12, 2019

Soil Classification: SM

Sieve Size, in	Sieve Size, mm	Percent Passing
2"	50.8	100.0
1 1/2"	38.1	100.0
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	100.0
#16	1.18	99.8
#30	0.60	99.6
#50	0.30	93.1
#100	0.15	63.4
#200	0.075	24.9



Sladden Engineering

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Gradation

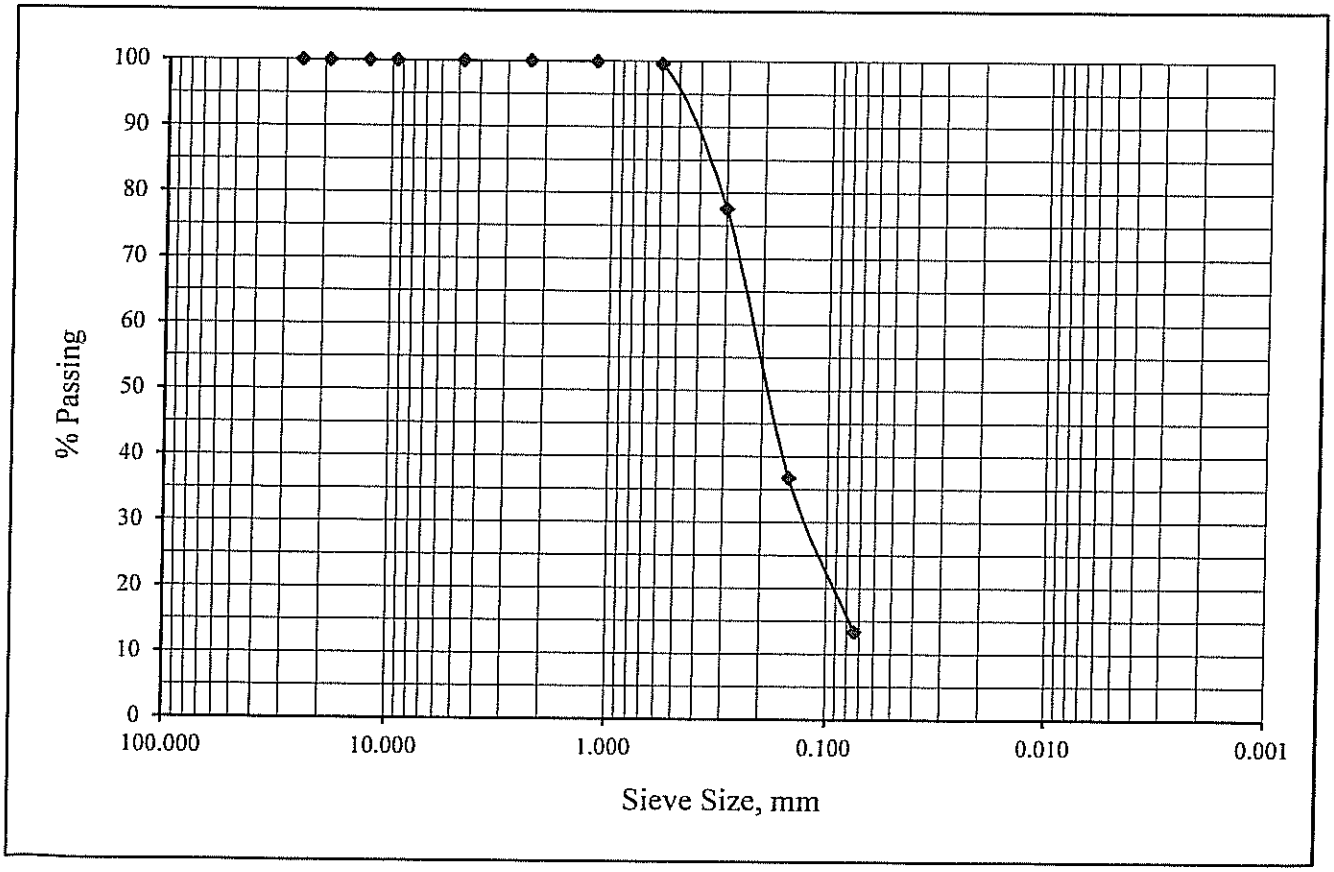
ASTM C117 & C136

Project Number: 544-19025
Project Name: Andalusia - Westside Development
Lab ID Number: LN6-19062
Sample ID: BH-2 S-3 @ 10'

February 12, 2019

Soil Classification: SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	100.0
#16	1.18	99.9
#30	0.60	99.6
#50	0.30	77.6
#100	0.15	36.8
#200	0.074	13.4



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Gradation

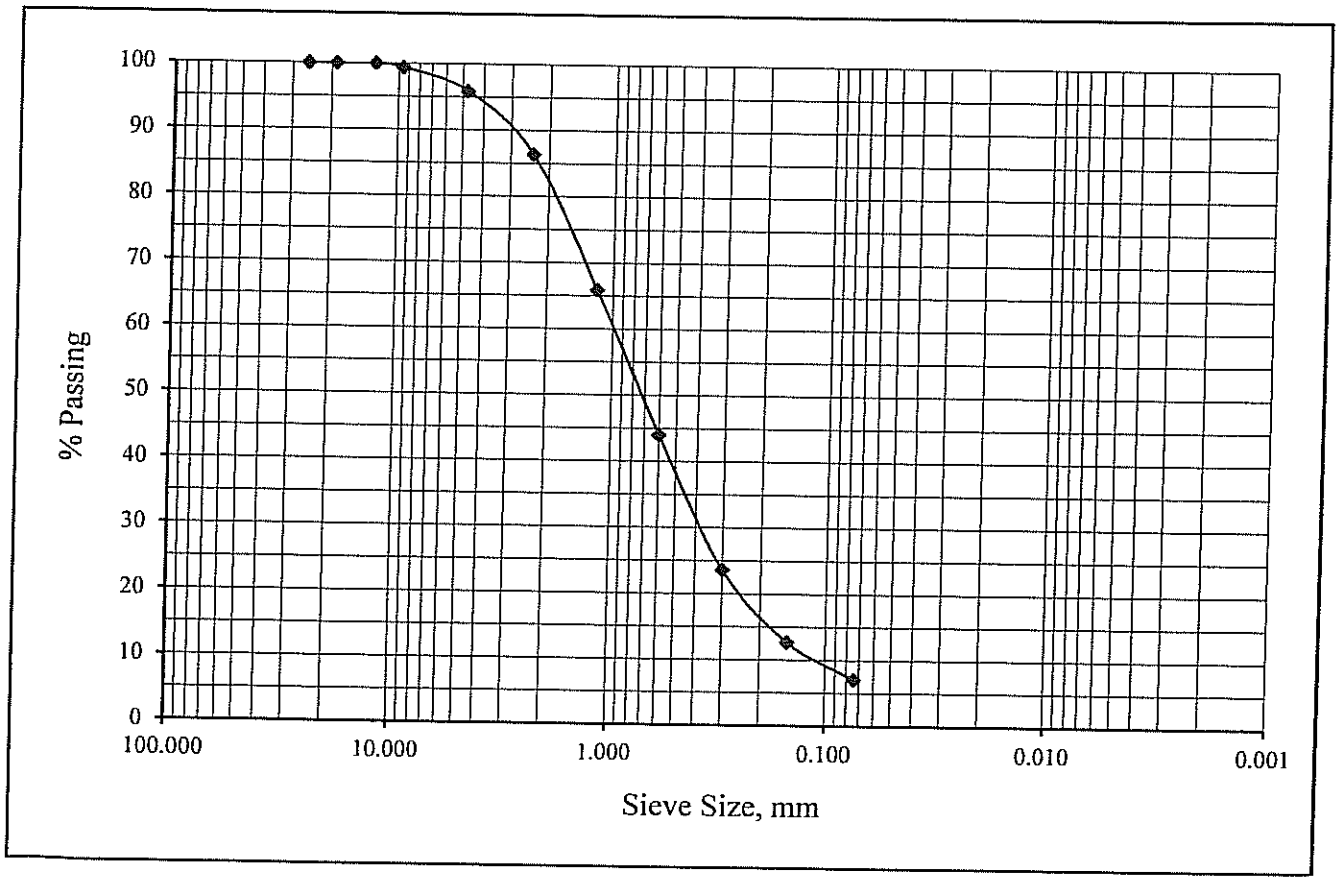
ASTM C117 & C136

Project Number: 544-19025
Project Name: Andalusia - Westside Development
Lab ID Number: LN6-19062
Sample ID: BH-2 R-8 @ 35'

February 12, 2019

Soil Classification: SW-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	99.4
#4	4.75	95.9
#8	2.36	86.4
#16	1.18	65.9
#30	0.60	44.0
#50	0.30	23.6
#100	0.15	12.7
#200	0.074	7.1



Sladden Engineering

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Gradation

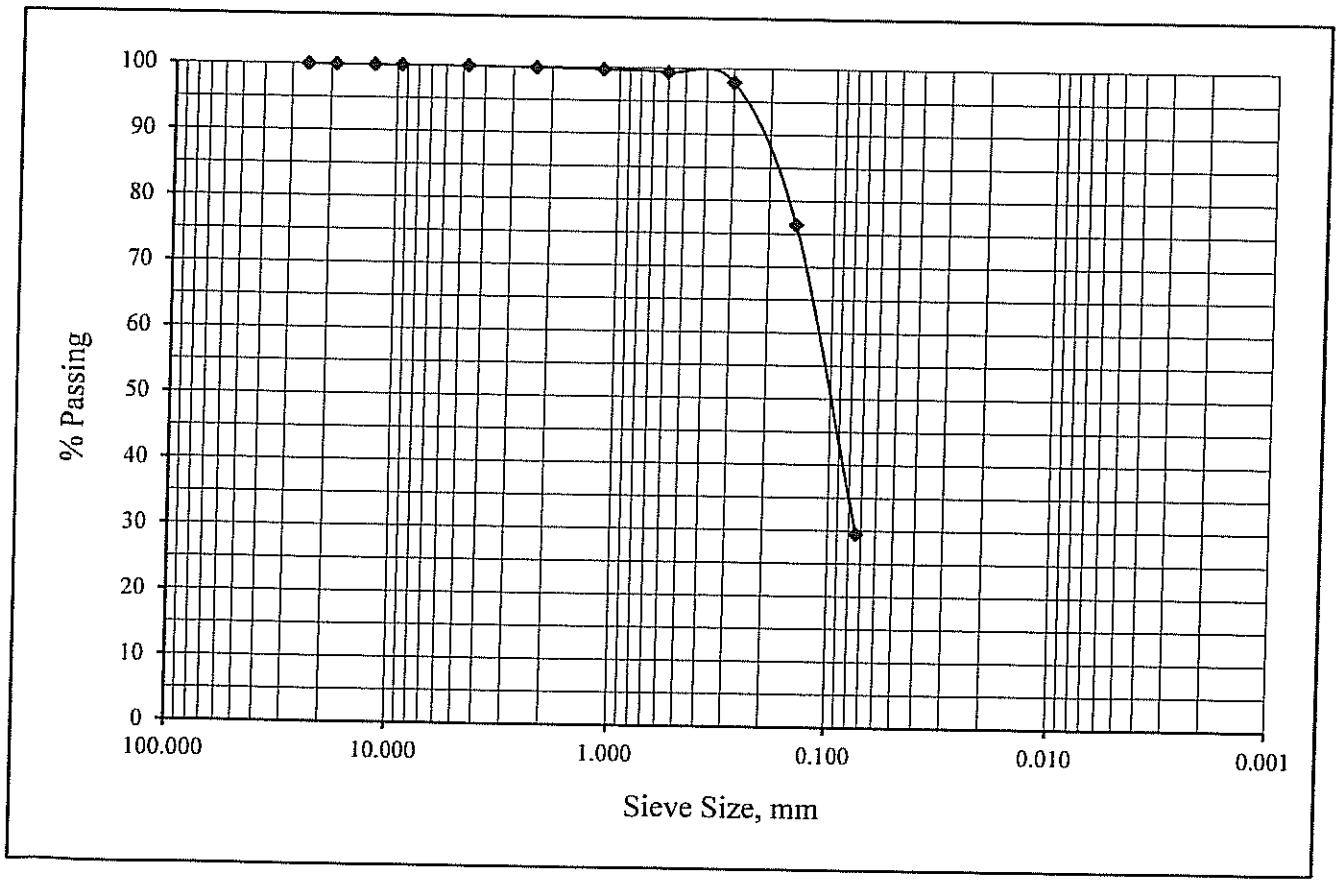
ASTM C117 & C136

Project Number: 544-19025
Project Name: Andalusia - Westside Development
Lab ID Number: LN6-19062
Sample ID: BH-3 S-3 @ 15'

February 12, 2019

Soil Classification: SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	99.9
#16	1.18	99.7
#30	0.60	99.4
#50	0.30	97.9
#100	0.15	76.4
#200	0.074	29.6



Sladden Engineering

450 Egan Avenue, Beaumont, CA 92223 (951) 845-7743 Fax (951) 845-8863

Gradation

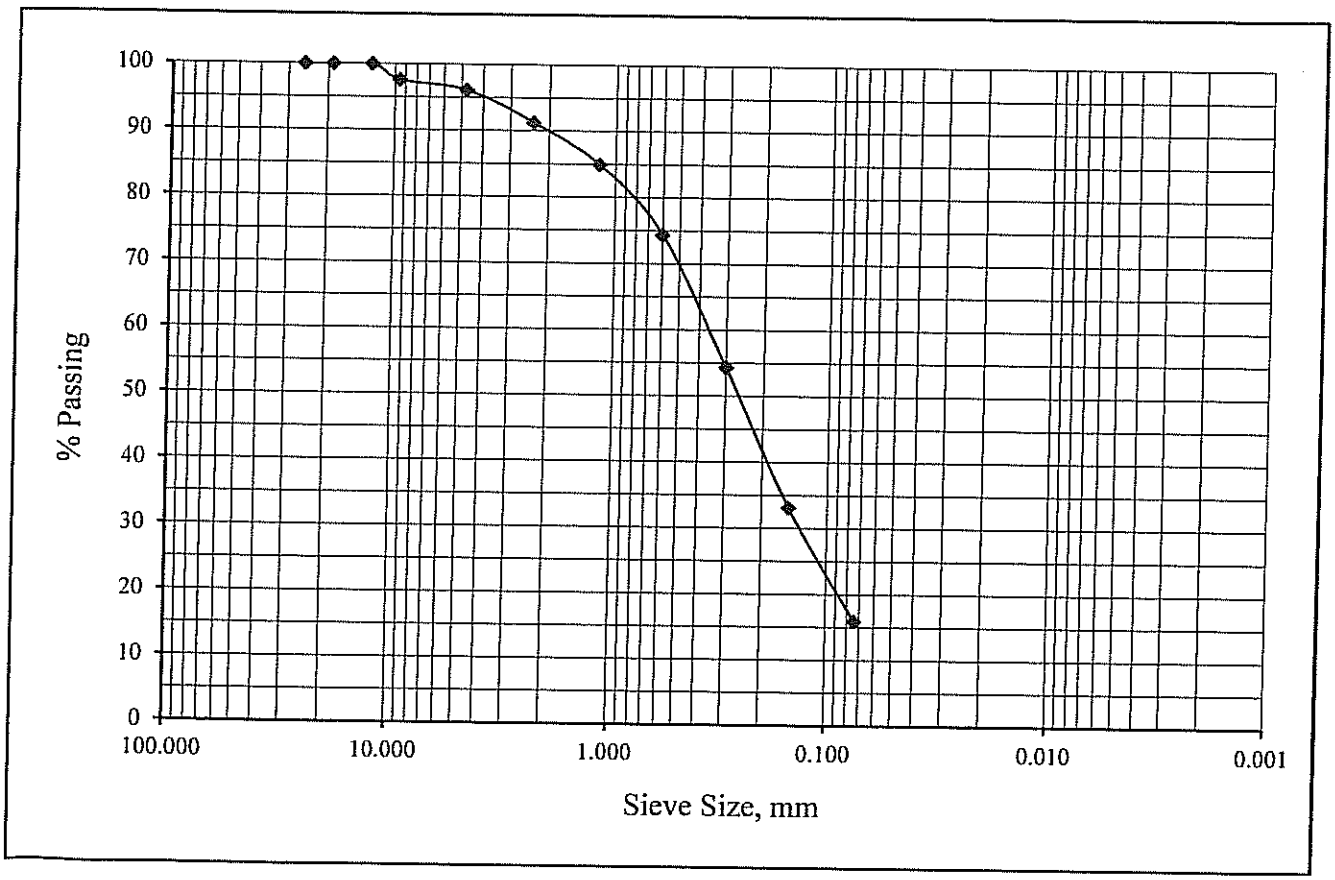
ASTM C117 & C136

Project Number: 544-19025
Project Name: Andalusia - Westside Development
Lab ID Number: LN6-19062
Sample ID: BH-5 S-1 @ 5'

February 12, 2019

Soil Classification: SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	97.6
#4	4.75	96.1
#8	2.36	91.3
#16	1.18	84.9
#30	0.60	74.4
#50	0.30	54.3
#100	0.15	33.1
#200	0.074	15.9



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Gradation

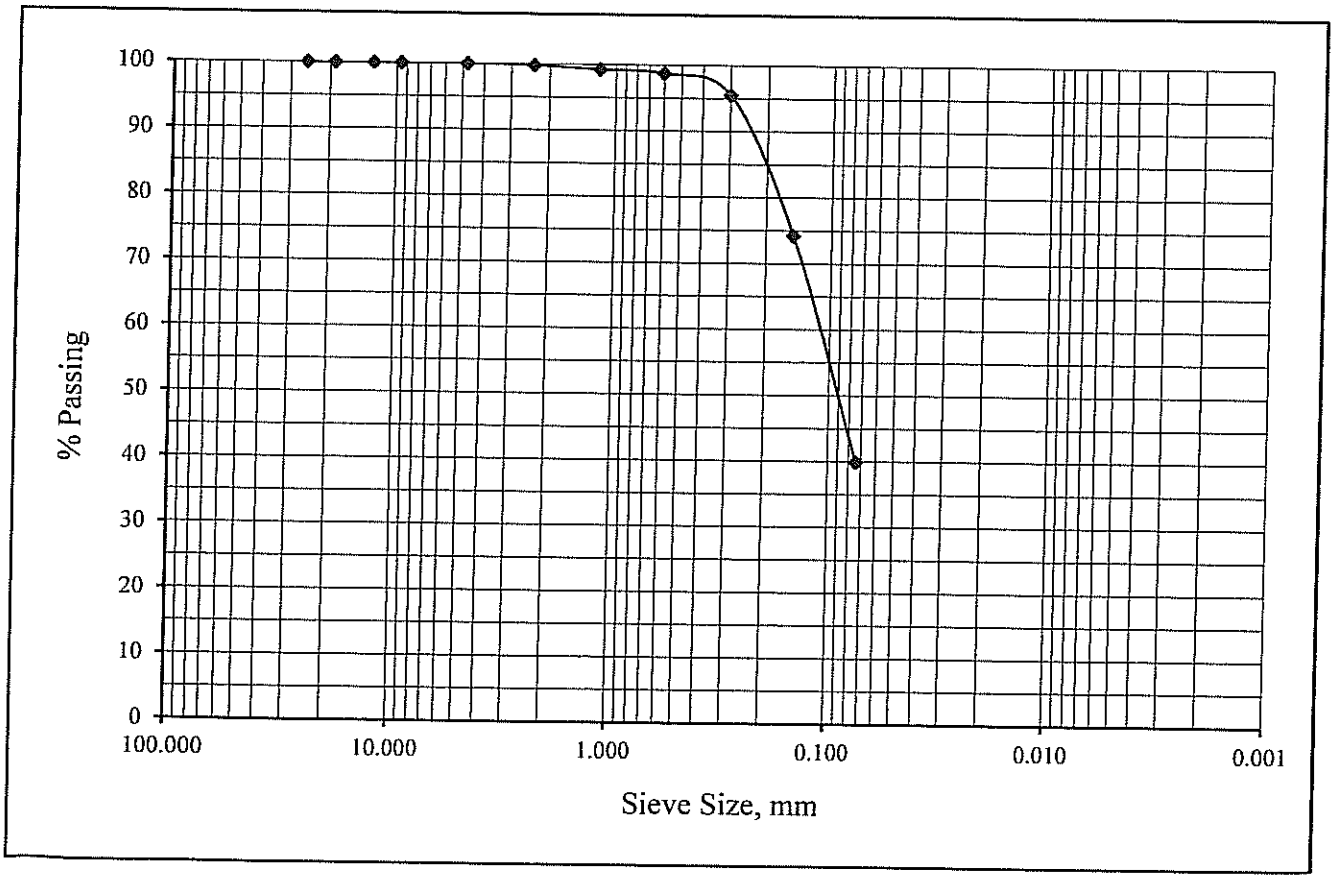
ASTM C117 & C136

Project Number: 544-19025
Project Name: Andalusia - Westside Development
Lab ID Number: LN6-19062
Sample ID: BH-6 R-5 @ 20'

February 12, 2019

Soil Classification: SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	99.8
#16	1.18	99.3
#30	0.60	98.7
#50	0.30	95.5
#100	0.15	74.2
#200	0.074	39.9



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Gradation

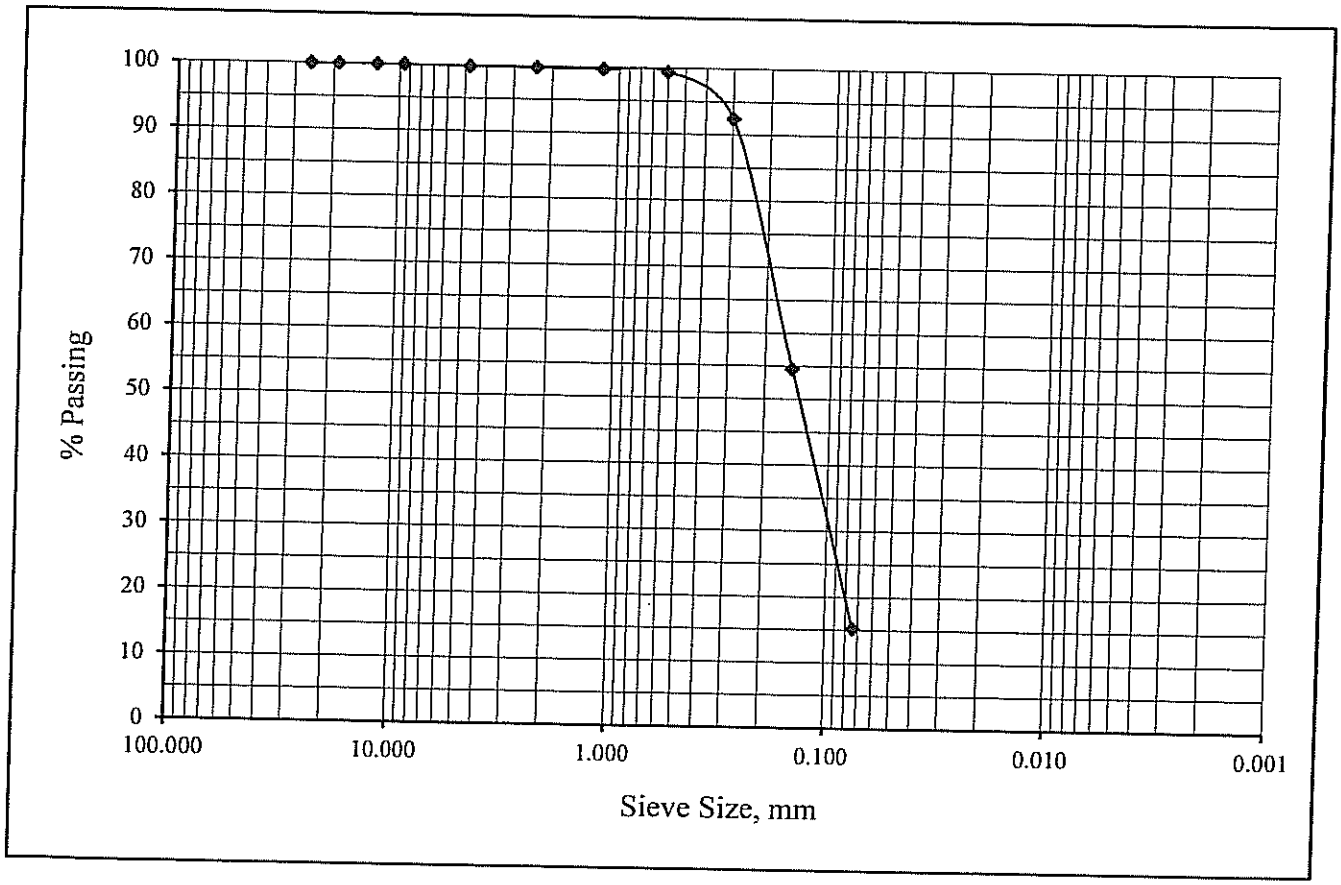
ASTM C117 & C136

Project Number: 544-19025
Project Name: Andalusia - Westside Development
Lab ID Number: LN6-19062
Sample ID: BH-8 R-4 @ 20'

February 12, 2019

Soil Classification: SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	99.9
#8	2.36	99.8
#16	1.18	99.7
#30	0.60	99.4
#50	0.30	92.4
#100	0.15	54.6
#200	0.074	15.2



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Gradation

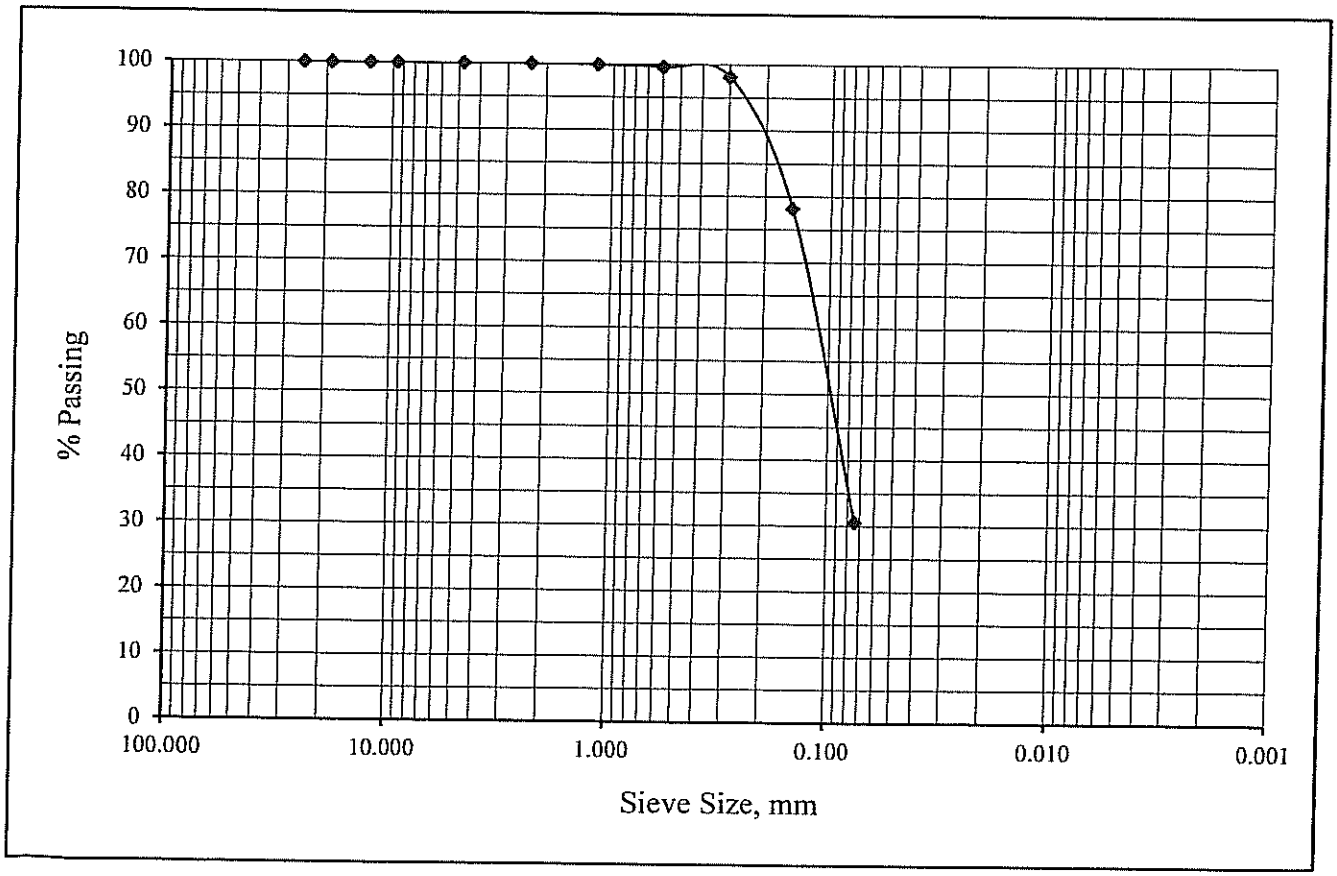
ASTM C117 & C136

Project Number: 544-19025
Project Name: Andalusia - Westside Development
Lab ID Number: LN6-19062
Sample ID: BH-10 S-1 @ 5'

February 12, 2019

Soil Classification: SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	100.0
#16	1.18	99.9
#30	0.60	99.6
#50	0.30	98.2
#100	0.15	78.2
#200	0.074	30.6



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One Dimensional Consolidation

ASTM D2435 & D5333

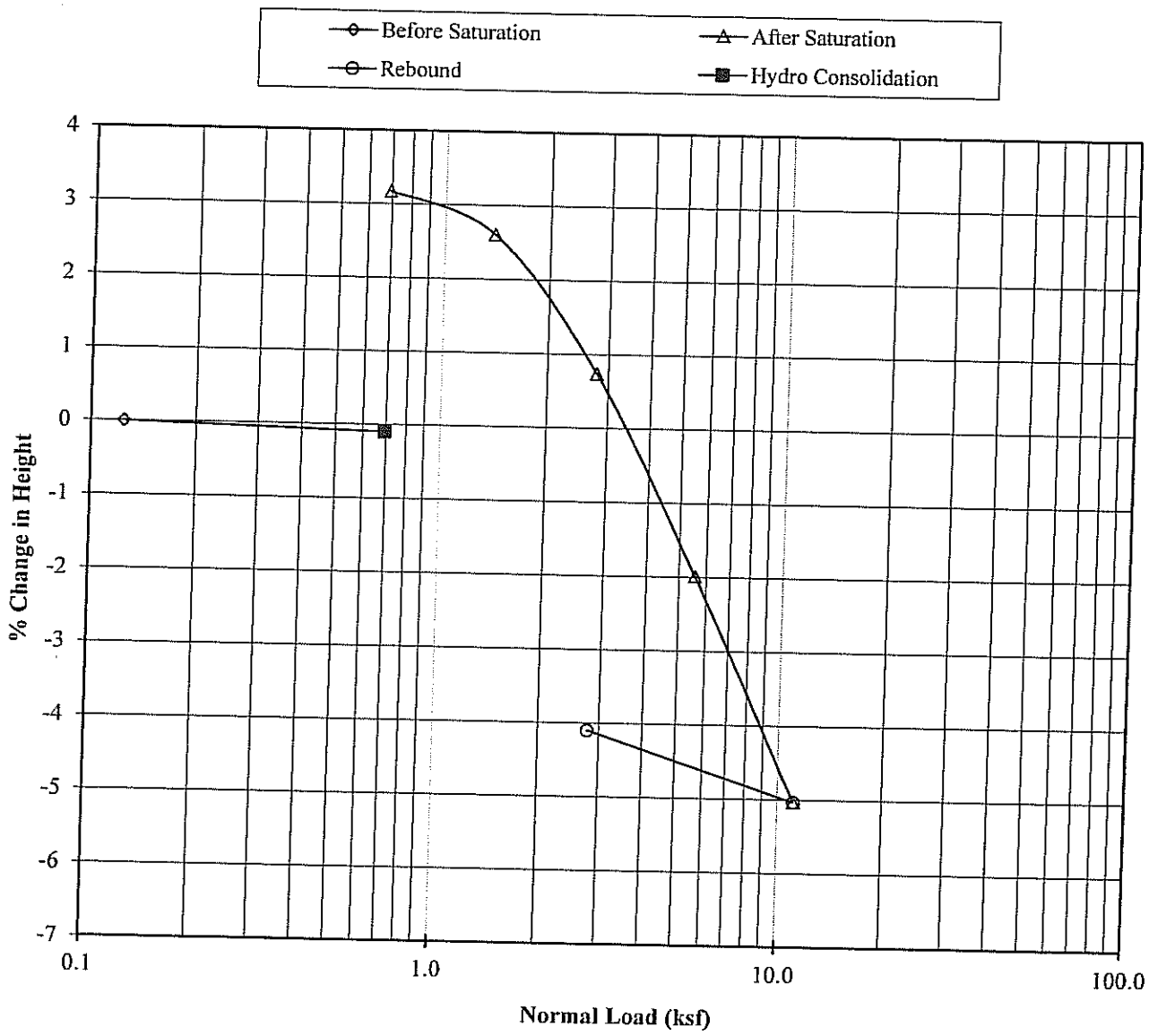
Job Number: 544-19025
Job Name: Andalusia - Westside Development

February 12, 2019

Lab ID Number: LN6-19062
Sample ID: BH-2 R-2 @5'
Soil Description: Olive Brown Clay (CL)

Initial Dry Density, pcf:	90.9
Initial Moisture, %:	5.8
Initial Void Ratio:	0.834
Specific Gravity:	2.67

% Change in Height vs Normal Presssure Diagram



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One Dimensional Consolidation

ASTM D2435 & D5333

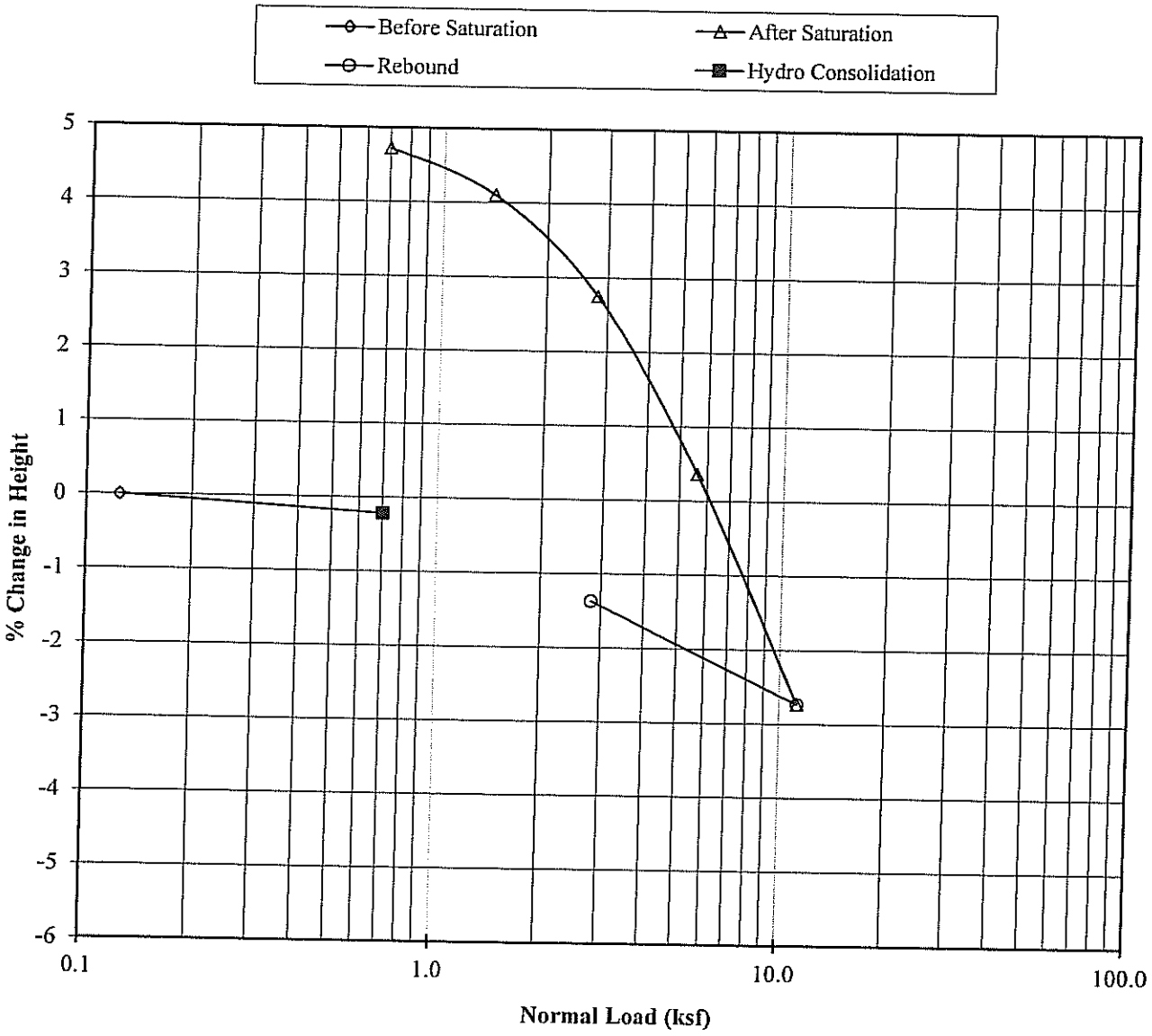
Job Number: 544-19025
Job Name: Andalusia - Westside Development

February 12, 2019

Lab ID Number: LN6-19062
Sample ID: BH-3 R-2 @ 10'
Soil Description: Olive Brown Clay (CL)

Initial Dry Density, pcf:	91.2
Initial Moisture, %:	9.1
Initial Void Ratio:	0.827
Specific Gravity:	2.67

% Change in Height vs Normal Presssure Diagram



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One Dimensional Consolidation

ASTM D2435 & D5333

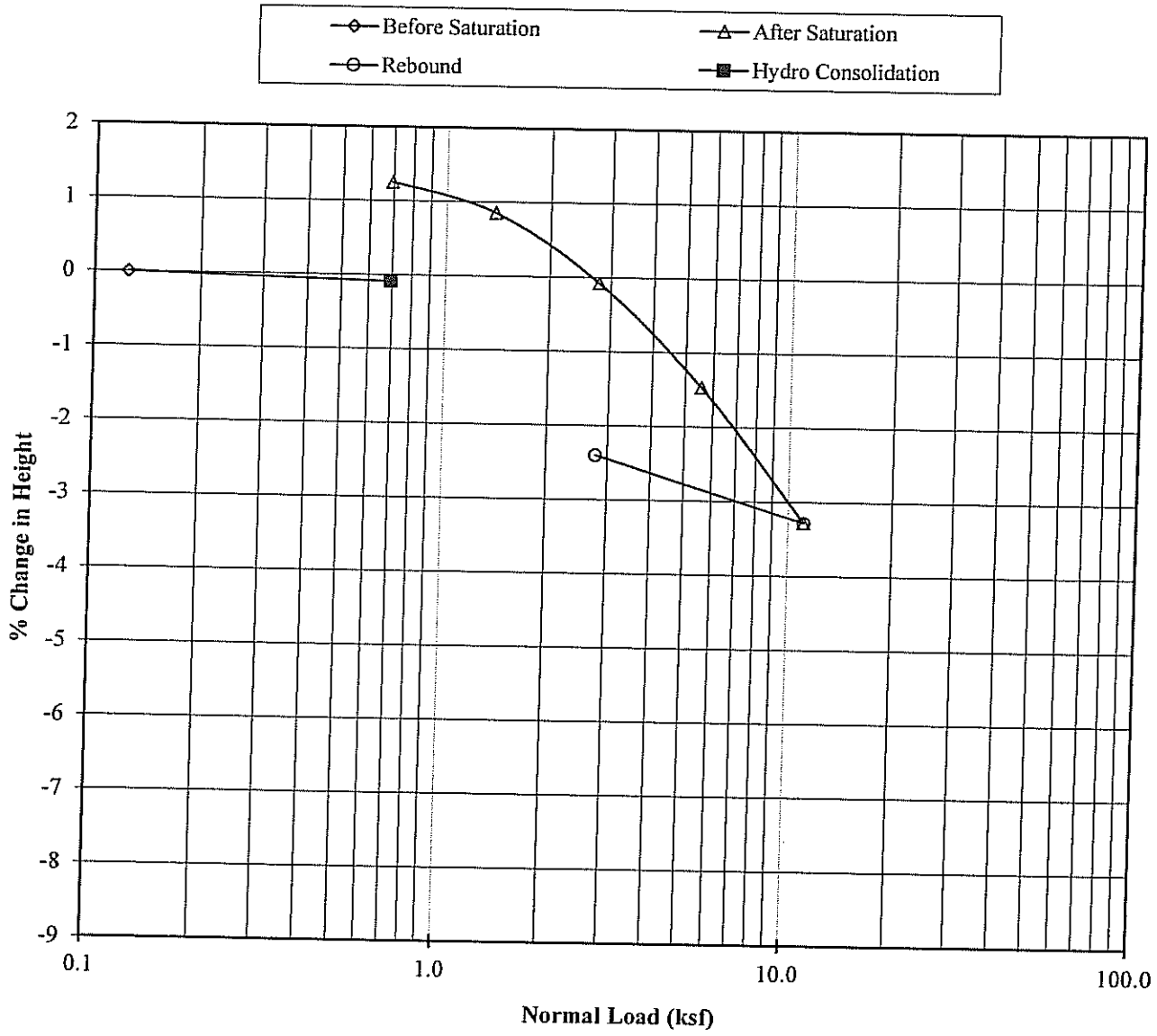
Job Number: 544-19025
Job Name: Andalusia - Westside Development

February 12, 2019

Lab ID Number: LN6-19062
Sample ID: BH-8 R-2 @ 10'
Soil Description: Olive Brown Clay (CL)

Initial Dry Density, pcf:	89.6
Initial Moisture, %:	15.2
Initial Void Ratio:	0.861
Specific Gravity:	2.67

% Change in Height vs Normal Presssure Diagram



Sladden Engineering

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One Dimensional Consolidation

ASTM D2435 & D5333

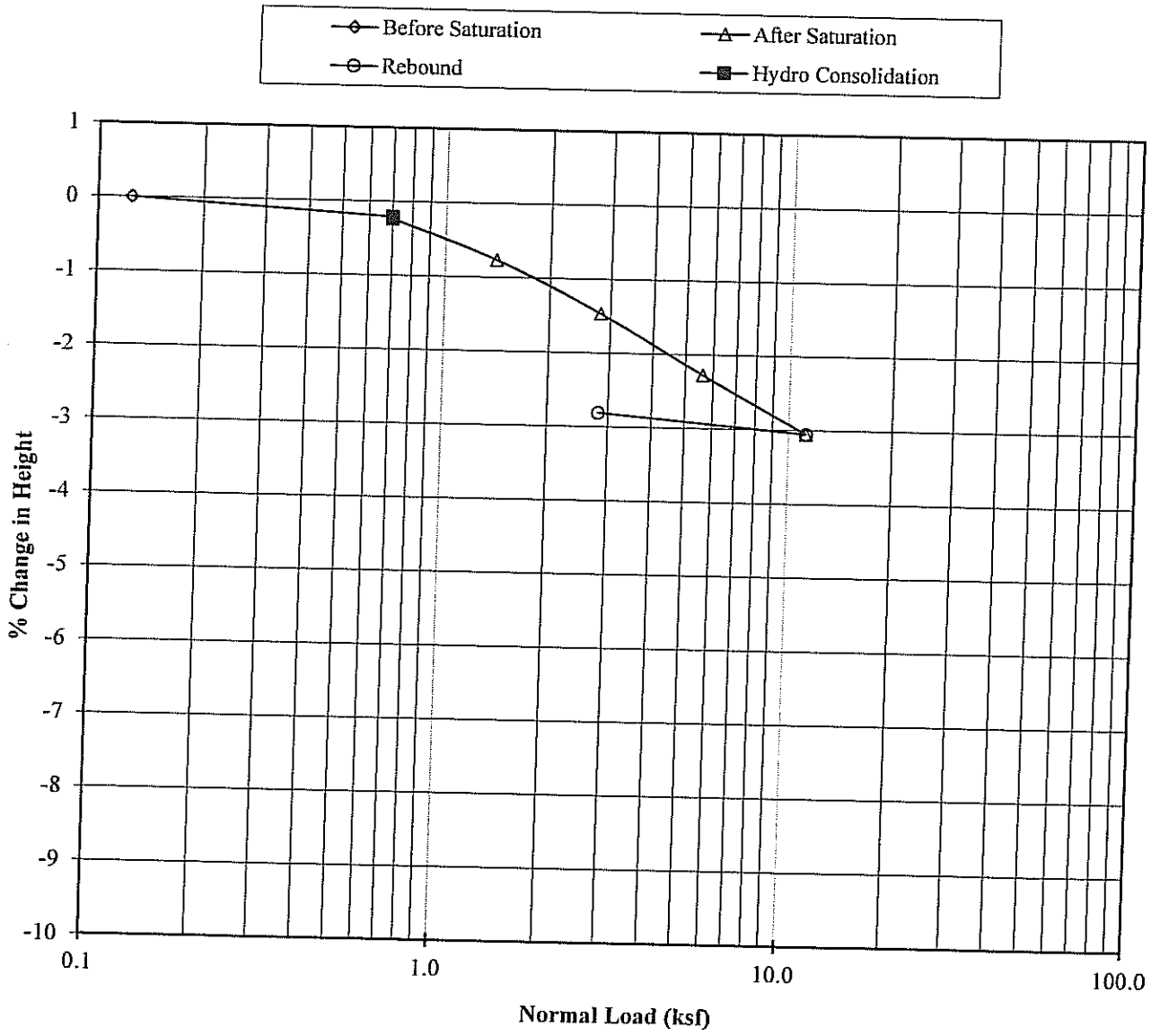
Job Number: 544-19025
Job Name: Andalusia - Westside Development

February 12, 2019

Lab ID Number: LN6-19062
Sample ID: BH-9 R-1 @ 5'
Soil Description: Dark Brown Sandy Silt (ML)

Initial Dry Density, pcf:	96.0
Initial Moisture, %:	15.3
Initial Void Ratio:	0.736
Specific Gravity:	2.67

% Change in Height vs Normal Presssure Diagram



Sladden Engineering

6782 Stanton Ave., Suite C, Buena Park, CA 90621 (714) 523-0952 Fax (714) 523-1369
45090 Golf Center Pkwy, Suite F, Indio, CA 92201 (760) 863-0713 Fax (760) 863-0847
450 Egan Avenue, Beaumont, CA 92223 (951) 845-7743 Fax (951) 845-8863

Date: February 12, 2019

Account No.: 544-19025

Customer: Meriwether Companies

Location: SWC Madison Street & Avenue 58, La Quinta

Analytical Report

Corrosion Series

	pH per CA 643	Soluble Sulfates per CA 417 ppm	Soluble Chloride per CA 422 ppm	Min. Resistivity per CA 643 ohm-cm
BH-2 @ 0-5'	9.0	600	180	970
BH-6 @ 0-5'	9.0	280	90	2600

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RESISTANCE '*R*' VALUE AND EXPANSION PRESSURE

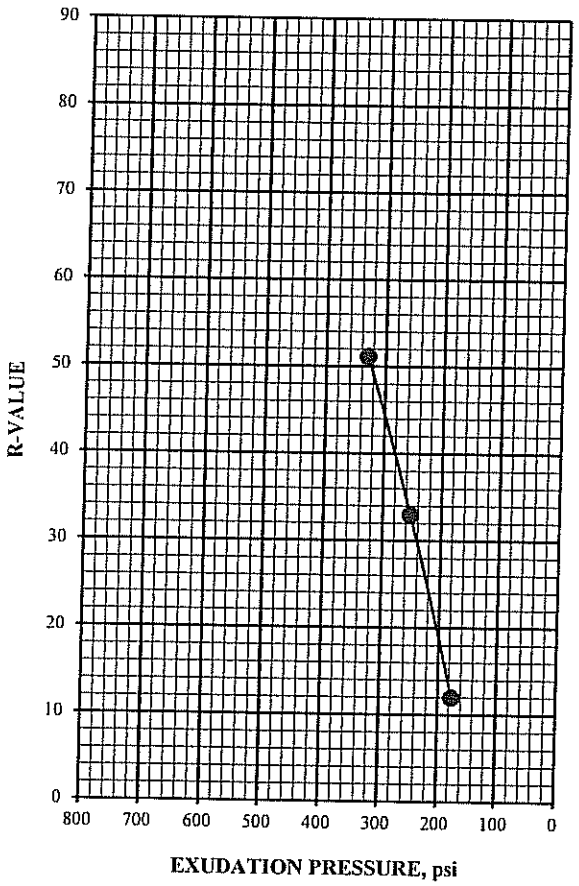
CTM 301

February 20, 2019

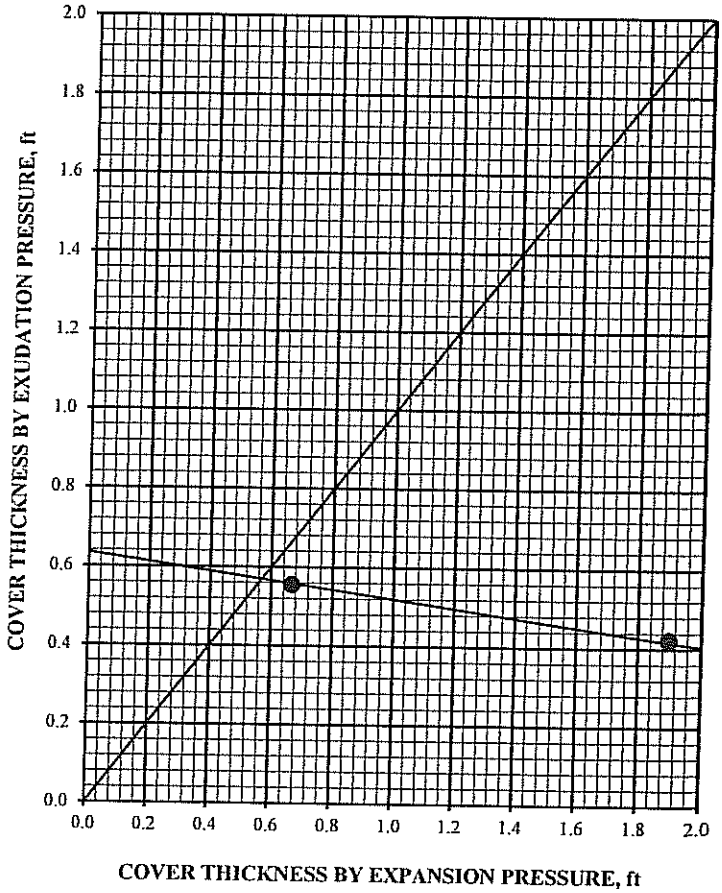
Project Number: 544-19025
Project Name: Andalusia - Westside Development
Lab ID Number: LN6-19062
Sample ID: BH-2 Bulk 1 @ 0-5'
Sample Description: Olive Brown Silt (ML)
Specified Traffic Index: 5.0

Dry Density @ 300 psi Exudation Pressure: 103.5-pcf
%Moisture @ 300 psi Exudation Pressure: 19.0%
R-Value - Exudation Pressure: 45
R-Value - Expansion Pressure: 10
R-Value @ Equilibrium: 10

EXUDATION PRESSURE CHART



EXPANSION PRESSURE CHART



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RESISTANCE '*R*' VALUE AND EXPANSION PRESSURE

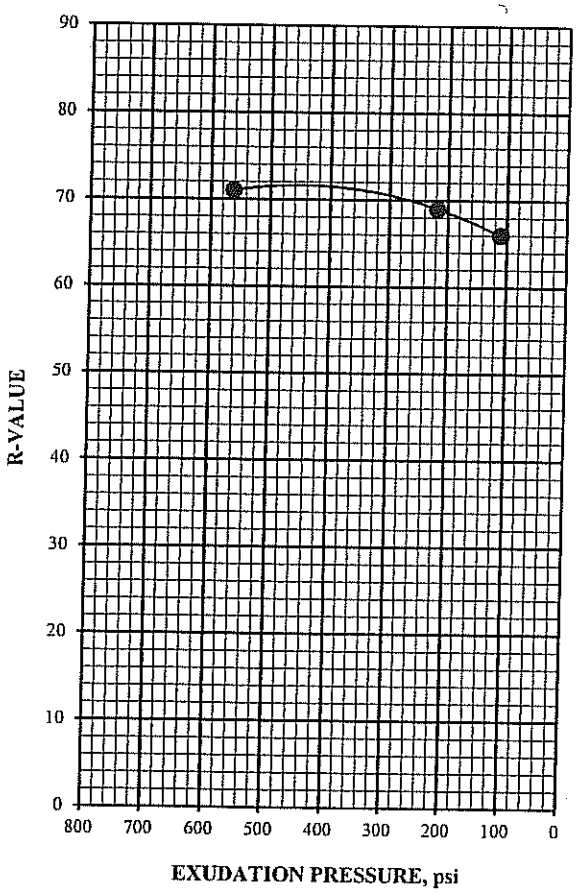
CTM 301

February 20, 2019

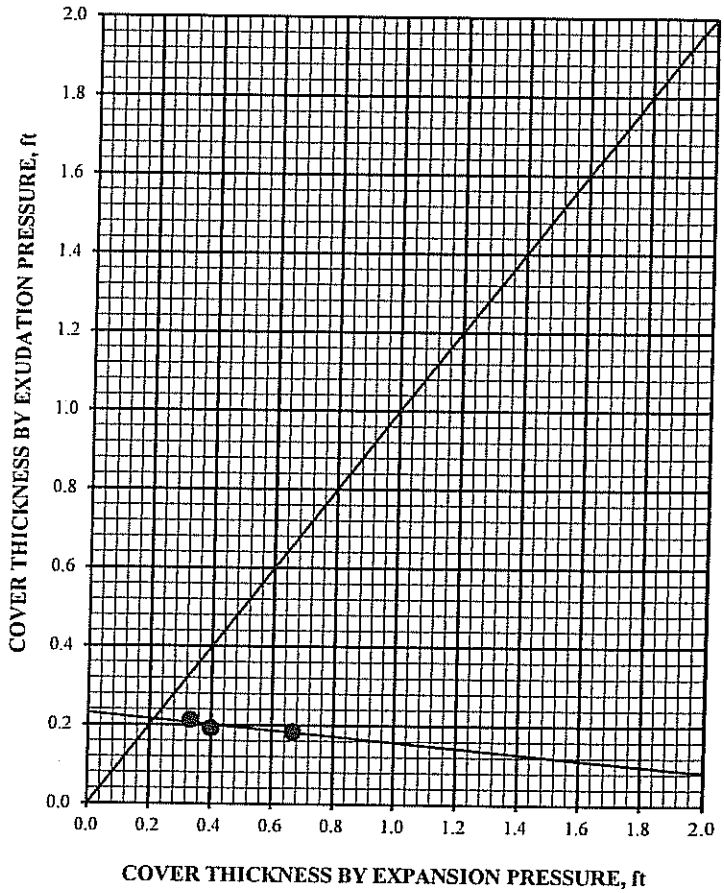
Project Number: 544-19025
Project Name: Andalusia - Westside Development
Lab ID Number: LN6-19062
Sample ID: BH-6 Bulk 2 @ 0-5'
Sample Description: Dark Brown Silty Sand (SM)
Specified Traffic Index: 5.0

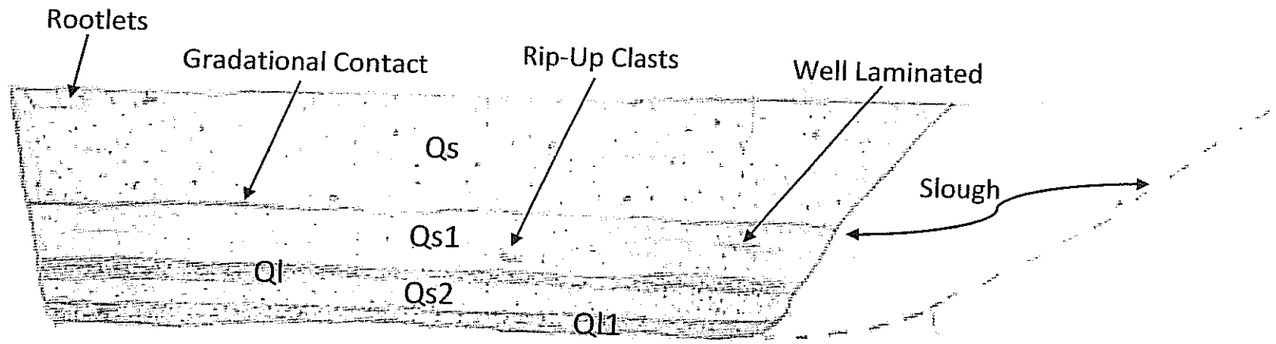
Dry Density @ 300 psi Exudation Pressure: 108.6-pcf
%Moisture @ 300 psi Exudation Pressure: 13.6%
R-Value - Exudation Pressure: 71
R-Value - Expansion Pressure: 66
R-Value @ Equilibrium: 66

EXUDATION PRESSURE CHART



EXPANSION PRESSURE CHART





Qs: Dune sand (SM); grayish brown, dry, fine-grained.

Qs1: Dune sand (SM); grayish brown, dry, fine-grained, well-laminated.

Qs2: Dune sand (SM); grayish brown, dry, fine-grained, interbedded SM/ML layers, gastropods

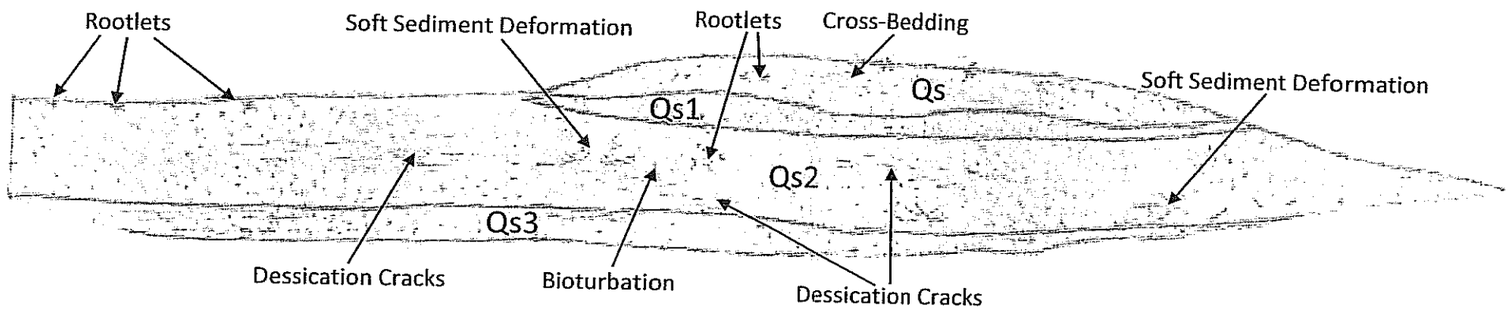
Ql: lacutrine deposits (ML/CL); grayish brown, slighlty moist, exhibitted low to medium plasticity

Ql1: lacutrine deposits (ML/CL); grayish brown, slighlty moist, exhibitted low to medium plasticity

SCALE: 1"=2'
HORIZONTAL = VERTICAL

Sladden Engineering	TP-1		PLATE
	Project Number:	544-19025	1
	Report Number:	19-01-049	
	Date:	February 21, 2019	

N29E



Qs: Dune sand (SM); grayish brown, dry, fine-grained.

Qs1: Dune sand (SM); grayish brown, dry, fine-grained, gastropod shells throughout.

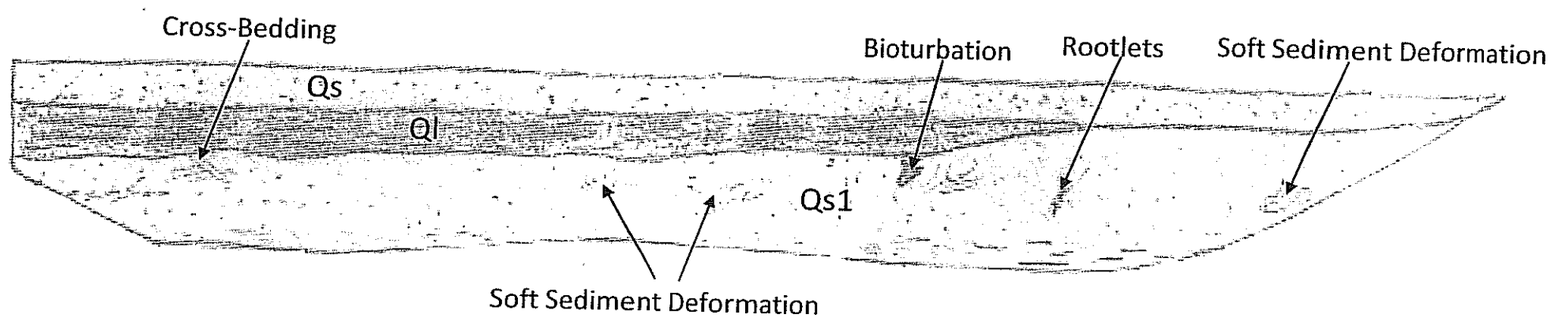
Qs2: Silty Sand (SM); mottled orangish and grayish brown, dry, fine-grained, dessication cracks present, well-laminated and gastropod shells throughout.

Qs3: Silty Sand (SM); mottled orangish and grayish brown, dry, fine-grained, well-laminated

SCALE: 1"=5'
HORIZONTAL = VERTICAL

Sladden Engineering	TP-2		PLATE
	Project Number:	544-19025	2
	Report Number:	19-01-049	
	Date:	February 21, 2019	

N45E



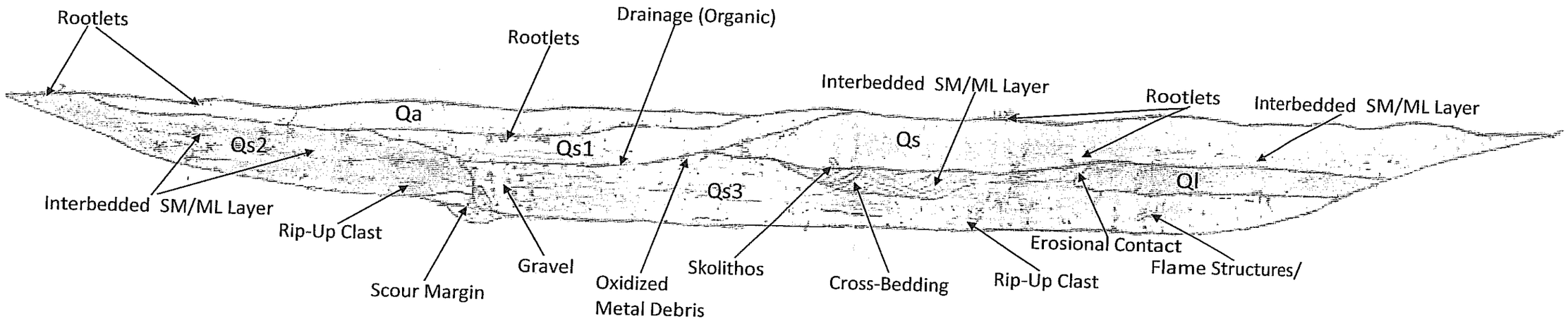
Qs: Dune sand (SM); grayish brown, dry, fine-grained, gastropods throughout.

Qs1: Dune sand (SM); grayish brown, dry, fine-grained, well-laminated, gastropods throughout.

Ql: lacutrine deposits (ML/CL); grayish brown, slighlty moist, exhibitted low to medium plasticity characteristics..

SCALE: 1"=5'
HORIZONTAL = VERTICAL

Sladden Engineering	TP-3		PLATE
	Project Number:	544-19025	3
	Report Number:	19-01-049	
	Date:	February 21, 2019	



Qa: Sand (SP); grayish brown, dry, fine to coarse-grained.

Qs: Dune sand (SM); grayish brown, dry, fine-grained, gastropods throughout.

Qs1: Dune sand (SM); grayish brown, dry, fine-grained, well-laminated.

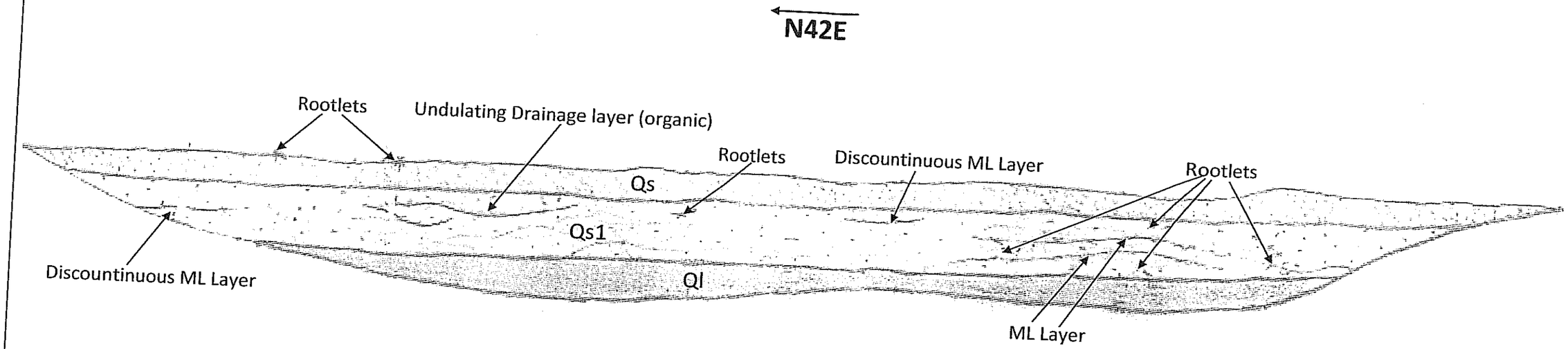
Qs2: Silty sand (SM); grayish brown, dry, fine-grained, well-laminated, interbedded with SM/ML layers.

Qs3: Silty sand (SM); grayish brown, dry, fine to coarse-grained, well-laminated, gastropods throughout.

Ql: lacutrine deposits (ML/CL); grayish brown, slighlty moist, exhibitted low to medium plasticity characteristics..

SCALE: 1"=5'
HORIZONTAL = VERTICAL

Sladden Engineering	TP-4		PLATE
	Project Number:	544-19025	4
	Report Number:	19-01-049	
	Date:	February 21, 2019	



Qs: Organic rich silty sand (SM); grayish brown, dry, fine-grained, gastropods throughout.

Qs1: Silty sand (SM); grayish brown, dry, fine-grained, well-laminated, interbedded with silt (ML) layers, gastropods throughout.

Ql: clayey silt (ML) lacutrine deposits; grayish brown, slighlty moist, exhibitted low to medium plasticity characteristics..

SCALE: 1"=5'
HORIZONTAL = VERTICAL

Sladden Engineering

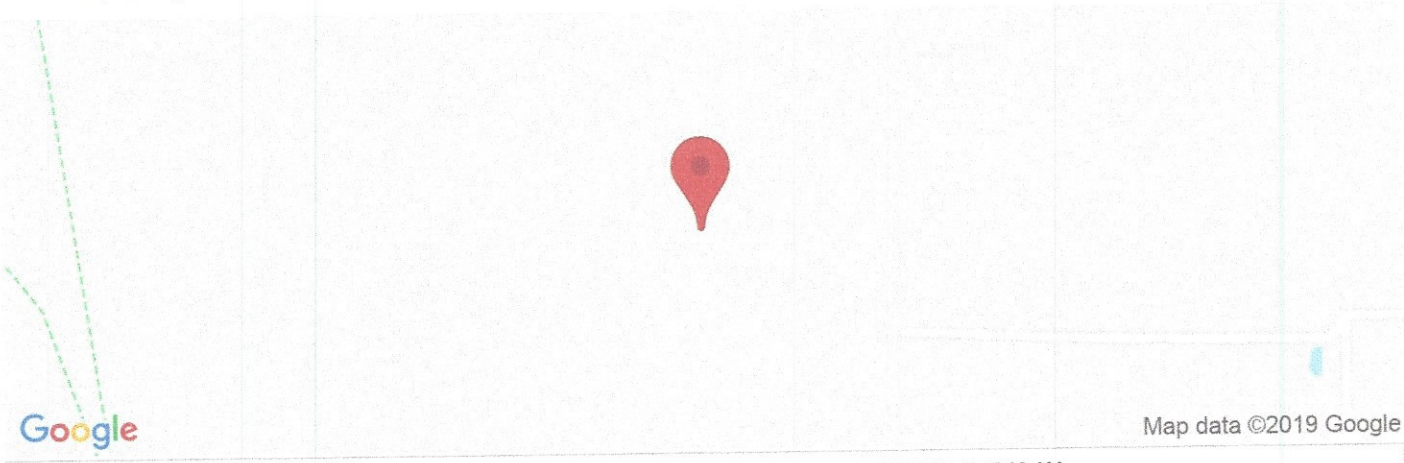
TP-5		PLATE
Project Number:	544-19025	5
Report Number:	19-01-049	
Date:	February 21, 2019	

APPENDIX C

SEISMIC DESIGN MAPS AND REPORTS
DEAGGREGATION OUTPUT

OSHPD

Latitude, Longitude: 33.621233, -116.257031

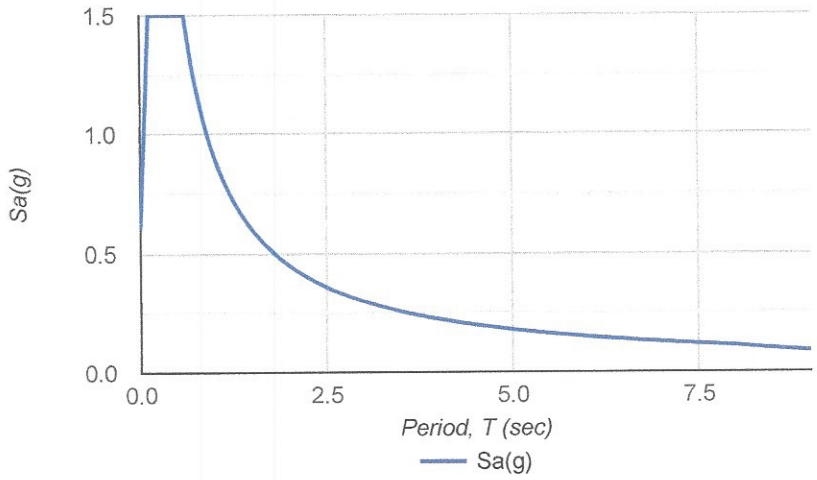


Date	2/4/2019, 9:45:00 AM
Design Code Reference Document	ASCE7-10
Risk Category	II
Site Class	D - Stiff Soil

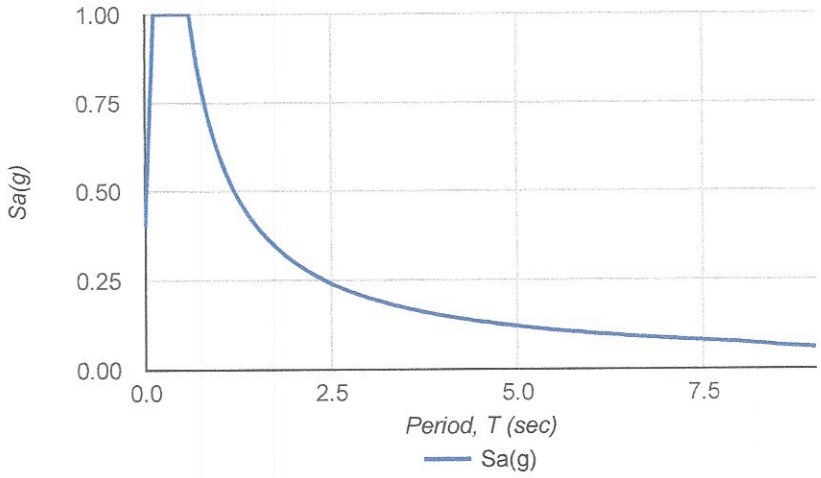
Type	Value	Description
S_S	1.5	MCE_R ground motion. (for 0.2 second period)
S_1	0.6	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.5	Site-modified spectral acceleration value
S_{M1}	0.901	Site-modified spectral acceleration value
S_{DS}	1	Numeric seismic design value at 0.2 second SA
S_{D1}	0.6	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	1.5	Site amplification factor at 1.0 second
PGA	0.513	MCE_G peak ground acceleration
F_{PGA}	1	Site amplification factor at PGA
PGA_M	0.513	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.964	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.841	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.728	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.706	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.513	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	1.067	Mapped value of the risk coefficient at short periods
C_{R1}	1.031	Mapped value of the risk coefficient at a period of 1 s

MCER Response Spectrum



Design Response Spectrum



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U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (v4.1.

Spectral Period

Peak ground acceleration

Latitude

Decimal degrees

33.621233

Time Horizon

Return period in years

475

Longitude

Decimal degrees, negative values for western longitudes

-116.257031

Site Class

259 m/s (Site class D)

Hazard Curve

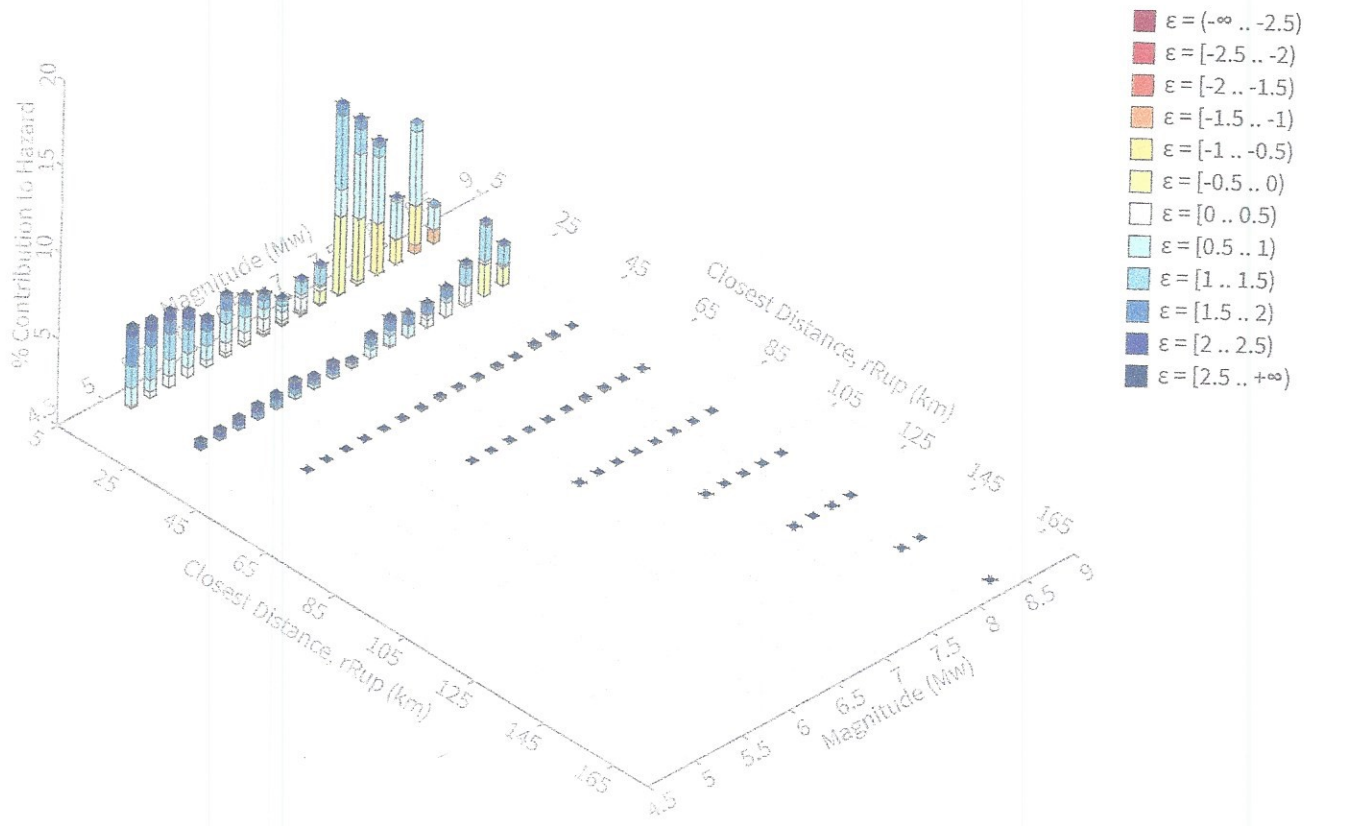
Please select "Edition", "Location" & "Site Class" above to compute a hazard curve.

Compute Hazard Curve

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr^{-1}
PGA ground motion: 0.53248168 g

Recovered targets

Return period: 512.06357 yrs
Exceedance rate: 0.0019528825 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.24 %

Mean (for all sources)

r: 16.62 km
m: 6.96
ε_0: 0.82 σ

Mode (largest r-m bin)

r: 13.92 km
m: 7.34
ε_0: 0.54 σ
Contribution: 10.99 %

Mode (largest ε_0 bin)

r: 13.96 km
m: 7.34
ε_0: -0.28 σ
Contribution: 4.41 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UC33brAvg_FM31	System							32.14
San Andreas (Coachella) rev [2]		13.97	7.61	0.39	116.150°W	33.710°N	45.15	21.93
San Jacinto (Clark) rev [1]		25.87	7.64	0.92	116.420°W	33.433°N	215.79	3.48
San Jacinto (Anza) rev [5]		27.90	7.97	0.76	116.513°W	33.490°N	238.41	3.32
UC33brAvg_FM32	System							31.98
San Andreas (Coachella) rev [2]		13.97	7.61	0.40	116.150°W	33.710°N	45.15	21.80
San Jacinto (Anza) rev [5]		27.90	7.96	0.77	116.513°W	33.490°N	238.41	3.39
San Jacinto (Clark) rev [1]		25.87	7.65	0.91	116.420°W	33.433°N	215.79	3.36
UC33brAvg_FM31 (opt)	Grid							17.94
PointSourceFinite: -116.257, 33.662		6.61	5.72	0.72	116.257°W	33.662°N	0.00	2.04
PointSourceFinite: -116.257, 33.662		6.61	5.72	0.72	116.257°W	33.662°N	0.00	2.03
PointSourceFinite: -116.257, 33.671		7.38	5.63	0.86	116.257°W	33.671°N	0.00	1.28
PointSourceFinite: -116.257, 33.671		7.38	5.63	0.86	116.257°W	33.671°N	0.00	1.27
PointSourceFinite: -116.257, 33.752		14.10	5.85	1.37	116.257°W	33.752°N	0.00	1.27
PointSourceFinite: -116.257, 33.752		14.10	5.85	1.37	116.257°W	33.752°N	0.00	1.25
UC33brAvg_FM32 (opt)	Grid							17.93
PointSourceFinite: -116.257, 33.662		6.61	5.72	0.72	116.257°W	33.662°N	0.00	2.04
PointSourceFinite: -116.257, 33.662		6.61	5.72	0.72	116.257°W	33.662°N	0.00	2.03
PointSourceFinite: -116.257, 33.671		7.38	5.63	0.86	116.257°W	33.671°N	0.00	1.28
PointSourceFinite: -116.257, 33.671		7.38	5.63	0.86	116.257°W	33.671°N	0.00	1.27
PointSourceFinite: -116.257, 33.752		14.10	5.84	1.37	116.257°W	33.752°N	0.00	1.27
PointSourceFinite: -116.257, 33.752		14.10	5.84	1.37	116.257°W	33.752°N	0.00	1.25

APPENDIX D

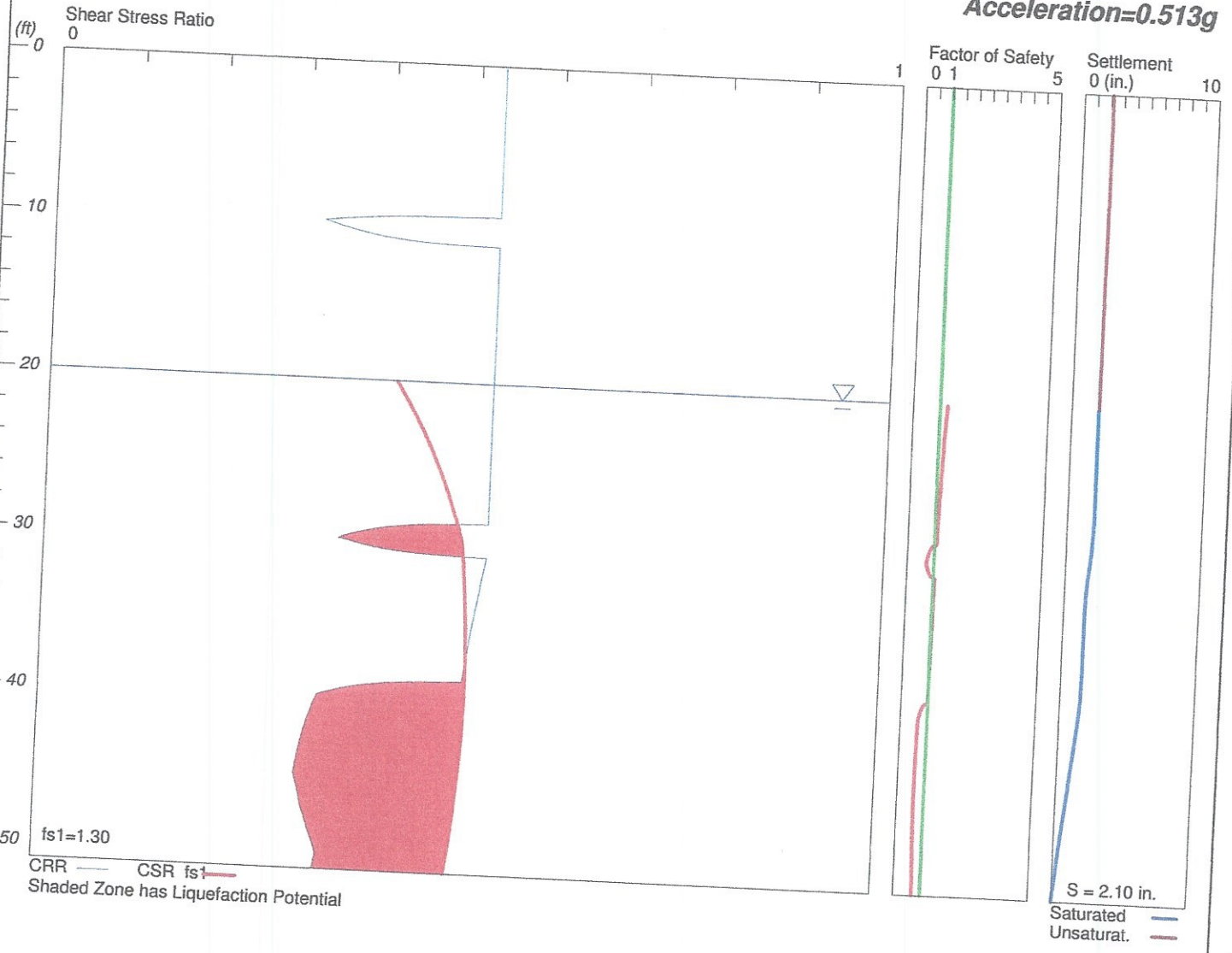
LIQUEFACTION ANALYSES

LIQUEFACTION ANALYSIS

Andalusia-Westside Development

Hole No.=BH-2 Water Depth=20 ft Surface Elev.=-40

Magnitude=7.34
Acceleration=0.513g



LiquefyPro CivilTech Software USA www.civiltech.com

CivilTech Corporation

544-19025

Plate A-1

****

LIQUEFACTION ANALYSIS SUMMARY

****

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Licensed to , 2/14/2019 10:19:01 AM

Input File Name: G:\Liquefy5\444-04194 Sage BH-1.liq
Title: Andalusia-Westside Development
Subtitle: 544-19025

Surface Elev.=-40
Hole No.=BH-2
Depth of Hole= 51.00 ft
Water Table during Earthquake= 20.00 ft
Water Table during In-Situ Testing= 47.00 ft
Max. Acceleration= 0.51 g
Earthquake Magnitude= 7.34

Input Data:

Surface Elev.=-40
Hole No.=BH-2
Depth of Hole=51.00 ft
Water Table during Earthquake= 20.00 ft
Water Table during In-Situ Testing= 47.00 ft
Max. Acceleration=0.51 g
Earthquake Magnitude=7.34
No-Liquefiable Soils: Based on Analysis

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Modify Stark/Olson
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
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 %
0.00	23.33	89.20	97.80
2.00	23.33	89.20	97.80
5.00	22.00	93.60	97.70
10.00	15.00	93.60	13.40
15.00	16.66	106.20	90.10
20.00	22.00	106.20	64.30
25.00	22.00	140.10	64.30
30.00	20.00	140.10	35.60
35.00	43.33	119.90	7.10
40.00	20.00	119.90	48.40
45.00	10.66	120.50	81.10
50.00	24.00	120.50	45.90

Output Results:

Settlement of Saturated Sands=1.99 in.
Settlement of Unsaturated Sands=0.11 in.
Total Settlement of Saturated and Unsaturated Sands=2.10 in.
Differential Settlement=1.050 to 1.386 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.53	0.43	5.00	1.99	0.11	2.10
0.05	0.53	0.43	5.00	1.99	0.11	2.10
0.10	0.53	0.43	5.00	1.99	0.11	2.10
0.15	0.53	0.43	5.00	1.99	0.11	2.10
0.20	0.53	0.43	5.00	1.99	0.11	2.10
0.25	0.53	0.43	5.00	1.99	0.11	2.10
0.30	0.53	0.43	5.00	1.99	0.11	2.10
0.35	0.53	0.43	5.00	1.99	0.11	2.10
0.40	0.53	0.43	5.00	1.99	0.11	2.10
0.45	0.53	0.43	5.00	1.99	0.11	2.10
0.50	0.53	0.43	5.00	1.99	0.11	2.10
0.55	0.53	0.43	5.00	1.99	0.11	2.10
0.60	0.53	0.43	5.00	1.99	0.11	2.10
0.65	0.53	0.43	5.00	1.99	0.11	2.10
0.70	0.53	0.43	5.00	1.99	0.11	2.10
0.75	0.53	0.43	5.00	1.99	0.11	2.10
0.80	0.53	0.43	5.00	1.99	0.11	2.10
0.85	0.53	0.43	5.00	1.99	0.11	2.10
0.90	0.53	0.43	5.00	1.99	0.11	2.10
0.95	0.53	0.43	5.00	1.99	0.11	2.10
1.00	0.53	0.43	5.00	1.99	0.11	2.10

1.05	0.53	0.43	5.00	1.99	0.11	2.10
1.10	0.53	0.43	5.00	1.99	0.11	2.10
1.15	0.53	0.43	5.00	1.99	0.11	2.10
1.20	0.53	0.43	5.00	1.99	0.11	2.10
1.25	0.53	0.43	5.00	1.99	0.11	2.10
1.30	0.53	0.43	5.00	1.99	0.11	2.10
1.35	0.53	0.43	5.00	1.99	0.11	2.10
1.40	0.53	0.43	5.00	1.99	0.11	2.10
1.45	0.53	0.43	5.00	1.99	0.11	2.10
1.50	0.53	0.43	5.00	1.99	0.11	2.10
1.55	0.53	0.43	5.00	1.99	0.11	2.10
1.60	0.53	0.43	5.00	1.99	0.11	2.10
1.65	0.53	0.43	5.00	1.99	0.11	2.10
1.70	0.53	0.43	5.00	1.99	0.11	2.10
1.75	0.53	0.43	5.00	1.99	0.11	2.10
1.80	0.53	0.43	5.00	1.99	0.11	2.10
1.85	0.53	0.43	5.00	1.99	0.11	2.10
1.90	0.53	0.43	5.00	1.99	0.11	2.10
1.95	0.53	0.43	5.00	1.99	0.11	2.10
2.00	0.53	0.43	5.00	1.99	0.11	2.10
2.05	0.53	0.43	5.00	1.99	0.11	2.10
2.10	0.53	0.43	5.00	1.99	0.11	2.10
2.15	0.53	0.43	5.00	1.99	0.11	2.10
2.20	0.53	0.43	5.00	1.99	0.11	2.10
2.25	0.53	0.43	5.00	1.99	0.11	2.10
2.30	0.53	0.43	5.00	1.99	0.11	2.10
2.35	0.53	0.43	5.00	1.99	0.11	2.10
2.40	0.53	0.43	5.00	1.99	0.11	2.10
2.45	0.53	0.43	5.00	1.99	0.11	2.10
2.50	0.53	0.43	5.00	1.99	0.11	2.10
2.55	0.53	0.43	5.00	1.99	0.11	2.10
2.60	0.53	0.43	5.00	1.99	0.11	2.10
2.65	0.53	0.43	5.00	1.99	0.11	2.10
2.70	0.53	0.43	5.00	1.99	0.11	2.10
2.75	0.53	0.43	5.00	1.99	0.11	2.10
2.80	0.53	0.43	5.00	1.99	0.11	2.10
2.85	0.53	0.43	5.00	1.99	0.11	2.10
2.90	0.53	0.43	5.00	1.99	0.11	2.10
2.95	0.53	0.43	5.00	1.99	0.11	2.10
3.00	0.53	0.43	5.00	1.99	0.11	2.10
3.05	0.53	0.43	5.00	1.99	0.11	2.10
3.10	0.53	0.43	5.00	1.99	0.11	2.10
3.15	0.53	0.43	5.00	1.99	0.11	2.10
3.20	0.53	0.43	5.00	1.99	0.11	2.10
3.25	0.53	0.43	5.00	1.99	0.11	2.10
3.30	0.53	0.43	5.00	1.99	0.11	2.10
3.35	0.53	0.43	5.00	1.99	0.11	2.10
3.40	0.53	0.43	5.00	1.99	0.11	2.10

3.45	0.53	0.43	5.00	1.99	0.11	2.10
3.50	0.53	0.43	5.00	1.99	0.11	2.10
3.55	0.53	0.43	5.00	1.99	0.11	2.10
3.60	0.53	0.43	5.00	1.99	0.11	2.10
3.65	0.53	0.43	5.00	1.99	0.11	2.10
3.70	0.53	0.43	5.00	1.99	0.11	2.10
3.75	0.53	0.43	5.00	1.99	0.11	2.10
3.80	0.53	0.43	5.00	1.99	0.11	2.10
3.85	0.53	0.43	5.00	1.99	0.11	2.10
3.90	0.53	0.43	5.00	1.99	0.11	2.10
3.95	0.53	0.43	5.00	1.99	0.11	2.10
4.00	0.53	0.43	5.00	1.99	0.11	2.09
4.05	0.53	0.43	5.00	1.99	0.11	2.09
4.10	0.53	0.43	5.00	1.99	0.11	2.09
4.15	0.53	0.43	5.00	1.99	0.11	2.09
4.20	0.53	0.43	5.00	1.99	0.11	2.09
4.25	0.53	0.43	5.00	1.99	0.11	2.09
4.30	0.53	0.43	5.00	1.99	0.11	2.09
4.35	0.53	0.43	5.00	1.99	0.11	2.09
4.40	0.53	0.43	5.00	1.99	0.11	2.09
4.45	0.53	0.43	5.00	1.99	0.11	2.09
4.50	0.53	0.43	5.00	1.99	0.10	2.09
4.55	0.53	0.43	5.00	1.99	0.10	2.09
4.60	0.53	0.43	5.00	1.99	0.10	2.09
4.65	0.53	0.43	5.00	1.99	0.10	2.09
4.70	0.53	0.43	5.00	1.99	0.10	2.09
4.75	0.53	0.43	5.00	1.99	0.10	2.09
4.80	0.53	0.43	5.00	1.99	0.10	2.09
4.85	0.53	0.43	5.00	1.99	0.10	2.09
4.90	0.53	0.43	5.00	1.99	0.10	2.09
4.95	0.53	0.43	5.00	1.99	0.10	2.09
5.00	0.53	0.43	5.00	1.99	0.10	2.09
5.05	0.53	0.43	5.00	1.99	0.10	2.09
5.10	0.53	0.43	5.00	1.99	0.10	2.09
5.15	0.53	0.43	5.00	1.99	0.10	2.09
5.20	0.53	0.43	5.00	1.99	0.10	2.09
5.25	0.53	0.43	5.00	1.99	0.10	2.09
5.30	0.53	0.43	5.00	1.99	0.10	2.09
5.35	0.53	0.43	5.00	1.99	0.10	2.09
5.40	0.53	0.43	5.00	1.99	0.10	2.09
5.45	0.53	0.43	5.00	1.99	0.10	2.09
5.50	0.53	0.43	5.00	1.99	0.10	2.09
5.55	0.53	0.43	5.00	1.99	0.10	2.09
5.60	0.53	0.43	5.00	1.99	0.10	2.09
5.65	0.53	0.43	5.00	1.99	0.10	2.09
5.70	0.53	0.43	5.00	1.99	0.10	2.09
5.75	0.53	0.43	5.00	1.99	0.10	2.09
5.80	0.53	0.43	5.00	1.99	0.10	2.09

5.85	0.53	0.43	5.00	1.99	0.10	2.09
5.90	0.53	0.43	5.00	1.99	0.10	2.09
5.95	0.53	0.43	5.00	1.99	0.10	2.09
6.00	0.53	0.43	5.00	1.99	0.10	2.09
6.05	0.53	0.43	5.00	1.99	0.10	2.09
6.10	0.53	0.43	5.00	1.99	0.10	2.09
6.15	0.53	0.43	5.00	1.99	0.10	2.09
6.20	0.53	0.43	5.00	1.99	0.10	2.09
6.25	0.53	0.43	5.00	1.99	0.10	2.09
6.30	0.53	0.43	5.00	1.99	0.10	2.09
6.35	0.53	0.43	5.00	1.99	0.10	2.09
6.40	0.53	0.43	5.00	1.99	0.10	2.09
6.45	0.53	0.43	5.00	1.99	0.10	2.09
6.50	0.53	0.43	5.00	1.99	0.10	2.09
6.55	0.53	0.43	5.00	1.99	0.10	2.09
6.60	0.53	0.43	5.00	1.99	0.10	2.09
6.65	0.53	0.43	5.00	1.99	0.10	2.09
6.70	0.53	0.43	5.00	1.99	0.10	2.09
6.75	0.53	0.43	5.00	1.99	0.10	2.09
6.80	0.53	0.43	5.00	1.99	0.10	2.09
6.85	0.53	0.43	5.00	1.99	0.10	2.09
6.90	0.53	0.43	5.00	1.99	0.10	2.09
6.95	0.53	0.43	5.00	1.99	0.10	2.09
7.00	0.53	0.43	5.00	1.99	0.10	2.09
7.05	0.53	0.43	5.00	1.99	0.10	2.09
7.10	0.53	0.43	5.00	1.99	0.10	2.09
7.15	0.53	0.43	5.00	1.99	0.10	2.09
7.20	0.53	0.43	5.00	1.99	0.10	2.09
7.25	0.53	0.43	5.00	1.99	0.10	2.09
7.30	0.53	0.43	5.00	1.99	0.10	2.09
7.35	0.53	0.43	5.00	1.99	0.10	2.09
7.40	0.53	0.43	5.00	1.99	0.10	2.09
7.45	0.53	0.43	5.00	1.99	0.10	2.09
7.50	0.53	0.43	5.00	1.99	0.10	2.09
7.55	0.53	0.43	5.00	1.99	0.10	2.09
7.60	0.53	0.43	5.00	1.99	0.10	2.09
7.65	0.53	0.43	5.00	1.99	0.10	2.09
7.70	0.53	0.43	5.00	1.99	0.10	2.09
7.75	0.53	0.43	5.00	1.99	0.10	2.09
7.80	0.53	0.43	5.00	1.99	0.10	2.09
7.85	0.53	0.43	5.00	1.99	0.10	2.09
7.90	0.53	0.43	5.00	1.99	0.10	2.09
7.95	0.53	0.43	5.00	1.99	0.10	2.09
8.00	0.53	0.43	5.00	1.99	0.10	2.09
8.05	0.53	0.43	5.00	1.99	0.10	2.09
8.10	0.53	0.43	5.00	1.99	0.10	2.09
8.15	0.53	0.43	5.00	1.99	0.10	2.08
8.20	0.53	0.43	5.00	1.99	0.10	2.08

8.25	0.53	0.43	5.00	1.99	0.10	2.08
8.30	0.53	0.43	5.00	1.99	0.10	2.08
8.35	0.53	0.43	5.00	1.99	0.10	2.08
8.40	0.53	0.42	5.00	1.99	0.09	2.08
8.45	0.53	0.42	5.00	1.99	0.09	2.08
8.50	0.53	0.42	5.00	1.99	0.09	2.08
8.55	0.53	0.42	5.00	1.99	0.09	2.08
8.60	0.53	0.42	5.00	1.99	0.09	2.08
8.65	0.53	0.42	5.00	1.99	0.09	2.08
8.70	0.53	0.42	5.00	1.99	0.09	2.08
8.75	0.53	0.42	5.00	1.99	0.09	2.08
8.80	0.53	0.42	5.00	1.99	0.09	2.08
8.85	0.53	0.42	5.00	1.99	0.09	2.08
8.90	0.53	0.42	5.00	1.99	0.09	2.08
8.95	0.53	0.42	5.00	1.99	0.09	2.08
9.00	0.53	0.42	5.00	1.99	0.09	2.08
9.05	0.53	0.42	5.00	1.99	0.09	2.08
9.10	0.53	0.42	5.00	1.99	0.09	2.08
9.15	0.53	0.42	5.00	1.99	0.09	2.08
9.20	0.53	0.42	5.00	1.99	0.09	2.08
9.25	0.53	0.42	5.00	1.99	0.09	2.08
9.30	0.53	0.42	5.00	1.99	0.09	2.08
9.35	0.53	0.42	5.00	1.99	0.09	2.08
9.40	0.53	0.42	5.00	1.99	0.09	2.08
9.45	0.53	0.42	5.00	1.99	0.09	2.08
9.50	0.48	0.42	5.00	1.99	0.09	2.08
9.55	0.43	0.42	5.00	1.99	0.09	2.08
9.60	0.41	0.42	5.00	1.99	0.09	2.08
9.65	0.39	0.42	5.00	1.99	0.09	2.08
9.70	0.38	0.42	5.00	1.99	0.09	2.08
9.75	0.36	0.42	5.00	1.99	0.09	2.08
9.80	0.35	0.42	5.00	1.99	0.09	2.07
9.85	0.34	0.42	5.00	1.99	0.08	2.07
9.90	0.34	0.42	5.00	1.99	0.08	2.07
9.95	0.33	0.42	5.00	1.99	0.08	2.07
10.00	0.32	0.42	5.00	1.99	0.08	2.07
10.05	0.32	0.42	5.00	1.99	0.08	2.07
10.10	0.33	0.42	5.00	1.99	0.08	2.07
10.15	0.33	0.42	5.00	1.99	0.08	2.07
10.20	0.33	0.42	5.00	1.99	0.08	2.07
10.25	0.34	0.42	5.00	1.99	0.08	2.07
10.30	0.34	0.42	5.00	1.99	0.08	2.07
10.35	0.34	0.42	5.00	1.99	0.08	2.07
10.40	0.35	0.42	5.00	1.99	0.08	2.07
10.45	0.35	0.42	5.00	1.99	0.08	2.06
10.50	0.35	0.42	5.00	1.99	0.07	2.06
10.55	0.36	0.42	5.00	1.99	0.07	2.06
10.60	0.36	0.42	5.00	1.99	0.07	2.06

10.65	0.37	0.42	5.00	1.99	0.07	2.06
10.70	0.37	0.42	5.00	1.99	0.07	2.06
10.75	0.38	0.42	5.00	1.99	0.07	2.06
10.80	0.38	0.42	5.00	1.99	0.07	2.06
10.85	0.39	0.42	5.00	1.99	0.07	2.06
10.90	0.39	0.42	5.00	1.99	0.07	2.06
10.95	0.40	0.42	5.00	1.99	0.07	2.06
11.00	0.41	0.42	5.00	1.99	0.07	2.06
11.05	0.41	0.42	5.00	1.99	0.07	2.06
11.10	0.42	0.42	5.00	1.99	0.07	2.05
11.15	0.44	0.42	5.00	1.99	0.06	2.05
11.20	0.45	0.42	5.00	1.99	0.06	2.05
11.25	0.48	0.42	5.00	1.99	0.06	2.05
11.30	0.53	0.42	5.00	1.99	0.06	2.05
11.35	0.53	0.42	5.00	1.99	0.06	2.05
11.40	0.53	0.42	5.00	1.99	0.06	2.05
11.45	0.53	0.42	5.00	1.99	0.06	2.05
11.50	0.53	0.42	5.00	1.99	0.06	2.05
11.55	0.53	0.42	5.00	1.99	0.06	2.05
11.60	0.53	0.42	5.00	1.99	0.06	2.05
11.65	0.53	0.42	5.00	1.99	0.06	2.05
11.70	0.53	0.42	5.00	1.99	0.06	2.05
11.75	0.53	0.42	5.00	1.99	0.06	2.05
11.80	0.53	0.42	5.00	1.99	0.06	2.04
11.85	0.53	0.42	5.00	1.99	0.05	2.04
11.90	0.53	0.42	5.00	1.99	0.05	2.04
11.95	0.53	0.42	5.00	1.99	0.05	2.04
12.00	0.53	0.42	5.00	1.99	0.05	2.04
12.05	0.53	0.42	5.00	1.99	0.05	2.04
12.10	0.53	0.42	5.00	1.99	0.05	2.04
12.15	0.53	0.42	5.00	1.99	0.05	2.04
12.20	0.53	0.42	5.00	1.99	0.05	2.04
12.25	0.53	0.42	5.00	1.99	0.05	2.04
12.30	0.53	0.42	5.00	1.99	0.05	2.04
12.35	0.53	0.42	5.00	1.99	0.05	2.04
12.40	0.53	0.42	5.00	1.99	0.05	2.04
12.45	0.53	0.42	5.00	1.99	0.05	2.04
12.50	0.53	0.42	5.00	1.99	0.05	2.04
12.55	0.53	0.42	5.00	1.99	0.05	2.04
12.60	0.53	0.42	5.00	1.99	0.05	2.04
12.65	0.53	0.42	5.00	1.99	0.05	2.04
12.70	0.53	0.42	5.00	1.99	0.05	2.03
12.75	0.53	0.42	5.00	1.99	0.05	2.03
12.80	0.53	0.42	5.00	1.99	0.04	2.03
12.85	0.53	0.42	5.00	1.99	0.04	2.03
12.90	0.53	0.42	5.00	1.99	0.04	2.03
12.95	0.53	0.42	5.00	1.99	0.04	2.03
13.00	0.53	0.42	5.00	1.99	0.04	2.03

13.05	0.53	0.42	5.00	1.99	0.04	2.03
13.10	0.53	0.42	5.00	1.99	0.04	2.03
13.15	0.53	0.42	5.00	1.99	0.04	2.03
13.20	0.53	0.42	5.00	1.99	0.04	2.03
13.25	0.53	0.42	5.00	1.99	0.04	2.03
13.30	0.53	0.42	5.00	1.99	0.04	2.03
13.35	0.53	0.42	5.00	1.99	0.04	2.03
13.40	0.53	0.42	5.00	1.99	0.04	2.03
13.45	0.53	0.42	5.00	1.99	0.04	2.03
13.50	0.53	0.42	5.00	1.99	0.04	2.03
13.55	0.53	0.42	5.00	1.99	0.04	2.03
13.60	0.53	0.42	5.00	1.99	0.04	2.03
13.65	0.53	0.42	5.00	1.99	0.04	2.03
13.70	0.53	0.42	5.00	1.99	0.04	2.03
13.75	0.53	0.42	5.00	1.99	0.04	2.03
13.80	0.53	0.42	5.00	1.99	0.04	2.03
13.85	0.53	0.42	5.00	1.99	0.04	2.03
13.90	0.53	0.42	5.00	1.99	0.04	2.03
13.95	0.53	0.42	5.00	1.99	0.04	2.03
14.00	0.53	0.42	5.00	1.99	0.04	2.03
14.05	0.53	0.42	5.00	1.99	0.04	2.03
14.10	0.53	0.42	5.00	1.99	0.04	2.03
14.15	0.53	0.42	5.00	1.99	0.04	2.03
14.20	0.53	0.42	5.00	1.99	0.04	2.03
14.25	0.53	0.42	5.00	1.99	0.04	2.03
14.30	0.53	0.42	5.00	1.99	0.04	2.03
14.35	0.53	0.42	5.00	1.99	0.04	2.02
14.40	0.53	0.42	5.00	1.99	0.04	2.02
14.45	0.53	0.42	5.00	1.99	0.04	2.02
14.50	0.53	0.42	5.00	1.99	0.04	2.02
14.55	0.53	0.42	5.00	1.99	0.03	2.02
14.60	0.53	0.42	5.00	1.99	0.03	2.02
14.65	0.53	0.42	5.00	1.99	0.03	2.02
14.70	0.53	0.42	5.00	1.99	0.03	2.02
14.75	0.53	0.42	5.00	1.99	0.03	2.02
14.80	0.53	0.42	5.00	1.99	0.03	2.02
14.85	0.53	0.42	5.00	1.99	0.03	2.02
14.90	0.53	0.42	5.00	1.99	0.03	2.02
14.95	0.53	0.42	5.00	1.99	0.03	2.02
15.00	0.53	0.42	5.00	1.99	0.03	2.02
15.05	0.53	0.42	5.00	1.99	0.03	2.02
15.10	0.53	0.42	5.00	1.99	0.03	2.02
15.15	0.53	0.42	5.00	1.99	0.03	2.02
15.20	0.53	0.42	5.00	1.99	0.03	2.02
15.25	0.53	0.42	5.00	1.99	0.03	2.02
15.30	0.53	0.42	5.00	1.99	0.03	2.02
15.35	0.53	0.42	5.00	1.99	0.03	2.02
15.40	0.53	0.42	5.00	1.99	0.03	2.02

15.45	0.53	0.42	5.00	1.99	0.03	2.02
15.50	0.53	0.42	5.00	1.99	0.03	2.02
15.55	0.53	0.42	5.00	1.99	0.03	2.02
15.60	0.53	0.42	5.00	1.99	0.03	2.02
15.65	0.53	0.42	5.00	1.99	0.03	2.02
15.70	0.53	0.42	5.00	1.99	0.03	2.02
15.75	0.53	0.42	5.00	1.99	0.03	2.02
15.80	0.53	0.42	5.00	1.99	0.03	2.02
15.85	0.53	0.42	5.00	1.99	0.03	2.02
15.90	0.53	0.42	5.00	1.99	0.03	2.02
15.95	0.53	0.42	5.00	1.99	0.03	2.02
16.00	0.53	0.42	5.00	1.99	0.03	2.02
16.05	0.53	0.42	5.00	1.99	0.03	2.02
16.10	0.53	0.42	5.00	1.99	0.03	2.02
16.15	0.53	0.42	5.00	1.99	0.03	2.02
16.20	0.53	0.42	5.00	1.99	0.03	2.02
16.25	0.53	0.42	5.00	1.99	0.03	2.02
16.30	0.53	0.42	5.00	1.99	0.03	2.01
16.35	0.53	0.42	5.00	1.99	0.03	2.01
16.40	0.53	0.42	5.00	1.99	0.03	2.01
16.45	0.53	0.42	5.00	1.99	0.02	2.01
16.50	0.53	0.42	5.00	1.99	0.02	2.01
16.55	0.53	0.42	5.00	1.99	0.02	2.01
16.60	0.53	0.42	5.00	1.99	0.02	2.01
16.65	0.53	0.42	5.00	1.99	0.02	2.01
16.70	0.53	0.42	5.00	1.99	0.02	2.01
16.75	0.53	0.42	5.00	1.99	0.02	2.01
16.80	0.53	0.42	5.00	1.99	0.02	2.01
16.85	0.53	0.42	5.00	1.99	0.02	2.01
16.90	0.53	0.42	5.00	1.99	0.02	2.01
16.95	0.53	0.42	5.00	1.99	0.02	2.01
17.00	0.53	0.42	5.00	1.99	0.02	2.01
17.05	0.53	0.42	5.00	1.99	0.02	2.01
17.10	0.53	0.42	5.00	1.99	0.02	2.01
17.15	0.53	0.42	5.00	1.99	0.02	2.01
17.20	0.53	0.42	5.00	1.99	0.02	2.01
17.25	0.53	0.42	5.00	1.99	0.02	2.01
17.30	0.53	0.42	5.00	1.99	0.02	2.01
17.35	0.53	0.42	5.00	1.99	0.02	2.01
17.40	0.53	0.42	5.00	1.99	0.02	2.01
17.45	0.53	0.42	5.00	1.99	0.02	2.01
17.50	0.53	0.42	5.00	1.99	0.02	2.01
17.55	0.53	0.42	5.00	1.99	0.02	2.01
17.60	0.53	0.42	5.00	1.99	0.02	2.01
17.65	0.53	0.42	5.00	1.99	0.02	2.01
17.70	0.53	0.42	5.00	1.99	0.02	2.01
17.75	0.53	0.42	5.00	1.99	0.02	2.01
17.80	0.53	0.42	5.00	1.99	0.02	2.01

17.85	0.53	0.42	5.00	1.99	0.02	2.01
17.90	0.53	0.42	5.00	1.99	0.02	2.01
17.95	0.53	0.42	5.00	1.99	0.02	2.00
18.00	0.53	0.42	5.00	1.99	0.02	2.00
18.05	0.53	0.42	5.00	1.99	0.01	2.00
18.10	0.53	0.42	5.00	1.99	0.01	2.00
18.15	0.53	0.42	5.00	1.99	0.01	2.00
18.20	0.53	0.42	5.00	1.99	0.01	2.00
18.25	0.53	0.42	5.00	1.99	0.01	2.00
18.30	0.53	0.41	5.00	1.99	0.01	2.00
18.35	0.53	0.41	5.00	1.99	0.01	2.00
18.40	0.53	0.41	5.00	1.99	0.01	2.00
18.45	0.53	0.41	5.00	1.99	0.01	2.00
18.50	0.53	0.41	5.00	1.99	0.01	2.00
18.55	0.53	0.41	5.00	1.99	0.01	2.00
18.60	0.53	0.41	5.00	1.99	0.01	2.00
18.65	0.53	0.41	5.00	1.99	0.01	2.00
18.70	0.53	0.41	5.00	1.99	0.01	2.00
18.75	0.53	0.41	5.00	1.99	0.01	2.00
18.80	0.53	0.41	5.00	1.99	0.01	2.00
18.85	0.53	0.41	5.00	1.99	0.01	2.00
18.90	0.53	0.41	5.00	1.99	0.01	2.00
18.95	0.53	0.41	5.00	1.99	0.01	2.00
19.00	0.53	0.41	5.00	1.99	0.01	2.00
19.05	0.53	0.41	5.00	1.99	0.01	2.00
19.10	0.53	0.41	5.00	1.99	0.01	2.00
19.15	0.53	0.41	5.00	1.99	0.01	2.00
19.20	0.53	0.41	5.00	1.99	0.01	2.00
19.25	0.53	0.41	5.00	1.99	0.01	2.00
19.30	0.53	0.41	5.00	1.99	0.01	2.00
19.35	0.53	0.41	5.00	1.99	0.01	1.99
19.40	0.53	0.41	5.00	1.99	0.01	1.99
19.45	0.53	0.41	5.00	1.99	0.00	1.99
19.50	0.53	0.41	5.00	1.99	0.00	1.99
19.55	0.53	0.41	5.00	1.99	0.00	1.99
19.60	0.53	0.41	5.00	1.99	0.00	1.99
19.65	0.53	0.41	5.00	1.99	0.00	1.99
19.70	0.53	0.41	5.00	1.99	0.00	1.99
19.75	0.53	0.41	5.00	1.99	0.00	1.99
19.80	0.53	0.41	5.00	1.99	0.00	1.99
19.85	0.53	0.41	5.00	1.99	0.00	1.99
19.90	0.53	0.41	5.00	1.99	0.00	1.99
19.95	0.53	0.41	5.00	1.99	0.00	1.99
20.00	0.53	0.41	5.00	1.99	0.00	1.99
20.05	0.53	0.41	1.28	1.99	0.00	1.99
20.10	0.53	0.41	1.28	1.99	0.00	1.99
20.15	0.53	0.41	1.27	1.99	0.00	1.99
20.20	0.53	0.42	1.27	1.99	0.00	1.99

20.25	0.53	0.42	1.27	1.99	0.00	1.99
20.30	0.53	0.42	1.27	1.99	0.00	1.99
20.35	0.53	0.42	1.27	1.99	0.00	1.99
20.40	0.53	0.42	1.27	1.99	0.00	1.99
20.45	0.53	0.42	1.26	1.99	0.00	1.99
20.50	0.53	0.42	1.26	1.99	0.00	1.99
20.55	0.53	0.42	1.26	1.99	0.00	1.99
20.60	0.53	0.42	1.26	1.99	0.00	1.99
20.65	0.53	0.42	1.26	1.99	0.00	1.99
20.70	0.53	0.42	1.25	1.99	0.00	1.99
20.75	0.53	0.42	1.25	1.99	0.00	1.99
20.80	0.53	0.42	1.25	1.99	0.00	1.99
20.85	0.53	0.42	1.25	1.99	0.00	1.99
20.90	0.53	0.42	1.25	1.99	0.00	1.99
20.95	0.53	0.42	1.25	1.99	0.00	1.99
21.00	0.53	0.42	1.24	1.99	0.00	1.99
21.05	0.53	0.43	1.24	1.99	0.00	1.99
21.10	0.53	0.43	1.24	1.99	0.00	1.99
21.15	0.53	0.43	1.24	1.99	0.00	1.99
21.20	0.53	0.43	1.24	1.99	0.00	1.99
21.25	0.53	0.43	1.24	1.99	0.00	1.99
21.30	0.53	0.43	1.23	1.99	0.00	1.99
21.35	0.53	0.43	1.23	1.99	0.00	1.99
21.40	0.53	0.43	1.23	1.99	0.00	1.99
21.45	0.53	0.43	1.23	1.99	0.00	1.99
21.50	0.53	0.43	1.23	1.99	0.00	1.99
21.55	0.53	0.43	1.23	1.99	0.00	1.99
21.60	0.53	0.43	1.22	1.99	0.00	1.99
21.65	0.53	0.43	1.22	1.99	0.00	1.99
21.70	0.53	0.43	1.22	1.99	0.00	1.99
21.75	0.53	0.43	1.22	1.99	0.00	1.99
21.80	0.53	0.43	1.22	1.99	0.00	1.99
21.85	0.53	0.43	1.22	1.99	0.00	1.99
21.90	0.53	0.43	1.22	1.99	0.00	1.99
21.95	0.53	0.44	1.21	1.99	0.00	1.99
22.00	0.53	0.44	1.21	1.99	0.00	1.99
22.05	0.53	0.44	1.21	1.99	0.00	1.99
22.10	0.53	0.44	1.21	1.99	0.00	1.99
22.15	0.53	0.44	1.21	1.99	0.00	1.99
22.20	0.53	0.44	1.21	1.99	0.00	1.99
22.25	0.53	0.44	1.21	1.99	0.00	1.99
22.30	0.53	0.44	1.20	1.99	0.00	1.99
22.35	0.53	0.44	1.20	1.99	0.00	1.99
22.40	0.53	0.44	1.20	1.99	0.00	1.99
22.45	0.53	0.44	1.20	1.99	0.00	1.99
22.50	0.53	0.44	1.20	1.99	0.00	1.99
22.55	0.53	0.44	1.20	1.99	0.00	1.99
22.60	0.53	0.44	1.20	1.99	0.00	1.99

22.65	0.53	0.44	1.19	1.99	0.00	1.99
22.70	0.53	0.44	1.19	1.99	0.00	1.99
22.75	0.53	0.44	1.19	1.99	0.00	1.99
22.80	0.53	0.44	1.19	1.99	0.00	1.99
22.85	0.53	0.44	1.19	1.99	0.00	1.99
22.90	0.53	0.44	1.19	1.99	0.00	1.99
22.95	0.53	0.45	1.19	1.99	0.00	1.99
23.00	0.53	0.45	1.18	1.99	0.00	1.99
23.05	0.53	0.45	1.18	1.99	0.00	1.99
23.10	0.53	0.45	1.18	1.99	0.00	1.99
23.15	0.53	0.45	1.18	1.99	0.00	1.99
23.20	0.53	0.45	1.18	1.99	0.00	1.99
23.25	0.53	0.45	1.18	1.99	0.00	1.99
23.30	0.53	0.45	1.18	1.99	0.00	1.99
23.35	0.53	0.45	1.18	1.99	0.00	1.99
23.40	0.53	0.45	1.17	1.99	0.00	1.99
23.45	0.53	0.45	1.17	1.99	0.00	1.99
23.50	0.53	0.45	1.17	1.99	0.00	1.99
23.55	0.53	0.45	1.17	1.99	0.00	1.99
23.60	0.53	0.45	1.17	1.99	0.00	1.99
23.65	0.53	0.45	1.17	1.99	0.00	1.99
23.70	0.53	0.45	1.17	1.99	0.00	1.99
23.75	0.53	0.45	1.17	1.99	0.00	1.99
23.80	0.53	0.45	1.16	1.99	0.00	1.99
23.85	0.53	0.45	1.16	1.99	0.00	1.99
23.90	0.53	0.45	1.16	1.99	0.00	1.99
23.95	0.53	0.45	1.16	1.99	0.00	1.99
24.00	0.53	0.46	1.16	1.99	0.00	1.99
24.05	0.53	0.46	1.16	1.99	0.00	1.99
24.10	0.53	0.46	1.16	1.99	0.00	1.99
24.15	0.53	0.46	1.16	1.99	0.00	1.99
24.20	0.53	0.46	1.16	1.99	0.00	1.99
24.25	0.53	0.46	1.15	1.99	0.00	1.99
24.30	0.53	0.46	1.15	1.99	0.00	1.99
24.35	0.53	0.46	1.15	1.99	0.00	1.99
24.40	0.53	0.46	1.15	1.99	0.00	1.99
24.45	0.53	0.46	1.15	1.99	0.00	1.99
24.50	0.53	0.46	1.15	1.99	0.00	1.99
24.55	0.53	0.46	1.15	1.99	0.00	1.99
24.60	0.53	0.46	1.15	1.99	0.00	1.99
24.65	0.53	0.46	1.15	1.99	0.00	1.99
24.70	0.53	0.46	1.14	1.99	0.00	1.99
24.75	0.53	0.46	1.14	1.99	0.00	1.99
24.80	0.53	0.46	1.14	1.99	0.00	1.99
24.85	0.53	0.46	1.14	1.99	0.00	1.99
24.90	0.53	0.46	1.14	1.99	0.00	1.99
24.95	0.53	0.46	1.14	1.99	0.00	1.99
25.00	0.53	0.46	1.14	1.99	0.00	1.99

25.05	0.53	0.46	1.14	1.99	0.00	1.99
25.10	0.53	0.46	1.14	1.99	0.00	1.99
25.15	0.53	0.47	1.14	1.99	0.00	1.99
25.20	0.53	0.47	1.13	1.99	0.00	1.99
25.25	0.53	0.47	1.13	1.99	0.00	1.99
25.30	0.53	0.47	1.13	1.99	0.00	1.99
25.35	0.53	0.47	1.13	1.99	0.00	1.99
25.40	0.53	0.47	1.13	1.99	0.00	1.99
25.45	0.53	0.47	1.13	1.99	0.00	1.99
25.50	0.53	0.47	1.13	1.99	0.00	1.99
25.55	0.53	0.47	1.13	1.99	0.00	1.99
25.60	0.53	0.47	1.13	1.99	0.00	1.99
25.65	0.53	0.47	1.13	1.99	0.00	1.99
25.70	0.53	0.47	1.12	1.99	0.00	1.99
25.75	0.53	0.47	1.12	1.99	0.00	1.99
25.80	0.53	0.47	1.12	1.99	0.00	1.99
25.85	0.53	0.47	1.12	1.99	0.00	1.99
25.90	0.53	0.47	1.12	1.99	0.00	1.99
25.95	0.53	0.47	1.12	1.99	0.00	1.99
26.00	0.53	0.47	1.12	1.99	0.00	1.99
26.05	0.53	0.47	1.12	1.99	0.00	1.99
26.10	0.53	0.47	1.12	1.99	0.00	1.99
26.15	0.53	0.47	1.12	1.99	0.00	1.99
26.20	0.53	0.47	1.12	1.99	0.00	1.99
26.25	0.53	0.47	1.11	1.99	0.00	1.99
26.30	0.53	0.47	1.11	1.99	0.00	1.99
26.35	0.53	0.47	1.11	1.99	0.00	1.99
26.40	0.53	0.47	1.11	1.99	0.00	1.99
26.45	0.53	0.48	1.11	1.98	0.00	1.98
26.50	0.53	0.48	1.11	1.98	0.00	1.98
26.55	0.53	0.48	1.11	1.98	0.00	1.98
26.60	0.53	0.48	1.11	1.98	0.00	1.98
26.65	0.53	0.48	1.11	1.98	0.00	1.98
26.70	0.53	0.48	1.11	1.98	0.00	1.98
26.75	0.53	0.48	1.11	1.98	0.00	1.98
26.80	0.53	0.48	1.11	1.98	0.00	1.98
26.85	0.53	0.48	1.10	1.98	0.00	1.98
26.90	0.53	0.48	1.10	1.98	0.00	1.98
26.95	0.53	0.48	1.10	1.98	0.00	1.98
27.00	0.53	0.48	1.10	1.97	0.00	1.97
27.05	0.53	0.48	1.10	1.97	0.00	1.97
27.10	0.53	0.48	1.10	1.97	0.00	1.97
27.15	0.53	0.48	1.10	1.97	0.00	1.97
27.20	0.53	0.48	1.10	1.97	0.00	1.97
27.25	0.53	0.48	1.10	1.97	0.00	1.97
27.30	0.53	0.48	1.10	1.97	0.00	1.97
27.35	0.53	0.48	1.10	1.96	0.00	1.96
27.40	0.53	0.48	1.10	1.96	0.00	1.96

27.45	0.53	0.48	1.10	1.96	0.00	1.96
27.50	0.53	0.48	1.09	1.96	0.00	1.96
27.55	0.53	0.48	1.09	1.96	0.00	1.96
27.60	0.53	0.48	1.09	1.95	0.00	1.95
27.65	0.53	0.48	1.09	1.95	0.00	1.95
27.70	0.53	0.48	1.09	1.95	0.00	1.95
27.75	0.53	0.48	1.09	1.94	0.00	1.94
27.80	0.53	0.48	1.09	1.94	0.00	1.94
27.85	0.53	0.48	1.09	1.94	0.00	1.94
27.90	0.53	0.49	1.09	1.93	0.00	1.93
27.95	0.53	0.49	1.09	1.93	0.00	1.93
28.00	0.53	0.49	1.09	1.93	0.00	1.93
28.05	0.53	0.49	1.09	1.93	0.00	1.93
28.10	0.53	0.49	1.09	1.92	0.00	1.92
28.15	0.53	0.49	1.08	1.92	0.00	1.92
28.20	0.53	0.49	1.08	1.92	0.00	1.92
28.25	0.53	0.49	1.08	1.91	0.00	1.91
28.30	0.53	0.49	1.08	1.91	0.00	1.91
28.35	0.53	0.49	1.08	1.91	0.00	1.91
28.40	0.53	0.49	1.08	1.90	0.00	1.90
28.45	0.53	0.49	1.08	1.90	0.00	1.90
28.50	0.53	0.49	1.08	1.90	0.00	1.90
28.55	0.53	0.49	1.08	1.89	0.00	1.89
28.60	0.53	0.49	1.08	1.89	0.00	1.89
28.65	0.53	0.49	1.08	1.89	0.00	1.89
28.70	0.53	0.49	1.08	1.88	0.00	1.88
28.75	0.53	0.49	1.08	1.88	0.00	1.88
28.80	0.53	0.49	1.08	1.87	0.00	1.87
28.85	0.50	0.49	1.01	1.87	0.00	1.87
28.90	0.47	0.49	0.96*	1.87	0.00	1.87
28.95	0.45	0.49	0.92*	1.86	0.00	1.86
29.00	0.44	0.49	0.89*	1.86	0.00	1.86
29.05	0.43	0.49	0.87*	1.85	0.00	1.85
29.10	0.42	0.49	0.85*	1.85	0.00	1.85
29.15	0.41	0.49	0.84*	1.84	0.00	1.84
29.20	0.41	0.49	0.83*	1.84	0.00	1.84
29.25	0.40	0.49	0.82*	1.83	0.00	1.83
29.30	0.40	0.49	0.80*	1.83	0.00	1.83
29.35	0.39	0.49	0.79*	1.82	0.00	1.82
29.40	0.39	0.49	0.78*	1.82	0.00	1.82
29.45	0.38	0.49	0.78*	1.81	0.00	1.81
29.50	0.38	0.49	0.77*	1.81	0.00	1.81
29.55	0.38	0.50	0.76*	1.80	0.00	1.80
29.60	0.37	0.50	0.75*	1.80	0.00	1.80
29.65	0.37	0.50	0.74*	1.79	0.00	1.79
29.70	0.37	0.50	0.74*	1.78	0.00	1.78
29.75	0.36	0.50	0.73*	1.78	0.00	1.78
29.80	0.36	0.50	0.72*	1.77	0.00	1.77

29.85	0.36	0.50	0.72*	1.77	0.00	1.77
29.90	0.35	0.50	0.71*	1.76	0.00	1.76
29.95	0.35	0.50	0.71*	1.76	0.00	1.76
30.00	0.35	0.50	0.70*	1.75	0.00	1.75
30.05	0.35	0.50	0.71*	1.74	0.00	1.74
30.10	0.36	0.50	0.72*	1.74	0.00	1.74
30.15	0.36	0.50	0.73*	1.73	0.00	1.73
30.20	0.37	0.50	0.73*	1.72	0.00	1.72
30.25	0.37	0.50	0.74*	1.72	0.00	1.72
30.30	0.37	0.50	0.75*	1.71	0.00	1.71
30.35	0.38	0.50	0.76*	1.71	0.00	1.71
30.40	0.38	0.50	0.77*	1.70	0.00	1.70
30.45	0.39	0.50	0.78*	1.70	0.00	1.70
30.50	0.39	0.50	0.79*	1.69	0.00	1.69
30.55	0.40	0.50	0.80*	1.69	0.00	1.69
30.60	0.40	0.50	0.81*	1.68	0.00	1.68
30.65	0.41	0.50	0.83*	1.68	0.00	1.68
30.70	0.42	0.50	0.84*	1.67	0.00	1.67
30.75	0.43	0.50	0.86*	1.67	0.00	1.67
30.80	0.44	0.50	0.89*	1.66	0.00	1.66
30.85	0.46	0.50	0.92*	1.66	0.00	1.66
30.90	0.49	0.50	0.97*	1.65	0.00	1.65
30.95	0.53	0.50	1.06	1.65	0.00	1.65
31.00	0.53	0.50	1.06	1.64	0.00	1.64
31.05	0.53	0.50	1.05	1.64	0.00	1.64
31.10	0.53	0.50	1.05	1.64	0.00	1.64
31.15	0.53	0.50	1.05	1.63	0.00	1.63
31.20	0.53	0.50	1.05	1.63	0.00	1.63
31.25	0.53	0.50	1.05	1.62	0.00	1.62
31.30	0.53	0.50	1.05	1.62	0.00	1.62
31.35	0.53	0.50	1.05	1.62	0.00	1.62
31.40	0.53	0.50	1.05	1.61	0.00	1.61
31.45	0.53	0.50	1.05	1.61	0.00	1.61
31.50	0.53	0.50	1.05	1.61	0.00	1.61
31.55	0.53	0.50	1.05	1.60	0.00	1.60
31.60	0.53	0.50	1.05	1.60	0.00	1.60
31.65	0.53	0.50	1.05	1.60	0.00	1.60
31.70	0.53	0.50	1.05	1.59	0.00	1.59
31.75	0.53	0.50	1.05	1.59	0.00	1.59
31.80	0.52	0.50	1.05	1.59	0.00	1.59
31.85	0.52	0.50	1.05	1.59	0.00	1.59
31.90	0.52	0.50	1.05	1.59	0.00	1.59
31.95	0.52	0.50	1.05	1.58	0.00	1.58
32.00	0.52	0.50	1.04	1.58	0.00	1.58
32.05	0.52	0.50	1.04	1.58	0.00	1.58
32.10	0.52	0.50	1.04	1.58	0.00	1.58
32.15	0.52	0.50	1.04	1.58	0.00	1.58
32.20	0.52	0.50	1.04	1.58	0.00	1.58

32.25	0.52	0.50	1.04	1.58	0.00	1.58
32.30	0.52	0.50	1.04	1.57	0.00	1.57
32.35	0.52	0.50	1.04	1.57	0.00	1.57
32.40	0.52	0.50	1.04	1.57	0.00	1.57
32.45	0.52	0.50	1.04	1.57	0.00	1.57
32.50	0.52	0.50	1.04	1.57	0.00	1.57
32.55	0.52	0.50	1.04	1.57	0.00	1.57
32.60	0.52	0.50	1.04	1.57	0.00	1.57
32.65	0.52	0.50	1.04	1.57	0.00	1.57
32.70	0.52	0.50	1.04	1.57	0.00	1.57
32.75	0.52	0.50	1.04	1.57	0.00	1.57
32.80	0.52	0.50	1.04	1.56	0.00	1.56
32.85	0.52	0.50	1.04	1.56	0.00	1.56
32.90	0.52	0.50	1.04	1.56	0.00	1.56
32.95	0.52	0.50	1.04	1.56	0.00	1.56
33.00	0.52	0.50	1.03	1.56	0.00	1.56
33.05	0.52	0.50	1.03	1.56	0.00	1.56
33.10	0.52	0.50	1.03	1.56	0.00	1.56
33.15	0.52	0.50	1.03	1.56	0.00	1.56
33.20	0.52	0.50	1.03	1.56	0.00	1.56
33.25	0.52	0.50	1.03	1.56	0.00	1.56
33.30	0.52	0.50	1.03	1.56	0.00	1.56
33.35	0.52	0.50	1.03	1.56	0.00	1.56
33.40	0.52	0.50	1.03	1.56	0.00	1.56
33.45	0.52	0.50	1.03	1.56	0.00	1.56
33.50	0.52	0.50	1.03	1.56	0.00	1.56
33.55	0.52	0.50	1.03	1.56	0.00	1.56
33.60	0.52	0.50	1.03	1.56	0.00	1.56
33.65	0.52	0.50	1.03	1.56	0.00	1.56
33.70	0.52	0.50	1.03	1.56	0.00	1.56
33.75	0.52	0.50	1.03	1.56	0.00	1.56
33.80	0.52	0.50	1.03	1.56	0.00	1.56
33.85	0.52	0.50	1.03	1.56	0.00	1.56
33.90	0.52	0.50	1.03	1.56	0.00	1.56
33.95	0.52	0.50	1.03	1.56	0.00	1.56
34.00	0.52	0.50	1.03	1.56	0.00	1.56
34.05	0.52	0.50	1.03	1.56	0.00	1.56
34.10	0.52	0.50	1.03	1.56	0.00	1.56
34.15	0.52	0.50	1.02	1.56	0.00	1.56
34.20	0.52	0.51	1.02	1.56	0.00	1.56
34.25	0.52	0.51	1.02	1.56	0.00	1.56
34.30	0.52	0.51	1.02	1.56	0.00	1.56
34.35	0.52	0.51	1.02	1.56	0.00	1.56
34.40	0.52	0.51	1.02	1.56	0.00	1.56
34.45	0.52	0.51	1.02	1.56	0.00	1.56
34.50	0.52	0.51	1.02	1.56	0.00	1.56
34.55	0.52	0.51	1.02	1.56	0.00	1.56
34.60	0.52	0.51	1.02	1.56	0.00	1.56

34.65	0.52	0.51	1.02	1.56	0.00	1.56
34.70	0.52	0.51	1.02	1.56	0.00	1.56
34.75	0.52	0.51	1.02	1.56	0.00	1.56
34.80	0.52	0.51	1.02	1.56	0.00	1.56
34.85	0.52	0.51	1.02	1.56	0.00	1.56
34.90	0.52	0.51	1.02	1.56	0.00	1.56
34.95	0.52	0.51	1.02	1.56	0.00	1.56
35.00	0.51	0.51	1.02	1.56	0.00	1.56
35.05	0.51	0.51	1.02	1.56	0.00	1.56
35.10	0.51	0.51	1.02	1.56	0.00	1.56
35.15	0.51	0.51	1.02	1.56	0.00	1.56
35.20	0.51	0.51	1.02	1.56	0.00	1.56
35.25	0.51	0.51	1.02	1.56	0.00	1.56
35.30	0.51	0.51	1.02	1.56	0.00	1.56
35.35	0.51	0.51	1.01	1.56	0.00	1.56
35.40	0.51	0.51	1.01	1.56	0.00	1.56
35.45	0.51	0.51	1.01	1.56	0.00	1.56
35.50	0.51	0.51	1.01	1.56	0.00	1.56
35.55	0.51	0.51	1.01	1.56	0.00	1.56
35.60	0.51	0.51	1.01	1.56	0.00	1.56
35.65	0.51	0.51	1.01	1.56	0.00	1.56
35.70	0.51	0.51	1.01	1.56	0.00	1.56
35.75	0.51	0.51	1.01	1.56	0.00	1.56
35.80	0.51	0.51	1.01	1.56	0.00	1.56
35.85	0.51	0.51	1.01	1.56	0.00	1.56
35.90	0.51	0.51	1.01	1.56	0.00	1.56
35.95	0.51	0.51	1.01	1.56	0.00	1.56
36.00	0.51	0.51	1.01	1.56	0.00	1.56
36.05	0.51	0.51	1.01	1.56	0.00	1.56
36.10	0.51	0.51	1.01	1.56	0.00	1.56
36.15	0.51	0.51	1.01	1.56	0.00	1.56
36.20	0.51	0.51	1.01	1.56	0.00	1.56
36.25	0.51	0.51	1.01	1.56	0.00	1.56
36.30	0.51	0.51	1.01	1.56	0.00	1.56
36.35	0.51	0.51	1.01	1.56	0.00	1.56
36.40	0.51	0.51	1.01	1.56	0.00	1.56
36.45	0.51	0.51	1.01	1.56	0.00	1.56
36.50	0.51	0.51	1.01	1.56	0.00	1.56
36.55	0.51	0.51	1.01	1.56	0.00	1.56
36.60	0.51	0.51	1.01	1.56	0.00	1.56
36.65	0.51	0.51	1.01	1.56	0.00	1.56
36.70	0.51	0.51	1.01	1.56	0.00	1.56
36.75	0.51	0.51	1.00	1.56	0.00	1.56
36.80	0.51	0.51	1.00	1.56	0.00	1.56
36.85	0.51	0.51	1.00	1.55	0.00	1.55
36.90	0.51	0.51	1.00	1.55	0.00	1.55
36.95	0.51	0.51	1.00	1.55	0.00	1.55
37.00	0.51	0.51	1.00	1.55	0.00	1.55

37.05	0.51	0.51	1.00	1.55	0.00	1.55
37.10	0.51	0.51	1.00	1.55	0.00	1.55
37.15	0.51	0.51	1.00	1.55	0.00	1.55
37.20	0.51	0.51	1.00	1.55	0.00	1.55
37.25	0.51	0.51	1.00	1.55	0.00	1.55
37.30	0.51	0.51	1.00	1.55	0.00	1.55
37.35	0.51	0.51	1.00	1.55	0.00	1.55
37.40	0.51	0.51	1.00	1.54	0.00	1.54
37.45	0.51	0.51	1.00	1.54	0.00	1.54
37.50	0.51	0.51	1.00*	1.54	0.00	1.54
37.55	0.51	0.51	1.00*	1.54	0.00	1.54
37.60	0.51	0.51	1.00*	1.54	0.00	1.54
37.65	0.51	0.51	1.00*	1.54	0.00	1.54
37.70	0.51	0.51	1.00*	1.54	0.00	1.54
37.75	0.51	0.51	1.00*	1.54	0.00	1.54
37.80	0.51	0.51	1.00*	1.53	0.00	1.53
37.85	0.51	0.51	1.00*	1.53	0.00	1.53
37.90	0.51	0.51	1.00*	1.53	0.00	1.53
37.95	0.51	0.51	1.00*	1.53	0.00	1.53
38.00	0.51	0.51	1.00*	1.53	0.00	1.53
38.05	0.51	0.51	1.00*	1.52	0.00	1.52
38.10	0.51	0.51	1.00*	1.52	0.00	1.52
38.15	0.51	0.51	1.00*	1.52	0.00	1.52
38.20	0.51	0.51	1.00*	1.51	0.00	1.51
38.25	0.51	0.51	1.00*	1.51	0.00	1.51
38.30	0.51	0.51	1.00*	1.51	0.00	1.51
38.35	0.51	0.51	0.99*	1.50	0.00	1.50
38.40	0.51	0.51	0.99*	1.50	0.00	1.50
38.45	0.51	0.51	0.99*	1.50	0.00	1.50
38.50	0.50	0.51	0.99*	1.49	0.00	1.49
38.55	0.50	0.51	0.99*	1.49	0.00	1.49
38.60	0.50	0.51	0.99*	1.49	0.00	1.49
38.65	0.50	0.51	0.99*	1.48	0.00	1.48
38.70	0.50	0.51	0.99*	1.48	0.00	1.48
38.75	0.50	0.51	0.99*	1.47	0.00	1.47
38.80	0.50	0.51	0.99*	1.47	0.00	1.47
38.85	0.50	0.51	0.99*	1.47	0.00	1.47
38.90	0.48	0.51	0.94*	1.46	0.00	1.46
38.95	0.45	0.51	0.89*	1.46	0.00	1.46
39.00	0.43	0.51	0.85*	1.45	0.00	1.45
39.05	0.42	0.51	0.83*	1.45	0.00	1.45
39.10	0.41	0.51	0.81*	1.44	0.00	1.44
39.15	0.40	0.51	0.79*	1.44	0.00	1.44
39.20	0.39	0.51	0.78*	1.43	0.00	1.43
39.25	0.39	0.51	0.76*	1.43	0.00	1.43
39.30	0.38	0.51	0.75*	1.42	0.00	1.42
39.35	0.38	0.51	0.74*	1.42	0.00	1.42
39.40	0.37	0.51	0.73*	1.41	0.00	1.41

39.45	0.37	0.51	0.72*	1.41	0.00	1.41
39.50	0.36	0.51	0.72*	1.40	0.00	1.40
39.55	0.36	0.51	0.71*	1.40	0.00	1.40
39.60	0.36	0.51	0.70*	1.39	0.00	1.39
39.65	0.35	0.51	0.70*	1.39	0.00	1.39
39.70	0.35	0.51	0.69*	1.38	0.00	1.38
39.75	0.35	0.51	0.68*	1.38	0.00	1.38
39.80	0.34	0.51	0.68*	1.37	0.00	1.37
39.85	0.34	0.51	0.67*	1.36	0.00	1.36
39.90	0.34	0.51	0.66*	1.36	0.00	1.36
39.95	0.33	0.51	0.66*	1.35	0.00	1.35
40.00	0.33	0.51	0.65*	1.35	0.00	1.35
40.05	0.33	0.51	0.65*	1.34	0.00	1.34
40.10	0.33	0.51	0.65*	1.33	0.00	1.33
40.15	0.33	0.51	0.65*	1.33	0.00	1.33
40.20	0.33	0.51	0.65*	1.32	0.00	1.32
40.25	0.33	0.51	0.65*	1.31	0.00	1.31
40.30	0.33	0.51	0.65*	1.31	0.00	1.31
40.35	0.33	0.51	0.65*	1.30	0.00	1.30
40.40	0.33	0.51	0.65*	1.30	0.00	1.30
40.45	0.33	0.51	0.65*	1.29	0.00	1.29
40.50	0.33	0.51	0.65*	1.28	0.00	1.28
40.55	0.33	0.51	0.65*	1.28	0.00	1.28
40.60	0.33	0.51	0.65*	1.27	0.00	1.27
40.65	0.33	0.51	0.64*	1.27	0.00	1.27
40.70	0.33	0.51	0.64*	1.26	0.00	1.26
40.75	0.33	0.51	0.64*	1.25	0.00	1.25
40.80	0.33	0.51	0.64*	1.25	0.00	1.25
40.85	0.33	0.51	0.64*	1.24	0.00	1.24
40.90	0.33	0.51	0.64*	1.23	0.00	1.23
40.95	0.33	0.51	0.64*	1.23	0.00	1.23
41.00	0.32	0.51	0.64*	1.22	0.00	1.22
41.05	0.32	0.51	0.64*	1.22	0.00	1.22
41.10	0.32	0.51	0.64*	1.21	0.00	1.21
41.15	0.32	0.51	0.64*	1.20	0.00	1.20
41.20	0.32	0.51	0.64*	1.20	0.00	1.20
41.25	0.32	0.51	0.64*	1.19	0.00	1.19
41.30	0.32	0.51	0.64*	1.18	0.00	1.18
41.35	0.32	0.51	0.64*	1.18	0.00	1.18
41.40	0.32	0.51	0.64*	1.17	0.00	1.17
41.45	0.32	0.51	0.64*	1.17	0.00	1.17
41.50	0.32	0.51	0.63*	1.16	0.00	1.16
41.55	0.32	0.51	0.63*	1.15	0.00	1.15
41.60	0.32	0.51	0.63*	1.15	0.00	1.15
41.65	0.32	0.51	0.63*	1.14	0.00	1.14
41.70	0.32	0.51	0.63*	1.13	0.00	1.13
41.75	0.32	0.51	0.63*	1.13	0.00	1.13
41.80	0.32	0.51	0.63*	1.12	0.00	1.12

41.85	0.32	0.51	0.63*	1.12	0.00	1.12
41.90	0.32	0.51	0.63*	1.11	0.00	1.11
41.95	0.32	0.51	0.63*	1.10	0.00	1.10
42.00	0.32	0.51	0.63*	1.10	0.00	1.10
42.05	0.32	0.51	0.63*	1.09	0.00	1.09
42.10	0.32	0.51	0.63*	1.08	0.00	1.08
42.15	0.32	0.51	0.63*	1.08	0.00	1.08
42.20	0.32	0.51	0.63*	1.07	0.00	1.07
42.25	0.32	0.51	0.63*	1.07	0.00	1.07
42.30	0.32	0.51	0.63*	1.06	0.00	1.06
42.35	0.32	0.51	0.63*	1.05	0.00	1.05
42.40	0.32	0.51	0.63*	1.05	0.00	1.05
42.45	0.32	0.51	0.63*	1.04	0.00	1.04
42.50	0.32	0.51	0.63*	1.03	0.00	1.03
42.55	0.32	0.51	0.63*	1.03	0.00	1.03
42.60	0.32	0.51	0.62*	1.02	0.00	1.02
42.65	0.32	0.51	0.62*	1.02	0.00	1.02
42.70	0.32	0.51	0.62*	1.01	0.00	1.01
42.75	0.32	0.51	0.62*	1.00	0.00	1.00
42.80	0.32	0.51	0.62*	1.00	0.00	1.00
42.85	0.32	0.51	0.62*	0.99	0.00	0.99
42.90	0.31	0.51	0.62*	0.98	0.00	0.98
42.95	0.31	0.51	0.62*	0.98	0.00	0.98
43.00	0.31	0.51	0.62*	0.97	0.00	0.97
43.05	0.31	0.51	0.62*	0.96	0.00	0.96
43.10	0.31	0.51	0.62*	0.96	0.00	0.96
43.15	0.31	0.51	0.62*	0.95	0.00	0.95
43.20	0.31	0.51	0.62*	0.95	0.00	0.95
43.25	0.31	0.51	0.62*	0.94	0.00	0.94
43.30	0.31	0.51	0.62*	0.93	0.00	0.93
43.35	0.31	0.51	0.62*	0.93	0.00	0.93
43.40	0.31	0.51	0.62*	0.92	0.00	0.92
43.45	0.31	0.51	0.62*	0.91	0.00	0.91
43.50	0.31	0.51	0.62*	0.91	0.00	0.91
43.55	0.31	0.51	0.62*	0.90	0.00	0.90
43.60	0.31	0.51	0.62*	0.89	0.00	0.89
43.65	0.31	0.51	0.62*	0.89	0.00	0.89
43.70	0.31	0.50	0.62*	0.88	0.00	0.88
43.75	0.31	0.50	0.62*	0.88	0.00	0.88
43.80	0.31	0.50	0.62*	0.87	0.00	0.87
43.85	0.31	0.50	0.62*	0.86	0.00	0.86
43.90	0.31	0.50	0.62*	0.86	0.00	0.86
43.95	0.31	0.50	0.62*	0.85	0.00	0.85
44.00	0.31	0.50	0.62*	0.84	0.00	0.84
44.05	0.31	0.50	0.62*	0.84	0.00	0.84
44.10	0.31	0.50	0.62*	0.83	0.00	0.83
44.15	0.31	0.50	0.62*	0.82	0.00	0.82
44.20	0.31	0.50	0.62*	0.82	0.00	0.82

44.25	0.31	0.50	0.61*	0.81	0.00	0.81
44.30	0.31	0.50	0.61*	0.81	0.00	0.81
44.35	0.31	0.50	0.61*	0.80	0.00	0.80
44.40	0.31	0.50	0.61*	0.79	0.00	0.79
44.45	0.31	0.50	0.61*	0.79	0.00	0.79
44.50	0.31	0.50	0.61*	0.78	0.00	0.78
44.55	0.31	0.50	0.61*	0.77	0.00	0.77
44.60	0.31	0.50	0.61*	0.77	0.00	0.77
44.65	0.31	0.50	0.61*	0.76	0.00	0.76
44.70	0.31	0.50	0.61*	0.75	0.00	0.75
44.75	0.31	0.50	0.61*	0.75	0.00	0.75
44.80	0.31	0.50	0.61*	0.74	0.00	0.74
44.85	0.31	0.50	0.61*	0.74	0.00	0.74
44.90	0.31	0.50	0.61*	0.73	0.00	0.73
44.95	0.31	0.50	0.61*	0.72	0.00	0.72
45.00	0.31	0.50	0.61*	0.72	0.00	0.72
45.05	0.31	0.50	0.61*	0.71	0.00	0.71
45.10	0.31	0.50	0.61*	0.70	0.00	0.70
45.15	0.31	0.50	0.61*	0.70	0.00	0.70
45.20	0.31	0.50	0.61*	0.69	0.00	0.69
45.25	0.31	0.50	0.62*	0.68	0.00	0.68
45.30	0.31	0.50	0.62*	0.68	0.00	0.68
45.35	0.31	0.50	0.62*	0.67	0.00	0.67
45.40	0.31	0.50	0.62*	0.67	0.00	0.67
45.45	0.31	0.50	0.62*	0.66	0.00	0.66
45.50	0.31	0.50	0.62*	0.65	0.00	0.65
45.55	0.31	0.50	0.62*	0.65	0.00	0.65
45.60	0.31	0.50	0.62*	0.64	0.00	0.64
45.65	0.31	0.50	0.62*	0.63	0.00	0.63
45.70	0.31	0.50	0.62*	0.63	0.00	0.63
45.75	0.31	0.50	0.62*	0.62	0.00	0.62
45.80	0.31	0.50	0.62*	0.61	0.00	0.61
45.85	0.31	0.50	0.62*	0.61	0.00	0.61
45.90	0.31	0.50	0.62*	0.60	0.00	0.60
45.95	0.31	0.50	0.62*	0.60	0.00	0.60
46.00	0.31	0.50	0.62*	0.59	0.00	0.59
46.05	0.31	0.50	0.63*	0.58	0.00	0.58
46.10	0.31	0.50	0.63*	0.58	0.00	0.58
46.15	0.31	0.50	0.63*	0.57	0.00	0.57
46.20	0.31	0.50	0.63*	0.56	0.00	0.56
46.25	0.31	0.50	0.63*	0.56	0.00	0.56
46.30	0.31	0.50	0.63*	0.55	0.00	0.55
46.35	0.32	0.50	0.63*	0.55	0.00	0.55
46.40	0.32	0.50	0.63*	0.54	0.00	0.54
46.45	0.32	0.50	0.63*	0.53	0.00	0.53
46.50	0.32	0.50	0.63*	0.53	0.00	0.53
46.55	0.32	0.50	0.63*	0.52	0.00	0.52
46.60	0.32	0.50	0.63*	0.52	0.00	0.52

46.65	0.32	0.50	0.63*	0.51	0.00	0.51
46.70	0.32	0.50	0.63*	0.50	0.00	0.50
46.75	0.32	0.50	0.63*	0.50	0.00	0.50
46.80	0.32	0.50	0.63*	0.49	0.00	0.49
46.85	0.32	0.50	0.63*	0.48	0.00	0.48
46.90	0.32	0.50	0.63*	0.48	0.00	0.48
46.95	0.32	0.50	0.64*	0.47	0.00	0.47
47.00	0.32	0.50	0.64*	0.47	0.00	0.47
47.05	0.32	0.50	0.64*	0.46	0.00	0.46
47.10	0.32	0.50	0.64*	0.45	0.00	0.45
47.15	0.32	0.50	0.64*	0.45	0.00	0.45
47.20	0.32	0.50	0.64*	0.44	0.00	0.44
47.25	0.32	0.50	0.64*	0.44	0.00	0.44
47.30	0.32	0.50	0.64*	0.43	0.00	0.43
47.35	0.32	0.50	0.64*	0.42	0.00	0.42
47.40	0.32	0.50	0.64*	0.42	0.00	0.42
47.45	0.32	0.50	0.64*	0.41	0.00	0.41
47.50	0.32	0.50	0.64*	0.40	0.00	0.40
47.55	0.32	0.50	0.64*	0.40	0.00	0.40
47.60	0.32	0.50	0.65*	0.39	0.00	0.39
47.65	0.32	0.50	0.65*	0.39	0.00	0.39
47.70	0.32	0.50	0.65*	0.38	0.00	0.38
47.75	0.32	0.50	0.65*	0.37	0.00	0.37
47.80	0.32	0.50	0.65*	0.37	0.00	0.37
47.85	0.32	0.50	0.65*	0.36	0.00	0.36
47.90	0.32	0.50	0.65*	0.36	0.00	0.36
47.95	0.32	0.50	0.65*	0.35	0.00	0.35
48.00	0.32	0.50	0.65*	0.34	0.00	0.34
48.05	0.32	0.50	0.65*	0.34	0.00	0.34
48.10	0.33	0.50	0.65*	0.33	0.00	0.33
48.15	0.33	0.50	0.65*	0.33	0.00	0.33
48.20	0.33	0.50	0.65*	0.32	0.00	0.32
48.25	0.33	0.50	0.66*	0.31	0.00	0.31
48.30	0.33	0.50	0.66*	0.31	0.00	0.31
48.35	0.33	0.50	0.66*	0.30	0.00	0.30
48.40	0.33	0.50	0.66*	0.30	0.00	0.30
48.45	0.33	0.50	0.66*	0.29	0.00	0.29
48.50	0.33	0.50	0.66*	0.28	0.00	0.28
48.55	0.33	0.50	0.66*	0.28	0.00	0.28
48.60	0.33	0.50	0.66*	0.27	0.00	0.27
48.65	0.33	0.50	0.66*	0.27	0.00	0.27
48.70	0.33	0.50	0.66*	0.26	0.00	0.26
48.75	0.33	0.50	0.66*	0.25	0.00	0.25
48.80	0.33	0.50	0.66*	0.25	0.00	0.25
48.85	0.33	0.50	0.67*	0.24	0.00	0.24
48.90	0.33	0.50	0.67*	0.24	0.00	0.24
48.95	0.33	0.50	0.67*	0.23	0.00	0.23
49.00	0.33	0.50	0.67*	0.23	0.00	0.23

49.05	0.33	0.50	0.67*	0.22	0.00	0.22
49.10	0.33	0.50	0.67*	0.21	0.00	0.21
49.15	0.33	0.50	0.67*	0.21	0.00	0.21
49.20	0.33	0.50	0.67*	0.20	0.00	0.20
49.25	0.33	0.50	0.67*	0.20	0.00	0.20
49.30	0.33	0.50	0.67*	0.19	0.00	0.19
49.35	0.33	0.50	0.67*	0.19	0.00	0.19
49.40	0.33	0.50	0.67*	0.18	0.00	0.18
49.45	0.33	0.50	0.68*	0.17	0.00	0.17
49.50	0.33	0.50	0.68*	0.17	0.00	0.17
49.55	0.34	0.49	0.68*	0.16	0.00	0.16
49.60	0.34	0.49	0.68*	0.16	0.00	0.16
49.65	0.34	0.49	0.68*	0.15	0.00	0.15
49.70	0.34	0.49	0.68*	0.15	0.00	0.15
49.75	0.34	0.49	0.68*	0.14	0.00	0.14
49.80	0.34	0.49	0.68*	0.13	0.00	0.13
49.85	0.34	0.49	0.68*	0.13	0.00	0.13
49.90	0.34	0.49	0.68*	0.12	0.00	0.12
49.95	0.34	0.49	0.68*	0.12	0.00	0.12
50.00	0.34	0.49	0.69*	0.11	0.00	0.11
50.05	0.34	0.49	0.68*	0.11	0.00	0.11
50.10	0.34	0.49	0.68*	0.10	0.00	0.10
50.15	0.34	0.49	0.68*	0.10	0.00	0.10
50.20	0.34	0.49	0.68*	0.09	0.00	0.09
50.25	0.34	0.49	0.68*	0.08	0.00	0.08
50.30	0.34	0.49	0.68*	0.08	0.00	0.08
50.35	0.34	0.49	0.68*	0.07	0.00	0.07
50.40	0.34	0.49	0.68*	0.07	0.00	0.07
50.45	0.34	0.49	0.68*	0.06	0.00	0.06
50.50	0.34	0.49	0.68*	0.06	0.00	0.06
50.55	0.34	0.49	0.68*	0.05	0.00	0.05
50.60	0.34	0.49	0.68*	0.04	0.00	0.04
50.65	0.34	0.49	0.68*	0.04	0.00	0.04
50.70	0.34	0.49	0.68*	0.03	0.00	0.03
50.75	0.34	0.49	0.68*	0.03	0.00	0.03
50.80	0.34	0.49	0.68*	0.02	0.00	0.02
50.85	0.34	0.49	0.68*	0.02	0.00	0.02
50.90	0.34	0.49	0.68*	0.01	0.00	0.01
50.95	0.34	0.49	0.68*	0.01	0.00	0.01
51.00	0.33	0.49	0.68*	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: Welcome to LiquefyPro!

1 atm (atmosphere) = 1 tsf (ton/ft2)

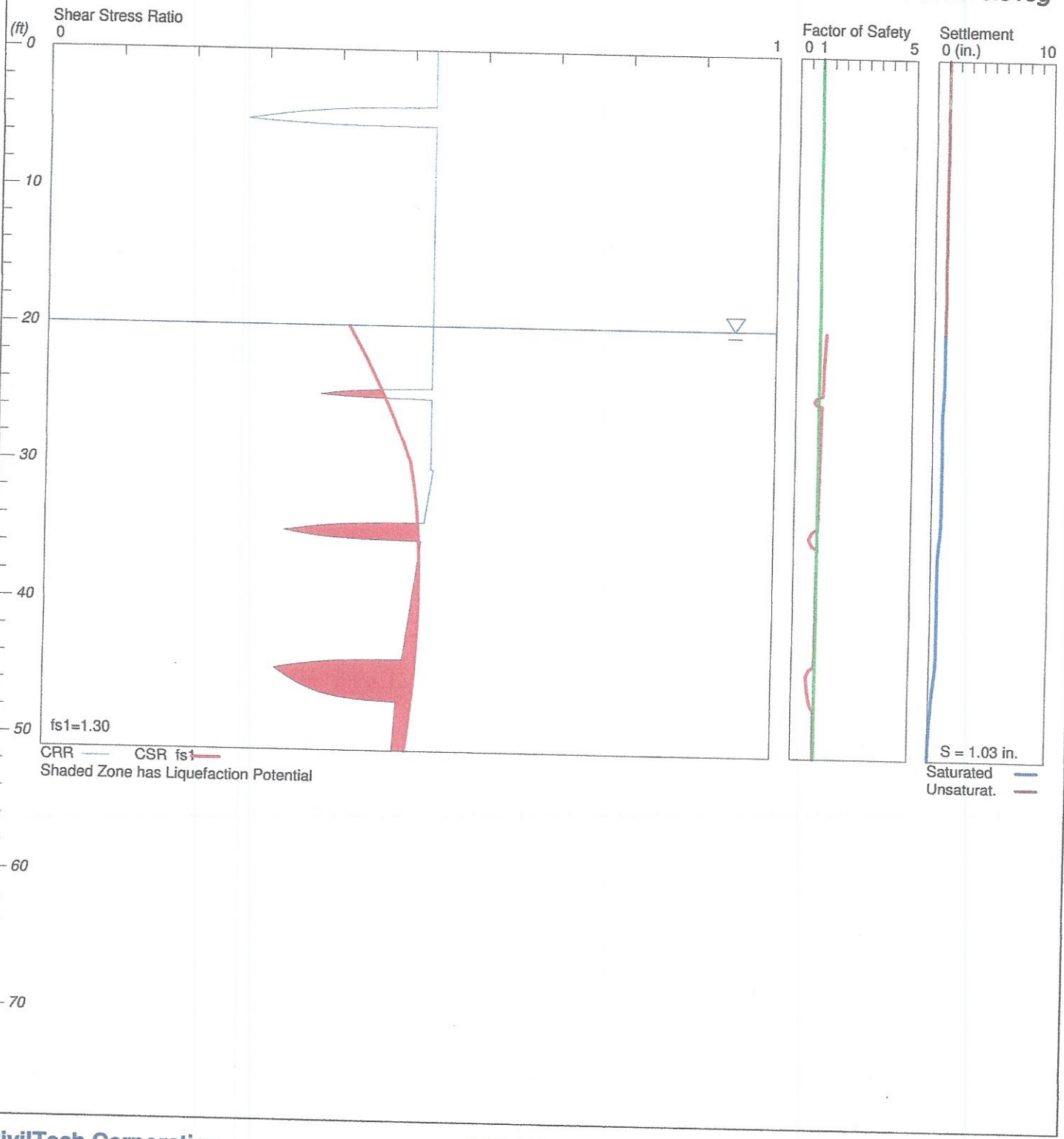
CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated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

LIQUEFACTION ANALYSIS

Andalusia-Westside Development

Hole No.=BH-6 Water Depth=20 ft Surface Elev.=-55

Magnitude=7.34
Acceleration=0.513g



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LIQUEFACTION ANALYSIS SUMMARY

****

Font: Courier New, Regular, Size 8 is recommended for this report.
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Input File Name: G:\Liquefy5\544-19025 BH-2.liq
Title: Andalusia-Westside Development
Subtitle: 544-19025

Surface Elev.=-55
Hole No.=BH-6
Depth of Hole= 51.00 ft
Water Table during Earthquake= 20.00 ft
Water Table during In-Situ Testing= 47.00 ft
Max. Acceleration= 0.51 g
Earthquake Magnitude= 7.34

Input Data:

Surface Elev.=-55
Hole No.=BH-6
Depth of Hole=51.00 ft
Water Table during Earthquake= 20.00 ft
Water Table during In-Situ Testing= 47.00 ft
Max. Acceleration=0.51 g
Earthquake Magnitude=7.34
No-Liquefiable Soils: Based on Analysis

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Modify Stark/Olson
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
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

BH-6 Summary Liquefy.sum

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	26.66	108.20	14.60
2.00	26.66	108.20	14.60
5.00	13.33	104.80	13.40
10.00	52.00	104.80	78.80
15.00	25.33	105.40	92.10
20.00	36.00	105.40	39.90
25.00	18.66	109.50	41.00
30.00	53.00	109.50	11.70
35.00	10.66	120.00	75.30
40.00	35.00	120.00	84.90
45.00	6.66	119.90	95.60
50.00	18.00	119.90	84.60

Output Results:

Settlement of Saturated Sands=0.96 in.
Settlement of Unsaturated Sands=0.08 in.
Total Settlement of Saturated and Unsaturated Sands=1.03 in.
Differential Settlement=0.517 to 0.683 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.53	0.43	5.00	0.96	0.08	1.03
0.05	0.53	0.43	5.00	0.96	0.08	1.03
0.10	0.53	0.43	5.00	0.96	0.08	1.03
0.15	0.53	0.43	5.00	0.96	0.08	1.03
0.20	0.53	0.43	5.00	0.96	0.08	1.03
0.25	0.53	0.43	5.00	0.96	0.08	1.03
0.30	0.53	0.43	5.00	0.96	0.08	1.03
0.35	0.53	0.43	5.00	0.96	0.08	1.03
0.40	0.53	0.43	5.00	0.96	0.08	1.03
0.45	0.53	0.43	5.00	0.96	0.08	1.03
0.50	0.53	0.43	5.00	0.96	0.08	1.03
0.55	0.53	0.43	5.00	0.96	0.08	1.03
0.60	0.53	0.43	5.00	0.96	0.08	1.03
0.65	0.53	0.43	5.00	0.96	0.08	1.03
0.70	0.53	0.43	5.00	0.96	0.08	1.03
0.75	0.53	0.43	5.00	0.96	0.08	1.03
0.80	0.53	0.43	5.00	0.96	0.08	1.03
0.85	0.53	0.43	5.00	0.96	0.08	1.03
0.90	0.53	0.43	5.00	0.96	0.08	1.03
0.95	0.53	0.43	5.00	0.96	0.08	1.03
1.00	0.53	0.43	5.00	0.96	0.08	1.03

1.05	0.53	0.43	5.00	0.96	0.08	1.03
1.10	0.53	0.43	5.00	0.96	0.08	1.03
1.15	0.53	0.43	5.00	0.96	0.08	1.03
1.20	0.53	0.43	5.00	0.96	0.08	1.03
1.25	0.53	0.43	5.00	0.96	0.08	1.03
1.30	0.53	0.43	5.00	0.96	0.08	1.03
1.35	0.53	0.43	5.00	0.96	0.08	1.03
1.40	0.53	0.43	5.00	0.96	0.08	1.03
1.45	0.53	0.43	5.00	0.96	0.08	1.03
1.50	0.53	0.43	5.00	0.96	0.08	1.03
1.55	0.53	0.43	5.00	0.96	0.08	1.03
1.60	0.53	0.43	5.00	0.96	0.08	1.03
1.65	0.53	0.43	5.00	0.96	0.08	1.03
1.70	0.53	0.43	5.00	0.96	0.08	1.03
1.75	0.53	0.43	5.00	0.96	0.08	1.03
1.80	0.53	0.43	5.00	0.96	0.08	1.03
1.85	0.53	0.43	5.00	0.96	0.08	1.03
1.90	0.53	0.43	5.00	0.96	0.08	1.03
1.95	0.53	0.43	5.00	0.96	0.08	1.03
2.00	0.53	0.43	5.00	0.96	0.08	1.03
2.05	0.53	0.43	5.00	0.96	0.08	1.03
2.10	0.53	0.43	5.00	0.96	0.07	1.03
2.15	0.53	0.43	5.00	0.96	0.07	1.03
2.20	0.53	0.43	5.00	0.96	0.07	1.03
2.25	0.53	0.43	5.00	0.96	0.07	1.03
2.30	0.53	0.43	5.00	0.96	0.07	1.03
2.35	0.53	0.43	5.00	0.96	0.07	1.03
2.40	0.53	0.43	5.00	0.96	0.07	1.03
2.45	0.53	0.43	5.00	0.96	0.07	1.03
2.50	0.53	0.43	5.00	0.96	0.07	1.03
2.55	0.53	0.43	5.00	0.96	0.07	1.03
2.60	0.53	0.43	5.00	0.96	0.07	1.03
2.65	0.53	0.43	5.00	0.96	0.07	1.03
2.70	0.53	0.43	5.00	0.96	0.07	1.03
2.75	0.53	0.43	5.00	0.96	0.07	1.03
2.80	0.53	0.43	5.00	0.96	0.07	1.03
2.85	0.53	0.43	5.00	0.96	0.07	1.03
2.90	0.53	0.43	5.00	0.96	0.07	1.03
2.95	0.53	0.43	5.00	0.96	0.07	1.03
3.00	0.53	0.43	5.00	0.96	0.07	1.03
3.05	0.53	0.43	5.00	0.96	0.07	1.03
3.10	0.53	0.43	5.00	0.96	0.07	1.03
3.15	0.53	0.43	5.00	0.96	0.07	1.03
3.20	0.53	0.43	5.00	0.96	0.07	1.03
3.25	0.53	0.43	5.00	0.96	0.07	1.03
3.30	0.53	0.43	5.00	0.96	0.07	1.03
3.35	0.53	0.43	5.00	0.96	0.07	1.03
3.40	0.53	0.43	5.00	0.96	0.07	1.03

3.45	0.53	0.43	5.00	0.96	0.07	1.03
3.50	0.53	0.43	5.00	0.96	0.07	1.03
3.55	0.53	0.43	5.00	0.96	0.07	1.03
3.60	0.53	0.43	5.00	0.96	0.07	1.03
3.65	0.53	0.43	5.00	0.96	0.07	1.03
3.70	0.53	0.43	5.00	0.96	0.07	1.03
3.75	0.53	0.43	5.00	0.96	0.07	1.03
3.80	0.53	0.43	5.00	0.96	0.07	1.03
3.85	0.53	0.43	5.00	0.96	0.07	1.03
3.90	0.53	0.43	5.00	0.96	0.07	1.03
3.95	0.53	0.43	5.00	0.96	0.07	1.03
4.00	0.53	0.43	5.00	0.96	0.07	1.03
4.05	0.51	0.43	5.00	0.96	0.07	1.03
4.10	0.44	0.43	5.00	0.96	0.07	1.03
4.15	0.41	0.43	5.00	0.96	0.07	1.03
4.20	0.40	0.43	5.00	0.96	0.07	1.03
4.25	0.38	0.43	5.00	0.96	0.07	1.03
4.30	0.37	0.43	5.00	0.96	0.07	1.03
4.35	0.36	0.43	5.00	0.96	0.07	1.03
4.40	0.35	0.43	5.00	0.96	0.07	1.02
4.45	0.34	0.43	5.00	0.96	0.07	1.02
4.50	0.33	0.43	5.00	0.96	0.07	1.02
4.55	0.33	0.43	5.00	0.96	0.07	1.02
4.60	0.32	0.43	5.00	0.96	0.07	1.02
4.65	0.31	0.43	5.00	0.96	0.07	1.02
4.70	0.31	0.43	5.00	0.96	0.07	1.02
4.75	0.30	0.43	5.00	0.96	0.06	1.02
4.80	0.29	0.43	5.00	0.96	0.06	1.02
4.85	0.29	0.43	5.00	0.96	0.06	1.02
4.90	0.28	0.43	5.00	0.96	0.06	1.02
4.95	0.28	0.43	5.00	0.96	0.06	1.02
5.00	0.27	0.43	5.00	0.96	0.06	1.02
5.05	0.28	0.43	5.00	0.96	0.06	1.02
5.10	0.30	0.43	5.00	0.96	0.06	1.02
5.15	0.31	0.43	5.00	0.96	0.06	1.02
5.20	0.32	0.43	5.00	0.96	0.06	1.02
5.25	0.34	0.43	5.00	0.96	0.06	1.02
5.30	0.36	0.43	5.00	0.96	0.06	1.02
5.35	0.38	0.43	5.00	0.96	0.06	1.02
5.40	0.42	0.43	5.00	0.96	0.06	1.02
5.45	0.53	0.43	5.00	0.96	0.06	1.02
5.50	0.53	0.43	5.00	0.96	0.06	1.02
5.55	0.53	0.43	5.00	0.96	0.06	1.02
5.60	0.53	0.43	5.00	0.96	0.06	1.02
5.65	0.53	0.43	5.00	0.96	0.06	1.02
5.70	0.53	0.43	5.00	0.96	0.06	1.02
5.75	0.53	0.43	5.00	0.96	0.06	1.02
5.80	0.53	0.43	5.00	0.96	0.06	1.02

5.85	0.53	0.43	5.00	0.96	0.06	1.02
5.90	0.53	0.43	5.00	0.96	0.06	1.02
5.95	0.53	0.43	5.00	0.96	0.06	1.02
6.00	0.53	0.43	5.00	0.96	0.06	1.01
6.05	0.53	0.43	5.00	0.96	0.06	1.01
6.10	0.53	0.43	5.00	0.96	0.06	1.01
6.15	0.53	0.43	5.00	0.96	0.06	1.01
6.20	0.53	0.43	5.00	0.96	0.06	1.01
6.25	0.53	0.43	5.00	0.96	0.06	1.01
6.30	0.53	0.43	5.00	0.96	0.06	1.01
6.35	0.53	0.43	5.00	0.96	0.06	1.01
6.40	0.53	0.43	5.00	0.96	0.06	1.01
6.45	0.53	0.43	5.00	0.96	0.06	1.01
6.50	0.53	0.43	5.00	0.96	0.06	1.01
6.55	0.53	0.43	5.00	0.96	0.06	1.01
6.60	0.53	0.43	5.00	0.96	0.06	1.01
6.65	0.53	0.43	5.00	0.96	0.06	1.01
6.70	0.53	0.43	5.00	0.96	0.06	1.01
6.75	0.53	0.43	5.00	0.96	0.06	1.01
6.80	0.53	0.43	5.00	0.96	0.06	1.01
6.85	0.53	0.43	5.00	0.96	0.06	1.01
6.90	0.53	0.43	5.00	0.96	0.05	1.01
6.95	0.53	0.43	5.00	0.96	0.05	1.01
7.00	0.53	0.43	5.00	0.96	0.05	1.01
7.05	0.53	0.43	5.00	0.96	0.05	1.01
7.10	0.53	0.43	5.00	0.96	0.05	1.01
7.15	0.53	0.43	5.00	0.96	0.05	1.01
7.20	0.53	0.43	5.00	0.96	0.05	1.01
7.25	0.53	0.43	5.00	0.96	0.05	1.01
7.30	0.53	0.43	5.00	0.96	0.05	1.01
7.35	0.53	0.43	5.00	0.96	0.05	1.01
7.40	0.53	0.43	5.00	0.96	0.05	1.01
7.45	0.53	0.43	5.00	0.96	0.05	1.01
7.50	0.53	0.43	5.00	0.96	0.05	1.01
7.55	0.53	0.43	5.00	0.96	0.05	1.01
7.60	0.53	0.43	5.00	0.96	0.05	1.01
7.65	0.53	0.43	5.00	0.96	0.05	1.01
7.70	0.53	0.43	5.00	0.96	0.05	1.01
7.75	0.53	0.43	5.00	0.96	0.05	1.01
7.80	0.53	0.43	5.00	0.96	0.05	1.01
7.85	0.53	0.43	5.00	0.96	0.05	1.01
7.90	0.53	0.43	5.00	0.96	0.05	1.01
7.95	0.53	0.43	5.00	0.96	0.05	1.01
8.00	0.53	0.43	5.00	0.96	0.05	1.01
8.05	0.53	0.43	5.00	0.96	0.05	1.01
8.10	0.53	0.43	5.00	0.96	0.05	1.01
8.15	0.53	0.43	5.00	0.96	0.05	1.01
8.20	0.53	0.43	5.00	0.96	0.05	1.01

8.25	0.53	0.43	5.00	0.96	0.05	1.01
8.30	0.53	0.43	5.00	0.96	0.05	1.01
8.35	0.53	0.43	5.00	0.96	0.05	1.01
8.40	0.53	0.42	5.00	0.96	0.05	1.01
8.45	0.53	0.42	5.00	0.96	0.05	1.01
8.50	0.53	0.42	5.00	0.96	0.05	1.01
8.55	0.53	0.42	5.00	0.96	0.05	1.01
8.60	0.53	0.42	5.00	0.96	0.05	1.01
8.65	0.53	0.42	5.00	0.96	0.05	1.01
8.70	0.53	0.42	5.00	0.96	0.05	1.01
8.75	0.53	0.42	5.00	0.96	0.05	1.01
8.80	0.53	0.42	5.00	0.96	0.05	1.01
8.85	0.53	0.42	5.00	0.96	0.05	1.01
8.90	0.53	0.42	5.00	0.96	0.05	1.01
8.95	0.53	0.42	5.00	0.96	0.05	1.01
9.00	0.53	0.42	5.00	0.96	0.05	1.01
9.05	0.53	0.42	5.00	0.96	0.05	1.01
9.10	0.53	0.42	5.00	0.96	0.05	1.01
9.15	0.53	0.42	5.00	0.96	0.05	1.01
9.20	0.53	0.42	5.00	0.96	0.05	1.01
9.25	0.53	0.42	5.00	0.96	0.05	1.01
9.30	0.53	0.42	5.00	0.96	0.05	1.01
9.35	0.53	0.42	5.00	0.96	0.05	1.01
9.40	0.53	0.42	5.00	0.96	0.05	1.01
9.45	0.53	0.42	5.00	0.96	0.05	1.01
9.50	0.53	0.42	5.00	0.96	0.05	1.01
9.55	0.53	0.42	5.00	0.96	0.05	1.01
9.60	0.53	0.42	5.00	0.96	0.05	1.01
9.65	0.53	0.42	5.00	0.96	0.05	1.00
9.70	0.53	0.42	5.00	0.96	0.05	1.00
9.75	0.53	0.42	5.00	0.96	0.05	1.00
9.80	0.53	0.42	5.00	0.96	0.05	1.00
9.85	0.53	0.42	5.00	0.96	0.05	1.00
9.90	0.53	0.42	5.00	0.96	0.05	1.00
9.95	0.53	0.42	5.00	0.96	0.05	1.00
10.00	0.53	0.42	5.00	0.96	0.05	1.00
10.05	0.53	0.42	5.00	0.96	0.05	1.00
10.10	0.53	0.42	5.00	0.96	0.05	1.00
10.15	0.53	0.42	5.00	0.96	0.05	1.00
10.20	0.53	0.42	5.00	0.96	0.05	1.00
10.25	0.53	0.42	5.00	0.96	0.05	1.00
10.30	0.53	0.42	5.00	0.96	0.05	1.00
10.35	0.53	0.42	5.00	0.96	0.05	1.00
10.40	0.53	0.42	5.00	0.96	0.05	1.00
10.45	0.53	0.42	5.00	0.96	0.05	1.00
10.50	0.53	0.42	5.00	0.96	0.05	1.00
10.55	0.53	0.42	5.00	0.96	0.05	1.00
10.60	0.53	0.42	5.00	0.96	0.04	1.00

10.65	0.53	0.42	5.00	0.96	0.04	1.00
10.70	0.53	0.42	5.00	0.96	0.04	1.00
10.75	0.53	0.42	5.00	0.96	0.04	1.00
10.80	0.53	0.42	5.00	0.96	0.04	1.00
10.85	0.53	0.42	5.00	0.96	0.04	1.00
10.90	0.53	0.42	5.00	0.96	0.04	1.00
10.95	0.53	0.42	5.00	0.96	0.04	1.00
11.00	0.53	0.42	5.00	0.96	0.04	1.00
11.05	0.53	0.42	5.00	0.96	0.04	1.00
11.10	0.53	0.42	5.00	0.96	0.04	1.00
11.15	0.53	0.42	5.00	0.96	0.04	1.00
11.20	0.53	0.42	5.00	0.96	0.04	1.00
11.25	0.53	0.42	5.00	0.96	0.04	1.00
11.30	0.53	0.42	5.00	0.96	0.04	1.00
11.35	0.53	0.42	5.00	0.96	0.04	1.00
11.40	0.53	0.42	5.00	0.96	0.04	1.00
11.45	0.53	0.42	5.00	0.96	0.04	1.00
11.50	0.53	0.42	5.00	0.96	0.04	1.00
11.55	0.53	0.42	5.00	0.96	0.04	1.00
11.60	0.53	0.42	5.00	0.96	0.04	1.00
11.65	0.53	0.42	5.00	0.96	0.04	1.00
11.70	0.53	0.42	5.00	0.96	0.04	1.00
11.75	0.53	0.42	5.00	0.96	0.04	1.00
11.80	0.53	0.42	5.00	0.96	0.04	1.00
11.85	0.53	0.42	5.00	0.96	0.04	1.00
11.90	0.53	0.42	5.00	0.96	0.04	1.00
11.95	0.53	0.42	5.00	0.96	0.04	1.00
12.00	0.53	0.42	5.00	0.96	0.04	1.00
12.05	0.53	0.42	5.00	0.96	0.04	1.00
12.10	0.53	0.42	5.00	0.96	0.04	1.00
12.15	0.53	0.42	5.00	0.96	0.04	1.00
12.20	0.53	0.42	5.00	0.96	0.04	1.00
12.25	0.53	0.42	5.00	0.96	0.04	1.00
12.30	0.53	0.42	5.00	0.96	0.04	1.00
12.35	0.53	0.42	5.00	0.96	0.04	1.00
12.40	0.53	0.42	5.00	0.96	0.04	1.00
12.45	0.53	0.42	5.00	0.96	0.04	1.00
12.50	0.53	0.42	5.00	0.96	0.04	1.00
12.55	0.53	0.42	5.00	0.96	0.04	1.00
12.60	0.53	0.42	5.00	0.96	0.04	1.00
12.65	0.53	0.42	5.00	0.96	0.04	1.00
12.70	0.53	0.42	5.00	0.96	0.04	1.00
12.75	0.53	0.42	5.00	0.96	0.04	1.00
12.80	0.53	0.42	5.00	0.96	0.04	1.00
12.85	0.53	0.42	5.00	0.96	0.04	1.00
12.90	0.53	0.42	5.00	0.96	0.04	1.00
12.95	0.53	0.42	5.00	0.96	0.04	1.00
13.00	0.53	0.42	5.00	0.96	0.04	1.00

13.05	0.53	0.42	5.00	0.96	0.04	1.00
13.10	0.53	0.42	5.00	0.96	0.04	1.00
13.15	0.53	0.42	5.00	0.96	0.04	0.99
13.20	0.53	0.42	5.00	0.96	0.04	0.99
13.25	0.53	0.42	5.00	0.96	0.04	0.99
13.30	0.53	0.42	5.00	0.96	0.04	0.99
13.35	0.53	0.42	5.00	0.96	0.04	0.99
13.40	0.53	0.42	5.00	0.96	0.04	0.99
13.45	0.53	0.42	5.00	0.96	0.04	0.99
13.50	0.53	0.42	5.00	0.96	0.04	0.99
13.55	0.53	0.42	5.00	0.96	0.04	0.99
13.60	0.53	0.42	5.00	0.96	0.04	0.99
13.65	0.53	0.42	5.00	0.96	0.04	0.99
13.70	0.53	0.42	5.00	0.96	0.04	0.99
13.75	0.53	0.42	5.00	0.96	0.04	0.99
13.80	0.53	0.42	5.00	0.96	0.04	0.99
13.85	0.53	0.42	5.00	0.96	0.03	0.99
13.90	0.53	0.42	5.00	0.96	0.03	0.99
13.95	0.53	0.42	5.00	0.96	0.03	0.99
14.00	0.53	0.42	5.00	0.96	0.03	0.99
14.05	0.53	0.42	5.00	0.96	0.03	0.99
14.10	0.53	0.42	5.00	0.96	0.03	0.99
14.15	0.53	0.42	5.00	0.96	0.03	0.99
14.20	0.53	0.42	5.00	0.96	0.03	0.99
14.25	0.53	0.42	5.00	0.96	0.03	0.99
14.30	0.53	0.42	5.00	0.96	0.03	0.99
14.35	0.53	0.42	5.00	0.96	0.03	0.99
14.40	0.53	0.42	5.00	0.96	0.03	0.99
14.45	0.53	0.42	5.00	0.96	0.03	0.99
14.50	0.53	0.42	5.00	0.96	0.03	0.99
14.55	0.53	0.42	5.00	0.96	0.03	0.99
14.60	0.53	0.42	5.00	0.96	0.03	0.99
14.65	0.53	0.42	5.00	0.96	0.03	0.99
14.70	0.53	0.42	5.00	0.96	0.03	0.99
14.75	0.53	0.42	5.00	0.96	0.03	0.99
14.80	0.53	0.42	5.00	0.96	0.03	0.99
14.85	0.53	0.42	5.00	0.96	0.03	0.99
14.90	0.53	0.42	5.00	0.96	0.03	0.99
14.95	0.53	0.42	5.00	0.96	0.03	0.99
15.00	0.53	0.42	5.00	0.96	0.03	0.99
15.05	0.53	0.42	5.00	0.96	0.03	0.99
15.10	0.53	0.42	5.00	0.96	0.03	0.99
15.15	0.53	0.42	5.00	0.96	0.03	0.99
15.20	0.53	0.42	5.00	0.96	0.03	0.99
15.25	0.53	0.42	5.00	0.96	0.03	0.99
15.30	0.53	0.42	5.00	0.96	0.03	0.99
15.35	0.53	0.42	5.00	0.96	0.03	0.99
15.40	0.53	0.42	5.00	0.96	0.03	0.99

15.45	0.53	0.42	5.00	0.96	0.03	0.99
15.50	0.53	0.42	5.00	0.96	0.03	0.98
15.55	0.53	0.42	5.00	0.96	0.03	0.98
15.60	0.53	0.42	5.00	0.96	0.03	0.98
15.65	0.53	0.42	5.00	0.96	0.03	0.98
15.70	0.53	0.42	5.00	0.96	0.03	0.98
15.75	0.53	0.42	5.00	0.96	0.03	0.98
15.80	0.53	0.42	5.00	0.96	0.03	0.98
15.85	0.53	0.42	5.00	0.96	0.03	0.98
15.90	0.53	0.42	5.00	0.96	0.03	0.98
15.95	0.53	0.42	5.00	0.96	0.03	0.98
16.00	0.53	0.42	5.00	0.96	0.03	0.98
16.05	0.53	0.42	5.00	0.96	0.02	0.98
16.10	0.53	0.42	5.00	0.96	0.02	0.98
16.15	0.53	0.42	5.00	0.96	0.02	0.98
16.20	0.53	0.42	5.00	0.96	0.02	0.98
16.25	0.53	0.42	5.00	0.96	0.02	0.98
16.30	0.53	0.42	5.00	0.96	0.02	0.98
16.35	0.53	0.42	5.00	0.96	0.02	0.98
16.40	0.53	0.42	5.00	0.96	0.02	0.98
16.45	0.53	0.42	5.00	0.96	0.02	0.98
16.50	0.53	0.42	5.00	0.96	0.02	0.98
16.55	0.53	0.42	5.00	0.96	0.02	0.98
16.60	0.53	0.42	5.00	0.96	0.02	0.98
16.65	0.53	0.42	5.00	0.96	0.02	0.98
16.70	0.53	0.42	5.00	0.96	0.02	0.98
16.75	0.53	0.42	5.00	0.96	0.02	0.98
16.80	0.53	0.42	5.00	0.96	0.02	0.98
16.85	0.53	0.42	5.00	0.96	0.02	0.98
16.90	0.53	0.42	5.00	0.96	0.02	0.98
16.95	0.53	0.42	5.00	0.96	0.02	0.98
17.00	0.53	0.42	5.00	0.96	0.02	0.98
17.05	0.53	0.42	5.00	0.96	0.02	0.98
17.10	0.53	0.42	5.00	0.96	0.02	0.98
17.15	0.53	0.42	5.00	0.96	0.02	0.98
17.20	0.53	0.42	5.00	0.96	0.02	0.98
17.25	0.53	0.42	5.00	0.96	0.02	0.98
17.30	0.53	0.42	5.00	0.96	0.02	0.98
17.35	0.53	0.42	5.00	0.96	0.02	0.98
17.40	0.53	0.42	5.00	0.96	0.02	0.97
17.45	0.53	0.42	5.00	0.96	0.02	0.97
17.50	0.53	0.42	5.00	0.96	0.02	0.97
17.55	0.53	0.42	5.00	0.96	0.02	0.97
17.60	0.53	0.42	5.00	0.96	0.02	0.97
17.65	0.53	0.42	5.00	0.96	0.02	0.97
17.70	0.53	0.42	5.00	0.96	0.02	0.97
17.75	0.53	0.42	5.00	0.96	0.02	0.97
17.80	0.53	0.42	5.00	0.96	0.02	0.97

17.85	0.53	0.42	5.00	0.96	0.01	0.97
17.90	0.53	0.42	5.00	0.96	0.01	0.97
17.95	0.53	0.42	5.00	0.96	0.01	0.97
18.00	0.53	0.42	5.00	0.96	0.01	0.97
18.05	0.53	0.42	5.00	0.96	0.01	0.97
18.10	0.53	0.42	5.00	0.96	0.01	0.97
18.15	0.53	0.42	5.00	0.96	0.01	0.97
18.20	0.53	0.42	5.00	0.96	0.01	0.97
18.25	0.53	0.42	5.00	0.96	0.01	0.97
18.30	0.53	0.41	5.00	0.96	0.01	0.97
18.35	0.53	0.41	5.00	0.96	0.01	0.97
18.40	0.53	0.41	5.00	0.96	0.01	0.97
18.45	0.53	0.41	5.00	0.96	0.01	0.97
18.50	0.53	0.41	5.00	0.96	0.01	0.97
18.55	0.53	0.41	5.00	0.96	0.01	0.97
18.60	0.53	0.41	5.00	0.96	0.01	0.97
18.65	0.53	0.41	5.00	0.96	0.01	0.97
18.70	0.53	0.41	5.00	0.96	0.01	0.97
18.75	0.53	0.41	5.00	0.96	0.01	0.97
18.80	0.53	0.41	5.00	0.96	0.01	0.97
18.85	0.53	0.41	5.00	0.96	0.01	0.97
18.90	0.53	0.41	5.00	0.96	0.01	0.97
18.95	0.53	0.41	5.00	0.96	0.01	0.97
19.00	0.53	0.41	5.00	0.96	0.01	0.96
19.05	0.53	0.41	5.00	0.96	0.01	0.96
19.10	0.53	0.41	5.00	0.96	0.01	0.96
19.15	0.53	0.41	5.00	0.96	0.01	0.96
19.20	0.53	0.41	5.00	0.96	0.01	0.96
19.25	0.53	0.41	5.00	0.96	0.01	0.96
19.30	0.53	0.41	5.00	0.96	0.01	0.96
19.35	0.53	0.41	5.00	0.96	0.01	0.96
19.40	0.53	0.41	5.00	0.96	0.00	0.96
19.45	0.53	0.41	5.00	0.96	0.00	0.96
19.50	0.53	0.41	5.00	0.96	0.00	0.96
19.55	0.53	0.41	5.00	0.96	0.00	0.96
19.60	0.53	0.41	5.00	0.96	0.00	0.96
19.65	0.53	0.41	5.00	0.96	0.00	0.96
19.70	0.53	0.41	5.00	0.96	0.00	0.96
19.75	0.53	0.41	5.00	0.96	0.00	0.96
19.80	0.53	0.41	5.00	0.96	0.00	0.96
19.85	0.53	0.41	5.00	0.96	0.00	0.96
19.90	0.53	0.41	5.00	0.96	0.00	0.96
19.95	0.53	0.41	5.00	0.96	0.00	0.96
20.00	0.53	0.41	5.00	0.96	0.00	0.96
20.05	0.53	0.41	1.28	0.96	0.00	0.96
20.10	0.53	0.41	1.28	0.96	0.00	0.96
20.15	0.53	0.41	1.27	0.96	0.00	0.96
20.20	0.53	0.41	1.27	0.96	0.00	0.96

20.25	0.53	0.42	1.27	0.96	0.00	0.96
20.30	0.53	0.42	1.27	0.96	0.00	0.96
20.35	0.53	0.42	1.27	0.96	0.00	0.96
20.40	0.53	0.42	1.27	0.96	0.00	0.96
20.45	0.53	0.42	1.26	0.96	0.00	0.96
20.50	0.53	0.42	1.26	0.96	0.00	0.96
20.55	0.53	0.42	1.26	0.96	0.00	0.96
20.60	0.53	0.42	1.26	0.96	0.00	0.96
20.65	0.53	0.42	1.26	0.96	0.00	0.96
20.70	0.53	0.42	1.26	0.96	0.00	0.96
20.75	0.53	0.42	1.25	0.96	0.00	0.96
20.80	0.53	0.42	1.25	0.96	0.00	0.96
20.85	0.53	0.42	1.25	0.96	0.00	0.96
20.90	0.53	0.42	1.25	0.96	0.00	0.96
20.95	0.53	0.42	1.25	0.96	0.00	0.96
21.00	0.53	0.42	1.25	0.96	0.00	0.96
21.05	0.53	0.42	1.25	0.96	0.00	0.96
21.10	0.53	0.42	1.24	0.96	0.00	0.96
21.15	0.53	0.43	1.24	0.96	0.00	0.96
21.20	0.53	0.43	1.24	0.96	0.00	0.96
21.25	0.53	0.43	1.24	0.96	0.00	0.96
21.30	0.53	0.43	1.24	0.96	0.00	0.96
21.35	0.53	0.43	1.24	0.96	0.00	0.96
21.40	0.53	0.43	1.23	0.96	0.00	0.96
21.45	0.53	0.43	1.23	0.96	0.00	0.96
21.50	0.53	0.43	1.23	0.96	0.00	0.96
21.55	0.53	0.43	1.23	0.96	0.00	0.96
21.60	0.53	0.43	1.23	0.96	0.00	0.96
21.65	0.53	0.43	1.23	0.96	0.00	0.96
21.70	0.53	0.43	1.23	0.96	0.00	0.96
21.75	0.53	0.43	1.22	0.96	0.00	0.96
21.80	0.53	0.43	1.22	0.96	0.00	0.96
21.85	0.53	0.43	1.22	0.96	0.00	0.96
21.90	0.53	0.43	1.22	0.96	0.00	0.96
21.95	0.53	0.43	1.22	0.96	0.00	0.96
22.00	0.53	0.43	1.22	0.96	0.00	0.96
22.05	0.53	0.43	1.22	0.96	0.00	0.96
22.10	0.53	0.43	1.21	0.96	0.00	0.96
22.15	0.53	0.44	1.21	0.96	0.00	0.96
22.20	0.53	0.44	1.21	0.96	0.00	0.96
22.25	0.53	0.44	1.21	0.96	0.00	0.96
22.30	0.53	0.44	1.21	0.96	0.00	0.96
22.35	0.53	0.44	1.21	0.96	0.00	0.96
22.40	0.53	0.44	1.21	0.96	0.00	0.96
22.45	0.53	0.44	1.20	0.96	0.00	0.96
22.50	0.53	0.44	1.20	0.96	0.00	0.96
22.55	0.53	0.44	1.20	0.96	0.00	0.96
22.60	0.53	0.44	1.20	0.96	0.00	0.96

22.65	0.53	0.44	1.20	0.96	0.00	0.96
22.70	0.53	0.44	1.20	0.96	0.00	0.96
22.75	0.53	0.44	1.20	0.96	0.00	0.96
22.80	0.53	0.44	1.20	0.96	0.00	0.96
22.85	0.53	0.44	1.19	0.96	0.00	0.96
22.90	0.53	0.44	1.19	0.96	0.00	0.96
22.95	0.53	0.44	1.19	0.96	0.00	0.96
23.00	0.53	0.44	1.19	0.96	0.00	0.96
23.05	0.53	0.44	1.19	0.96	0.00	0.96
23.10	0.53	0.44	1.19	0.96	0.00	0.96
23.15	0.53	0.45	1.19	0.96	0.00	0.96
23.20	0.53	0.45	1.18	0.96	0.00	0.96
23.25	0.53	0.45	1.18	0.96	0.00	0.96
23.30	0.53	0.45	1.18	0.96	0.00	0.96
23.35	0.53	0.45	1.18	0.96	0.00	0.96
23.40	0.53	0.45	1.18	0.96	0.00	0.96
23.45	0.53	0.45	1.18	0.96	0.00	0.96
23.50	0.53	0.45	1.18	0.96	0.00	0.96
23.55	0.53	0.45	1.18	0.96	0.00	0.96
23.60	0.53	0.45	1.18	0.96	0.00	0.96
23.65	0.53	0.45	1.17	0.96	0.00	0.96
23.70	0.53	0.45	1.17	0.96	0.00	0.96
23.75	0.53	0.45	1.17	0.95	0.00	0.95
23.80	0.53	0.45	1.17	0.95	0.00	0.95
23.85	0.53	0.45	1.17	0.95	0.00	0.95
23.90	0.53	0.45	1.17	0.95	0.00	0.95
23.95	0.53	0.45	1.17	0.95	0.00	0.95
24.00	0.53	0.45	1.17	0.95	0.00	0.95
24.05	0.53	0.45	1.16	0.95	0.00	0.95
24.10	0.53	0.45	1.16	0.95	0.00	0.95
24.15	0.53	0.45	1.16	0.95	0.00	0.95
24.20	0.53	0.46	1.16	0.94	0.00	0.94
24.25	0.53	0.46	1.16	0.94	0.00	0.94
24.30	0.53	0.46	1.16	0.94	0.00	0.94
24.35	0.53	0.46	1.16	0.94	0.00	0.94
24.40	0.53	0.46	1.16	0.93	0.00	0.93
24.45	0.53	0.46	1.16	0.93	0.00	0.93
24.50	0.53	0.46	1.15	0.93	0.00	0.93
24.55	0.53	0.46	1.15	0.92	0.00	0.92
24.60	0.51	0.46	1.10	0.92	0.00	0.92
24.65	0.46	0.46	1.00	0.91	0.00	0.91
24.70	0.44	0.46	0.95*	0.91	0.00	0.91
24.75	0.42	0.46	0.91*	0.91	0.00	0.91
24.80	0.41	0.46	0.89*	0.90	0.00	0.90
24.85	0.40	0.46	0.86*	0.90	0.00	0.90
24.90	0.39	0.46	0.85*	0.89	0.00	0.89
24.95	0.38	0.46	0.83*	0.89	0.00	0.89
25.00	0.38	0.46	0.81*	0.88	0.00	0.88

25.05	0.38	0.46	0.83*	0.88	0.00	0.88
25.10	0.40	0.46	0.85*	0.87	0.00	0.87
25.15	0.41	0.46	0.88*	0.87	0.00	0.87
25.20	0.43	0.46	0.92*	0.86	0.00	0.86
25.25	0.45	0.46	0.97*	0.86	0.00	0.86
25.30	0.51	0.46	1.09	0.85	0.00	0.85
25.35	0.53	0.47	1.14	0.85	0.00	0.85
25.40	0.53	0.47	1.13	0.85	0.00	0.85
25.45	0.53	0.47	1.13	0.84	0.00	0.84
25.50	0.53	0.47	1.13	0.84	0.00	0.84
25.55	0.53	0.47	1.13	0.83	0.00	0.83
25.60	0.53	0.47	1.13	0.83	0.00	0.83
25.65	0.53	0.47	1.13	0.83	0.00	0.83
25.70	0.53	0.47	1.13	0.83	0.00	0.83
25.75	0.53	0.47	1.13	0.82	0.00	0.82
25.80	0.53	0.47	1.13	0.82	0.00	0.82
25.85	0.53	0.47	1.13	0.82	0.00	0.82
25.90	0.53	0.47	1.12	0.82	0.00	0.82
25.95	0.53	0.47	1.12	0.82	0.00	0.82
26.00	0.53	0.47	1.12	0.82	0.00	0.82
26.05	0.53	0.47	1.12	0.82	0.00	0.82
26.10	0.53	0.47	1.12	0.82	0.00	0.82
26.15	0.53	0.47	1.12	0.82	0.00	0.82
26.20	0.53	0.47	1.12	0.82	0.00	0.82
26.25	0.53	0.47	1.12	0.81	0.00	0.81
26.30	0.53	0.47	1.12	0.81	0.00	0.81
26.35	0.53	0.47	1.12	0.81	0.00	0.81
26.40	0.53	0.47	1.11	0.81	0.00	0.81
26.45	0.53	0.47	1.11	0.81	0.00	0.81
26.50	0.53	0.47	1.11	0.81	0.00	0.81
26.55	0.53	0.47	1.11	0.81	0.00	0.81
26.60	0.53	0.48	1.11	0.81	0.00	0.81
26.65	0.53	0.48	1.11	0.81	0.00	0.81
26.70	0.53	0.48	1.11	0.81	0.00	0.81
26.75	0.53	0.48	1.11	0.81	0.00	0.81
26.80	0.53	0.48	1.11	0.81	0.00	0.81
26.85	0.53	0.48	1.11	0.81	0.00	0.81
26.90	0.53	0.48	1.11	0.81	0.00	0.81
26.95	0.53	0.48	1.10	0.81	0.00	0.81
27.00	0.53	0.48	1.10	0.81	0.00	0.81
27.05	0.53	0.48	1.10	0.81	0.00	0.81
27.10	0.53	0.48	1.10	0.81	0.00	0.81
27.15	0.53	0.48	1.10	0.81	0.00	0.81
27.20	0.53	0.48	1.10	0.81	0.00	0.81
27.25	0.53	0.48	1.10	0.81	0.00	0.81
27.30	0.53	0.48	1.10	0.81	0.00	0.81
27.35	0.53	0.48	1.10	0.81	0.00	0.81
27.40	0.53	0.48	1.10	0.81	0.00	0.81

27.45	0.53	0.48	1.10	0.81	0.00	0.81
27.50	0.53	0.48	1.09	0.81	0.00	0.81
27.55	0.53	0.48	1.09	0.81	0.00	0.81
27.60	0.53	0.48	1.09	0.81	0.00	0.81
27.65	0.53	0.48	1.09	0.81	0.00	0.81
27.70	0.53	0.48	1.09	0.81	0.00	0.81
27.75	0.53	0.48	1.09	0.81	0.00	0.81
27.80	0.53	0.48	1.09	0.81	0.00	0.81
27.85	0.53	0.49	1.09	0.81	0.00	0.81
27.90	0.53	0.49	1.09	0.81	0.00	0.81
27.95	0.53	0.49	1.09	0.81	0.00	0.81
28.00	0.53	0.49	1.09	0.81	0.00	0.81
28.05	0.53	0.49	1.09	0.81	0.00	0.81
28.10	0.53	0.49	1.08	0.81	0.00	0.81
28.15	0.53	0.49	1.08	0.81	0.00	0.81
28.20	0.53	0.49	1.08	0.81	0.00	0.81
28.25	0.53	0.49	1.08	0.81	0.00	0.81
28.30	0.53	0.49	1.08	0.81	0.00	0.81
28.35	0.53	0.49	1.08	0.81	0.00	0.81
28.40	0.53	0.49	1.08	0.81	0.00	0.81
28.45	0.53	0.49	1.08	0.81	0.00	0.81
28.50	0.53	0.49	1.08	0.81	0.00	0.81
28.55	0.53	0.49	1.08	0.81	0.00	0.81
28.60	0.53	0.49	1.08	0.81	0.00	0.81
28.65	0.53	0.49	1.08	0.81	0.00	0.81
28.70	0.53	0.49	1.08	0.81	0.00	0.81
28.75	0.53	0.49	1.07	0.81	0.00	0.81
28.80	0.53	0.49	1.07	0.81	0.00	0.81
28.85	0.53	0.49	1.07	0.81	0.00	0.81
28.90	0.53	0.49	1.07	0.81	0.00	0.81
28.95	0.53	0.49	1.07	0.81	0.00	0.81
29.00	0.53	0.49	1.07	0.81	0.00	0.81
29.05	0.53	0.49	1.07	0.81	0.00	0.81
29.10	0.53	0.49	1.07	0.81	0.00	0.81
29.15	0.53	0.49	1.07	0.81	0.00	0.81
29.20	0.53	0.49	1.07	0.81	0.00	0.81
29.25	0.53	0.50	1.07	0.81	0.00	0.81
29.30	0.53	0.50	1.07	0.81	0.00	0.81
29.35	0.53	0.50	1.07	0.81	0.00	0.81
29.40	0.53	0.50	1.06	0.81	0.00	0.81
29.45	0.53	0.50	1.06	0.81	0.00	0.81
29.50	0.53	0.50	1.06	0.81	0.00	0.81
29.55	0.53	0.50	1.06	0.81	0.00	0.81
29.60	0.53	0.50	1.06	0.81	0.00	0.81
29.65	0.53	0.50	1.06	0.81	0.00	0.81
29.70	0.53	0.50	1.06	0.81	0.00	0.81
29.75	0.53	0.50	1.06	0.81	0.00	0.81
29.80	0.53	0.50	1.06	0.81	0.00	0.81

29.85	0.53	0.50	1.06	0.81	0.00	0.81
29.90	0.53	0.50	1.06	0.81	0.00	0.81
29.95	0.53	0.50	1.06	0.81	0.00	0.81
30.00	0.53	0.50	1.06	0.81	0.00	0.81
30.05	0.53	0.50	1.06	0.81	0.00	0.81
30.10	0.53	0.50	1.06	0.81	0.00	0.81
30.15	0.53	0.50	1.05	0.81	0.00	0.81
30.20	0.53	0.50	1.05	0.81	0.00	0.81
30.25	0.53	0.50	1.05	0.81	0.00	0.81
30.30	0.53	0.50	1.05	0.81	0.00	0.81
30.35	0.53	0.50	1.05	0.81	0.00	0.81
30.40	0.53	0.50	1.05	0.81	0.00	0.81
30.45	0.53	0.50	1.05	0.81	0.00	0.81
30.50	0.53	0.50	1.05	0.81	0.00	0.81
30.55	0.53	0.50	1.06	0.81	0.00	0.81
30.60	0.53	0.50	1.06	0.81	0.00	0.81
30.65	0.53	0.50	1.06	0.81	0.00	0.81
30.70	0.53	0.50	1.06	0.81	0.00	0.81
30.75	0.53	0.50	1.06	0.81	0.00	0.81
30.80	0.53	0.50	1.06	0.81	0.00	0.81
30.85	0.53	0.50	1.05	0.81	0.00	0.81
30.90	0.53	0.50	1.05	0.81	0.00	0.81
30.95	0.53	0.50	1.05	0.81	0.00	0.81
31.00	0.53	0.50	1.05	0.81	0.00	0.81
31.05	0.53	0.50	1.05	0.81	0.00	0.81
31.10	0.53	0.50	1.05	0.81	0.00	0.81
31.15	0.53	0.50	1.05	0.81	0.00	0.81
31.20	0.53	0.50	1.05	0.81	0.00	0.81
31.25	0.53	0.50	1.05	0.81	0.00	0.81
31.30	0.53	0.50	1.05	0.81	0.00	0.81
31.35	0.53	0.50	1.05	0.81	0.00	0.81
31.40	0.53	0.50	1.05	0.81	0.00	0.81
31.45	0.53	0.50	1.05	0.81	0.00	0.81
31.50	0.53	0.51	1.05	0.81	0.00	0.81
31.55	0.53	0.51	1.05	0.81	0.00	0.81
31.60	0.53	0.51	1.05	0.81	0.00	0.81
31.65	0.53	0.51	1.05	0.81	0.00	0.81
31.70	0.53	0.51	1.04	0.81	0.00	0.81
31.75	0.53	0.51	1.04	0.81	0.00	0.81
31.80	0.53	0.51	1.04	0.81	0.00	0.81
31.85	0.53	0.51	1.04	0.81	0.00	0.81
31.90	0.53	0.51	1.04	0.81	0.00	0.81
31.95	0.53	0.51	1.04	0.81	0.00	0.81
32.00	0.53	0.51	1.04	0.81	0.00	0.81
32.05	0.53	0.51	1.04	0.81	0.00	0.81
32.10	0.53	0.51	1.04	0.81	0.00	0.81
32.15	0.53	0.51	1.04	0.81	0.00	0.81
32.20	0.53	0.51	1.04	0.81	0.00	0.81

32.25	0.53	0.51	1.04	0.81	0.00	0.81
32.30	0.53	0.51	1.04	0.81	0.00	0.81
32.35	0.53	0.51	1.04	0.81	0.00	0.81
32.40	0.53	0.51	1.04	0.81	0.00	0.81
32.45	0.53	0.51	1.04	0.81	0.00	0.81
32.50	0.53	0.51	1.04	0.81	0.00	0.81
32.55	0.53	0.51	1.04	0.81	0.00	0.81
32.60	0.53	0.51	1.03	0.81	0.00	0.81
32.65	0.53	0.51	1.03	0.81	0.00	0.81
32.70	0.53	0.51	1.03	0.81	0.00	0.81
32.75	0.53	0.51	1.03	0.81	0.00	0.81
32.80	0.52	0.51	1.03	0.81	0.00	0.81
32.85	0.52	0.51	1.03	0.81	0.00	0.81
32.90	0.52	0.51	1.03	0.81	0.00	0.81
32.95	0.52	0.51	1.03	0.81	0.00	0.81
33.00	0.52	0.51	1.03	0.81	0.00	0.81
33.05	0.52	0.51	1.03	0.81	0.00	0.81
33.10	0.52	0.51	1.03	0.81	0.00	0.81
33.15	0.52	0.51	1.03	0.81	0.00	0.81
33.20	0.52	0.51	1.03	0.81	0.00	0.81
33.25	0.52	0.51	1.03	0.81	0.00	0.81
33.30	0.52	0.51	1.03	0.81	0.00	0.81
33.35	0.52	0.51	1.03	0.81	0.00	0.81
33.40	0.52	0.51	1.03	0.81	0.00	0.81
33.45	0.52	0.51	1.03	0.81	0.00	0.81
33.50	0.52	0.51	1.03	0.81	0.00	0.81
33.55	0.52	0.51	1.03	0.81	0.00	0.81
33.60	0.52	0.51	1.02	0.81	0.00	0.81
33.65	0.52	0.51	1.02	0.81	0.00	0.81
33.70	0.52	0.51	1.02	0.81	0.00	0.81
33.75	0.52	0.51	1.02	0.81	0.00	0.81
33.80	0.52	0.51	1.02	0.80	0.00	0.80
33.85	0.52	0.51	1.02	0.80	0.00	0.80
33.90	0.52	0.51	1.02	0.80	0.00	0.80
33.95	0.52	0.51	1.02	0.80	0.00	0.80
34.00	0.52	0.51	1.02	0.80	0.00	0.80
34.05	0.52	0.51	1.02	0.79	0.00	0.79
34.10	0.52	0.51	1.02	0.79	0.00	0.79
34.15	0.52	0.51	1.02	0.79	0.00	0.79
34.20	0.52	0.51	1.02	0.78	0.00	0.78
34.25	0.52	0.51	1.02	0.78	0.00	0.78
34.30	0.52	0.51	1.02	0.78	0.00	0.78
34.35	0.52	0.51	1.02	0.77	0.00	0.77
34.40	0.46	0.51	0.90*	0.77	0.00	0.77
34.45	0.43	0.51	0.84*	0.76	0.00	0.76
34.50	0.41	0.51	0.80*	0.76	0.00	0.76
34.55	0.40	0.51	0.77*	0.75	0.00	0.75
34.60	0.39	0.51	0.75*	0.75	0.00	0.75

34.65	0.38	0.51	0.73*	0.74	0.00	0.74
34.70	0.37	0.51	0.72*	0.74	0.00	0.74
34.75	0.36	0.51	0.70*	0.73	0.00	0.73
34.80	0.35	0.51	0.69*	0.73	0.00	0.73
34.85	0.35	0.51	0.68*	0.72	0.00	0.72
34.90	0.34	0.51	0.66*	0.71	0.00	0.71
34.95	0.33	0.51	0.65*	0.71	0.00	0.71
35.00	0.33	0.51	0.64*	0.70	0.00	0.70
35.05	0.33	0.51	0.65*	0.69	0.00	0.69
35.10	0.34	0.51	0.66*	0.69	0.00	0.69
35.15	0.34	0.51	0.67*	0.68	0.00	0.68
35.20	0.35	0.51	0.68*	0.68	0.00	0.68
35.25	0.36	0.51	0.70*	0.67	0.00	0.67
35.30	0.36	0.51	0.71*	0.66	0.00	0.66
35.35	0.37	0.51	0.72*	0.66	0.00	0.66
35.40	0.38	0.51	0.74*	0.65	0.00	0.65
35.45	0.39	0.51	0.76*	0.65	0.00	0.65
35.50	0.40	0.51	0.78*	0.64	0.00	0.64
35.55	0.41	0.51	0.81*	0.64	0.00	0.64
35.60	0.43	0.51	0.85*	0.63	0.00	0.63
35.65	0.47	0.51	0.92*	0.63	0.00	0.63
35.70	0.52	0.51	1.01	0.62	0.00	0.62
35.75	0.52	0.51	1.01	0.62	0.00	0.62
35.80	0.52	0.51	1.01	0.62	0.00	0.62
35.85	0.52	0.51	1.01	0.61	0.00	0.61
35.90	0.52	0.51	1.01	0.61	0.00	0.61
35.95	0.52	0.51	1.00	0.60	0.00	0.60
36.00	0.52	0.51	1.00	0.60	0.00	0.60
36.05	0.52	0.51	1.00	0.60	0.00	0.60
36.10	0.52	0.51	1.00	0.59	0.00	0.59
36.15	0.52	0.51	1.00	0.59	0.00	0.59
36.20	0.51	0.51	1.00	0.59	0.00	0.59
36.25	0.51	0.51	1.00	0.59	0.00	0.59
36.30	0.51	0.51	1.00	0.59	0.00	0.59
36.35	0.51	0.51	1.00	0.58	0.00	0.58
36.40	0.51	0.51	1.00	0.58	0.00	0.58
36.45	0.51	0.51	1.00	0.58	0.00	0.58
36.50	0.51	0.51	1.00	0.58	0.00	0.58
36.55	0.51	0.51	1.00	0.58	0.00	0.58
36.60	0.51	0.51	1.00	0.58	0.00	0.58
36.65	0.51	0.51	1.00*	0.58	0.00	0.58
36.70	0.51	0.51	1.00*	0.58	0.00	0.58
36.75	0.51	0.51	1.00*	0.57	0.00	0.57
36.80	0.51	0.51	1.00*	0.57	0.00	0.57
36.85	0.51	0.51	1.00*	0.57	0.00	0.57
36.90	0.51	0.51	1.00*	0.57	0.00	0.57
36.95	0.51	0.51	1.00*	0.57	0.00	0.57
37.00	0.51	0.51	1.00*	0.57	0.00	0.57

37.05	0.51	0.51	1.00*	0.57	0.00	0.57
37.10	0.51	0.51	1.00*	0.57	0.00	0.57
37.15	0.51	0.51	1.00*	0.57	0.00	0.57
37.20	0.51	0.51	1.00*	0.57	0.00	0.57
37.25	0.51	0.51	1.00*	0.57	0.00	0.57
37.30	0.51	0.51	1.00*	0.57	0.00	0.57
37.35	0.51	0.51	1.00*	0.57	0.00	0.57
37.40	0.51	0.51	0.99*	0.57	0.00	0.57
37.45	0.51	0.51	0.99*	0.57	0.00	0.57
37.50	0.51	0.51	0.99*	0.57	0.00	0.57
37.55	0.51	0.51	0.99*	0.57	0.00	0.57
37.60	0.51	0.51	0.99*	0.57	0.00	0.57
37.65	0.51	0.51	0.99*	0.57	0.00	0.57
37.70	0.51	0.51	0.99*	0.57	0.00	0.57
37.75	0.51	0.51	0.99*	0.57	0.00	0.57
37.80	0.51	0.51	0.99*	0.57	0.00	0.57
37.85	0.51	0.51	0.99*	0.57	0.00	0.57
37.90	0.51	0.51	0.99*	0.57	0.00	0.57
37.95	0.51	0.51	0.99*	0.57	0.00	0.57
38.00	0.51	0.51	0.99*	0.57	0.00	0.57
38.05	0.51	0.51	0.99*	0.57	0.00	0.57
38.10	0.51	0.51	0.99*	0.57	0.00	0.57
38.15	0.51	0.51	0.99*	0.57	0.00	0.57
38.20	0.51	0.51	0.99*	0.57	0.00	0.57
38.25	0.51	0.51	0.99*	0.57	0.00	0.57
38.30	0.51	0.51	0.99*	0.57	0.00	0.57
38.35	0.51	0.51	0.99*	0.57	0.00	0.57
38.40	0.51	0.51	0.99*	0.57	0.00	0.57
38.45	0.51	0.51	0.99*	0.57	0.00	0.57
38.50	0.51	0.51	0.99*	0.57	0.00	0.57
38.55	0.51	0.51	0.99*	0.57	0.00	0.57
38.60	0.51	0.51	0.99*	0.57	0.00	0.57
38.65	0.51	0.51	0.99*	0.57	0.00	0.57
38.70	0.51	0.51	0.99*	0.57	0.00	0.57
38.75	0.51	0.51	0.99*	0.57	0.00	0.57
38.80	0.51	0.51	0.99*	0.57	0.00	0.57
38.85	0.51	0.51	0.99*	0.57	0.00	0.57
38.90	0.51	0.51	0.99*	0.57	0.00	0.57
38.95	0.51	0.51	0.99*	0.57	0.00	0.57
39.00	0.51	0.51	0.99*	0.57	0.00	0.57
39.05	0.51	0.51	0.99*	0.57	0.00	0.57
39.10	0.51	0.51	0.98*	0.57	0.00	0.57
39.15	0.51	0.51	0.98*	0.57	0.00	0.57
39.20	0.51	0.51	0.98*	0.57	0.00	0.57
39.25	0.51	0.51	0.98*	0.57	0.00	0.57
39.30	0.51	0.51	0.98*	0.57	0.00	0.57
39.35	0.51	0.51	0.98*	0.57	0.00	0.57
39.40	0.51	0.51	0.98*	0.57	0.00	0.57

39.45	0.51	0.51	0.98*	0.57	0.00	0.57
39.50	0.51	0.51	0.98*	0.57	0.00	0.57
39.55	0.51	0.51	0.98*	0.57	0.00	0.57
39.60	0.51	0.51	0.98*	0.57	0.00	0.57
39.65	0.51	0.51	0.98*	0.57	0.00	0.57
39.70	0.50	0.51	0.98*	0.57	0.00	0.57
39.75	0.50	0.51	0.98*	0.57	0.00	0.57
39.80	0.50	0.51	0.98*	0.57	0.00	0.57
39.85	0.50	0.51	0.98*	0.57	0.00	0.57
39.90	0.50	0.51	0.98*	0.57	0.00	0.57
39.95	0.50	0.51	0.98*	0.57	0.00	0.57
40.00	0.50	0.51	0.98*	0.57	0.00	0.57
40.05	0.50	0.51	0.98*	0.57	0.00	0.57
40.10	0.50	0.51	0.98*	0.57	0.00	0.57
40.15	0.50	0.51	0.98*	0.57	0.00	0.57
40.20	0.50	0.51	0.98*	0.57	0.00	0.57
40.25	0.50	0.51	0.98*	0.57	0.00	0.57
40.30	0.50	0.51	0.98*	0.57	0.00	0.57
40.35	0.50	0.51	0.98*	0.57	0.00	0.57
40.40	0.50	0.51	0.98*	0.57	0.00	0.57
40.45	0.50	0.51	0.98*	0.57	0.00	0.57
40.50	0.50	0.51	0.98*	0.57	0.00	0.57
40.55	0.50	0.51	0.98*	0.57	0.00	0.57
40.60	0.50	0.51	0.98*	0.57	0.00	0.57
40.65	0.50	0.51	0.98*	0.57	0.00	0.57
40.70	0.50	0.51	0.98*	0.57	0.00	0.57
40.75	0.50	0.51	0.98*	0.57	0.00	0.57
40.80	0.50	0.51	0.98*	0.57	0.00	0.57
40.85	0.50	0.51	0.98*	0.57	0.00	0.57
40.90	0.50	0.51	0.98*	0.57	0.00	0.57
40.95	0.50	0.51	0.98*	0.57	0.00	0.57
41.00	0.50	0.51	0.98*	0.57	0.00	0.57
41.05	0.50	0.51	0.98*	0.57	0.00	0.57
41.10	0.50	0.51	0.98*	0.57	0.00	0.57
41.15	0.50	0.51	0.98*	0.57	0.00	0.57
41.20	0.50	0.51	0.97*	0.57	0.00	0.57
41.25	0.50	0.51	0.97*	0.57	0.00	0.57
41.30	0.50	0.51	0.97*	0.57	0.00	0.57
41.35	0.50	0.51	0.97*	0.57	0.00	0.57
41.40	0.50	0.51	0.97*	0.57	0.00	0.57
41.45	0.50	0.51	0.97*	0.57	0.00	0.57
41.50	0.50	0.51	0.97*	0.57	0.00	0.57
41.55	0.50	0.51	0.97*	0.57	0.00	0.57
41.60	0.50	0.51	0.97*	0.57	0.00	0.57
41.65	0.50	0.51	0.97*	0.57	0.00	0.57
41.70	0.50	0.51	0.97*	0.57	0.00	0.57
41.75	0.50	0.51	0.97*	0.57	0.00	0.57
41.80	0.50	0.51	0.97*	0.57	0.00	0.57

41.85	0.50	0.51	0.97*	0.57	0.00	0.57
41.90	0.50	0.51	0.97*	0.57	0.00	0.57
41.95	0.50	0.51	0.97*	0.57	0.00	0.57
42.00	0.50	0.51	0.97*	0.57	0.00	0.57
42.05	0.50	0.51	0.97*	0.57	0.00	0.57
42.10	0.50	0.51	0.97*	0.57	0.00	0.57
42.15	0.50	0.51	0.97*	0.57	0.00	0.57
42.20	0.50	0.51	0.97*	0.57	0.00	0.57
42.25	0.50	0.51	0.97*	0.57	0.00	0.57
42.30	0.50	0.51	0.97*	0.57	0.00	0.57
42.35	0.50	0.51	0.97*	0.57	0.00	0.57
42.40	0.50	0.51	0.97*	0.57	0.00	0.57
42.45	0.50	0.51	0.97*	0.57	0.00	0.57
42.50	0.50	0.51	0.97*	0.57	0.00	0.57
42.55	0.50	0.51	0.97*	0.57	0.00	0.57
42.60	0.50	0.51	0.97*	0.57	0.00	0.57
42.65	0.50	0.51	0.97*	0.57	0.00	0.57
42.70	0.50	0.51	0.97*	0.57	0.00	0.57
42.75	0.50	0.51	0.97*	0.57	0.00	0.57
42.80	0.50	0.51	0.97*	0.57	0.00	0.57
42.85	0.50	0.51	0.97*	0.57	0.00	0.57
42.90	0.50	0.51	0.97*	0.57	0.00	0.57
42.95	0.50	0.51	0.97*	0.57	0.00	0.57
43.00	0.50	0.51	0.97*	0.57	0.00	0.57
43.05	0.50	0.51	0.97*	0.57	0.00	0.57
43.10	0.50	0.51	0.97*	0.57	0.00	0.57
43.15	0.50	0.51	0.97*	0.57	0.00	0.57
43.20	0.50	0.51	0.97*	0.57	0.00	0.57
43.25	0.50	0.51	0.97*	0.57	0.00	0.57
43.30	0.50	0.51	0.97*	0.57	0.00	0.57
43.35	0.50	0.51	0.97*	0.56	0.00	0.56
43.40	0.49	0.51	0.97*	0.56	0.00	0.56
43.45	0.49	0.51	0.97*	0.56	0.00	0.56
43.50	0.49	0.51	0.97*	0.56	0.00	0.56
43.55	0.49	0.51	0.97*	0.56	0.00	0.56
43.60	0.49	0.51	0.97*	0.56	0.00	0.56
43.65	0.49	0.51	0.97*	0.56	0.00	0.56
43.70	0.49	0.51	0.97*	0.56	0.00	0.56
43.75	0.49	0.51	0.97*	0.55	0.00	0.55
43.80	0.49	0.51	0.97*	0.55	0.00	0.55
43.85	0.49	0.51	0.97*	0.55	0.00	0.55
43.90	0.49	0.51	0.97*	0.55	0.00	0.55
43.95	0.49	0.51	0.97*	0.54	0.00	0.54
44.00	0.49	0.51	0.97*	0.54	0.00	0.54
44.05	0.49	0.51	0.97*	0.54	0.00	0.54
44.10	0.49	0.51	0.96*	0.53	0.00	0.53
44.15	0.49	0.51	0.96*	0.53	0.00	0.53
44.20	0.49	0.51	0.96*	0.53	0.00	0.53

44.25	0.49	0.51	0.96*	0.52	0.00	0.52
44.30	0.49	0.51	0.96*	0.52	0.00	0.52
44.35	0.44	0.51	0.85*	0.51	0.00	0.51
44.40	0.41	0.51	0.80*	0.51	0.00	0.51
44.45	0.39	0.51	0.77*	0.50	0.00	0.50
44.50	0.38	0.51	0.75*	0.50	0.00	0.50
44.55	0.37	0.51	0.73*	0.49	0.00	0.49
44.60	0.36	0.51	0.71*	0.49	0.00	0.49
44.65	0.36	0.51	0.70*	0.48	0.00	0.48
44.70	0.35	0.51	0.68*	0.48	0.00	0.48
44.75	0.34	0.51	0.67*	0.47	0.00	0.47
44.80	0.34	0.51	0.66*	0.47	0.00	0.47
44.85	0.33	0.51	0.65*	0.46	0.00	0.46
44.90	0.33	0.51	0.64*	0.45	0.00	0.45
44.95	0.32	0.51	0.63*	0.45	0.00	0.45
45.00	0.32	0.51	0.62*	0.44	0.00	0.44
45.05	0.32	0.51	0.62*	0.44	0.00	0.44
45.10	0.32	0.51	0.63*	0.43	0.00	0.43
45.15	0.32	0.51	0.63*	0.42	0.00	0.42
45.20	0.32	0.51	0.63*	0.42	0.00	0.42
45.25	0.32	0.51	0.64*	0.41	0.00	0.41
45.30	0.33	0.51	0.64*	0.41	0.00	0.41
45.35	0.33	0.51	0.64*	0.40	0.00	0.40
45.40	0.33	0.51	0.64*	0.39	0.00	0.39
45.45	0.33	0.51	0.65*	0.39	0.00	0.39
45.50	0.33	0.51	0.65*	0.38	0.00	0.38
45.55	0.33	0.51	0.65*	0.37	0.00	0.37
45.60	0.33	0.51	0.66*	0.37	0.00	0.37
45.65	0.34	0.51	0.66*	0.36	0.00	0.36
45.70	0.34	0.51	0.66*	0.36	0.00	0.36
45.75	0.34	0.51	0.66*	0.35	0.00	0.35
45.80	0.34	0.51	0.67*	0.35	0.00	0.35
45.85	0.34	0.51	0.67*	0.34	0.00	0.34
45.90	0.34	0.51	0.67*	0.33	0.00	0.33
45.95	0.34	0.51	0.68*	0.33	0.00	0.33
46.00	0.35	0.51	0.68*	0.32	0.00	0.32
46.05	0.35	0.51	0.68*	0.32	0.00	0.32
46.10	0.35	0.51	0.69*	0.31	0.00	0.31
46.15	0.35	0.51	0.69*	0.31	0.00	0.31
46.20	0.35	0.51	0.70*	0.30	0.00	0.30
46.25	0.36	0.51	0.70*	0.29	0.00	0.29
46.30	0.36	0.51	0.70*	0.29	0.00	0.29
46.35	0.36	0.51	0.71*	0.28	0.00	0.28
46.40	0.36	0.51	0.71*	0.28	0.00	0.28
46.45	0.36	0.51	0.72*	0.27	0.00	0.27
46.50	0.37	0.51	0.72*	0.27	0.00	0.27
46.55	0.37	0.51	0.73*	0.26	0.00	0.26
46.60	0.37	0.51	0.73*	0.26	0.00	0.26

46.65	0.37	0.51	0.74*	0.25	0.00	0.25
46.70	0.38	0.51	0.74*	0.25	0.00	0.25
46.75	0.38	0.51	0.75*	0.24	0.00	0.24
46.80	0.38	0.51	0.75*	0.24	0.00	0.24
46.85	0.38	0.51	0.76*	0.23	0.00	0.23
46.90	0.39	0.51	0.77*	0.23	0.00	0.23
46.95	0.39	0.51	0.77*	0.22	0.00	0.22
47.00	0.40	0.51	0.78*	0.22	0.00	0.22
47.05	0.40	0.51	0.79*	0.21	0.00	0.21
47.10	0.41	0.51	0.80*	0.21	0.00	0.21
47.15	0.41	0.51	0.81*	0.20	0.00	0.20
47.20	0.42	0.51	0.83*	0.20	0.00	0.20
47.25	0.43	0.51	0.85*	0.20	0.00	0.20
47.30	0.44	0.51	0.87*	0.19	0.00	0.19
47.35	0.45	0.51	0.90*	0.19	0.00	0.19
47.40	0.47	0.51	0.93*	0.18	0.00	0.18
47.45	0.49	0.51	0.96*	0.18	0.00	0.18
47.50	0.49	0.51	0.96*	0.17	0.00	0.17
47.55	0.49	0.51	0.96*	0.17	0.00	0.17
47.60	0.48	0.51	0.96*	0.17	0.00	0.17
47.65	0.48	0.51	0.96*	0.16	0.00	0.16
47.70	0.48	0.51	0.96*	0.16	0.00	0.16
47.75	0.48	0.51	0.96*	0.15	0.00	0.15
47.80	0.48	0.51	0.96*	0.15	0.00	0.15
47.85	0.48	0.51	0.96*	0.14	0.00	0.14
47.90	0.48	0.50	0.96*	0.14	0.00	0.14
47.95	0.48	0.50	0.96*	0.14	0.00	0.14
48.00	0.48	0.50	0.96*	0.13	0.00	0.13
48.05	0.48	0.50	0.96*	0.13	0.00	0.13
48.10	0.48	0.50	0.96*	0.13	0.00	0.13
48.15	0.48	0.50	0.96*	0.12	0.00	0.12
48.20	0.48	0.50	0.96*	0.12	0.00	0.12
48.25	0.48	0.50	0.96*	0.11	0.00	0.11
48.30	0.48	0.50	0.96*	0.11	0.00	0.11
48.35	0.48	0.50	0.96*	0.11	0.00	0.11
48.40	0.48	0.50	0.96*	0.10	0.00	0.10
48.45	0.48	0.50	0.96*	0.10	0.00	0.10
48.50	0.48	0.50	0.96*	0.10	0.00	0.10
48.55	0.48	0.50	0.96*	0.09	0.00	0.09
48.60	0.48	0.50	0.96*	0.09	0.00	0.09
48.65	0.48	0.50	0.96*	0.09	0.00	0.09
48.70	0.48	0.50	0.96*	0.08	0.00	0.08
48.75	0.48	0.50	0.96*	0.08	0.00	0.08
48.80	0.48	0.50	0.96*	0.08	0.00	0.08
48.85	0.48	0.50	0.96*	0.07	0.00	0.07
48.90	0.48	0.50	0.96*	0.07	0.00	0.07
48.95	0.48	0.50	0.96*	0.07	0.00	0.07
49.00	0.48	0.50	0.96*	0.07	0.00	0.07

49.05	0.48	0.50	0.96*	0.06	0.00	0.06
49.10	0.48	0.50	0.96*	0.06	0.00	0.06
49.15	0.48	0.50	0.96*	0.06	0.00	0.06
49.20	0.48	0.50	0.96*	0.06	0.00	0.06
49.25	0.48	0.50	0.96*	0.05	0.00	0.05
49.30	0.48	0.50	0.96*	0.05	0.00	0.05
49.35	0.48	0.50	0.96*	0.05	0.00	0.05
49.40	0.48	0.50	0.96*	0.05	0.00	0.05
49.45	0.48	0.50	0.96*	0.04	0.00	0.04
49.50	0.48	0.50	0.96*	0.04	0.00	0.04
49.55	0.48	0.50	0.96*	0.04	0.00	0.04
49.60	0.48	0.50	0.96*	0.04	0.00	0.04
49.65	0.48	0.50	0.96*	0.04	0.00	0.04
49.70	0.48	0.50	0.96*	0.03	0.00	0.03
49.75	0.48	0.50	0.96*	0.03	0.00	0.03
49.80	0.48	0.50	0.96*	0.03	0.00	0.03
49.85	0.48	0.50	0.96*	0.03	0.00	0.03
49.90	0.48	0.50	0.96*	0.03	0.00	0.03
49.95	0.48	0.50	0.96*	0.03	0.00	0.03
50.00	0.48	0.50	0.96*	0.02	0.00	0.02
50.05	0.48	0.50	0.96*	0.02	0.00	0.02
50.10	0.48	0.50	0.96*	0.02	0.00	0.02
50.15	0.48	0.50	0.96*	0.02	0.00	0.02
50.20	0.48	0.50	0.96*	0.02	0.00	0.02
50.25	0.48	0.50	0.96*	0.02	0.00	0.02
50.30	0.48	0.50	0.96*	0.02	0.00	0.02
50.35	0.48	0.50	0.96*	0.02	0.00	0.02
50.40	0.48	0.50	0.96*	0.01	0.00	0.01
50.45	0.48	0.50	0.96*	0.01	0.00	0.01
50.50	0.48	0.50	0.96*	0.01	0.00	0.01
50.55	0.48	0.50	0.96*	0.01	0.00	0.01
50.60	0.48	0.50	0.96*	0.01	0.00	0.01
50.65	0.48	0.50	0.96*	0.01	0.00	0.01
50.70	0.48	0.50	0.96*	0.01	0.00	0.01
50.75	0.48	0.50	0.96*	0.01	0.00	0.01
50.80	0.48	0.50	0.97*	0.01	0.00	0.01
50.85	0.48	0.50	0.97*	0.00	0.00	0.00
50.90	0.48	0.50	0.97*	0.00	0.00	0.00
50.95	0.48	0.50	0.97*	0.00	0.00	0.00
51.00	0.48	0.50	0.97*	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: Welcome to LiquefyPro!

1 atm (atmosphere) = 1 tsf (ton/ft2)

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

Appendix F

STRUCTURAL BMP AND/OR RETENTION FACILITY SIZING CALCULATIONS AND DESIGN DETAILS

SUMMARY OF PRELIMINARY HYDROLOGY REPORT FOR THE WAVE AT CORAL MOUNTAIN (TTM 37815)

Whitewater Watershed

BMP Design Volume, V_{BMP} & Design Flow Rate, Q_{BMP} (Rev. 06-2014)

Legend: Required Entries / Calculated Cells

Company Name	MSA Consulting, Inc	Date	October 21, 2019
Designed By	DLS	County/City Case No.	
Company Project Number/Name	THE WAVE - MSA JOB #2553		
Drainage Area Number/Name	DRAINAGE AREA 'A'		

Enter the Area Tributary to this Feature (A_{TRIB}) — A_{TRIB} = 162.171 acres

Determine the Impervious Area Ratio

Determine the Impervious Area Within A_{TRIB} (A_{IMP}) — A_{IMP} = 38.874 acres

Calculate the Impervious Area Ratio (I_F)

$I_F = A_{IMP}/A_{TRIB}$ — I_F = 0.24

Calculate the Composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C_{BMP} = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ — C_{BMP} = 0.19

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 80% Unit Storage Volume $V_U = 0.40 \times C_{BMP}$ — V_U = 0.08 (in*ac)/ac

Calculate the design storage volume of the BMP, V_{BMP}

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12(in/ft)}$$

V_{BMP} = 45,337 ft^3

BMP Design Flow Rate, Q_{BMP}

$Q_{BMP} = C_{BMP} \times I \times A_{TRIB}$ — Q_{BMP} = 6.24 ft^3/s

I = Design Rainfall Intensity, 0.2 in/hr

Notes:

BASIN VOLUME WORKSHEET

PROECT THE WAVE
JOB No. 2553
BASIN DESIGNATION: WAVE LAGOON

BASIN CHARACTERISTICS

CONTOUR ELEVATION	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	(acre-ft)
451	0	0		548,486	0	0	0.00
456	5	5	178,499	726,985	3,178,217	3,178,217	72.96

WHERE:

$$V = \frac{1}{3}(E_1 - E_2)\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$$

BASIN VOLUME WORKSHEET

PROECT THE WAVE
JOB No. 2553
BASIN DESIGNATION: 10 YEAR BASIN

BASIN CHARACTERISTICS

CONTOUR ELEVATION	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	(acre-ft)
459	0	0		65,765	0	0	0.00
460	1	1	11,545	77,310	71,460	71,460	1.64
461	1	2	12,170	89,480	83,321	154,781	3.55

WHERE:

$$V = \frac{1}{3}(E_1 - E_2)\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$$

BASIN VOLUME WORKSHEET

PROECT THE WAVE
JOB No. 2553
BASIN DESIGNATION: 10 YEAR BASIN

BASIN CHARACTERISTICS

CONTOUR ELEVATION	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	(acre-ft)
468	0	0		10,730	0	0	0.00
469	1	1	6,330	17,060	13,773	13,773	0.32
470	1	2	6,965	24,025	20,443	34,217	0.79

WHERE:

$$V = \frac{1}{3}(E_1 - E_2)\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$$

Whitewater Watershed

BMP Design Volume, V_{BMP} & Design Flow Rate, Q_{BMP} (Rev. 06-2014)

Legend: Required Entries / Calculated Cells

Company Name	MSA Consulting, Inc	Date	October 21, 2019
Designed By	DLS	County/City Case No.	
Company Project Number/Name	THE WAVE - MSA JOB #2553		
Drainage Area Number/Name	DRAINAGE AREA 'B'		

Enter the Area Tributary to this Feature (A_{TRIB}) — A_{TRIB} = 41.586 acres

Determine the Impervious Area Ratio

Determine the Impervious Area Within A_{TRIB} (A_{IMP}) — A_{IMP} = 17.512 acres

Calculate the Impervious Area Ratio (I_F)

$I_F = A_{IMP}/A_{TRIB}$ — I_F = 0.42

Calculate the Composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C_{BMP} = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ — C_{BMP} = 0.29

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 80% Unit Storage Volume $V_U = 0.40 \times C_{BMP}$ — V_U = 0.12 (in*ac)/ac

Calculate the design storage volume of the BMP, V_{BMP}

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12(in/ft)}$$

V_{BMP} = 17,613 ft^3

BMP Design Flow Rate, Q_{BMP}

$Q_{BMP} = C_{BMP} \times I \times A_{TRIB}$ — Q_{BMP} = 2.43 ft^3/s

I = Design Rainfall Intensity, 0.2 in/hr

Notes:

BASIN VOLUME WORKSHEET

PROECT THE WAVE
JOB No. 2553
BASIN DESIGNATION: BASIN B

BASIN CHARACTERISTICS

CONTOUR ELEVATION	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	(acre-ft)
458	0	0		279,800	0	0	0.00
459	1	1	24,605	304,405	292,016	292,016	6.70

WHERE:

$$V = \frac{1}{3}(E_1 - E_2)\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$$

Whitewater Watershed

BMP Design Volume, V_{BMP} & Design Flow Rate, Q_{BMP} (Rev. 06-2014)

Legend: Required Entries / Calculated Cells

Company Name	MSA Consulting, Inc	Date	October 21, 2019
Designed By	DLS	County/City Case No.	
Company Project Number/Name	THE WAVE - MSA JOB #2553		
Drainage Area Number/Name	DRAINAGE AREA 'C'		

Enter the Area Tributary to this Feature (A_{TRIB}) — A_{TRIB} = 10.191 acres

Determine the Impervious Area Ratio

Determine the Impervious Area Within A_{TRIB} (A_{IMP}) — A_{IMP} = 4.419 acres

Calculate the Impervious Area Ratio (I_F)

$I_F = A_{IMP}/A_{TRIB}$ — I_F = 0.43

Calculate the Composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C_{BMP} = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ — C_{BMP} = 0.30

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 80% Unit Storage Volume $V_U = 0.40 \times C_{BMP}$ — V_U = 0.12 (in*ac)/ac

Calculate the design storage volume of the BMP, V_{BMP}

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12(in/ft)}$$

V_{BMP} = 4,423 ft^3

BMP Design Flow Rate, Q_{BMP}

$Q_{BMP} = C_{BMP} \times I \times A_{TRIB}$ — Q_{BMP} = 0.61 ft^3/s

I = Design Rainfall Intensity, 0.2 in/hr

Notes:

BASIN VOLUME WORKSHEET

PROECT THE WAVE
JOB No. 2553
BASIN DESIGNATION: BASIN C

BASIN CHARACTERISTICS

CONTOUR ELEVATION	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	(acre-ft)
452	0	0		25,035	0	0	0.00
453	1	1	3,930	28,965	26,976	26,976	0.62
454	1	2	4,095	33,060	30,990	57,966	1.33

WHERE:

$$V = \frac{1}{3}(E_1 - E_2)\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$$

Whitewater Watershed

BMP Design Volume, V_{BMP} & Design Flow Rate, Q_{BMP} (Rev. 06-2014)

Legend: Required Entries / Calculated Cells

Company Name	MSA Consulting, Inc	Date	October 21, 2019
Designed By	DLS	County/City Case No.	
Company Project Number/Name	THE WAVE - MSA JOB #2553		
Drainage Area Number/Name	DRAINAGE AREA 'D'		

Enter the Area Tributary to this Feature (A_{TRIB}) — A_{TRIB} = 28.976 acres

Determine the Impervious Area Ratio

Determine the Impervious Area Within A_{TRIB} (A_{IMP}) — A_{IMP} = 14.177 acres

Calculate the Impervious Area Ratio (I_F)

$I_F = A_{IMP}/A_{TRIB}$ — I_F = 0.49

Calculate the Composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C_{BMP} = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ — C_{BMP} = 0.33

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 80% Unit Storage Volume $V_U = 0.40 \times C_{BMP}$ — V_U = 0.13 (in*ac)/ac

Calculate the design storage volume of the BMP, V_{BMP}

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12(in/ft)}$$

V_{BMP} = 13,988 ft^3

BMP Design Flow Rate, Q_{BMP}

$Q_{BMP} = C_{BMP} \times I \times A_{TRIB}$ — Q_{BMP} = 1.93 ft^3/s

I = Design Rainfall Intensity, 0.2 in/hr

Notes:

BASIN VOLUME WORKSHEET

PROECT THE WAVE
JOB No. 2553
BASIN DESIGNATION: BASIN D

BASIN CHARACTERISTICS

CONTOUR ELEVATION	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	(acre-ft)
451	0	0		101,190	0	0	0.00
452	1	1	11,305	112,495	106,793	106,793	2.45
452.5	0.5	1.5	23,075	135,570	61,927	168,719	3.87

WHERE:

$$V = \frac{1}{3}(E_1 - E_2)\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$$

Whitewater Watershed

BMP Design Volume, V_{BMP} & Design Flow Rate, Q_{BMP} (Rev. 06-2014)

Legend: Required Entries / Calculated Cells

Company Name	MSA Consulting, Inc	Date	October 21, 2019
Designed By	DLS	County/City Case No.	
Company Project Number/Name	THE WAVE - MSA JOB #2553		
Drainage Area Number/Name	DRAINAGE AREA 'E'		

Enter the Area Tributary to this Feature (A_{TRIB}) — A_{TRIB} = 62.903 acres

Determine the Impervious Area Ratio

Determine the Impervious Area Within A_{TRIB} (A_{IMP}) — A_{IMP} = 19.414 acres

Calculate the Impervious Area Ratio (I_F)

$I_F = A_{IMP}/A_{TRIB}$ — I_F = 0.31

Calculate the Composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C_{BMP} = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ — C_{BMP} = 0.23

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 80% Unit Storage Volume $V_U = 0.40 \times C_{BMP}$ — V_U = 0.09 (in*ac)/ac

Calculate the design storage volume of the BMP, V_{BMP}

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12(in/ft)}$$

V_{BMP} = 20,990 ft^3

BMP Design Flow Rate, Q_{BMP}

$Q_{BMP} = C_{BMP} \times I \times A_{TRIB}$ — Q_{BMP} = 2.89 ft^3/s

I = Design Rainfall Intensity, 0.2 in/hr

Notes:

BASIN VOLUME WORKSHEET

PROECT THE WAVE
JOB No. 2553
BASIN DESIGNATION: BASIN E

BASIN CHARACTERISTICS

CONTOUR ELEVATION	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	(acre-ft)
442	0	0		224,555	0	0	0.00
443	1	1	7,425	231,980	228,257	228,257	5.24
444	1	2	7,480	239,460	235,710	463,968	10.65
445	1	3	7,540	247,000	243,220	707,188	16.23
446	1	4	7,595	254,595	250,788	957,976	21.99
447	1	5	7,655	262,250	258,413	1,216,389	27.92

WHERE: $$V = \frac{1}{3}(E_1 - E_2)\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$$

PROJECT DESCRIPTION & LOCATION

The project is proposed to consist of residential structures, a multi-story hotel complex, a wave lagoon and various outdoor amenities. The project site comprises approximately 377 acres with an additional 75 acres of offsite tributary area. The subject property is located on the southwest corner of Avenue 58 and Madison Street in the City of La Quinta and is situated in a portion of Sections 27 & 28, Township 6 South, Range 7 East, SBM. Existing dikes 2 & 4 along with the Coral Mountains border the property to the west and south. A vicinity map obtained from the Riverside TLMA website is included as Appendix A.

EXISTING SITE CONDITIONS

Flood Rate Map

The proposed area is covered by FIRM Panel Number 06065C2900G, effective date of August 28, 2008, which indicates the subject property lies within Zone X (Shaded), defined *as "Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. Insurance purchase is not required in these areas.*" Refer to the attached NFIP Flood Insurance Rate Map in Appendix B.

Existing Topography

The property is generally vacant and undeveloped with CVWD irrigation mains, numerous dirt road and hiking trails. Various desert vegetation is found throughout the site.
The site is bounded to the east by Madison Street, to the north by 58th Avenue, existing levees and the Coral Mountains to the west and south, and 60th Avenue to the south. Groundwater was encountered at a depth of 47 feet for two of the borings. Site drainage appears to be controlled via sheet flow and surface infiltration generally from west to east.

PROPOSED FLOOD CONTROL REQUIREMENTS

The purpose of this report is to provide preliminary basin analyses for the subject property. The drainage requirements for this project fall under the jurisdiction of the City of La Quinta. Storm flows are conveyed through the site via street flow to localized low points. All proposed pad elevations are set a minimum of 1-foot above the high-side street elevation.

HYDROLOGY ANALYSIS DESIGN CRITERIA

Storm runoff volumes for the 100-year event were obtained utilizing the Synthetic Unit Hydrograph as described in the *RCFC&WCD Hydrology Manual*. The hydrologic data used for the calculations are as follows:

Hydrologic Soil Group

The existing soil is categorized primarily as hydrologic soil groups "A" and "B" for the majority of the subject property with soil group "D" being assigned to the Coral Mountain rock out-cropping as shown per the attached National Cooperative Soil Survey exhibits in Appendix C. For the purposes of this report, Soil Group 'B' was assigned to the analyses with the exception of the rock out-cropping.

Soil Group 'B' is defined by RCFCD as – "soils having moderate infiltration rates when thoroughly wetted and consisting chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission".

Soil Group 'D' is defined by RCFCD as – "soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high-water table, soils that have a claypan or clay layer at or near the surface and soils that are shallow over nearly impervious material".

Antecedent Moisture Condition

AMC II – Moderate runoff potential, an intermediate condition. Per RCFC & WCD Hydrology Manual (Dated: April 1978): "For the purposes of design hydrology using District methods, AMC II should normally be assumed for both the 10-year and 100-year frequency storm".

Land Use Classifications and Runoff Index Numbers

Runoff Index Numbers were obtained from RCFCD Plates E6.1, E6.2 and E6.3 are summarized below:

Commercial or Residential Landscaping (Soil Group B)	56
Rock Out-cropping (Soil Group D)	93
Existing Open Brush – Poor	76

Percent of Impervious Cover (RCFCD Plate E-6.3):	
Rock Out-cropping	5%
Existing Open Brush – Poor Condition	5%
Impervious Areas (Buildings, Pavement, Hardscape)	100%
Water Features	100%
Commercial Areas	90%
SFR – Low Density	30%
SFR – Medium Density	40%
SFR – High Density	50%
Open Space (Landscaping & Retention Basins)	10%
Low Loss Rates:	85%

Precipitation Frequency Estimates

Precipitation depths were obtained from NOAA Atlas 14:

2 Year - 1 Hour Precipitation:	0.358	inches
10 Year – 1 Hour Precipitation:	0.711	inches
10 Year –3 Hour Precipitation:	1.06	inches
10 Year – 6 Hour Precipitation:	1.36	inches
10 Year – 24 Hour Precipitation:	2.23	inches
100 Year – 1 Hour Precipitation:	1.44	inches
100 Year – 3 Hour Precipitation:	2.14	inches
100 Year - 6 Hour Precipitation	2.76	inches
100 Year – 24 Hour Precipitation	4.41	inches

Slope of Intensity Duration Curve:	0.52

See Appendix D for the NOAA Atlas 14 Point Precipitation Frequency Estimates and respective RCFCD Plates.

Site Infiltration

No percolation tests have been performed at the current time, therefore, for the purposes of this report a design percolation rate of 1 in/hr was used in the basin sizing calculations. Prior to the final design submittal, percolation tests will be performed, and should the 1 inch/hour rate not be achieved, Maxwell drywells will be proposed to de-water the basins within the required time period as specified by Riverside County BMP requirements.

Proposed Land Use Summaries

Land uses for each of the drainage areas were analyzed based on the preliminary site plan. In addition, a reconciliation was performed to verify the hydrologic boundary corresponds to the existing property boundary accounting for any differences. Land use worksheets are included in Appendix E.

SUMMARY of SYNTHETIC UNIT (SHORTCUT METHOD) ANALYSES

The proposed retention basins for the associated drainage areas were sized to retain the 100-year controlling storm event flood volumes and were analyzed utilizing the RCFCD Synthetic Unit (Shortcut Method). Per the manual, for areas of less than 100 – 200 acres, and lag times less than 7 – 8 minutes, the shortcut method is applicable. This method assumes that in a small watershed, response time to effective rainfall is very short. Therefore, runoff rates for a given period of time can be assumed to be directly proportional to effective rain. This method yields only approximate results (on the conservative side) and should be used only for watersheds meeting the criteria noted above.

It should be noted that the peak flow for the 1-hour storm is not necessarily representative for peak flow. Per RCFCD, peak discharges from the 3-hour storm should normally compare well with rational peaks.

The synthetic unit worksheets are included in Appendix F and are summarized on sheets 1 and 2 of the hydrology exhibits in Appendix H.

Drainage Area 'A'

This area is located on the westerly portion of the project and consists primarily of Dike Number 2, the Coral Mountains, a portion of Dike Number 4, the south-westerly portion of Planning Area IX and Planning Area X. Storm runoff (approximately 18.4 acre-feet) from this drainage sub-area is directed to the wave lagoon which provides over 73 acre-feet of retention. Shallow basins are proposed to retain 10-year storm flows from drainage areas 'A1' & 'A3'. During the final design process, once a more detailed land plan is provided, first flush storm flows from drainage area 'A2' will be captured and conveyed to an underground storage area prior to being discharged into the lagoon.

Drainage Area 'B'

Storm runoff of 4.2 acre-feet from this drainage area will be retained within the proposed lake.

Drainage Area 'C'

Storm runoff (roughly 1 acre-foot) for this drainage area will be conveyed to and retained in a temporary retention basin located in Drainage Area 'F'.

Drainage Area 'D'

Storm runoff of approximately 3.1 acre-feet for this drainage area will be conveyed to and retained in the proposed lake located within the "Farm".

Drainage Area 'E'

Storm runoff of approximately 5.7 acre-feet for this drainage area will be conveyed to and retained in a a large basin located in along the southerly portion of Planning Area VIII (Area 5). This basin will also provide a discharge location for the lagoon.

Drainage Area 'F'

This area is a future low-density residential development. Once developed it is anticipated approximately 4.0 acre-feet of retention will be required in addition to the 1 acre-foot basin required for Drainage Area 'C'.

Drainage Area 'G'

This area is a future low-density residential development. Once developed it is anticipated approximately 3.2 acre-feet of retention will be required.

Drainage Area 'H'

This area is a future commercial development. Once developed it is anticipated approximately 1.6 acre-feet of retention will be required.

Drainage Area 'I'

This area is a future low-density residential development. Once developed it is anticipated approximately 4.7 acre-feet of retention will be required.

Drainage Area 'Off-Site North'

This area consists of the south half of Avenue 58 and the northerly west half of Madison Street. The storm flows are captured by an existing catch basin and discharged into an existing basin which will remain when Drainage Area 'I' is developed.

Drainage Area 'Off-Site South'

This area consists of the north half of Avenue 60 and the southerly west half of Madison Street. The storm flows are captured by an existing catch basin and discharged into an existing basin which will remain when Drainage Area 'E' is developed.

PRELIMINARY WQMP ANALYSES

Preliminary design volume and flow for BMP measures were based on Worksheets 1 and 2 from the Riverside County – Whitewater River Region Water Quality Management Plan. Impervious area for the drainage sub-areas are derived from the preliminary land use worksheets. A summary of the BMP results is presented on sheet 1 of the Hydrology Exhibits in Appendix H with the worksheets being included as Appendix G.

RESULTS AND CONCLUSIONS

As the above narrative and appendices confirm, the proposed retention basins are sufficiently sized to contain the flood volume from the controlling 100-year storm. During the final design process, a more detailed hydrologic report will be submitted to the City for review and approval.

Appendix G

AGREEMENTS – CC&RS, COVENANT AND AGREEMENTS, BMP MAINTENANCE AGREEMENTS AND/OR OTHER MECHANISMS FOR ENSURING ONGOING OPERATION, MAINTENANCE, FUNDING AND TRANSFER OF REQUIREMENTS FOR THIS PROJECT-SPECIFIC WQMP

Appendix H

PHASE 1 ENVIRONMENTAL SITE ASSESSMENT – SUMMARY OF SITE REMEDIATION CONDUCTED AND USE RESTRICTIONS

(NOT AVAILABLE)

Appendix I

PROJECT-SPECIFIC WQMP SUMMARY DATA FORM

Project-Specific WQMP Summary Data Form

Applicant Information	
Name and Title	Garrett Simon
Company	CM Wave Development, L.L.C.
Phone	(970) 596-6642
Email	gsimon@meriwetherco.com

Project Information	
Project Name (as shown on project application/project-specific WQMP)	The Wave at Coral Mountain
Street Address	South of Avenue 58; West of Madison Street
Nearest Cross Streets	Madison Street
Municipality (City or Unincorporated County)	City of La Quinta
Zip Code	92253
Tract Number(s) and/or Assessor Parcel Number(s)	Tentative Tract Map No. 37815
Other (other information to help identify location of project)	

Indicate type of project.	**Priority Development Projects (Use an "X" in cell preceding project type):**
	SF hillside residence; impervious area ≥ 10,000 sq. ft.; Slope ≥ 25%
	SF hillside residence; impervious area ≥ 10,000 sq. ft.; Slope ≥ 10% & erosive soils
X	Commercial or Industrial ≥ 100,000 sq. ft. (Commercial Only)
	Automotive repair shop
X	Retail Gasoline Outlet disturbing > 5,000 sq. ft.
X	Restaurant disturbing > 5,000 sq. ft.
X	Home subdivision ≥ 10 housing units
X	Parking lot ≥ 5,000 sq. ft. or ≥ 25 parking spaces

Date Project-Specific WQMP Submitted	November 18, 2019, June 1, 2020
Size of Project Area (nearest 0.1 acre)	304.727Acres
Will the project replace more than 50% of the impervious surfaces on an existing developed site?	No
Project Area managed with LID/Site Design BMPs (nearest 0.1 acre)	461.432 Acres (with off-site tributary areas)
Are Treatment Control BMPs required?	No
Is the project subject to onsite retention by ordinance or policy?	Yes
Did the project meet the 100% LID/Site Design Measurable Goal?	Yes
Name of the entity that will implement, operate, and maintain the post-construction BMPs	CM Wave Development, L.L.C.
Contact Name	Garrett Simon
Street or Mailing Address	2440 Junction Place, Suite 200
City	Boulder, CO
Zip Code	80301
Phone	(970) 596-6642

Space Below for Use by City/County Staff Only	
Preceding Information Verified by (consistent with information in project-specific WQMP)	**Name:** **Date:**
Date Project-Specific WQMP Approved:	
Data Entered by	**Name:** **Date:**
Other Comments	