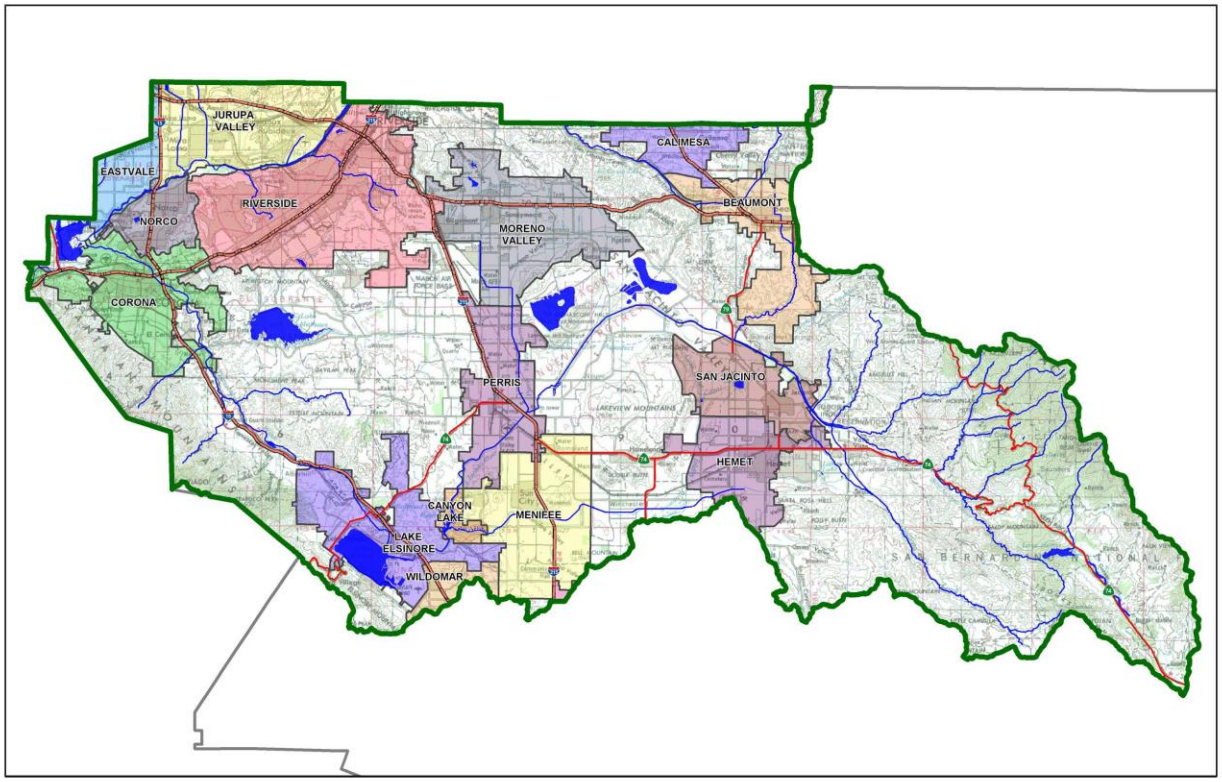
Project Specific Water Quality Management Plan

*A Template for Projects located within the **Santa Ana Watershed** Region of Riverside County*

Project Title: Crystal Cove

Development No: APN #: 484-030-028

Design Review/Case No: LWQ22-0010



☒ **Preliminary**
☐ **Final**

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Prepared for Compliance with
Regional Board Order No. **R8-2010-0033**

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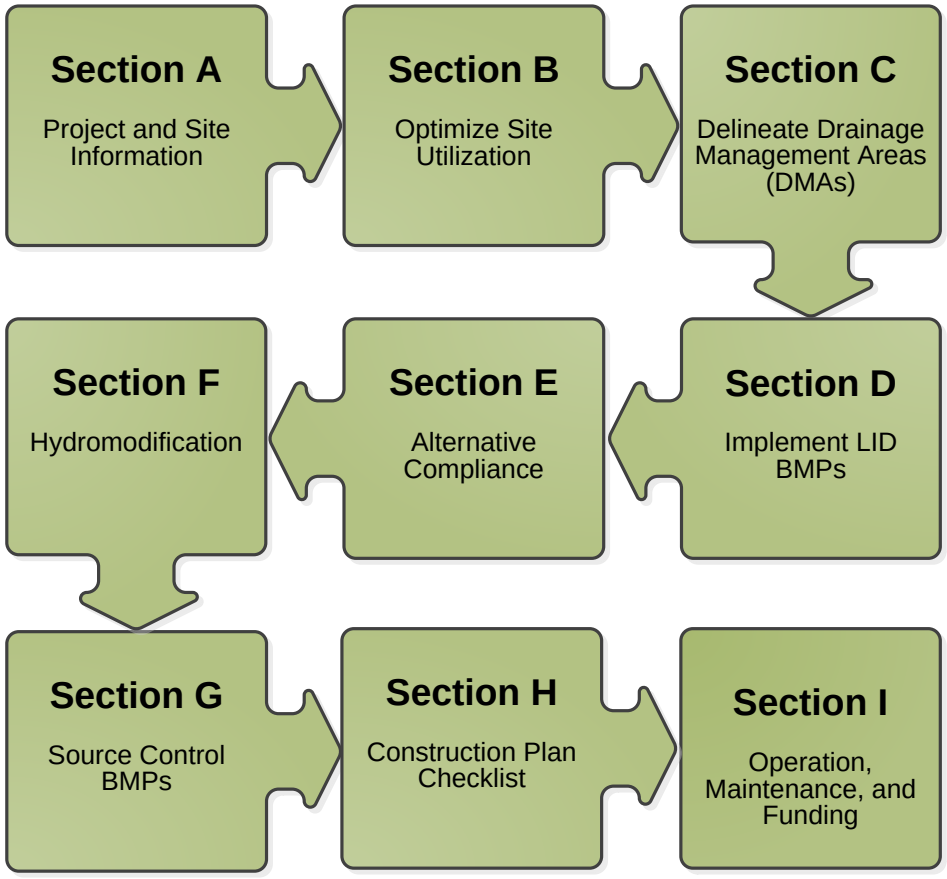
A Brief Introduction

This Project-Specific WQMP Template for the **Santa Ana Region** has been prepared to help guide you in documenting compliance for your project. Because this document has been designed to specifically document compliance, you will need to utilize the WQMP Guidance Document as your "how-to" manual to help guide you through this process. Both the Template and Guidance Document go hand-in-hand, and will help facilitate a well prepared Project-Specific WQMP. Below is a flowchart for the layout of this Template that will provide the steps required to document compliance.



OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for Empire Construction Management (Developer) by MDS Consulting for the Crystal Cove project.

This WQMP is intended to comply with the requirements of City of Moreno Valley for (Municipal Code Section 9.10.080) 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 and funding of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. In addition, the property owner accepts responsibility for interim operation and maintenance of Stormwater BMPs until such time as this responsibility is formally transferred to a subsequent owner. 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 Moreno Valley Water Quality Ordinance (Municipal Code Section 9.10.080).

"I, the undersigned, certify under penalty of law 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	Date: 10/12/22
Owner's Printed Name: Matthew Walters	Owner's Title/Position: Manager

PREPARER'S CERTIFICATION

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan meet the requirements of Regional Water Quality Control Board Order No. **R8-2010-0033** and any subsequent amendments thereto."

Preparer's Signature	Date: 10/12/22
Preparer's Printed Name: Edward J. Lenth, P.E.	Preparer's Title/Position: Principal

Preparer's Licensure:

REGISTERED PROFESSIONAL ENGINEER
EDWARD J. LENTH
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STATE OF CALIFORNIA

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Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Residential
Planning Area:	Corridor Mixed Use
Community Name:	Crystal Cove
Development Name:	Bear Valley and Alessandro Development Co.
PROJECT LOCATION	
Latitude & Longitude (DMS): 33˚54'59", -117˚12'36"	
Project Watershed and Sub-Watershed: Santa Ana Watershed, San Jacinto River Watershed	
Project Gross Area : 363,622 sf	
APN(s): 484-030-028	
Map Book and Page No.: Map Book 11, Page 10	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Residential
Proposed or Potential SIC Code(s)	1521
Area of Impervious Project Footprint (SF)	363,622
Total Area of proposed Impervious Surfaces within the Project limits (SF) / or replacement	246,938
Does the project consist of offsite road improvements?	☐ Y ☒ N
Does the project propose to construct unpaved roads?	☐ Y ☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y ☒ N
EXISTING SITE CHARACTERISTICS	
Total area of existing Impervious Surfaces within the project limits (SF)	0
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	N/A
Are there any natural hydrologic features on the project site?	☐ Y ☒ N
Is a Geotechnical Report attached?	☒ Y ☐ N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	B
What is the Water Quality Design Storm Depth for the project?	0.652

A.1 Maps and Site Plans

When completing your Project-Specific WQMP, include a map of the local vicinity and existing site. In addition, include all grading, drainage, landscape/plant palette and other pertinent construction plans in Appendix 2. At a **minimum**, your WQMP Site Plan should include the following:

- Drainage Management Areas
- Proposed Structural BMPs
- Drainage Path
- Drainage Infrastructure, Inlets, Overflows
- Source Control BMPs
- Buildings, Roof Lines, Downspouts
- Impervious Surfaces
- Standard Labeling

Use your discretion on whether or not you may need to create multiple sheets or can appropriately accommodate these features on one or two sheets. Keep in mind that the Co-Permittee plan reviewer must be able to easily analyze your project utilizing this template and its associated site plans and maps.

Project Description:

The project is located in the city of Moreno Valley. It is south of Alessandro Blvd, West of Lasselle St., and North of Copper Cove Ln. The project site is bounded on the north by Alessandro Blvd, on the east by Lasselle St., on the south by Copper Cove Ln., and west by the Moreno Hills Seventh-Day Adventist Church.

The project can be described as an attached residential development. The project will consist of nine apartments, a rec center/pool area, trash enclosures, parking lots, and private streets. Currently, the site sits as an unused vacant lot.

The 85th Percentile, 24 Hour storm will be diverted to an underground storage basin, and then it will be pumped to a proprietary biofiltration device for treatment. This device will be located on the east side of the site to maintain the natural drainage shape as much as possible. This device will be sized to handle the 85th percentile, 24-hour storm. Underground chambers will be installed to capture the difference between pre/post 100 yr. storm for mitigation. The runoff will then slowly be outletted through the flow based biofiltration device

A.2 Identify Receiving Waters

Using Table A.1 below, list in order of upstream to downstream, the receiving waters that the project site is tributary to. Continue to fill each row with the Receiving Water's 303(d) listed impairments (if any), designated beneficial uses, and proximity, if any, to a RARE beneficial use. Include a map of the receiving waters in Appendix 1.

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
San Jacinto River (Reach 3)	None	MUN-AGR-GWR-RECl1 – REC2-WARM-WILD-RARE	10.0 Miles
Canyon lake (San Jacinto River Reach 2)	Nutrients	MUN-AGR-GWR-REC1-REC2-WARM-WILD	N/A
San Jacinto River (Reach 1)	None	MUN-AGR-GWR-REC1-REC2-WARM-WILD-RARE	16.2 Miles
Lake Elsinore	Nutrients, DDI, PCBs, Organic Enrichment/Low Dissolved Oxygen	RECl-REC2-WARM-WILD	N/A
Temescal Wash	N/A	Mun, AGR, IND, PROC. REC1, REC2, WARM, COLD, WILD	N/A
Santa Ana River (Reach 3)	Copper (78216), Indicator Bacteria (97066), Lead (100184)	MUN, AGR, IND, PROC, GWR, NAV, POW, REC1, REC 2, COMM, WARM, COLD, BIOL, WILD, RARE, SPWN, MAR, and SHEL.	48 Miles
Santa Ana River (Reach 2)	Indicator Bacteria	AGR, GWR, REC1, REC2, WARM, WILD, RARE	52.0 miles
Santa Ana River (Reach 1	None	REC1, REC2, WARM, WILD	N/A
Pacific Ocean	None	IND, NAV, REC1, REC2, COMM, WILD, RARE, SPWN, MAR, SHEL	N/A

A.3 Additional Permits/Approvals required for the Project:

Table A.2 Other Applicable Permits

Agency	Permit Required	
State Department of Fish and Game, 1602 Streambed Alteration Agreement	☐ Y	☒ N
State Water Resources Control Board, Clean Water Act (CWA) Section 401 Water Quality Cert.	☐ 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
Western Riverside MSHCP Consistency Approval (e.g., JPR, DBESP)	☐ Y	☒ N
Other *(please list in the space below as required)* Grading Plan City of Moreno Valley	☒ Y	☐ N

If yes is answered to any of the questions above, the Co-Permittee may require proof of approval/coverage from those agencies as applicable including documentation of any associated requirements that may affect this Project-Specific WQMP.

Section B: Optimize Site Utilization (LID Principles)

Review of the information collected in Section 'A' will aid in identifying the principal constraints on site design and selection of LID BMPs as well as opportunities to reduce imperviousness and incorporate LID Principles into the site and landscape design. For example, **constraints** might include impermeable soils, high groundwater, groundwater pollution or contaminated soils, steep slopes, geotechnical instability, high-intensity land use, heavy pedestrian or vehicular traffic, utility locations or safety concerns. **Opportunities** might include existing natural areas, low areas, oddly configured or otherwise unbuildable parcels, easements and landscape amenities including open space and buffers (which can double as locations for bioretention BMPs), and differences in elevation (which can provide hydraulic head). Prepare a brief narrative for each of the site optimization strategies described below. This narrative will help you as you proceed with your LID design and explain your design decisions to others.

The 2010 Santa Ana MS4 Permit further requires that LID Retention BMPs (Infiltration Only or Harvest and Use) be used unless it can be shown that those BMPs are infeasible. Therefore, it is important that your narrative identify and justify if there are any constraints that would prevent the use of those categories of LID BMPs. Similarly, you should also note opportunities that exist which will be utilized during project design. Upon completion of identifying Constraints and Opportunities, include these on your WQMP Site plan in Appendix 1.

Site Optimization

The following questions are based upon Section 3.2 of the WQMP Guidance Document. Review of the WQMP Guidance Document will help you determine how best to optimize your site and subsequently identify opportunities and/or constraints, and document compliance.

Did you identify and preserve existing drainage patterns? If so, how? If not, why?

Yes, Project site will eventually discharge south of the project site similar to pre developed condition.

Did you identify and protect existing vegetation? If so, how? If not, why?

No. The entire site will be mass graded to accommodate the development, so it is not feasible to protect existing vegetation. This is based off of the recommendation of the soils engineer. In order to provide adequate structural support for the structures and roadway, compacted fill shall be constructed.

Landscaping will include drought resistant plants, trees, and turf grass.

Did you identify and preserve natural infiltration capacity? If so, how? If not, why?

Infiltration is infeasible due to low infiltration rates recorded onsite. Biofiltration shall be used.

Did you identify and minimize impervious area? If so, how? If not, why?

Yes. Impervious areas are limited to required streets, sidewalks and buildings. Each distinct area has been delineated on the WQMP plan. These areas are minimized to the extent possible in the site plan, using minimum roadway widths, minimum sidewalk widths, and maximizing landscape buffers as allowed in California Building Code.

Did you identify and disperse runoff to adjacent pervious areas? If so, how? If not, why?

No. Project site is a proposed high density residential area. There is limited pervious areas. Runoff generated from the site will be conveyed through proposed gutter and storm drain pipes.

Section C: Delineate Drainage Management Areas (DMAs)

Utilizing the procedure in Section 3.3 of the WQMP Guidance Document which discusses the methods of delineating and mapping your project site into individual DMAs, complete Table C.1 below to appropriately categorize the types of classification (e.g., Type A, Type B, etc.) per DMA for your project site. Upon completion of this table, this information will then be used to populate and tabulate the corresponding tables for their respective DMA classifications.

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1]	Area (Sq. Ft.)	DMA Type
1A	Ornamental Landscaping	50152	"D"
1B	Asphalt & Concrete (SW)	28725	"D"
1C	Roof	38999	"D"
1D	Asphalt & Concrete (Roadway)	70346	"D"
2A	Ornamental Landscaping	35524	"D"
2B	Asphalt & Concrete (SW)	22217	"D"
2C	Roof	40559	"D"
2D	Asphalt & Concrete (Roadway)	62921	"D"

[1]*Reference Table 2-1 in the WQMP Guidance Document to populate this column*

Table C.2 Type 'A', Self-Treating Areas

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)

Table C.3 Type 'B', Self-Retaining Areas

Self-Retaining Area				**Type 'C' DMAs that are draining to the Self-Retaining Area**		
DMA Name/ ID	Post-project surface type	Area (square feet) [A]	Storm Depth (inches) [B]	DMA Name / ID	[C] from Table C.4 = [C]	Required Retention Depth (inches) [D]

$$[D] = [B] + \frac{[B] \cdot [C]}{[A]}$$

Table C.4 Type 'C', Areas that Drain to Self-Retaining Areas

DMA					Receiving Self-Retaining DMA		
DMA Name/ ID	Area (square feet)	Post-project surface type	Runoff factor	Product	DMA name /ID	Area (square feet)	Ratio
	[A]		[B]	[C] = [A] x [B]		[D]	[C]/[D]

Table C.5 Type 'D', Areas Draining to BMPs

DMA Name or ID	BMP Name or ID
1A	Biofiltration - MWS
1B	Biofiltration - MWS
1C	Biofiltration - MWS
1D	Biofiltration - MWS
2A	Biofiltration - MWS
2B	Biofiltration - MWS
2C	Biofiltration - MWS
2D	Biofiltration - MWS

Note: More than one drainage management area can drain to a single LID BMP, however, one drainage management area may not drain to more than one BMP.

Section D: Implement LID BMPs

D.1 Infiltration Applicability

Is there an approved downstream 'Highest and Best Use' for stormwater runoff (see discussion in Chapter 2.4.4 of the WQMP Guidance Document for further details)? ☐ Y ☒ N

If yes has been checked, Infiltration BMPs shall not be used for the site. If no, continue working through this section to implement your LID BMPs. It is recommended that you contact your Co-Permittee to verify whether or not your project discharges to an approved downstream 'Highest and Best Use' feature.

Geotechnical Report

A Geotechnical Report or Phase I Environmental Site Assessment may be required by the Copermittee to confirm present and past site characteristics that may affect the use of Infiltration BMPs. In addition, the Co-Permittee, at their discretion, may not require a geotechnical report for small projects as described in Chapter 2 of the WQMP Guidance Document. If a geotechnical report has been prepared, include it in Appendix 3. In addition, if a Phase I Environmental Site Assessment has been prepared, include it in Appendix 4.

Is this project classified as a small project consistent with the requirements of Chapter 2 of the WQMP Guidance Document? ☐ Y ☒ N

Infiltration Feasibility

Table D.1 below is meant to provide a simple means of assessing which DMAs on your site support Infiltration BMPs and is discussed in the WQMP Guidance Document in Chapter 2.4.5. Check the appropriate box for each question and then list affected DMAs as applicable. If additional space is needed, add a row below the corresponding answer.

Table D.1 Infiltration Feasibility

Does the project site…	YES	NO
…have any DMAs with a seasonal high groundwater mark shallower than 10 feet?		x
If Yes, list affected DMAs:		
…have any DMAs located within 100 feet of a water supply well?		x
If Yes, list affected DMAs:		
…have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact?		x
If Yes, list affected DMAs:		
…have measured in-situ infiltration rates of less than 1.6 inches / hour?	x	
If Yes, list affected DMAs: DMA 1 & DMA 2		
…have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface?		x
If Yes, list affected DMAs:		
…geotechnical report identifies other site-specific factors that would preclude effective and safe infiltration?		x
Describe here:		

If you answered "Yes" to any of the questions above for any DMA, Infiltration BMPs should not be used for those DMAs and you should proceed to the assessment for Harvest and Use below.

D.2 Harvest and Use Assessment

Please check what applies*:*

☐ Reclaimed water will be used for the non-potable water demands for the project.

☐Downstream water rights may be impacted by Harvest and Use as approved by the Regional Board (verify with the Copermittee).

☐The Design Capture Volume will be addressed using Infiltration Only BMPs. In such a case, Harvest and Use BMPs are still encouraged, but it would not be required if the Design Capture Volume will be infiltrated or evapotranspired.

If any of the above boxes have been checked, Harvest and Use BMPs need not be assessed for the site. If neither of the above criteria applies, follow the steps below to assess the feasibility of irrigation use, toilet use and other non-potable uses (e.g., industrial use).

Irrigation Use Feasibility

Complete the following steps to determine the feasibility of harvesting stormwater runoff for Irrigation Use BMPs on your site:

Step 1: Identify the total area of irrigated landscape on the site, and the type of landscaping used.

Total Area of Irrigated Landscape: 2.36 Acres

Type of Landscaping (Conservation Design or Active Turf): Conservative Design

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for irrigation use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: 5.66 Acres

Step 3: Cross reference the Design Storm depth for the project site (see Exhibit A of the WQMP Guidance Document) with the left column of Table 2-3 in Chapter 2 to determine the minimum area of Effective Irrigated Area per Tributary Impervious Area (EIATIA).

Enter your EIATIA factor: 1.05

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum irrigated area that would be required.

Minimum required irrigated area: 5.94 Acres

Step 5: Determine if harvesting stormwater runoff for irrigation use is feasible for the project by comparing the total area of irrigated landscape (Step 1) to the minimum required irrigated area (Step 4).

Minimum required irrigated area (Step 4)	Available Irrigated Landscape (Step 1)
5.94 Acres	2.36 Acres

Toilet Use Feasibility

Complete the following steps to determine the feasibility of harvesting stormwater runoff for toilet flushing uses on your site:

Step 1: Identify the projected total number of daily toilet users during the wet season, and account for any periodic shut downs or other lapses in occupancy:

Projected Number of Daily Toilet Users: 308

Project Type: Residential

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for toilet use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: 5.66 Acres

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-1 in Chapter 2 to determine the minimum number or toilet users per tributary impervious acre (TUTIA).

Enter your TUTIA factor: 108

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum number of toilet users that would be required.

Minimum number of toilet users: 605

Step 5: Determine if harvesting stormwater runoff for toilet flushing use is feasible for the project by comparing the Number of Daily Toilet Users (Step 1) to the minimum required number of toilet users (Step 4).

Minimum required Toilet Users (Step 4)	**Projected number of toilet users (Step 1)**
605 Users	308 Users

Other Non-Potable Use Feasibility

Are there other non-potable uses for stormwater runoff on the site (e.g. industrial use)? See Chapter 2 of the Guidance for further information. If yes, describe below. If no, write N/A.

N/A

Step 1: Identify the projected average daily non-potable demand, in gallons per day, during the wet season and accounting for any periodic shut downs or other lapses in occupancy or operation.

Average Daily Demand: Projected Average Daily Use (gpd)

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for the identified non-potable use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: Insert Area (Acres)

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-3 in Chapter 2 to determine the minimum demand for non-potable uses per tributary impervious acre.

Enter the factor from Table 2-3: Enter Value

Step 4: Multiply the unit value obtained from Step 4 by the total of impervious areas from Step 3 to develop the minimum number of gallons per day of non-potable use that would be required.

Minimum required use: Minimum use required (gpd)

Step 5: Determine if harvesting stormwater runoff for other non-potable use is feasible for the project by comparing the Number of Daily Toilet Users (Step 1) to the minimum required number of toilet users (Step 4).

Minimum required non-potable use (Step 4)	**Projected average daily use (Step 1)**
Minimum use required (gpd)	Projected Average Daily Use (gpd)

If Irrigation, Toilet and Other Use feasibility anticipated demands are less than the applicable minimum values, Harvest and Use BMPs are not required and you should proceed to utilize LID Bioretention and Biotreatment, unless a site-specific analysis has been completed that demonstrates technical infeasibility as noted in D.3 below.

D.3 Bioretention and Biotreatment Assessment

Other LID Bioretention and Biotreatment BMPs as described in Chapter 2.4.7 of the WQMP Guidance Document are feasible on nearly all development sites with sufficient advance planning.

Select one of the following:

☑ LID Bioretention/Biotreatment BMPs will be used for some or all DMAs of the project as noted below in Section D.4 (note the requirements of Section 3.4.2 in the WQMP Guidance Document).

☐ A site-specific analysis demonstrating the technical infeasibility of all LID BMPs has been performed and is included in Appendix 5. If you plan to submit an analysis demonstrating the technical infeasibility of LID BMPs, request a pre-submittal meeting with the Copermittee to discuss this option. Proceed to Section E to document your alternative compliance measures.

D.4 Feasibility Assessment Summaries

From the Infiltration, Harvest and Use, Bioretention and Biotreatment Sections above, complete Table D.2 below to summarize which LID BMPs are technically feasible, and which are not, based upon the established hierarchy.

Table D.2 LID Prioritization Summary Matrix

DMA Name/ID	LID BMP Hierarchy				No LID (Alternative Compliance)
	1. Infiltration	2. Harvest and use	3. Bioretention	4. Biotreatment	
1A	☐	☐	☐	☒	☐
1B	☐	☐	☐	☒	☐
1C	☐	☐	☐	☒	☐
1D	☐	☐	☐	☒	☐
2A	☐	☐	☐	☒	☐
2B	☐	☐	☐	☒	☐
2C	☐	☐	☐	☒	☐
2D	☐	☐	☐	☒	☐

For those DMAs where LID BMPs are not feasible, provide a brief narrative below summarizing why they are not feasible, include your technical infeasibility criteria in Appendix 5, and proceed to Section E below to document Alternative Compliance measures for those DMAs. Recall that each proposed DMA must pass through the LID BMP hierarchy before alternative compliance measures may be considered.

D.5 LID BMP Sizing

Each LID BMP must be designed to ensure that the Design Capture Volume will be addressed by the selected BMPs. First**,** calculate the Design Capture Volume for each LID BMP using the V_{BMP} worksheet in Appendix F of the LID BMP Design Handbook. Second**,** design the LID BMP to meet the required V_{BMP} using a method approved by the Copermittee. Utilize the worksheets found in the LID BMP Design Handbook or consult with your Copermittee to assist you in correctly sizing your LID BMPs. Complete Table D.3 below to document the Design Capture Volume and the Proposed Volume for each LID BMP. Provide the completed design procedure sheets for each LID BMP in Appendix 6. You may add additional rows to the table below as needed.

Table D.3 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet) [A]	Post-Project Surface Type	Effective Impervious Fraction, I_f [B]	DMA Runoff Factor [C]	DMA Areas x Runoff Factor [A] x [C]	*Detention Basin to MWS*		
1A	*50,152*	*Landscaping*	*0.1*	*0.11*	*5,516*			
1B	*28,725*	*Concrete or Asphalt (SW)*	*1*	*0.89*	*25,565*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
1C	*38,999*	*Roofs*	*1*	*0.89*	*34,709*			
1D	*70,346*	*Concrete or Asphalt(Roadway)*	*1*	*0.89*	*62,608*			
	188,222				128,399	0.65	6,955	13,226

DMA Type/ID	DMA Area (square feet) [A]	Post-Project Surface Type	Effective Impervious Fraction, I_f [B]	DMA Runoff Factor [C]	DMA Areas x Runoff Factor [A] x [C]	*Detention Basin to MWS*		
2A	*35,524*	*Landscaping*	*0.1*	*0.11*	*3,908*			
2B	*22,217*	*Concrete or Asphalt (SW)*	*1*	*0.89*	*19,773*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
2C	*40,559*	*Roofs*	*1*	*0.89*	*36,097*			
2D	*62,921*	*Concrete or Asphalt(Roadway*	*1*	*0.89*	*55,600*			
	163,288				115,778	0.65	6,271	13,226

[B], [C] is obtained as described in Section 2.3.1 of the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

Section E: Alternative Compliance (LID Waiver Program)

LID BMPs are expected to be feasible on virtually all projects. Where LID BMPs have been demonstrated to be infeasible as documented in Section D, other Treatment Control BMPs must be used (subject to LID waiver approval by the Copermittee). Check one of the following Boxes:

☑ LID Principles and LID BMPs have been incorporated into the site design to fully address all Drainage Management Areas. No alternative compliance measures are required for this project and thus this Section is not required to be completed.

- *Or* -

☐ The following Drainage Management Areas are unable to be addressed using LID BMPs. A site-specific analysis demonstrating technical infeasibility of LID BMPs has been approved by the Co-Permittee and included in Appendix 5. Additionally, no downstream regional and/or sub-regional LID BMPs exist or are available for use by the project. The following alternative compliance measures on the following pages are being implemented to ensure that any pollutant loads expected to be discharged by not incorporating LID BMPs, are fully mitigated.

E.1 Identify Pollutants of Concern

Utilizing Table A.1 from Section A above which noted your project's receiving waters and their associated EPA approved 303(d) listed impairments, cross reference this information with that of your selected Priority Development Project Category in Table E.1 below. If the identified General Pollutant Categories are the same as those listed for your receiving waters, then these will be your Pollutants of Concern and the appropriate box or boxes will be checked on the last row. The purpose of this is to document compliance and to help you appropriately plan for mitigating your Pollutants of Concern in lieu of implementing LID BMPs.

Table E.1 Potential Pollutants by Land Use Type

Priority Development Project Categories and/or Project Features (check those that apply)	General Pollutant Categories							
	Bacterial Indicators	Metals	Nutrients	Pesticides	Toxic Organic Compounds	Sediments	Trash & Debris	Oil & Grease
☐ Detached Residential Development	P	N	P	P	N	P	P	P
☒ Attached Residential Development	P	N	P	P	N	P	P	P(2)
☐ Commercial/Industrial Development	P(3)	P	P(1)	P(1)	P(5)	P(1)	P	P
☐ Automotive Repair Shops	N	P	N	N	P(4, 5)	N	P	P
☐ Restaurants (>5,000 ft^2)	P	N	N	N	N	N	P	P
☐ Hillside Development (>5,000 ft^2)	P	N	P	P	N	P	P	P
☐ Parking Lots (>5,000 ft^2)	P(6)	P	P(1)	P(1)	P(4)	P(1)	P	P
☐ Retail Gasoline Outlets	N	P	N	N	P	N	P	P
Project Priority Pollutant(s) of Concern	☒	☐	☒	☐	☒	☐	☒	☒

P = Potential

N = Not Potential

(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 is land use involving animal waste

(4) Specifically petroleum hydrocarbons

(5) Specifically solvents

(6) Bacterial indicators are routinely detected in pavement runoff

E.2 Stormwater Credits

Projects that cannot implement LID BMPs but nevertheless implement smart growth principles are potentially eligible for Stormwater Credits. Utilize Table 3-8 within the WQMP Guidance Document to identify your Project Category and its associated Water Quality Credit. If not applicable, write N/A.

Table E.2 Water Quality Credits

Qualifying Project Categories	Credit Percentage[2]
Total Credit Percentage[1]	

[1]*Cannot Exceed 50%*
[2]*Obtain corresponding data from Table 3-8 in the WQMP Guidance Document*

E.3 Sizing Criteria

After you appropriately considered Stormwater Credits for your project, utilize Table E.3 below to appropriately size them to the DCV, or Design Flow Rate, as applicable. Please reference Chapter 3.5.2 of the WQMP Guidance Document for further information.

Table E.3 Treatment Control BMP Sizing

DMA Type/ ID	**DMA Area (square feet)** [A]	**Post-Project Surface Type**	**Effective Imperviousness Fraction, I_f** [B]	**DMA Runoff Factor** [C]	**DMA Area x Runoff Factor** [A] x [C]		***Proprietary Biofiltration Device 1***		
N/A	N/A	N/A	N/A	N/A	N/A	*Design Storm Intensity (in/hr)*	*Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)*	*Total Storm Water Credit % Reduction*	*Proposed Volume or Flow on Plans (cubic feet or cfs)*
	A_T = Σ[A]	***N/A***			Σ= N/A	N/A	N/A	N/A	N/A

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12
[H] is from the Total Credit Percentage as Calculated from Table E.2 above
[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

Table E.4 Treatment Control BMP Sizing

DMA Type/ ID	DMA Area (square feet) [A]	Post-Project Surface Type	Effective Impervious Fraction, I_f [B]	DMA Runoff Factor [C]	DMA Area x Runoff Factor [A] x [C]		*Proprietary Biofiltration Device 2*		
N/A	N/A	N/A	N/A	N/A	N/A	*Design Storm Intensity (in/hr)*	*Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)*	*Total Storm Water Credit % Reduction*	*Proposed Volume or Flow on Plans (cubic feet or cfs)*
	A_T = Σ[A]	***N/A***			Σ= N/A	N/A	N/A	N/A	N/A

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12
[H] is from the Total Credit Percentage as Calculated from Table E.2 above
[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

E.4 Treatment Control BMP Selection

Treatment Control BMPs typically provide proprietary treatment mechanisms to treat potential pollutants in runoff, but do not sustain significant biological processes. Treatment Control BMPs must have a removal efficiency of a medium or high effectiveness as quantified below:

- **High**: equal to or greater than 80% removal efficiency
- **Medium**: between 40% and 80% removal efficiency

Such removal efficiency documentation (e.g., studies, reports, etc.) as further discussed in Chapter 3.5.2 of the WQMP Guidance Document, must be included in Appendix 6. In addition, ensure that proposed Treatment Control BMPs are properly identified on the WQMP Site Plan in Appendix 1.

Table E.5 Treatment Control BMP Selection

Selected Treatment Control BMP Name or ID[1]	Priority Pollutant(s) of Concern to Mitigate[2]	Removal Efficiency Percentage[3]
MWS Modular Wetland	Bacteria Indicators Nutrients Toxic Organic Compounds Trash & Debris	TSS > 80% Metals 40-50% Nutrients > 55%

[1] Treatment Control BMPs must not be constructed within Receiving Waters. In addition, a proposed Treatment Control BMP may be listed more than once if they possess more than one qualifying pollutant removal efficiency.
[2] Cross Reference Table E.1 above to populate this column.
[3] As documented in a Co-Permittee Approved Study and provided in Appendix 6.

Section F: Hydromodification

F.1 Hydrologic Conditions of Concern (HCOC) Analysis

Once you have determined that the LID design is adequate to address water quality requirements, you will need to assess if the proposed LID Design may still create a HCOC. Review Chapters 2 and 3 (including Figure 3-7) of the WQMP Guidance Document to determine if your project must mitigate for Hydromodification impacts. If your project meets one of the following criteria which will be indicated by the check boxes below, you do not need to address Hydromodification at this time. However, if the project does not qualify for Exemptions 1, 2 or 3, then additional measures must be added to the design to comply with HCOC criteria. This is discussed in further detail below in Section F.2.

HCOC EXEMPTION 1: The Priority Development Project disturbs less than one acre. The Copermittee has the discretion to require a Project-Specific WQMP to address HCOCs on projects less than one acre on a case-by-case basis. The disturbed area calculation should include all disturbances associated with larger common plans of development.

Does the project qualify for this HCOC Exemption? 1

Y ☒ N

If Yes, HCOC criteria do not apply.

HCOC EXEMPTION 2: The volume and time of concentration[1] of storm water runoff for the post-development condition is not significantly different from the pre-development condition for a 2-year return frequency storm (a difference of 5% or less is considered insignificant) using one of the following methods to calculate:

- Riverside County Hydrology Manual
- Technical Release 55 (TR-55): Urban Hydrology for Small Watersheds (NRCS 1986), or derivatives thereof, such as the Santa Barbara Urban Hydrograph Method
- Other methods acceptable to the Co-Permittee

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, report results in Table F.1 below and provide your substantiated hydrologic analysis in Appendix 7.

Table F.1 Hydrologic Conditions of Concern Summary

	2 year – 24 hour		
	Pre-condition	**Post-condition**	**% Difference**
Time of Concentration	INSERT VALUE	INSERT VALUE	INSERT VALUE
Volume (Cubic Feet)	INSERT VALUE	INSERT VALUE	INSERT VALUE

[1] Time of concentration is defined as the time after the beginning of the rainfall when all portions of the drainage basin are contributing to flow at the outlet.

HCOC EXEMPTION 3: All downstream conveyance channels to an adequate sump (for example, Prado Dam, Lake Elsinore, Canyon Lake, Santa Ana River, or other lake, reservoir or naturally erosion resistant feature) that will receive runoff from the project are engineered and regularly maintained to ensure design flow capacity; no sensitive stream habitat areas will be adversely affected; or are not identified on the Co-Permittees Hydromodification Sensitivity Maps.

Does the project qualify for this HCOC Exemption? ☒ Y ☐ N

If Yes, HCOC criteria do not apply and note below which adequate sump applies to this HCOC qualifier:

Drains to Lake Elsinore through engineered channels. See HCOC Feasibility map in the appendix for more information.

F.2 HCOC Mitigation

If none of the above HCOC Exemption Criteria are applicable, HCOC criteria is considered mitigated if they meet one of the following conditions:

a. Additional LID BMPS are implemented onsite or offsite to mitigate potential erosion or habitat impacts as a result of HCOCs. This can be conducted by an evaluation of site-specific conditions utilizing accepted professional methodologies published by entities such as the California Stormwater Quality Association (CASQA), the Southern California Coastal Water Research Project (SCCRWP), or other Co-Permittee approved methodologies for site-specific HCOC analysis.

b. The project is developed consistent with an approved Watershed Action Plan that addresses HCOC in Receiving Waters.

c. Mimicking the pre-development hydrograph with the post-development hydrograph, for a 2-year return frequency storm. Generally, the hydrologic conditions of concern are not significant, if the post-development hydrograph is no more than 10% greater than pre-development hydrograph. In cases where excess volume cannot be infiltrated or captured and reused, discharge from the site must be limited to a flow rate no greater than 110% of the pre-development 2-year peak flow.

Be sure to include all pertinent documentation used in your analysis of the items a, b or c in Appendix 7.

Section G: Source Control BMPs

Source control BMPs include permanent, structural features that may be required in your project plans — such as roofs over and berms around trash and recycling areas — and Operational BMPs, such as regular sweeping and "housekeeping", that must be implemented by the site's occupant or user. The MEP standard typically requires both types of BMPs. In general, Operational BMPs cannot be substituted for a feasible and effective permanent BMP. Using the Pollutant Sources/Source Control Checklist in Appendix 8, review the following procedure to specify Source Control BMPs for your site:

1. ***Identify Pollutant Sources*:** Review Column 1 in the Pollutant Sources/Source Control Checklist. Check off the potential sources of Pollutants that apply to your site.

2. ***Note Locations on Project-Specific WQMP Exhibit*:** Note the corresponding requirements listed in Column 2 of the Pollutant Sources/Source Control Checklist. Show the location of each Pollutant source and each permanent Source Control BMP in your Project-Specific WQMP Exhibit located in Appendix 1.

3. ***Prepare a Table and Narrative*:** Check off the corresponding requirements listed in Column 3 in the Pollutant Sources/Source Control Checklist. In the left column of Table G.1 below, list each potential source of runoff Pollutants on your site (from those that you checked in the Pollutant Sources/Source Control Checklist). In the middle column, list the corresponding permanent, Structural Source Control BMPs (from Columns 2 and 3 of the Pollutant Sources/Source Control Checklist) used to prevent Pollutants from entering runoff. **Add additional narrative** in this column that explains any special features, materials or methods of construction that will be used to implement these permanent, Structural Source Control BMPs.

4. ***Identify Operational Source Control BMPs:*** To complete your table, refer once again to the Pollutant Sources/Source Control Checklist. List in the right column of your table the Operational BMPs that should be implemented as long as the anticipated activities continue at the site. Copermittee stormwater ordinances require that applicable Source Control BMPs be implemented; the same BMPs may also be required as a condition of a use permit or other revocable Discretionary Approval for use of the site.

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
A. On-site storm drain inlets	Locations of inlets.	• Maintain and periodically repaint or replace inlet markings. • See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at

		www.cabmphandbooks.com
D2. Landscape/ Outdoor Pesticide Use	Show self-retaining landscape areas, if any.	• Maintain landscaping using minimum or no pesticides. • See applicable operational BMPs in "What you should know for…..Landscape and Gardening" at http://rcflood.org/stormwater
G. Refuse areas	Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas. If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run- on and show locations of berms to prevent runoff from the area.	Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
J. Vehicle and Equipment Cleaning	Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shut- off to discourage such use). (3) Washing areas for cars, vehicles	Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system. Refer to "Outdoor Cleaning Activities and Professional Mobile Service Providers" for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/
K. Vehicle/Equipment Repair and Maintenance	Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater.	• No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains.

		• No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment. Refer to "Automotive Maintenance & Car Care Best Management Practices for Auto Body Shops, Auto Repair Shops, Car Dealerships, Gas Stations and FleetService Operations". Brochure can be found at http://rcflood.org/stormwater/ Refer to Outdoor Cleaning Activities and Professional Mobile Service Providers for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/
Condensate drain lines Roofing, gutters, and trim.	Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches. Foundation Planting – Landscape Planting can	

	be provided around the base to allow for increased opportunities for stormwater infiltration. See CASQA BMP SD-11 Roof Runoff Controls for more.	
P. Plazas, sidewalks, and parking lots.		Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Section H: Construction Plan Checklist

Populate Table H.1 below to assist the plan checker in an expeditious review of your project. The first two columns will contain information that was prepared in previous steps, while the last column will be populated with the corresponding plan sheets. This table is to be completed with the submittal of your final Project-Specific WQMP.

Table H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)
	Will be provided for Final WQMP	

Note that the updated table — or Construction Plan WQMP Checklist — is **only a reference tool** to facilitate an easy comparison of the construction plans to your Project-Specific WQMP. Co-Permittee staff can advise you regarding the process required to propose changes to the approved Project-Specific WQMP.

Section I: Operation, Maintenance and Funding

The Copermittee will periodically verify that Stormwater BMPs on your site are maintained and continue to operate as designed. To make this possible, your Copermittee will require that you include in Appendix 9 of this Project-Specific WQMP:

1. A means to finance and implement facility maintenance in perpetuity, including replacement cost.
2. Acceptance of responsibility for maintenance from the time the BMPs are constructed until responsibility for operation and maintenance is legally transferred. A warranty covering a period following construction may also be required.
3. An outline of general maintenance requirements for the Stormwater BMPs you have selected.
4. Figures delineating and designating pervious and impervious areas, location, and type of Stormwater BMP, and tables of pervious and impervious areas served by each facility. Geo-locating the BMPs using a coordinate system of latitude and longitude is recommended to help facilitate a future statewide database system.
5. A separate list and location of self-retaining areas or areas addressed by LID Principles that do not require specialized O&M or inspections but will require typical landscape maintenance as noted in Chapter 5, pages 85-86, in the WQMP Guidance. Include a brief description of typical landscape maintenance for these areas.

Your local Co-Permittee will also require that you prepare and submit a detailed Stormwater BMP Operation and Maintenance Plan that sets forth a maintenance schedule for each of the Stormwater BMPs built on your site. An agreement assigning responsibility for maintenance and providing for inspections and certification may also be required.

Details of these requirements and instructions for preparing a Stormwater BMP Operation and Maintenance Plan are in Chapter 5 of the WQMP Guidance Document.

Maintenance Mechanism: HOA

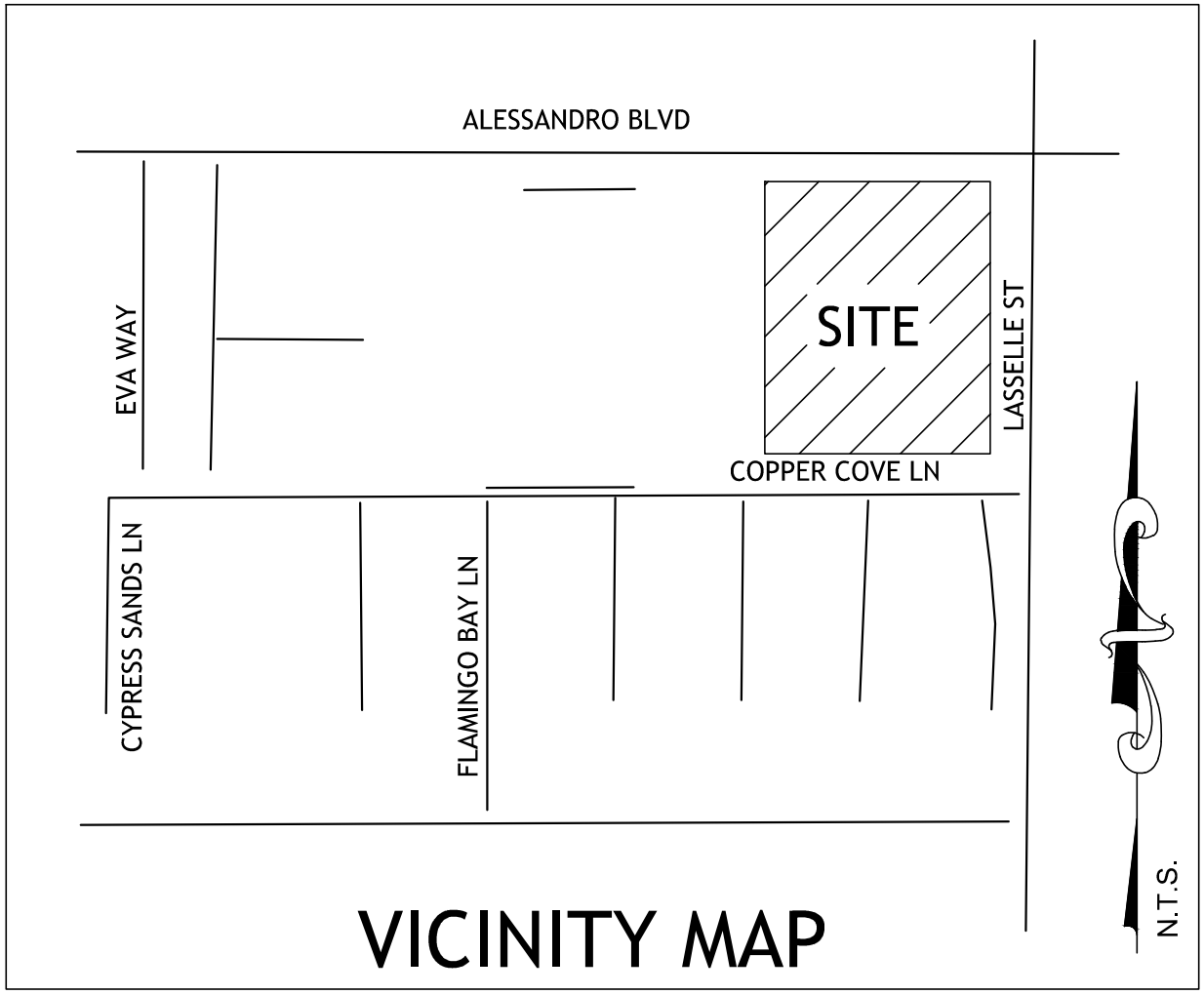
Will the proposed BMPs be maintained by a Home Owners' Association (HOA) or Property Owners Association (POA)?

☒ Y ☐ N

Include your Operation and Maintenance Plan and Maintenance Mechanism in Appendix 9. Additionally, include all pertinent forms of educational materials for those personnel that will be maintaining the proposed BMPs within this Project-Specific WQMP in Appendix 10.

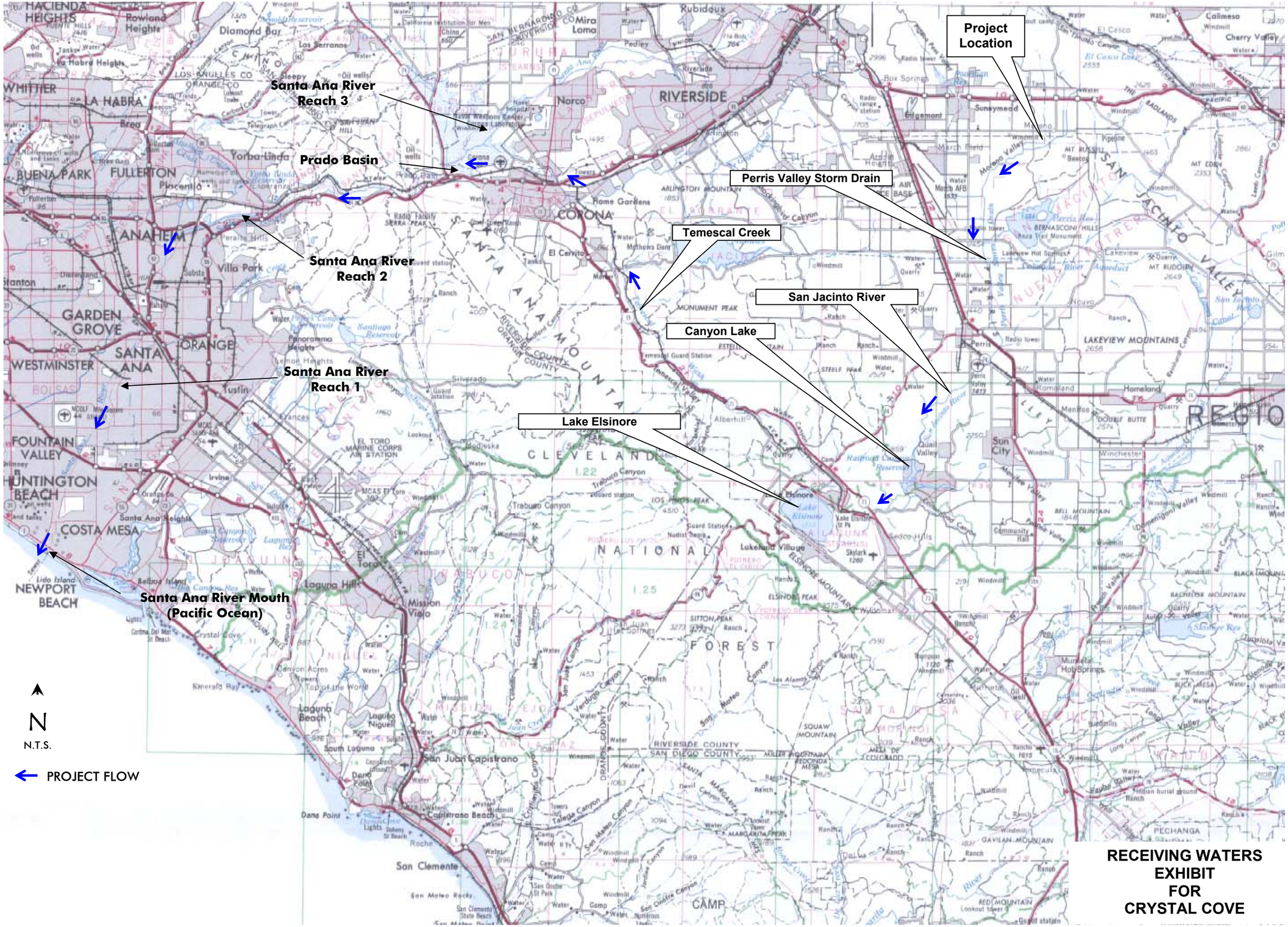
Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map

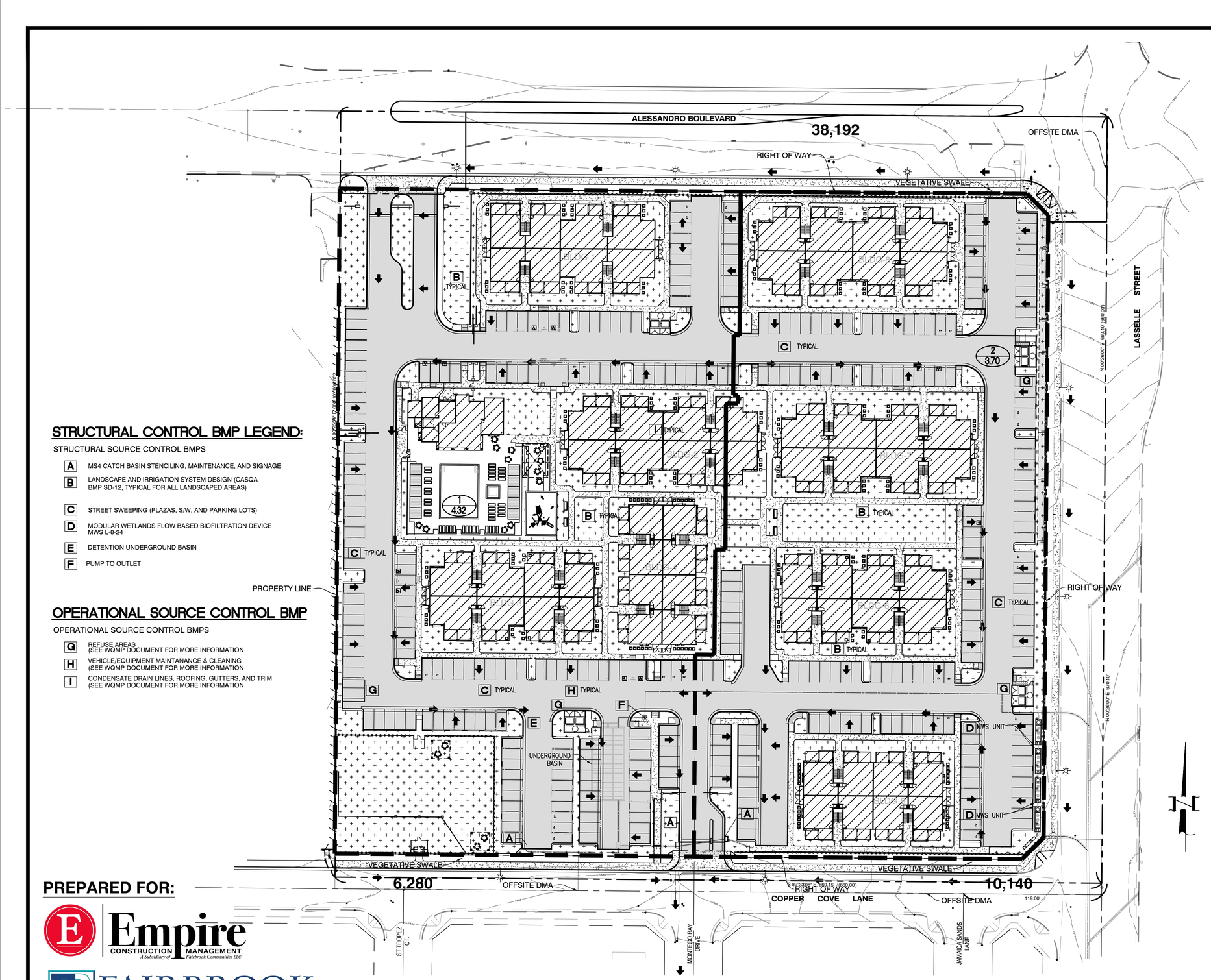


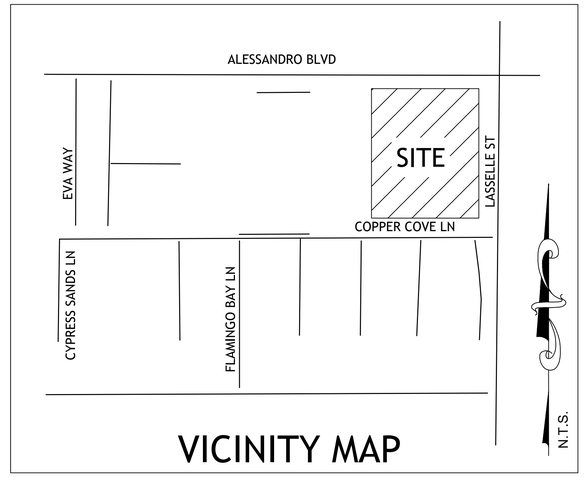
VICINITY MAP

CRYSTAL COVE
CITY OF MORENO VALLEY



RECEIVING WATERS EXHIBIT FOR CRYSTAL COVE





VICINITY MAP

NOTE:

1. SOIL TYPE "B" SOIL

LEGEND

- A / 10 — DRAINAGE MANAGEMENT AREA No. / DRAINAGE AREA (ACRE)
- CATCHBASIN
- STORMDRAIN PIPE
- DIRECTION OF FLOW
- DRAINAGE AREA BOUNDARY
- LANDSCAPE
- ROOF
- STREET/CONCRETE
- SIDEWALK

BMP SUMMARY

DETENTION UNDERGROUND BASIN WITH BIOFILTRATION		
BASIN 1	Vbmp	BASIN CAPACITY
	13,226-CU-FT	13,226 CU-FT
OFFSITE SWALE SIZING		
	Qbmp	Q PROVIDED
SWALE 1	0.1 CFS	0.1 CFS
SWALE 2	0.1 CFS	0.1 CFS
SWALE 3	0.1 CFS	0.1 CFS

NOTE: 1 CFS IS EQUIVALENT TO 86,400 CF PER DAY

STRUCTURAL CONTROL BMP LEGEND:

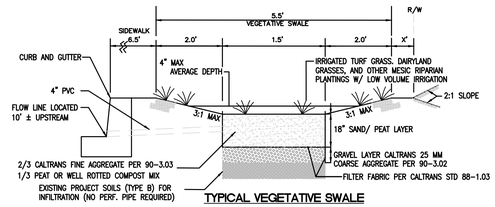
STRUCTURAL SOURCE CONTROL BMPS

- A — MS4 CATCH BASIN STENCILING, MAINTENANCE, AND SIGNAGE
- B — LANDSCAPE AND IRRIGATION SYSTEM DESIGN (CASQA BMP SD-12, TYPICAL FOR ALL LANDSCAPED AREAS)
- C — STREET SWEEPING (PLAZAS, S/W, AND PARKING LOTS)
- D — MODULAR WETLANDS FLOW BASED BIOFILTRATION DEVICE MWS L-8-24
- E — DETENTION UNDERGROUND BASIN
- F — PUMP TO OUTLET

OPERATIONAL SOURCE CONTROL BMP

OPERATIONAL SOURCE CONTROL BMPS

- G — REFUSE AREAS (SEE WQMP DOCUMENT FOR MORE INFORMATION
- H — VEHICLE/EQUIPMENT MAINTANANCE & CLEANING (SEE WQMP DOCUMENT FOR MORE INFORMATION
- I — CONDENSATE DRAIN LINES, ROOFING, GUTTERS, AND TRIM (SEE WQMP DOCUMENT FOR MORE INFORMATION



TYPICAL VEGETATIVE SWALE

N.T.S.

PREPARED FOR:

Empire CONSTRUCTION MANAGEMENT
A Subsidiary of Fairbrook Communities LLC

FAIRBROOK COMMUNITIES LLC

DMA 1 SUMMARY

DMA ID	AREA (SF)	AREA (AC)	LAND USE	IMPERVIOUS
DMA 1A	50,152	1.15	ORNAMENTAL LANDSCAPE	0.10
DMA 1B	28,725	0.66	SIDEWALKS	1.00
DMA 1C	38,999	0.90	ROOFS	1.00
DMA 1D	70,346	1.61	ROADWAY	1.00
∑ TOTAL	181,222	4.32	MIXED	72.3%

DMA 2 SUMMARY

DMA ID	AREA (SF)	AREA (AC)	LAND USE	IMPERVIOUS
DMA 2A	35,524	0.82	ORNAMENTAL LANDSCAPE	0.10
DMA 2B	22,217	0.51	SIDEWALKS	1.00
DMA 2C	40,559	0.93	ROOFS	1.00
DMA 2D	62,921	1.44	ROADWAY	1.00
∑ TOTAL	161,221	3.70	MIXED	77.9%

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

REGISTERED PROFESSIONAL ENGINEER
EDWARD J. LEAHY
No. 052496
Exp. 12-31-22
CIVIL
STATE OF CALIFORNIA

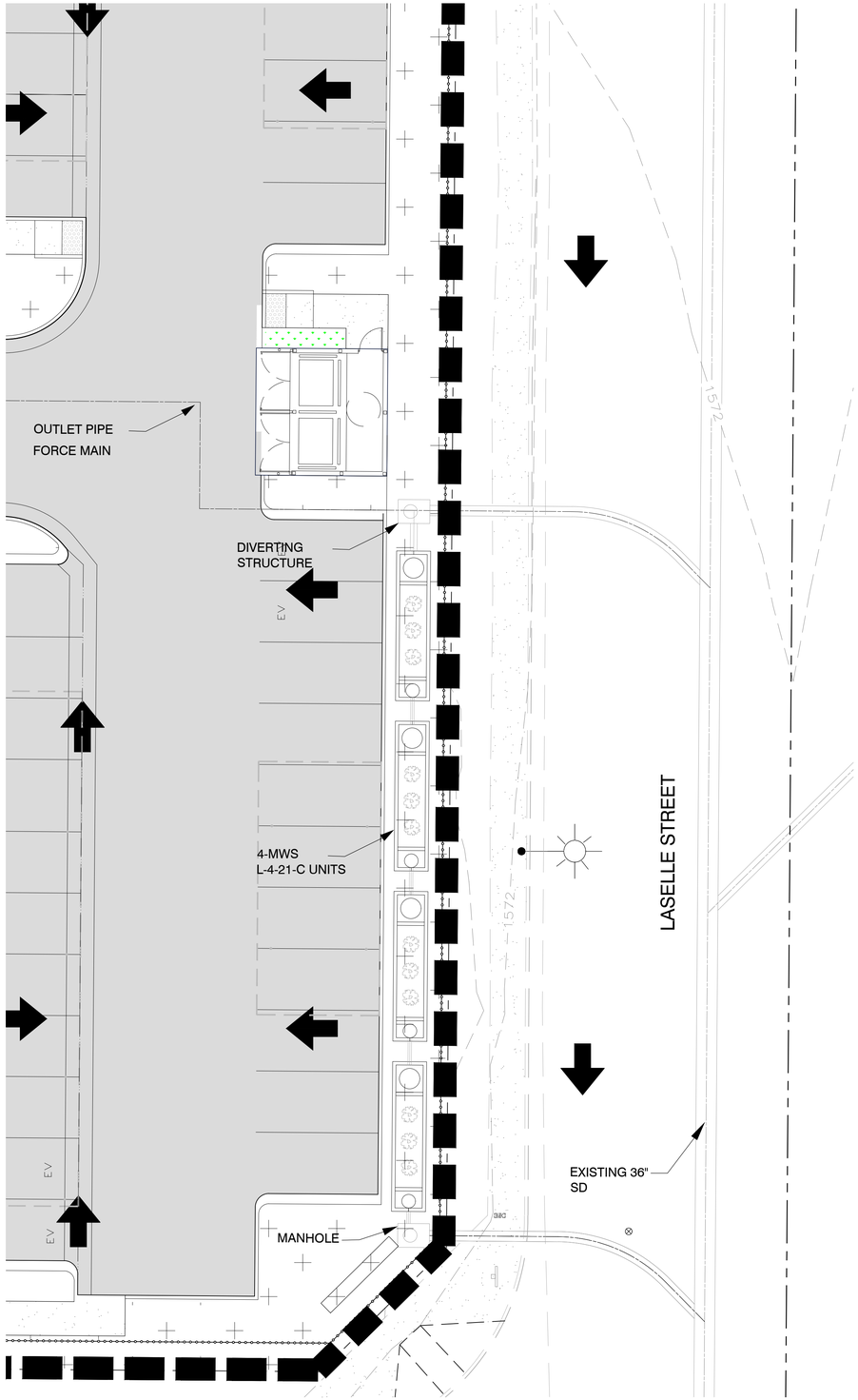
Date	By	REVISIONS	App'd

MDS CONSULTING
MORSE SCHULTZ
17320 Redhill Ave. Suite 350 Irvine, CA 92614
Voice: 949-251-8821 FAX: 949-251-0316
PLANNERS ENGINEERS SURVEYORS

PLATE 1

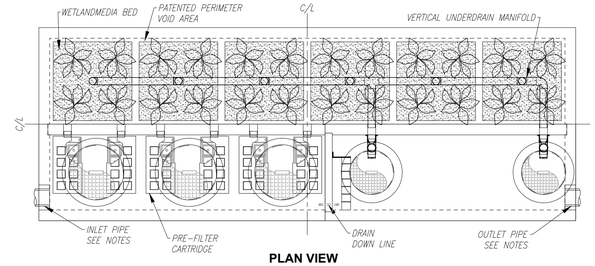
CRYSTAL COVE
PRELIMINARY WQMP MAP
CITY OF MORENO VALLEY
RIVERSIDE COUNTY

Last Revised: Thu Oct 06, 2022 – 9:40am Last Plotted: Thu Oct 06, 2022 – 11:49am Plotted By: jwagner Drawing: I:\92600\DRAINAGE\WQMP\PRELIMINARY\Drawing\92600-PRELIM WQMP MAP.dwg

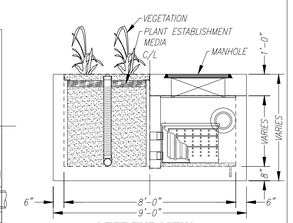


POINT OF CONNECTION
NTS

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD			
FRAME & COVER	3EA ø30"		2EA ø24"
NOTES:			



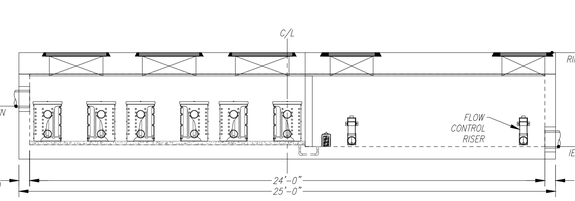
PLAN VIEW



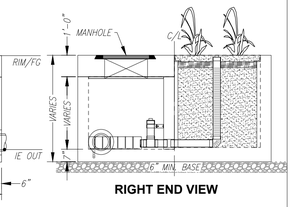
LEFT END VIEW

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.



ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	
OPERATING HEAD (FT)	
PRETREATMENT LOADING RATE (GPM/SF)	
WETLAND MEDIA LOADING RATE (GPM/SF)	

GENERAL NOTES

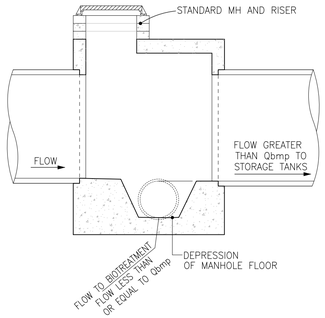
1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT BIO CLEAN.

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,263; 7,470,360; 7,674,378; 8,123,616; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

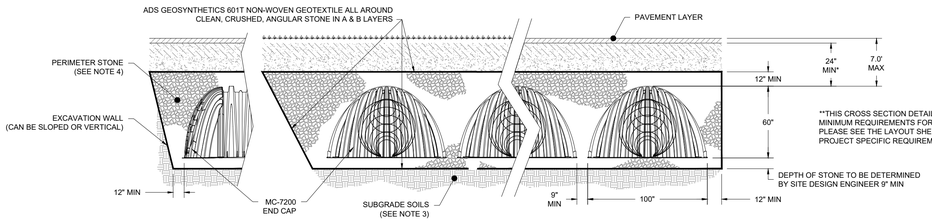
PROPRIETARY AND CONFIDENTIAL:
THE INFORMATION CONTAINED IN THIS DOCUMENT IS THE SOLE PROPERTY OF FORTERRA AND ITS COMPANIES. THIS DOCUMENT, NOR ANY PART THEREOF, MAY BE USED, REPRODUCED OR MODIFIED IN ANY MANNER WITH OUT THE WRITTEN CONSENT OF FORTERRA.

Bio Clean
A Forterra Company

MWS-L-8-24-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL



DIVERTING STRUCTURE
DETAIL
NOT TO SCALE



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101
2. MC-7200 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

SC-740 STORAGE BASIN
DETAIL
NOT TO SCALE

MDS CONSULTING
MORSE SCHULTZ
PLANNERS ENGINEERS SURVEYORS
17320 Redhill Ave, Suite 330
Irvine, CA 92614
Voice: 949-251-8851
FAX: 949-251-0316

PLATE 2

CRYSTAL COVE
PRELIMINARY WQMP MAP
CITY OF MORENO VALLEY
RIVERSIDE COUNTY

Appendix 2: Construction Plans

Grading and Drainage Plans

GENERAL INFORMATION

1. EXISTING LAND USE: VACANT
2. EXISTING ZONING: CORRIDOR MIXED USE (COMU)
3. PROPOSED LAND USE: COMU - APARTMENTS
4. PROPOSED ZONING: COMU
5. ADJACENT LAND USE AND ZONING:
   - NORTH: VACANT, COMU - CORRIDOR MIXED USE
   - EAST: VACANT, DOWNTOWN CENTER (DC)
   - SOUTH: SINGLE FAMILY RESIDENTIAL, RS SUBURBAN RESIDENTIAL
   - WEST: MORENO HILLS SEVENTH - DAY ADVENTIST CHURCH - OFFICE
6. SCHOOL DISTRICTS: MORENO VALLEY UNIFIED SCHOOL DISTRICT
   - ELEMENTARY: HENDRICK RANCH ELEMENTARY SCHOOL
   - MIDDLE SCHOOL: MOUNTAIN VIEW MIDDLE SCHOOL
   - HIGH SCHOOL: VALLEY VIEW HIGH SCHOOL
7. GEOTECHNICAL / SOILS INVESTIGATION REPORT WAS PREPARED BY LOR GEOTECHNICAL GROUP, INC DATED OCTOBER 20, 2021
8. FIRM MAP, NO. 06065C0765G, DATED AUGUST 28, 2008
   ZONE X
9. GROSS AREA - 10.0 AC
   NET AREA - 8.0 AC

ADJACENT PROPERTIES:

NORTH
479-031-010

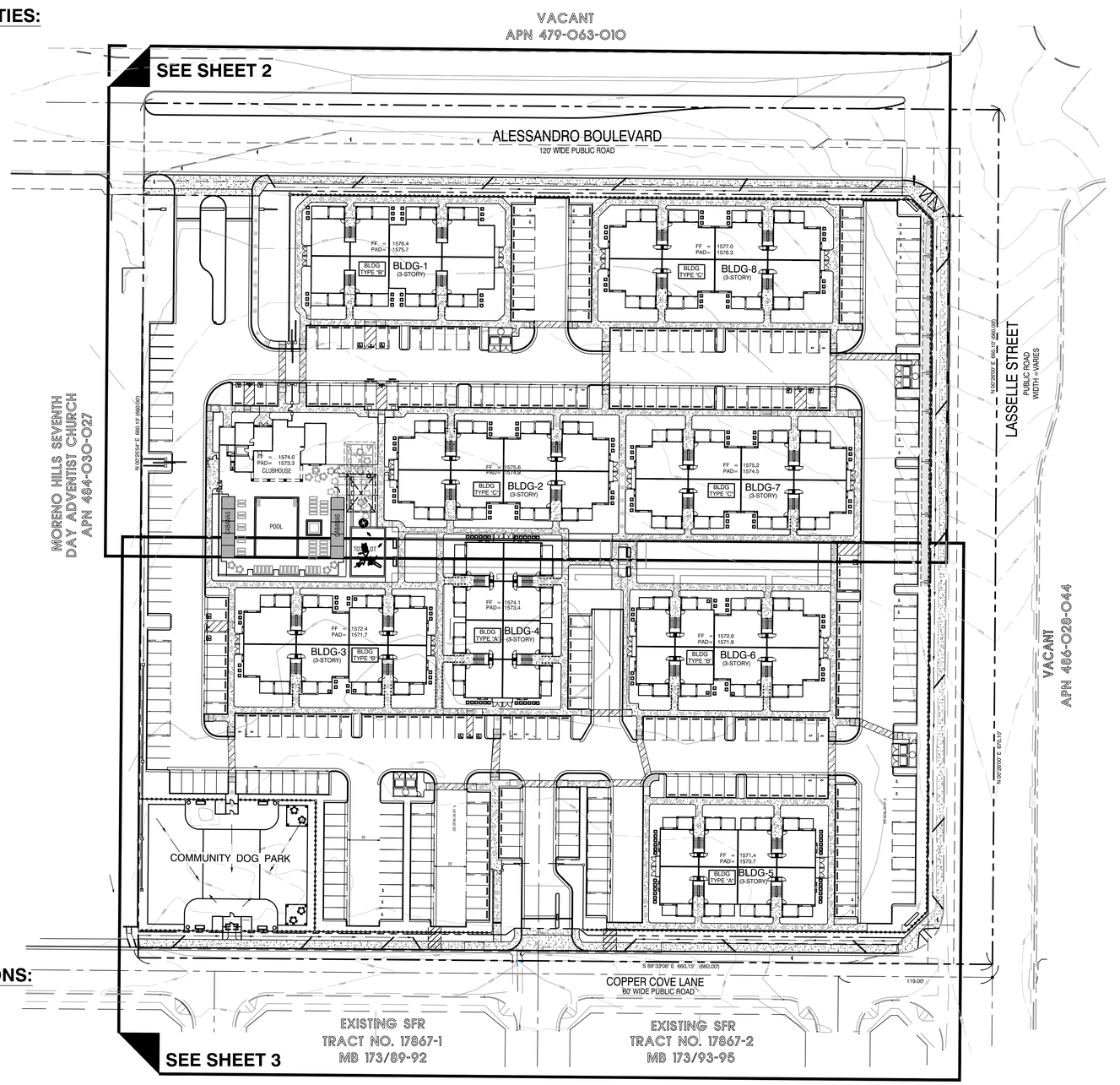
EAST
486-280-044

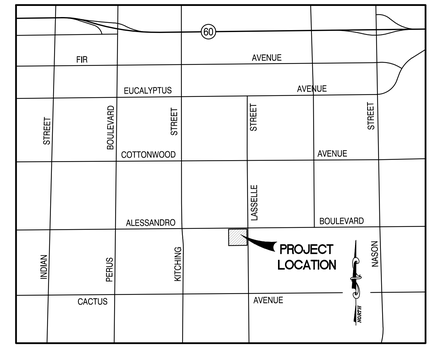
SOUTH
484-072-106
484-072-105
484-072-085
484-072-084
484-072-063
484-072-062

WEST
484-030-27

GENERAL NOTES:

1. NUMBER OF UNITS: 192
2. NUMBER OF BUILDING TYPES: 3
3. NUMBER OF STORIES: 3 STORIES
4. COMMUNITY DOG PARK - 0.3 AC
5. ALL INTERIOR DRIVE AISLES ARE PRIVATELY OWNED AND MAINTAINED.
6. THERE ARE NO KNOWN LIQUIDOR SOLID WASTE SITES ON THIS PROPERTY.
7. ALL LANDSCAPE AREAS ARE PRIVATELY OWNED AND MAINTAINED.
8. ALL DIMENSIONS SHOWN ARE APPROXIMATE.
9. ALL UNITS SHALL BE FIRE SPRINKLERED.
10. ALL WORK SHALL CONFORM TO THE CITY OF MORENO VALLEY GRADING REGULATIONS, THE ADOPTED CALIFORNIA BUILDING CODE, AND THE LATEST EDITION OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.
11. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THE LOCATION OF ALL UTILITIES OR STRUCTURES ABOVE OR BELOW GROUND, SHOWN OR NOT SHOWN ON THESE PLANS. THE CONTRACTOR WILL BE HELD RESPONSIBLE FOR ALL DAMAGE TO ANY UTILITIES OR STRUCTURES CAUSED BY HIS/HER OPERATION.
12. ADJACENT STREETS ARE TO BE CLEANED DAILY OF ALL DIRT AND DEBRIS THAT ARE THE RESULT OF THE OPERATION.
13. DUST SHALL BE CONTROLLED BY WATERING OR OTHER APPROVED METHODS.
14. HOURS OF OPERATION ARE 7:00 AM - 7:00 PM MONDAY THROUGH FRIDAY; 8:00 AM - 4:00 PM (RESIDENTIAL), SATURDAY BY PRIOR APPOINTMENT ONLY. NO WORK ON SUNDAY OR PUBLIC HOLIDAY WITHOUT PRIOR CITY APPROVAL.
15. THE CITY PUBLIC WORKS DEPARTMENT SHALL BE CONTACTED AT (951) 413-3120 TO SCHEDULE A PRE-GRADING MEETING 48 HOURS PRIOR TO BEGINNING OF GRADING.
16. ALL GRADING SHALL BE COMPLETED UNDER THE SUPERVISION OF A REGISTERED SOILS ENGINEER OF RECORD IN CONFORMANCE WITH RECOMMENDATIONS OF THE PRELIMINARY SOILS INVESTIGATION BY _____ DATED _____.
17. TWO SETS OF THE FINAL SOILS REPORT SHALL BE SUBMITTED TO THE ENGINEERING DEPARTMENT FOR REVIEW AND APPROVAL PRIOR TO THE ISSUANCE OF A BUILDING PERMIT. THE SOILS REPORT SHALL REFLECT THE FACT THAT THE COMPACTION HAS BEEN OBTAINED NOT ONLY IN THE BUILDING PAD LOCATIONS, BUT IN THE REMAINDER OF THE SITE, INCLUDING THE SLOPES. FINAL SOILS GRADING CERTIFICATION SHALL BE SUBMITTED BY THE SOILS ENGINEER OF RECORD THAT THE FINAL GRADING CONFORMS TO APPENDIX J OF THE CALIFORNIA BUILDING CODE (CBC) AND THE APPROVED GRADING PLAN.
18. ALL SLOPES SHALL BE A MAXIMUM OF 2:1, CUT OR FILL, UNLESS OTHERWISE RECOMMENDED BY REGISTERED SOILS ENGINEER AND APPROVED BY THE CITY ENGINEER.
19. ALL PADS AND SWALES SHALL DRAIN A MINIMUM OF 2%, ADJACENT TO AND WITHIN 10' OF A BUILDING, THEN A MINIMUM OF 1% TO THE STREETS OR DRIVES.
20. ALL TRENCH BACKFILLS SHALL BE TESTED AND CERTIFIED BY THE SOILS ENGINEER OF RECORD TO NOT LESS THAN 90% MAXIMUM DENSITY AS DETERMINED BY ASTM SOIL COMPACTION TEST D1557. THE TOP 1.5 FEET OF SUBGRADE BELOW THE STREET PAVEMENT STRUCTURAL SECTION SHALL BE COMPACTED TO 95% RELATIVE COMPACTION.
21. SEPARATE PERMITS SHALL BE REQUIRED FOR ANY IMPROVEMENT WORK WITHIN THE PUBLIC RIGHT-OF-WAY ("ROW").
22. CUT SLOPES GREATER THAN 5 FEET IN VERTICAL HEIGHT, AND FILL SLOPES GREATER THAN 3 FEET IN VERTICAL HEIGHT, SHALL BE PLANTED WITH APPROVED GROUNDCOVER OR OTHER APPROVED SLOPE EROSION CONTROL METHOD TO PROTECT SLOPE FROM EROSION AND INSTABILITY IN ACCORDANCE WITH THE GRADING REGULATIONS.
23. SEPARATE PERMITS FROM THE BUILDING DEPARTMENT SHALL BE REQUIRED FOR ALL WALLS AND FENCES.
24. SEPARATE PERMITS FROM THE BUILDING DEPARTMENT SHALL BE REQUIRED FOR ALL ONSITE WATER AND SEWER INSTALLATIONS.
25. ALL SLOPES ADJACENT TO THE PUBLIC ROW SHALL BE SET BACK 2 FEET IF HEIGHT IS LESS THAN 10 FEET, AND 3 FEET IF HEIGHT IS GREATER THAN 10 FEET.
26. DAMAGED OR ALTERED PUBLIC IMPROVEMENTS SHALL BE REPAIRED OR REPLACED AS REQUIRED BY THE CITY ENGINEER.
27. AN "AS-BUILT" GRADING PLAN SHALL BE SUBMITTED AT THE COMPLETION OF WORK AND PRIOR TO THE ISSUANCE OF THE OCCUPANCY PERMIT.
28. CERTIFICATION BY THE RCE OF RECORD THAT THE ROUGH GRADING SOIL COMPACTION HAS BEEN COMPLETED PER ITEMS 7, 8, AND 11 AND THE SITE CONFORMS TO THIS PLAN AS TO LINE AND GRADE, SHALL BE REQUIRED PRIOR TO ISSUANCE OF A BUILDING PERMIT.
29. THE RCE OF RECORD SIGNING THESE PLANS IS RESPONSIBLE FOR ASSURING THE ACCURACY AND ACCEPTABILITY OF THE DESIGN HEREON. IN THE EVENT OF DISCREPANCIES ARISING DURING CONSTRUCTION, THE RCE OF RECORD SHALL BE RESPONSIBLE FOR DETERMINING AN ACCEPTABLE SOLUTION AND REVISING THE PLANS FOR APPROVAL BY THE CITY ENGINEER.
30. ALL IMPORTED SOIL SHALL HAVE A CERTIFICATE GIVEN TO THE CITY ENGINEER STATING THAT THE SOIL IS FREE FROM CONTAMINANTS BEFORE SOIL IS UNLOADED.





VICINITY MAP

N.T.S.

BENCH MARK:

NGS BENCHMARK: DX0739: DESCRIBED BY COAST AND GEODETIC SURVEY 1950 (JCE) STATION IS LOCATED ABOUT 1-1/2 MILES NORTHWEST OF MORENO AND 5 MILES NORTHEAST OF MARCH FIELD ON THE HIGHEST POINT OF A ROCKY HILL ON LAND OWNED BY THE HENDRICKS RANCH. THE MARK, STAMPED MORENO 1950, IS A STANDARD DISK SET IN A DRILL HOLE IN A BOULDER ABOUT 3 FEET IN DIAMETER AND PROJECTING 8 INCHES.

EL = 2070.0 (NAVD88)

RECORD LEGAL DESCRIPTION:

ALL THAT CERTAIN REAL PROPERTY SITUATED IN THE COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, DESCRIBED AS FOLLOWS:

LOT 1 OF BLOCK 121 OF MAP 1 BEAR VALLEY AND ALESSANDRO DEVELOPMENT CO., TOGETHER WITH THOSE PORTIONS OF ALESSANDRO BOULEVARD AND LASSELLE STREET WITHIN SAID BLOCK LYING EASTERLY OF THE NORTHERLY PROLONGATION OF THE WEST LINE OF SAID LOT 1 AND NORTHERLY OF THE EASTERLY PROLONGATION OF THE SOUTH LINE OF SAID LOT 1, AS PER MAP RECORDED IN MAP BOOK 11, PAGE 10, IN THE OFFICE OF THE COUNTY RECORDER OF SAN BERNARDINO COUNTY.

ASSESSOR'S PARCEL NUMBER

484-030-028

EARTHWORK QUANTITIES:

	CUT:	FILL:
MASS EXCAVATION	5,851 CY	11,371 CY
UNDERGROUND CHAMBERS	3,200 CY	
	9,051 CY	11,371 CY
	(IMPORT = 2,320 CY)	

THESE FIGURES ARE GROSS AND DOES NOT INCLUDE OVER EXCAVATION. NO SHRINKAGE IS APPLIED.

LAND USE SUMMARY:

LAND USE	ACREAGE (AC)	PERCENT (%)
APT BUILDINGS (1-9)	1.94 AC	19.4%
REC CENTER / POOL AREA	0.30 AC	3.0%
TRASH DISPOSAL	0.05 AC	0.5%
OPEN SPACE / CORRIDORS	2.68 AC	26.8%
PARKING / INTERIOR STREETS	3.05 AC	30.5%
ALESSANDRO BOULEVARD	1.02 AC	10.2%
LASSELLE STREET	0.68 AC	6.80%
COPPER COVE LANE	0.28 AC	2.8%
	10.00 AC	100%

TOPOGRAPHY FROM:

DELTA SURVEYING AND MAPPING
39305 SALINAS DRIVE
MURRIETA, CA. 92563
PHONE: (951) 764-0158
DATE: AUGUST 20, 2021

LEGEND:

- BLDG-9 — BUILDING NUMBER
- BLDG TYPE "C" — BUILDING TYPE
- PROPOSED STREET LIGHT
- EXISTING STREET LIGHT
- 8" S — PROPOSED SANITARY SEWER
- 8" W — PROPOSED POTABLE WATER
- FIRE — PROPOSED FIRE LINE
- TENTATIVE TRACT BOUNDARY
- PROPOSED RETAINING WALL
- PROPOSED ADA CROSS WALK
- PROPOSED EASEMENT
- PROPOSED SLOPE
- EV — ELECTRIC VEHICLE PARKING SPOT
- ADA PARKING SPOT
- TRASH DISPOSAL AREA
- CARPORT
- EXISTING PAVING REMOVAL
- AC PAVING
- ENHANCED PAVING
- UNDERGROUND CHAMBER
- CONCRETE WALKWAY
- STORM DRAIN
- EX 36" SD — EXISTING STORM DRAIN
- 4" FM (SD) — 4" FORCE MAIN STORM DRAIN LINE
- ADA PATH OF TRAVEL

ABBREVIATIONS:

CB	CATCH BASIN
EG	EXISTING GROUND
EP	EDGE OF PAVEMENT
EX. CB	EXISTING CATCH BASIN
FF	FINISHED FLOOR
FG	FINISHED GRADE
FL	FLOWLINE
FS	FINISHED SURFACE
GB	GRADE BREAK
HP	HIGH POINT
LP	LOW POINT
R/W	RIGHT OF WAY
SRF	SINGLE FAMILY RESIDENTIAL
TC	TOP OF CURB
TOC	TOP OF CONCRETE
TW	TOP OF WALL

SHEET INDEX:

APPLICANT/DEVELOPER

FAIRBROOK COMMUNITIES, LLC
2280 WARDLOW CIRCLE, SUITE 250
CORONA, CA 92878
TEL: (951) 498-4939
CONTACT: BRIAN KING

ENGINEER

MDS CONSULTING
17320 REDHILL AVENUE, SUITE 350 IRVINE, CA 92614
TEL: (949) 251-8821
CONTACT: ED LENTH

OWNER

FB CRYSTAL COVE, LLC
2280 WARDLOW CIRCLE, SUITE 250
CORONA, CA 92878
TEL: (951) 498-4939
CONTACT: JAMES WALTERS
PEN 22-0022

SOILS ENGINEER

LOR GEOTECHNICAL GROUP, INC. 6121
QUAIL VALLEY COURT RIVERSIDE, CA 92507
TEL: (951) 653-1740
CONTACT: ROBERT MARKOFF

UTILITIES

WATER & SEWER
E.M.W.D.
2270 TRUMBLE ROAD
PERRIS, CA 92570 (951) 928-3777

GAS
SO. CALIFORNIA GAS COMPANY
1981 LUGONIA AVENUE
REDLANDS, CA 92374
(213) 244-1200

TRASH
WASTE MGMT, INLAND EMPIRE
17700 INDIAN STREET
MORENO VALLEY, CA 92551
(951) 280-5400

ELECTRIC
MORENO VALLEY ELECTRIC UTILITY
14331 FREDERICK STREET, SUITE 2
MORENO VALLEY, CA 92553
(951) 413-3500

SOUTHERN CALIFORNIA EDISON
26100 MENIFEE ROAD
REDLANDS, CA 92380
(951) 928-8245

CABLE / INTERNET
TIME WARNER
12625 FREDERICK STREET, SUITE F10
MORENO VALLEY, CA 92553
(888) 559-0206

TELEPHONE
VERIZON
12656 PERRIS BLVD MORENO VALLEY, CA 92553 (800) 827-4966

Date	By	REVISIONS	App'd

PREPARED FOR:

Empire CONSTRUCTION MANAGEMENT
A Subsidiary of Fairbrook Communities LLC

FAIRBROOK COMMUNITIES LLC

PREPARED BY:

MDS CONSULTING — MORSE SCHULTZ
17320 Redhill Avenue
Suite 350
Irvine, CA 92614
Voice: 949-251-8821
PLANNERS ENGINEERS SURVEYORS

REGISTERED PROFESSIONAL ENGINEER — EDWARD J. LENTH — No. 052496 — Exp. 12-31-22 — CIVIL — STATE OF CALIFORNIA

10/07/2022
EDWARD J. LENTH RCE 052496
EXP. DATE: DECEMBER 31, 2022

N

GRAPHIC SCALE
40 0 20 40 80 160
(IN FEET)
1 inch = 40 ft.

PEN22-0022

CRYSTAL COVE
CONCEPTUAL GRADING PLAN

DATE PREPARED: OCTOBER 07, 2022

CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

SHEET 1 OF 5

CONCEPTUAL GRADING PLAN, CRYSTAL COVE

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Last Edit: 10.10.2022 04:13:15 PM By: Station185

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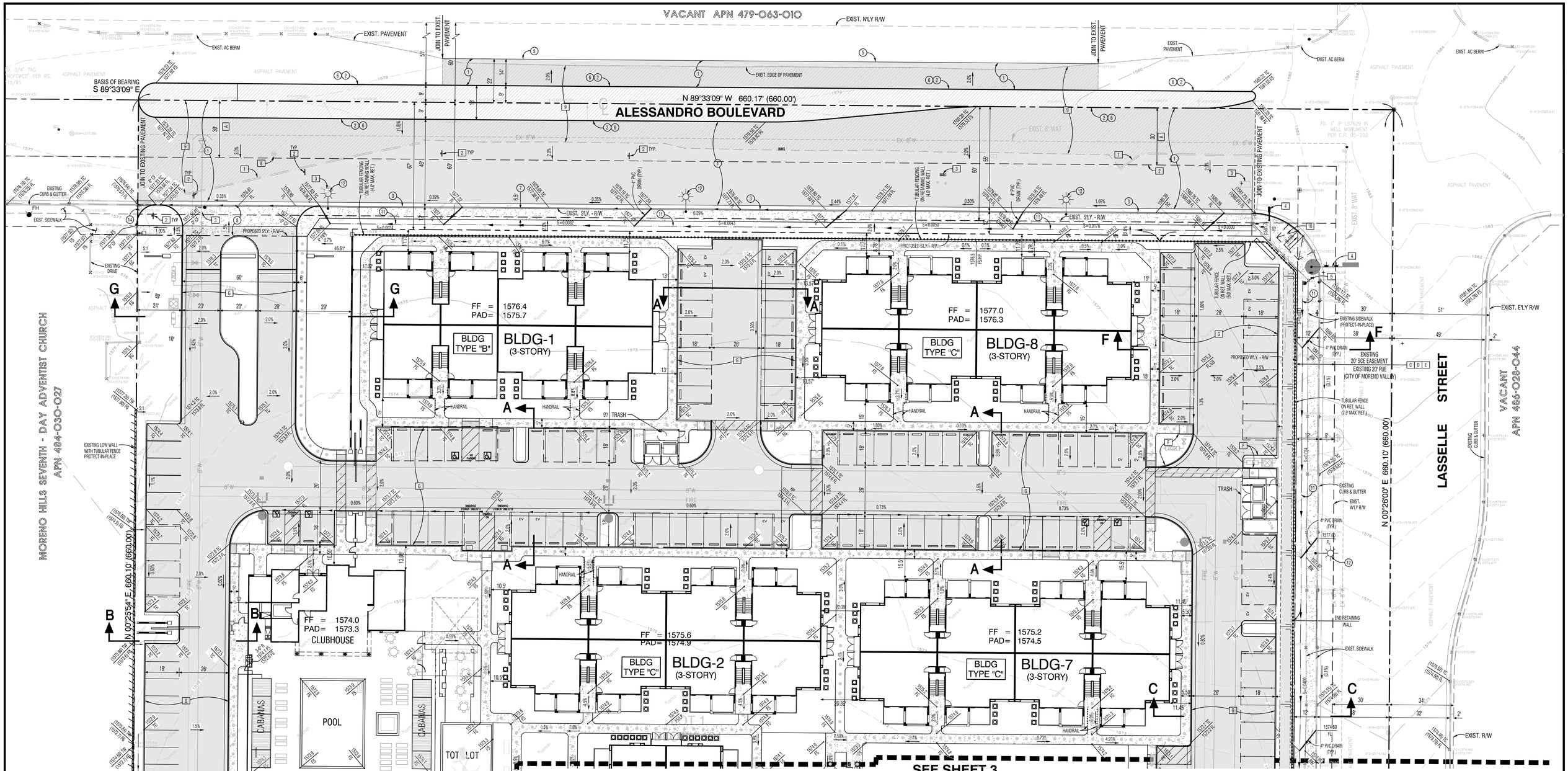

ADVISORY NOTES

1. EXISTING AC BERM TO BE REMOVED
2. EXISTING STREET TRAFFIC SIGNS/DELINEATORS TO BE REMOVED/RELOCATED
3. EXISTING UTILITY BOXES TO BE RELOCATED/ADJUSTED TO GRADE. BOLLARDS TO BE REMOVED
4. EXISTING TRAFFIC SIGNAL - PROTECT-IN-PLACE
5. EXISTING AIR VALVE - PROTECT-IN-PLACE
8. EXISTING MANHOLE - PROTECT-IN-PLACE
9. REMOVE EXISTING AC PAVEMENT
10. RAMP ACCESSIBILITY WILL BE FIELD VERIFIED AND REMOVE AND REPLACE IF NECESSARY PER CITY STD. MVSI-114A-2

EASEMENT NOTES

- A EXISTING EASEMENT(S) FOR PIPELINES AND CONDUITS, AND STREETS AND RIGHTS INCIDENTAL THERETO, AS DELINEATED ON OR AS OFFERED FOR DEDICATION ON BEAR VALLEY AND ALESSANDRO DEVELOPMENT CO. RECORDED IN BOOK 11, PAGE 10 OF MAPS SHOWN HEREIN - TO REMAIN
- C EXISTING EASEMENT(S) GRANTED TO SOUTHERN CALIFORNIA EDISON COMPANY FOR UTILITIES AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT RECORDED SEPTEMBER 30, 1991 AS INSTRUMENT NO. 1991-338061 OFFICIAL RECORD. SHOWN HEREIN - TO REMAIN
- D EXISTING EASEMENT(S) GRANTED TO SOUTHERN CALIFORNIA EDISON COMPANY FOR PUBLIC UTILITIES AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT RECORDED SEPTEMBER 30, 1991 AS INSTRUMENT NO. 1991-338062 OFFICIAL RECORDS. SHOWN HEREIN - TO REMAIN
- E EXISTING EASEMENT(S) GRANTED TO CTY OF MORENO VALLEY, A MUNICIPAL CORPORATION FOR PUBLIC HIGHWAY, PUBLIC UTILITIES, PUBLIC SERVICE FACILITIES, AS GRANTED IN A DOCUMENT RECORDED MAY 25, 2010 AS INSTRUMENT NO. 2010-0240745 OFFICIAL RECORDS. SHOWN HEREIN - TO REMAIN
- G PROPOSED UTILITY / ACESS EASEMENTS

PUBLIC IMPROVEMENT NOTES :

1. PROPOSED 6" AC OVER 12" CAB
2. PROPOSED TYPE 8A CURB PER CITY OF MORENO VALLEY STD. MVSI - 121B - 0
3. PROPOSED 8" INTEGRAL CURB AND GUTTER PER CITY OF MORENO VALLEY STD. MVSI - 120B - 0
5. PROPOSED PAVEMENT EDGE TAPER PER CITY OF MORENO VALLEY STD. MVSI - 130 - 0
6. PROPOSED RAISED MEDIAN PER CITY OF MORENO VALLEY STD. MVSI - 141-0, 142A-1 AND 142B-1
7. PROPOSED SIDEWALK PER CITY OF MORENO VALLEY STD. MVSI - 115A - 0
8. PROPOSED COMMERCIAL DRIVEWAY APPROACH, TYPE III PER CITY OF MORENO VALLEY STD. MVSI-112C-0
9. PROPOSED TYPE 6 INTEGRAL CURB AND GUTTER PER CITY OF MORENO VALLEY STD. MVSI - 120A - 0
10. PROPOSED 4" AC OVER 12" CAB
11. PROPOSED VEGETATIVE SWALE
12. PROPOSED STREET LIGHT PER CITY OF MORENO VALLEY STD. MVLT-400C-0
13. PROPOSED STREET LIGHT PER CITY OF MORENO VALLEY STD. MVLT-400A-2
14. CONSTRUCT COMMERCIAL DRIVEWAY APPROACH, TYPE III RADIUS PER CITY MORENO VALLEY STD. MVST-112C-0

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)
1 inch = 20 ft.

Date	By	REVISIONS	App'd

PREPARED FOR:

Empire CONSTRUCTION MANAGEMENT
A Subsidiary of Fairbrook Commercial LLC

FAIRBROOK COMMUNITIES LLC

PREPARED BY:

MDS CONSULTING — MORSE SCHULTZ
17320 Redhill Avenue
Suite 350
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Voice: 949-251-8821
PLANNERS ENGINEERS SURVEYORS

REGISTERED PROFESSIONAL ENGINEER — EDWARD J. LENTH — No. 052496 — Exp. 12-31-22 — CIVIL — STATE OF CALIFORNIA

10/07/2022

EDWARD J. LENTH RCE 052496
EXP. DATE: DECEMBER 31, 2022

CRYSTAL COVE
CONCEPTUAL GRADING PLAN

DATE PREPARED: OCTOBER 07, 2022

CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

SHEET 2 OF 5

CONCEPTUAL GRADING PLAN, CRYSTAL COVE

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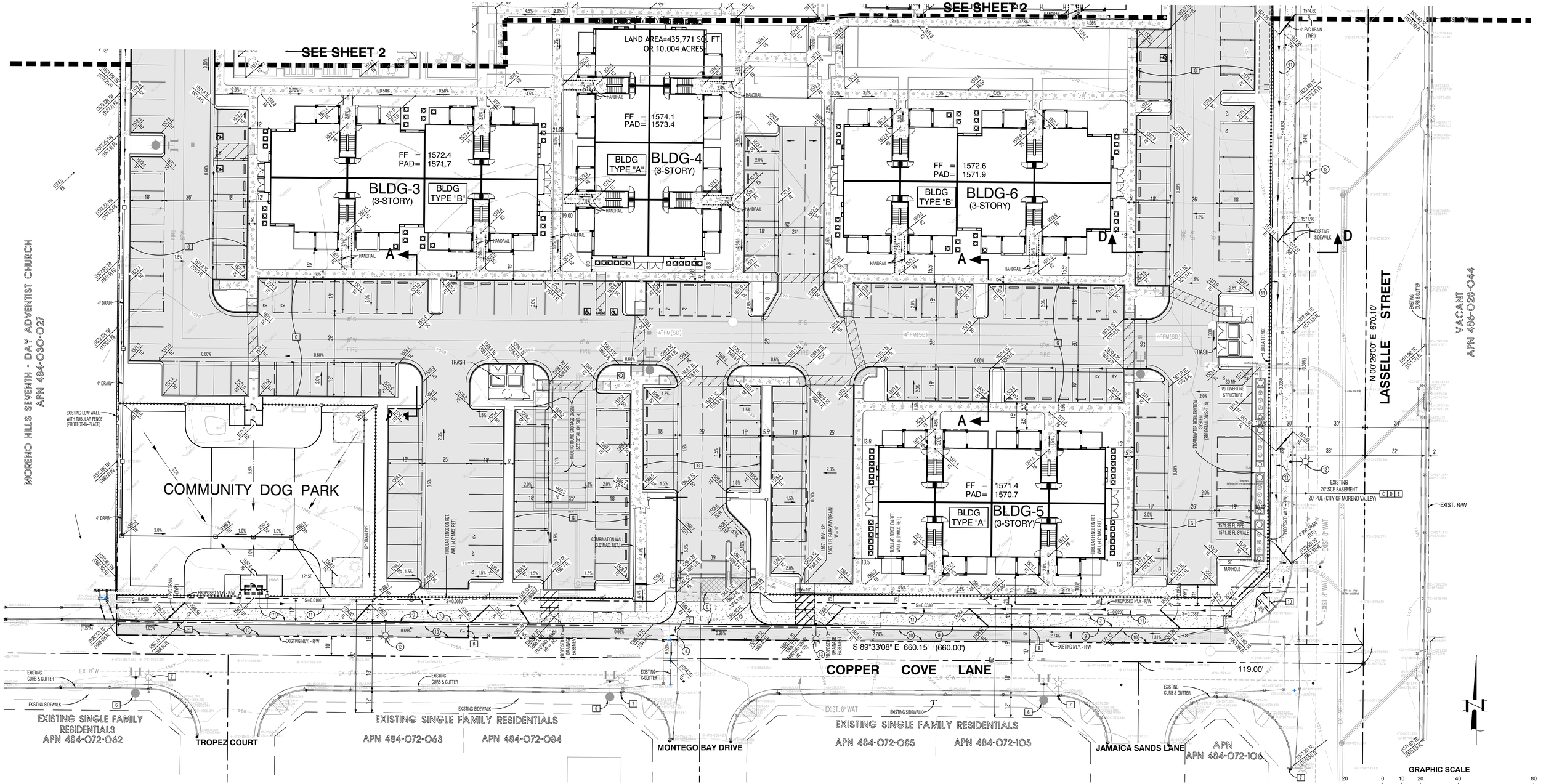

PUBLIC IMPROVEMENT NOTES :

1. PROPOSED 6' AC OVER 12' CAB
2. PROPOSED TYPE 8A CURB PER CITY OF MORENO VALLEY STD, MVSI - 121B - 0
3. PROPOSED 8' INTEGRAL CURB AND GUTTER PER CITY OF MORENO VALLEY STD, MVSI - 120B - 0
4. PROPOSED CROSS- GUTTER AND SPANDREL PER CITY OF MORENO VALLEY STD, MVSI - 127 - 0
5. PROPOSED PAVEMENT EDGE TAPER PER CITY OF MORENO VALLEY STD, MVSI - 130 - 0
6. PROPOSED RAISED MEDIAN PER CITY OF MORENO VALLEY STD, MVSI - 141-0, 142A-1 AND 142B-1
7. PROPOSED SIDEWALK PER CITY OF MORENO VALLEY STD, MVSI - 115A - 0
8. PROPOSED COMMERCIAL DRIVEWAY APPROACH, TYPE III PER CITY OF MORENO VALLEY STD, MVSI-112C-0
9. PROPOSED TYPE 6 INTEGRAL CURB AND GUTTER PER CITY OF MORENO VALLEY STD, MVSI - 120A - 0
10. PROPOSED 4' AC OVER 12' CAB
11. PROPOSED VEGETATIVE SWALE
12. PROPOSED STREET LIGHT PER CITY OF MORENO VALLEY STD, MVLT-400C-0

ADVISORY NOTES

2. EXISTING STREET TRAFFIC SIGNS/DELINEATORS TO BE REMOVED/RELOCATED
6. EXISTING FIRE HYDRANT - PROTECT-IN-PLACE
7. EXISTING STREET LIGHT - PROTECT-IN-PLACE
10. RAMP ACCESSIBILITY WILL BE FIELD VERIFIED AND REMOVE AND REPLACE IF NECESSARY PER CITY STD, MVSI-114A-2

EASEMENT NOTES

B. EXISTING EASEMENT(S) GRANTED TO CITY OF MORENO VALLEY FOR EXCAVATION AND EMBANKMENT SLOPES AND DRAINAGE AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT RECORDED SEPTEMBER 18, 1987 AS INSTRUMENT NO. 1987-271173 OFFICIAL RECORDS. -SHOWN HEREIN TO BE QUITCLAIMED.

C. EXISTING EASEMENT(S) GRANTED TO SOUTHERN CALIFORNIA EDISON COMPANY FOR UTILITIES AND RIGHTS INCIDENTAL THERETO. AS GRANTED IN A DOCUMENT RECORDED SEPTEMBER 30, 1991 AS INSTRUMENT NO. 1991-338061 OFFICIAL RECORD. SHOWN HEREIN - TO REMAIN

D. EXISTING EASEMENT(S) GRANTED TO SOUTHERN CALIFORNIA EDISON COMPANY FOR PUBLIC UTILITIES AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT RECORDED SEPTEMBER 30, 1991 AS INSTRUMENT NO. 1991-338062 OFFICIAL RECORDS. SHOWN HEREIN - TO REMAIN

E. EXISTING EASEMENT(S) GRANTED TO CITY OF MORENO VALLEY, A MUNICIPAL CORPORATION FOR PUBLIC HIGHWAY, PUBLIC UTILITIES, PUBLIC SERVICE FACILITIES, AS GRANTED IN A DOCUMENT RECORDED MAY 25, 2010 AS INSTRUMENT NO, 2010-0240745 OFFICIAL RECORDS. SHOWN HEREIN - TO REMAIN

F. EXISTING EASEMENT GRANTED TO CITY OF MORENO VALLEY FOR PUBLIC HIGHWAYS, INCLUDING UTILITY AND PUBLIC SERVICE FACILITIES AS GRANTED IN A DOCUMENT RECORDED MARCH 30, 2016 AS INSTRUMENT NO. 2016-0123944 OFFICIAL RECORDS SHOWN HEREON - TO REMAIN

G. PROPOSED UTILITY / ACESS EASEMENTS

Date	By	REVISIONS	App'd

PREPARED FOR:

Empire CONSTRUCTION MANAGEMENT, A Subsidiary of Fairbrook Communities LLC
FAIRBROOK COMMUNITIES LLC

PREPARED BY:

MDS CONSULTING
MORSE SCHULTZ
17320 Redhill Avenue
Suite 350
Irvine, CA 92614
Voice: 949-251-8821
PLANNERS ENGINEERS SURVEYORS

10/07/2022
EDWARD J. LENTH RCE 052496
EXP. DATE: DECEMBER 31, 2022

CRYSTAL COVE
CONCEPTUAL GRADING PLAN

DATE PREPARED: OCTOBER 07, 2022

CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

SHEET 3 OF 5

CONCEPTUAL GRADING PLAN, CRYSTAL COVE

MDS Proj. Data: I:\02600\PLANNING Plans\Concept Grade
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Last Edit: 10.07.2022 03:31:00 PM By: Station185

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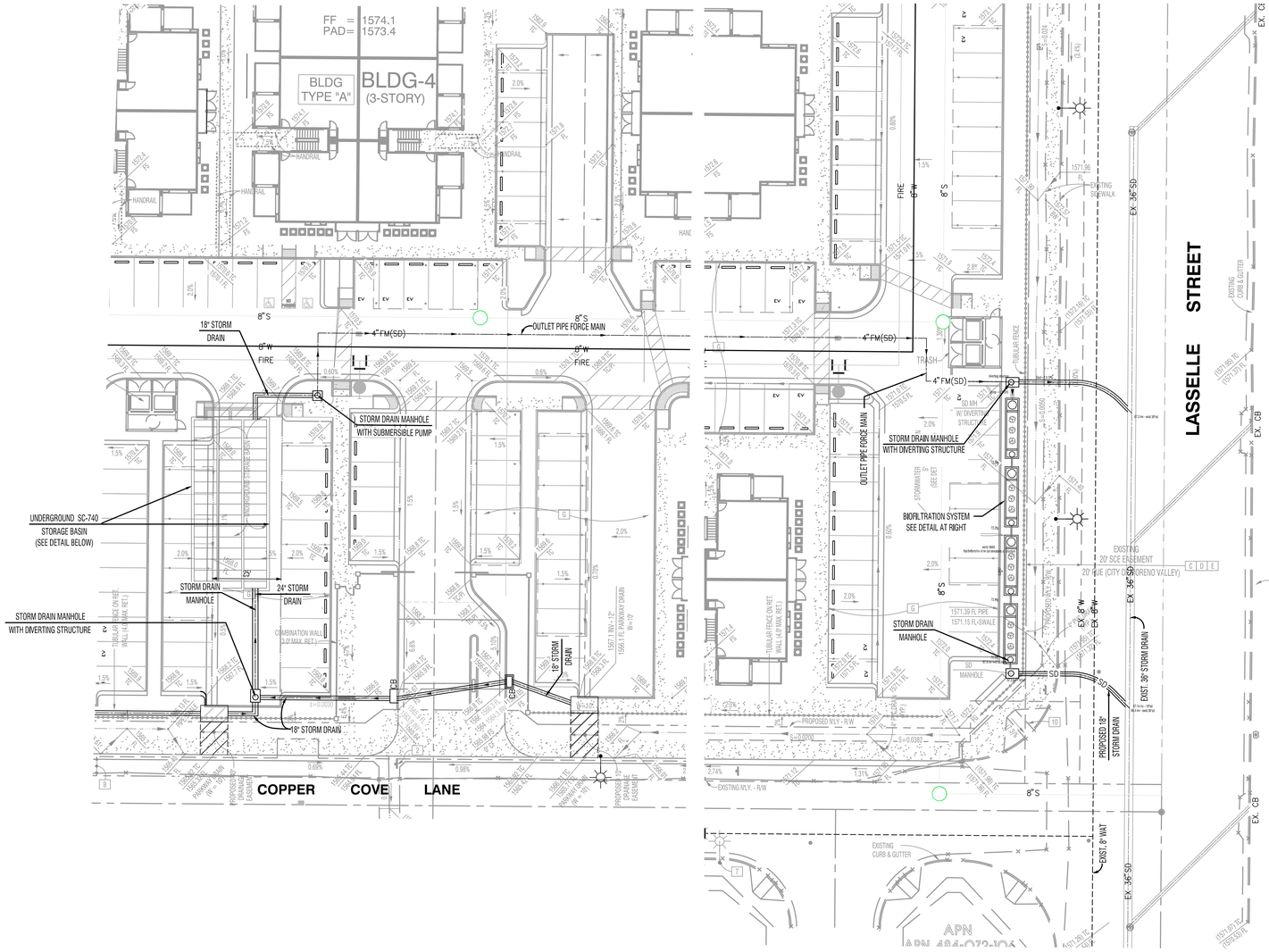
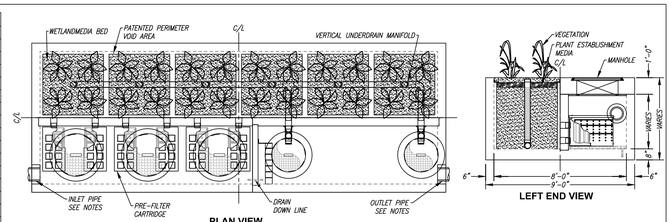
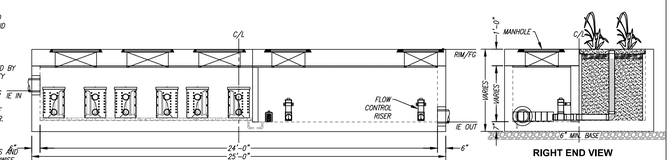


SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD			
FRAME & COVER	3EA #30"		2EA #24"
NOTES:			



INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.



GENERAL NOTES

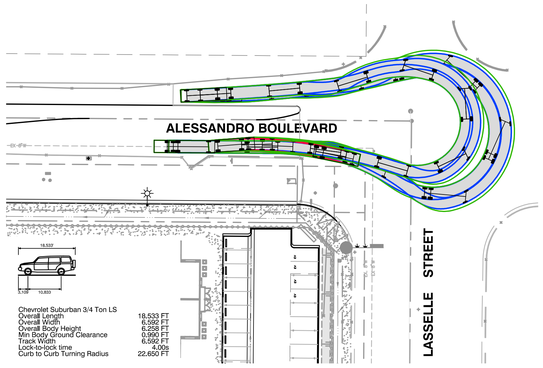
1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT BIO CLEAN.

TREATMENT FLOW (CFS)	
OPERATING HEAD (FT)	
PRETREATMENT LOADING RATE (GPM/SF)	
WETLAND MEDIA LOADING RATE (GPM/SF)	

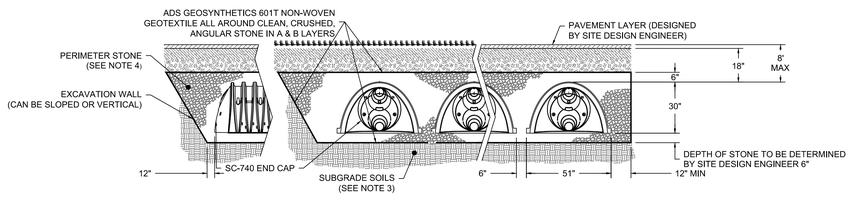
PROPRIETARY AND CONFIDENTIAL:
THE INFORMATION CONTAINED IN THIS DOCUMENT IS THE SOLE PROPERTY OF FORTERRA AND ITS COMPANIES. THIS DOCUMENT, NOR ANY PART THEREOF, MAY BE USED, REPRODUCED OR MODIFIED IN ANY MANNER WITH OUT THE WRITTEN CONSENT OF FORTERRA.

Bio Clean — A Forterra Company

MWS-L-8-24-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL



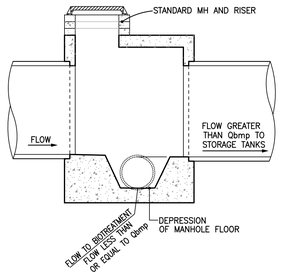
TURNING RADIUS EXHIBIT
SCALE 1"=40'



SC-740 STORAGE BASIN
DETAIL
NOT TO SCALE

NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-740 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.



STORM DRAIN MANHOLE
DIVERTING STRUCTURE DETAIL
NOT TO SCALE

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)
1 inch = 20 ft.

CRYSTAL COVE
CONCEPTUAL GRADING PLAN

DATE PREPARED: OCTOBER 07, 2022

CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

SHEET 4 OF 5

CONCEPTUAL GRADING PLAN, CRYSTAL COVE

Date	By	REVISIONS	App'd

PREPARED FOR:

Empire CONSTRUCTION MANAGEMENT — A Subsidiary of Fairbrook Commercial LLC
FAIRBROOK COMMUNITIES LLC

PREPARED BY:

MDS CONSULTING — MORSE SCHULTZ
17320 Redhill Avenue
Suite 350
Irvine, CA 92614
Voice: 949-251-8821
PLANNERS ENGINEERS SURVEYORS

10/07/2022
EDWARD J. LENTH RCE 052496
EXP. DATE: DECEMBER 31, 2022

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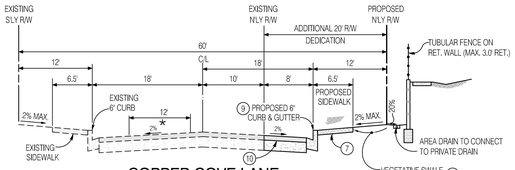
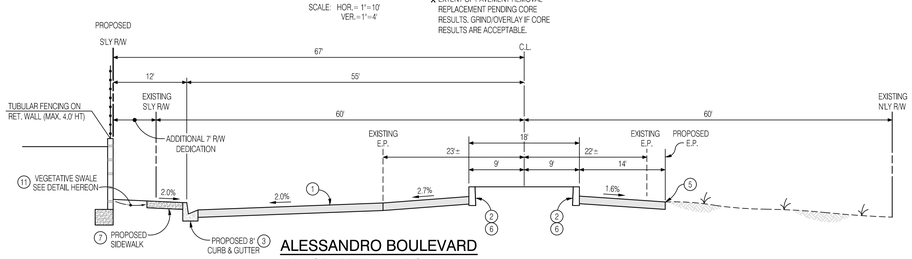


COPPER COVE LANE

LOCAL - MVSI-107A-0

SCALE: HOR.= 1"=10'
VER.=1"=4'

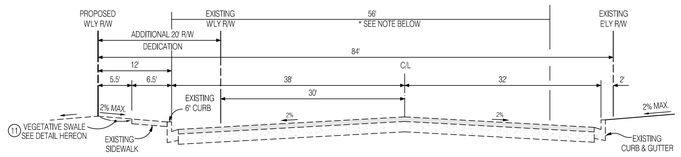
★ EXTENT OF PAVEMENT REMOVAL REPLACEMENT PENDING CORE RESULTS. GRIND/OVERLAY IF CORE RESULTS ARE ACCEPTABLE.



ALESSANDRO BOULEVARD

MAJOR ARTERIAL - MVSI-101A-1

SCALE: HOR.= 1"=10'
VER.=1"=4'

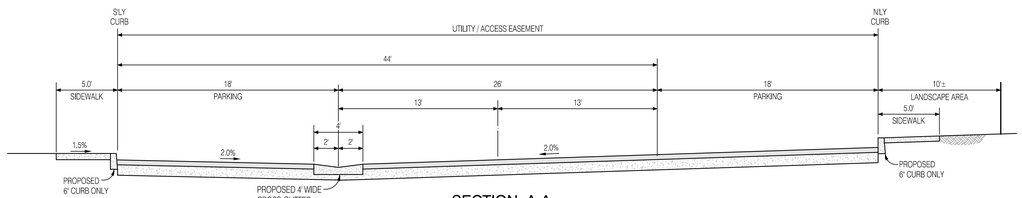


LASSELLE STREET

ARTERIAL - MVSI-104A-1

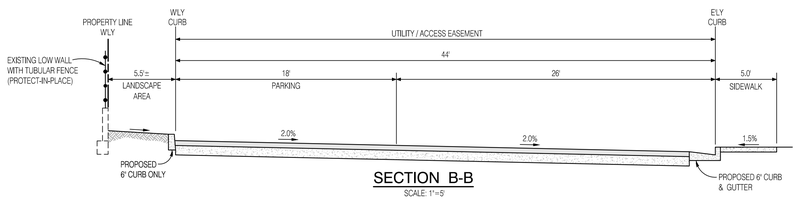
SCALE: HOR.= 1"=10'
VER.=1"=4'

★ EXTENT OF PAVEMENT REMOVAL REPLACEMENT PENDING CORE RESULTS. GRIND/OVERLAY IF CORE RESULTS ARE ACCEPTABLE.



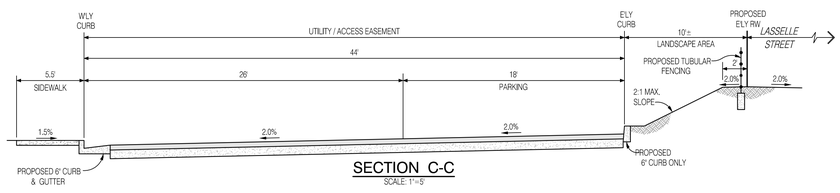
SECTION A-A

SCALE: 1"=5'



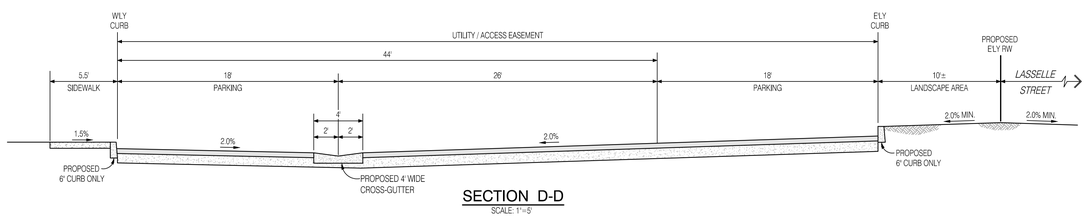
SECTION B-B

SCALE: 1"=5'



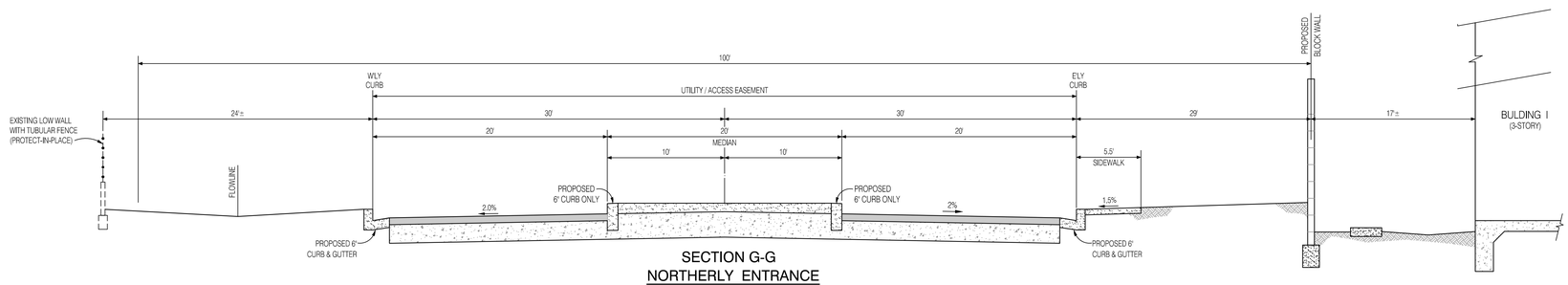
SECTION C-C

SCALE: 1"=5'



SECTION D-D

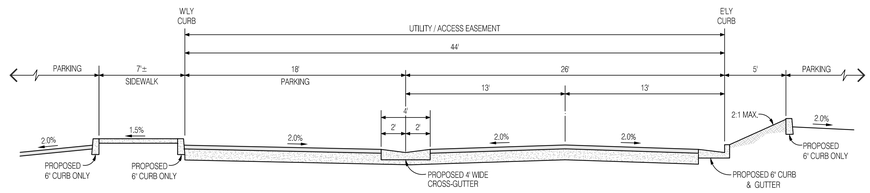
SCALE: 1"=5'



SECTION G-G

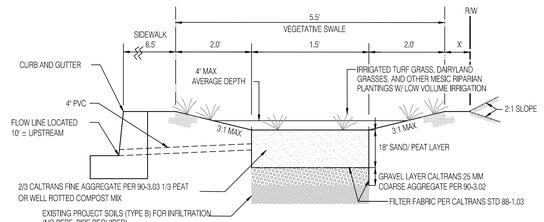
NORTHERLY ENTRANCE

SCALE: 1"=5'



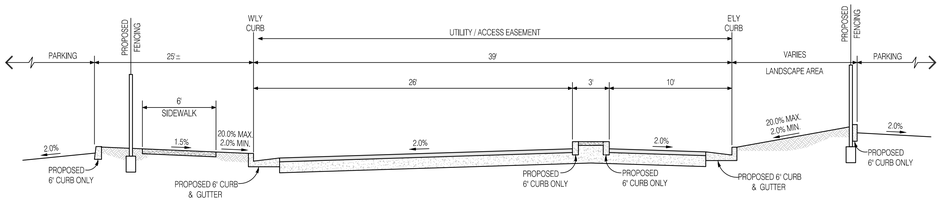
NORTH OF SOUTHERLY ENTRANCE

SCALE: 1"=5'



11 TYPICAL VEGETATIVE SWALE

N.T.S.



SOUTHERLY ENTRANCE

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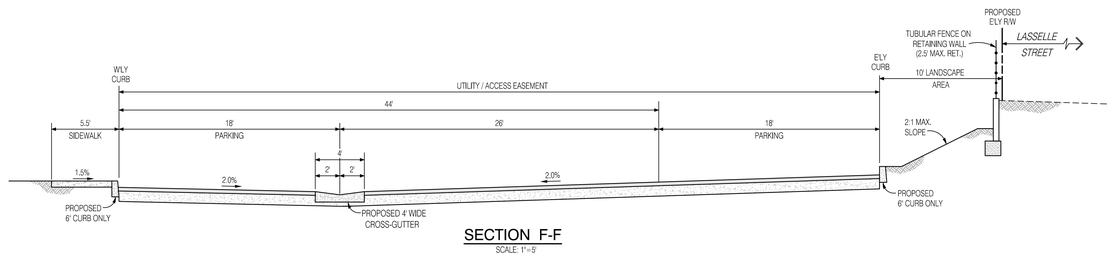

SECTION F-F

SCALE: 1"=5'

PUBLIC IMPROVEMENT NOTES :

1. PROPOSED 6" AC OVER 12" CAB
2. PROPOSED TYPE 8A CURB PER CITY OF MORENO VALLEY STD. MVSI - 121B - 0
3. PROPOSED 8" INTEGRAL CURB AND GUTTER PER CITY OF MORENO VALLEY STD. MVSI - 120B - 0
5. PROPOSED PAVEMENT EDGE TAPER PER CITY OF MORENO VALLEY STD. MVSI - 130 - 0
6. PROPOSED RAISED MEDIAN PER CITY OF MORENO VALLEY STD. MVSI - 141-0, 142A-1 AND 142B-1
7. PROPOSED SIDEWALK PER CITY OF MORENO VALLEY STD. MVSI - 115A - 0
8. PROPOSED COMMERCIAL DRIVEWAY APPROACH, TYPE III PER CITY OF MORENO VALLEY STD. MVSI-112C-0
9. PROPOSED TYPE 6 INTEGRAL CURB AND GUTTER PER CITY OF MORENO VALLEY STD. MVSI - 120A - 0
10. PROPOSED 4" AC OVER 12" CAB
11. PROPOSED VEGETATIVE SWALE

Date	By	REVISIONS	App'd

PREPARED FOR:

Empire CONSTRUCTION MANAGEMENT
A Subsidiary of Fairbrook Communities LLC

FAIRBROOK COMMUNITIES LLC

PREPARED BY:

MDS CONSULTING
MORSE SCHULTZ
17320 Redhill Avenue
Suite 350
Irvine, CA 92614
Voice: 949-251-8821
PLANNERS ENGINEERS SURVEYORS

REGISTERED PROFESSIONAL ENGINEER
EDWARD J. LENTH
No. 052496
Exp. 12-31-22
CIVIL
STATE OF CALIFORNIA

10/07/2022

EDWARD J. LENTH RCE 052496
EXP. DATE: DECEMBER 31, 2022

CRYSTAL COVE
CONCEPTUAL GRADING PLAN

DATE PREPARED: OCTOBER 07, 2022

CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

SHEET 5 OF 5

CONCEPTUAL GRADING PLAN, CRYSTAL COVE

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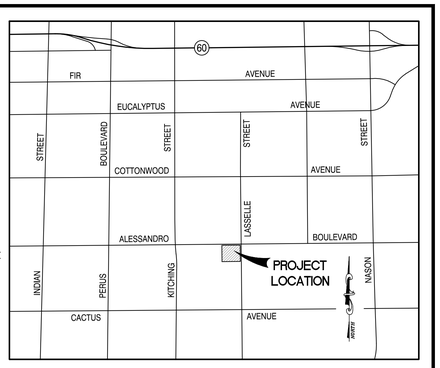
MDS File: CRYSTAL COVE -CGP-05.dwg
Plot Scale: 1" = 1' Dwg Scale: 1" = 200'
Plot Date: 10.07.2022 2:59:05 PM By: station185

LEGEND:

- BLDG-9 — BUILDING #
- BLDG TYPE 'C' — BLDG TYPE
- PROPOSED STREET LIGHT
- EXISTING STREET LIGHT
- PROPOSED SANITARY SEWER
- PROPOSED POTABLE WATER
- PROPOSED FIRE LINE
- TENTATIVE TRACT BOUNDARY
- PROPOSED RETAINING WALL
- PROPOSED ADA CROSS WALK
- PROPOSED EASEMENT
- PROPOSED SLOPE
- ELECTRIC VEHICLE PARKING
- ADA PARKING SPOT
- TRASH DISPOSAL AREA
- CARPORT
- AC PAVING
- ENHANCED PAVING
- LANDSCAPE AREA
- UNDERGROUND CHAMBER
- CONCRETE WALKWAY
- STORM DRAIN
- EXISTING STORM DRAIN
- 4" FORCE MAIN STORM DRAIN LINE



VICINITY MAP

N.T.S.

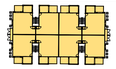
BUILDING HEIGHTS

BUILDING TYPE	HEIGHTS
BUILDING "A"	30'-2 9/16"
BUILDING "B"	39'-10 1/4"
BUILDING "C"	39'-10 1/4"
BUILDING "D"	39'-10 1/4"

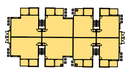
BUILDING SUMMARY

BUILDING TYPE	# OF BLDGS	# OF UNITS	PERCENT %
BUILDING "A"	2	32	16%
BUILDING "B"	1	24	12%
BUILDING "C"	3	72	36%
BUILDING "D"	3	72	36%
	9	200	100.%

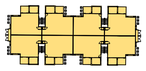
TYPICAL PLOTTING



BUILDING "A" 2-STORY
PLAN 1: 16 UNITS
PLAN 2: 0 UNITS
TOTAL: 16 UNITS
BEDROOMS: 16
BATHROOMS: 16



BUILDING "B" 3-STORY
PLAN 1: 12 UNITS
PLAN 2: 12 UNITS
TOTAL: 24 UNITS
BEDROOMS: 36
BATHROOMS: 36



BUILDING "C" 3-STORY
PLAN 1: 0 UNITS
PLAN 2: 24 UNITS
TOTAL: 24 UNITS
BEDROOMS: 48
BATHROOMS: 48

GENERAL NOTES:

1. NUMBER OF UNITS: 192
2. NUMBER OF BUILDING TYPES: 3
3. NUMBER OF STORIES: 3 STORIES
4. COMMUNITY DOG PARK: 0.3 AC.
5. ALL INTERIOR DRIVE AISLES ARE ARE PRIVATELY OWNED AND MAINTAINED
6. THERE ARE NO KNOWN LIQUIDOR SOLID WASTE SITE ON THE PROPERTY
7. ALL LANDSCAPE AREAS ARE PRIVATELY OWNED AND MAINTAINED.
8. ALL DIMENSIONS SHOWN ARE APPROXIMATE.
9. ALL UNITS SHALL BE FIRE SPRINKLERED.

RECORD LEGAL DESCRIPTION

ALL THAT CERTAIN REAL PROPERTY SITUATED IN THE COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, DESCRIBED AS FOLLOWS:

LOT 1 OF BLOCK 121 OF MAP 1 BEAR VALLEY AND ALESSANDRO DEVELOPMENT CO., TOGETHER WITH THOSE PORTIONS OF ALESSANDRO BOULEVARD AND LA SALLE STREET WITHIN SAID BLOCK LYING EASTERLY OF THE NORTHERLY PROLONGATION OF THE WEST LINE OF SAID LOT 1 AND NORTHERLY OF THE EASTERLY PROLONGATION OF THE SOUTH LINE OF SAID LOT 1, AS PER MAP RECORDED IN MAP BOOK 11, PAGE 10, IN THE OFFICE OF THE COUNTY RECORDER OF SAN BERNARDINO COUNTY.

ASSESSOR'S PARCEL NUMBER

484-030-028

GENERAL INFORMATION

1. EXISTING LAND USE: VACANT
2. EXISTING ZONING: COMU – CORRIDOR MIXED USE
3. PROPOSED LAND USE: COMU – APARTMENTS
4. PROPOSED ZONING: COMU
5. ADJACENT LAND USE AND ZONING:
   - NORTH: VACANT, COMU – CORRIDOR MIXED USE
   - EAST: VACANT, DOWNTOWN CENTER (DC)
   - SOUTH: SINGLE FAMILY RESIDENTIAL, R5 SUBURBAN RESIDENTIAL
   - WEST: MORENO HILLS SEVENTH – DAY ADVENTIST CHURCH – OFFICE
6. SCHOOL DISTRICTS: MORENO VALLEY UNIFIED SCHOOL DISTRICT
   - ELEMENTARY: HENDRICK RANCH ELEMENTARY SCHOOL
   - MIDDLE SCHOOL: MOUNTAIN VIEW MIDDLE SCHOOL
   - HIGH SCHOOL: VALLEY VIEW HIGH SCHOOL
7. GEOTECHNICAL / SOILS INVESTIGATION REPORT WAS PREPARED BY LOR GEOTECHNICAL GROUP, INC DATED OCTOBER 20, 2021
8. FIRM MAP, NO. 06065C0765G, DATED AUGUST 28, 2008 ZONE X
9. CONSTRUCTION: TYPE V – B SPRINKLERED
10. OCCUPANCY: APARTMENTS R-2; CLUB HOUSE B; CARPORTS U
11. GROSS AREA – 10.0 AC
    NET AREA – 8.0 AC

LAND USE SUMMARY:

LAND USE	ACREAGE (AC)	PERCENT (%)
APT BUILDINGS (1-9)	2.0 AC	20.0%
REC CENTER / POOL AREA	0.35 AC	3.5%
TRASH DISPOSAL	0.05 AC	0.5%
OPEN SPACE / CORRIDORS	2.62 AC	26.2%
PARKING / INTERIOR STREETS	3.0 AC	30.0%
ALESSANDRO BOULEVARD	1.02 AC	10.2%
LASSELLE STREET	0.68 AC	6.80%
COPPER COVE LANE	0.28 AC	2.8%
	10.00 AC	100%

UNIT SUMMARY:

BLDG	TYPE	1 BED/FLR	2 BED/FLR	BATH/FLR	FLOORS	TOTAL UNITS	TOTAL BED	TOTAL BATH	1 BED	2 BED	SF
1	B	4	4	12	3	24	36	36	12	12	22,140
2	C	–	8	16	3	24	48	48	0	24	25,200
3	B	4	4	12	3	24	36	36	12	12	22,140
4	A	8	–	8	3	24	24	24	24	0	19,080
5	A	8	–	8	3	24	24	24	24	0	19,080
6	B	4	4	12	3	24	36	36	12	12	22,140
7	C	–	8	16	3	24	48	48	0	24	25,200
8	C	–	8	16	3	24	48	48	0	24	25,200
TOTAL	–	–	–	–	–	192	300	300	84	108	180,180

PARKING SUMMARY:

PARKING PROVIDED:	
COVERED PARKING	208
UNCOVERED PARKING	151
TOTAL	359
ADA PARKING	
CARPORTS (208 SPACES @ 2%=5 SPACES REQUIRED)	6 PROVIDED
ASSIGNED OPEN SPACES (120 SPACES @ 2%=3 SPACES REQUIRED)	3 PROVIDED
UNASSIGNED OPEN SPACES (31 SPACES @ 5%=2 REQUIRED)	2 PROVIDED
EV PARKING (10% TOTAL PARKING)	36
PARKING REQUIRED:	
PLAN 1 92 UNITS x 1.5 SPACES / UNIT	138 SPACES
PLAN 2 108 UNITS x 2.0 SPACES / UNIT	216 SPACES
TOTAL	354 SPACES

ADJACENT PROPERTIES:

NORTH	**SOUTH**
479-631-010	484-072-106
EAST	484-072-105
486-280-044	484-072-085
	484-072-084
WEST	484-072-063
484-030-27	484-072-062

APPLICANT/DEVELOPER

FAIRBROOK COMMUNITIES, LLC
2280 WARDLOW CIRCLE, SUITE 250
CORONA, CA 92878
TEL: (951) 498-4939
CONTACT: BRIAN KING

OWNER

FB CRYSTAL COVE, LLC
2280 WARDLOW CIRCLE, SUITE 250
CORONA, CA 92878
TEL: (951) 498-4939
CONTACT: JAMES WALTERS

ENGINEER

MDS CONSULTING
17320 REDHILL AVENUE, SUITE 350
IRVINE, CA 92614
TEL: (949) 251-8821
CONTACT: ED LENTH

SOILS ENGINEER

LOR GEOTECHNICAL GROUP, INC.
6121 QUAIL VALLEY COURT
RIVERSIDE, CA 92507
TEL: (951) 653-1740
CONTACT: ROBERT MARKOFF

Date	By	REVISIONS	App'd

PREPARED BY:

MDS CONSULTING — MORSE SCHULTZ
17320 Redhill Avenue
Suite 350
Irvine, CA 92614
Voice: 949-251-8821
PLANNERS ENGINEERS SURVEYORS

REGISTERED PROFESSIONAL ENGINEER — EDWARD J. LENTH — No. 052496 — Exp. 12-31-22 — CIVIL — STATE OF CALIFORNIA

10/07/22

EDWARD J. LENTH RCE 052496
EXP. DATE: DECEMBER 31, 2022

PREPARED FOR:

Empire CONSTRUCTION MANAGEMENT, A Subsidiary of Fairbrook Communities LLC
FAIRBROOK COMMUNITIES LLC

GRAPHIC SCALE
30 0 15 30 60 120
(IN FEET)
1 inch = 30 ft.

PEN22-0022

CRYSTAL COVE SITE PLAN

DATE PREPARED: OCTOBER 07, 2022

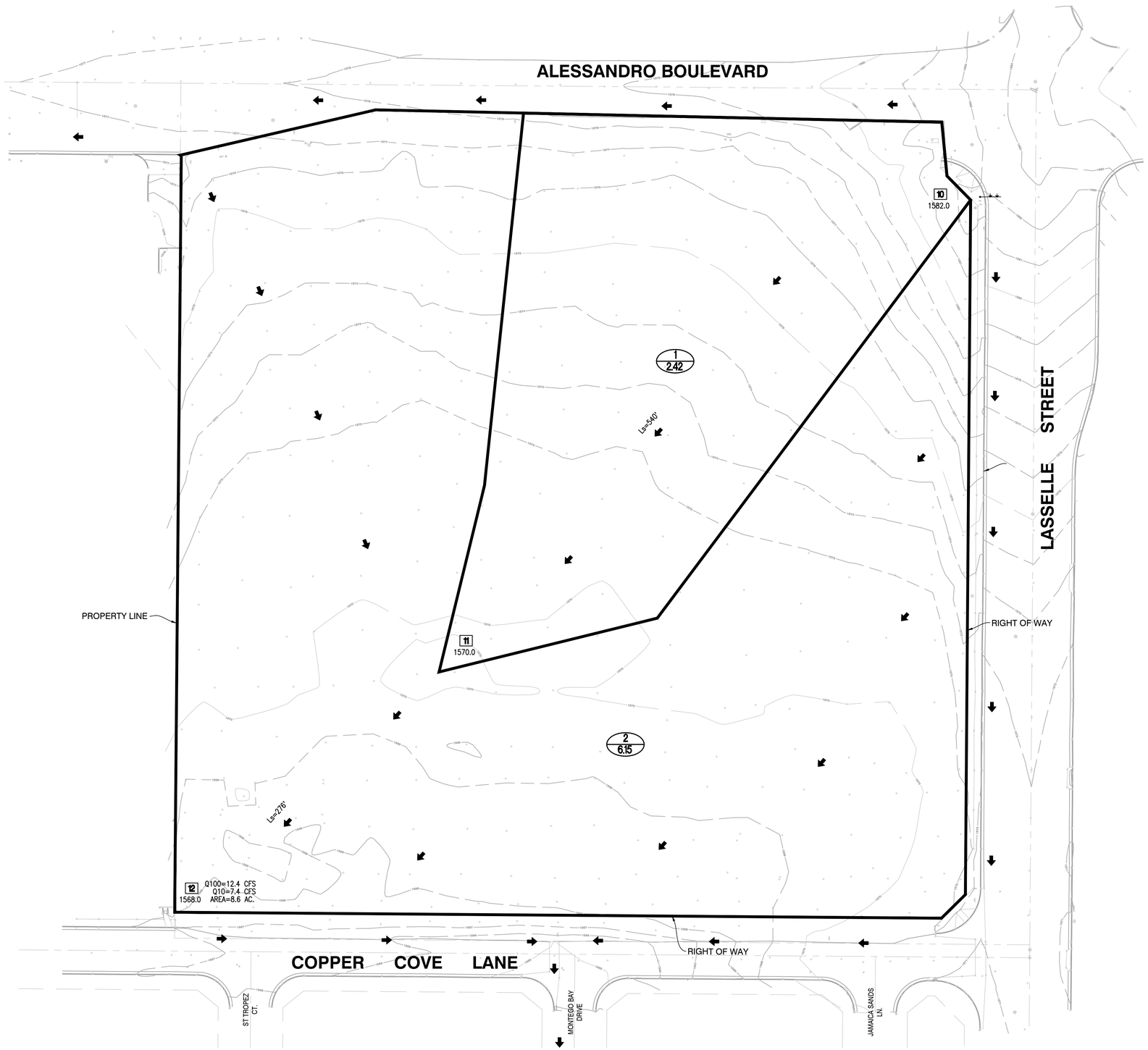
CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

SHEET 1 OF 1

SITE PLAN, SITE PLAN EXHIBIT

MDS Proj. Data: I:\92600\PLANNING\Exhibits
Created: 10.07.2022 03:31:31 PM Author: —
Last Edit: 10.10.2022 04:11:08 PM By: Station185

MDS File: CRYSTAL COVE -SITEPLAN.dwg
Plot Scale: 1" = 1' Dwg Scale: 1" = 200'
Plot Date: 10.11.2022 3:44:22 PM By: station185



VICINITY MAP

N.T.S.

NOTE:

SOIL TYPE "B"

LEGEND

1 / 1.0	DRAINAGE AREA No. / DRAINAGE AREA (ACRE)
25	NODE NUMBER
485.3 / 476.0	FINISH SURFACE ELEVATION / INVERT ELEVATION
28	NODE NUMBER
485.3	FINISH SURFACE ELEVATION
←	DIRECTION OF FLOW
	DRAINAGE AREA BOUNDARY
Lp=25'	LENGTH OF PIPE (FEET)
Ls=120'	SURFACE FLOW LENGTH (FEET)

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

PEN22-0022 (LST22-0008)

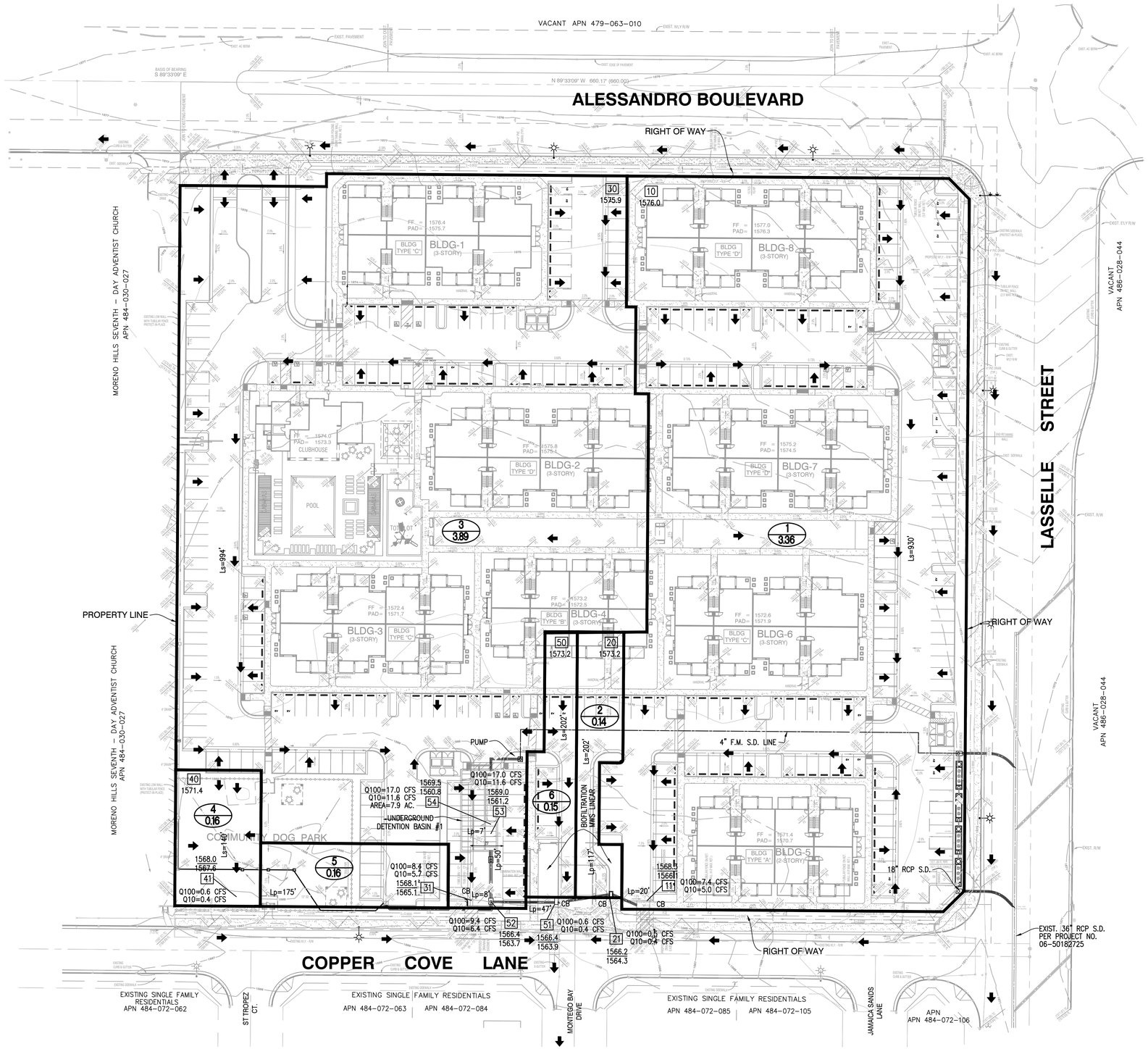
MDS CONSULTING
MORSE SCHULTZ
17320 Redhill Ave, Suite 320
Irvine, CA 92614
Voice: 949-251-8851
FAX: 949-251-0316
PLANNERS ENGINEERS SURVEYORS

PLATE 1

REGISTERED PROFESSIONAL ENGINEER
EDWARD J. LEITH
No. 052496
Exp. 12-31-22
CIVIL
STATE OF CALIFORNIA

CRYSTAL COVE
PRELIMINARY HYDROLOGY MAP
UNDEVELOPED CONDITION

Date	By	REVISIONS	App'd



VICINITY MAP

N.T.S.

NOTE:

SOIL TYPE "B"

LEGEND

- 1 / 1.0 — DRAINAGE AREA No. / DRAINAGE AREA (ACRE)
- 25 — NODE NUMBER
- 485.3 / 476.0 — FINISH SURFACE ELEVATION / INVERT ELEVATION
- 28 — NODE NUMBER
- 485.3 — FINISH SURFACE ELEVATION
- DIRECTION OF FLOW
- DRAINAGE AREA BOUNDARY
- Lp=25' — LENGTH OF PIPE (FEET)
- Ls=120' — SURFACE FLOW LENGTH (FEET)

PIPE NETWORK INFORMATION			
PIPES	SLOPE	Q100 (CFS)	DIAMETER
PIPE 11-21	0.0050	7.4	18"
PIPE 21-53	0.0264	7.9	16"
PIPE 31-52	0.1556	9.0	24"
PIPE 41-31	0.0135	0.6	8"
PIPE 51-52	0.0040	0.6	8"
PIPE 52-53	0.0440	9.4	18"
PIPE 53-54	0.0571	17.0	30"

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

PEN22-0022 (LST22-0008)

MDS CONSULTING
MOORE SCHULTZ
17320 Redhill Ave. Suite 330 Irvine, CA 92614
Voice: 949-251-8821 FAX: 949-251-8816
PLANNERS ENGINEERS SURVEYORS

PLATE 2

REGISTERED PROFESSIONAL ENGINEER EDWARD J. LEAHY No. 052496 Exp. 12-31-22 CIVIL STATE OF CALIFORNIA

CRYSTAL COVE
FINAL HYDROLOGY MAP
DEVELOPED CONDITION

Date	By	REVISIONS	App'd

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

United States Department of Agriculture

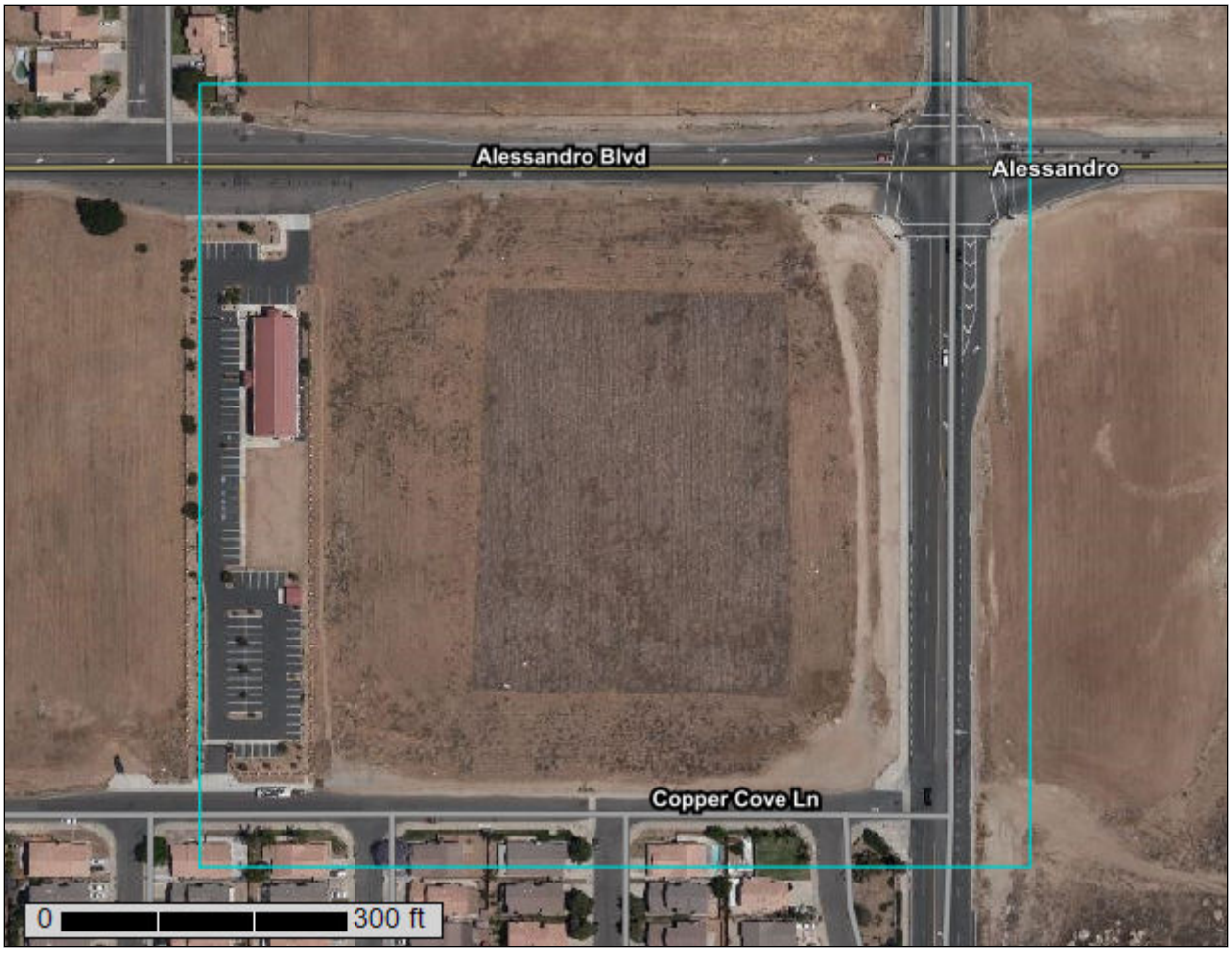
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Western Riverside Area, California

92600 CRYSTAL COVE



January 9, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:2,100 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Western Riverside Area, California
Survey Area Data: Version 14, Sep 13, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 25, 2019—Jun 25, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
RaA	Ramona sandy loam, 0 to 2 percent slopes, MLRA 19	15.1	92.5%
RaB2	Ramona sandy loam, 2 to 5 percent slopes, eroded	0.9	5.3%
VsD2	Vista coarse sandy loam, 8 to 15 percent slopes, eroded	0.4	2.2%
Totals for Area of Interest		**16.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Western Riverside Area, California

RaA—Ramona sandy loam, 0 to 2 percent slopes, MLRA 19

Map Unit Setting

National map unit symbol: 2x52z
Elevation: 370 to 2,620 feet
Mean annual precipitation: 9 to 17 inches
Mean annual air temperature: 64 to 65 degrees F
Frost-free period: 260 to 340 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Ramona and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ramona

Setting

Landform: Alluvial fans, terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

A - 0 to 20 inches: sandy loam
Bt - 20 to 60 inches: sandy clay loam
C - 60 to 74 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B
Ecological site: R019XD029CA - LOAMY
Hydric soil rating: No

Minor Components

Greenfield

Percent of map unit: 6 percent
Landform: Terraces, alluvial fans

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Hanford

Percent of map unit: 4 percent
Landform: Flood plains, alluvial fans
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Tujunga

Percent of map unit: 4 percent
Landform: Flood plains, alluvial fans
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Placentia

Percent of map unit: 1 percent
Landform: Terraces, alluvial fans
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

RaB2—Ramona sandy loam, 2 to 5 percent slopes, eroded

Map Unit Setting

National map unit symbol: hcy5
Elevation: 250 to 3,500 feet
Mean annual precipitation: 10 to 20 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 230 to 320 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Ramona and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ramona

Setting

Landform: Terraces, alluvial fans
Landform position (three-dimensional): Tread

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 14 inches: sandy loam
H2 - 14 to 23 inches: fine sandy loam
H3 - 23 to 68 inches: sandy clay loam
H4 - 68 to 74 inches: gravelly sandy loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Available water supply, 0 to 60 inches: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R019XD029CA - LOAMY
Hydric soil rating: No

Minor Components

Hanford

Percent of map unit: 4 percent
Hydric soil rating: No

Arlington

Percent of map unit: 4 percent
Hydric soil rating: No

Greenfield

Percent of map unit: 4 percent
Hydric soil rating: No

Tujunga

Percent of map unit: 3 percent
Hydric soil rating: No

VsD2—Vista coarse sandy loam, 8 to 15 percent slopes, eroded

Map Unit Setting

National map unit symbol: hczy

Elevation: 400 to 3,900 feet
Mean annual precipitation: 10 to 18 inches
Mean annual air temperature: 59 to 64 degrees F
Frost-free period: 210 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

Vista and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Vista

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from granite and/or residuum weathered from granodiorite

Typical profile

H1 - 0 to 15 inches: coarse sandy loam
H2 - 15 to 24 inches: coarse sandy loam
H3 - 24 to 28 inches: weathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R019XD029CA - LOAMY
Hydric soil rating: No

Minor Components

Fallbrook

Percent of map unit: 5 percent
Hydric soil rating: No

Bonsall

Percent of map unit: 5 percent
Hydric soil rating: No

Cieneba

Percent of map unit: 5 percent

Hydric soil rating: No

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March 21, 2022

Empire CM, Inc.
151 Kalmus Drive, Suite A202
Costa Mesa, California 92626

Project No. 33767.11

Attention: Mr. Brian King

Subject: Additional Infiltration Testing, Proposed Crystal Cove Multi-Family Residential Development, APN 484-030-028, Moreno Valley, California.

At your request, we have conducted additional infiltration testing for the subject project. This additional testing was conducted at the locations and depths provided by you.

This firm previously conducted two shallow borehole infiltration tests during our previous investigation of the subject site (LOR, 2021). These previous tests were conducted at a depth of approximately 5 feet and in a slightly different location than the currently proposed subsurface infiltration system. The depth of the currently proposed infiltration system is also greater than previously tested, approximately 10 to 12 feet. Thus, the purpose of this additional testing is to characterize the infiltration characteristics of the soils within the currently proposed infiltration area and at the depth of such.

Four borehole percolation tests were conducted in general accordance with the Deep Percolation Test procedure as outlined in the Design Handbook for Low Impact Development Best Management Practices (CRFCWCD, 2011). The general locations of our tests are illustrated on Enclosure 1 and were conducted at the requested locations and depths. Test borings were drilled to depths of approximately 10 and 12 feet below the existing ground surface on March 14, 2022. Subsequent to drilling, a 3-inch diameter, perforated PVC pipe wrapped in filter fabric was placed within each test hole and 3/4-inch gravel was placed between the outside of the pipe and the hole wall. Test holes were pre-soaked the same day as drilling. Testing took place the next day, March 15, 2022, within 26 hours but not before 15 hours, of the pre-soak. The holes were filled using water from a 200 gallon water tank. Test periods consisted of allowing the water to drop in 10- minute intervals for P-4 and 30-minute intervals for P-3, P-5, and P-6. After each reading, the holes were refilled. Testing was terminated after a total of six, 10 minute reading or 6± hours, as appropriate, were recorded.

Infiltration test results are summarized in the following table:

Test No.	Depth (ft)*	Infiltration Rate** (in/hr)
P-3	9.92	0.08
P-4	11.58	0.92
P-5	9.92	0.18
P-6	11.75	0.18

* depth measured below existing ground surface
** Porchet Method determined clear water rate

The results of this testing are presented as Enclosures 2 through 5. The test results indicate poor infiltration characteristics for the soils tested.

The results of our field investigation and test data indicates the site soils at the depths and locations tested are not conducive to infiltration. Therefore, water quality storm water systems at the depths and locations tested should not incorporate on-site infiltration when determining storm water treatment capacity in these locations.

We trust this information meets your present needs. If you have any questions, please do not hesitate to contact this firm at your convenience.

Respectively Submitted
LOR Geotechnical Group, Inc.

John P. Leuer, GE 2030
President

AAT:JPL:ss

Attachments: Enclosure 1 - Site Plan
Enclosures 2 through 5 - Borehole Percolation Test Data

Distribution: Addressee (1) via email bking@empirecminc.com

REFERENCES

Riverside County Flood Control and Water Conservation District, 2011, Design Handbook for Low Impact Development Best Management Practices, dated September 2011.

LOR Geotechnical Group, Inc., 2021, Preliminary Geotechnical and Infiltration Feasibility Investigation, Proposed Crystal Cove Multi-Family Residential Development, APN 484-030-028, Moreno Valley, California. Project No. 33767.11, dated October 20, 2021

Legend

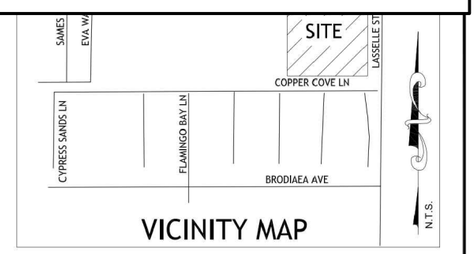
(Locations Approximate)

Map Symbols

P-6 - Borehole Percolation Test

LEGEND:

BLDG-9 BUILDING #
BLDG TYPE 'C' BLDG TYPE
PROPOSED STREET LIGHT
PROPOSED SANITARY SEWER
PROPOSED POTABLE WATER
PROPOSED FIRE LINE
TENTATIVE TRACT BOUNDARY
PROPOSED RETAINING WALL
PROPOSED ADA CROSS WALK
PROPOSED EASEMENT
PROPOSED SLOPE
EV PARKING SPOT
ADA PARKING SPOT
TRASH DISPOSAL AREA
CARPORT



VICINITY MAP

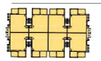
BUILDING HEIGHTS

BUILDING TYPE	HEIGHTS
BUILDING "A"	30'-2 9/16"
BUILDING "B"	39'-10 1/4"
BUILDING "C"	39'-10 1/4"
BUILDING "D"	39'-10 1/4"

BUILDING SUMMARY

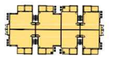
BUILDING TYPE	# OF BLDGS	# OF UNITS	PERCENT %
BUILDING "A"	2	32	16%
BUILDING "B"	1	24	12%
BUILDING "C"	3	72	36%
BUILDING "D"	3	72	36%
	9	200	100.%

TYPICAL PLOTTING

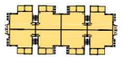


BUILDING "A" 2-STORY
PLAN 1: 16 UNITS
PLAN 2: 0 UNITS
TOTAL: 16 UNITS
BEDROOMS: 16
BATHROOMS: 16

BUILDING "B" 3-STORY
PLAN 1: 24 UNITS
PLAN 2: 0 UNITS
TOTAL: 24 UNITS
BEDROOMS: 24
BATHROOMS: 24



BUILDING "C" 3-STORY
PLAN 1: 12 UNITS
PLAN 2: 12 UNITS
TOTAL: 24 UNITS
BEDROOMS: 36
BATHROOMS: 36



BUILDING "D" 3-STORY
PLAN 1: 0 UNITS
PLAN 2: 24 UNITS
TOTAL: 24 UNITS
BEDROOMS: 48
BATHROOMS: 48

GENERAL NOTES:

1. NUMBER OF UNITS: 200
2. NUMBER OF BUILDING TYPES: 4
3. NUMBER OF STORIES: 2 AND 3 STORIES
4. ALL INTERIOR DRIVE AISLES ARE ARE PRIVATELY OWNED AND MAINTAINED
5. THERE ARE NO KNOWN LIQUIDOR SOLID WASTE SITE ON THE PROPERTY
6. ALL LANDSCAPE AREAS ARE PRIVATELY OWNED AND MAINTAINED.
7. ALL DIMENSIONS SHOWN ARE APPROXIMATE.
8. ALL UNITS SHALL BE FIRE SPRINKLERED.

RECORD LEGAL DESCRIPTION

ALL THAT CERTAIN REAL PROPERTY SITUATED IN THE COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, DESCRIBED AS FOLLOWS:

LOT 1 OF BLOCK 121 OF MAP 1 BEAR VALLEY AND ALESSANDRO DEVELOPMENT CO., TOGETHER WITH THOSE PORTIONS OF ALESSANDRO BOULEVARD AND LA SALLE STREET WITHIN SAID BLOCK LYING EASTERLY OF THE NORTHERLY PROLONGATION OF THE WEST LINE OF SAID LOT 1 AND NORTHERLY OF THE EASTERLY PROLONGATION OF THE SOUTH LINE OF SAID LOT 1, AS PER MAP RECORDED IN MAP BOOK 11, PAGE 10, IN THE OFFICE OF THE COUNTY RECORDER OF SAN BERNARDINO COUNTY.

ASSESSOR'S PARCEL NUMBER

484-030-028

GENERAL INFORMATION

1. EXISTING LAND USE: VACANT
2. EXISTING ZONING: COMU – CORRIDOR MIXED USE
3. PROPOSED LAND USE: COMU – APARTMENTS
4. PROPOSED ZONING: COMU
5. ADJACENT LAND USE AND ZONING:
   - NORTH: VACANT, COMU – CORRIDOR MIXED USE
   - EAST: VACANT, R30 – MULTIFAMILY RESIDENTIAL
   - SOUTH: SINGLE FAMILY RESIDENTIAL, R5 SUBURBAN RESIDENTIAL
   - WEST: MORENO HILLS SEVENTH – DAY ADVENTIST CHURCH – OFFICE
6. SCHOOL DISTRICTS: MORENO VALLEY UNIFIED SCHOOL DISTRICT
   - ELEMENTARY: HENDRICK RANCH ELEMENTARY SCHOOL
   - MIDDLE SCHOOL: MOUNTAIN VIEW MIDDLE SCHOOL
   - HIGH SCHOOL: VALLEY VIEW HIGH SCHOOL
7. GEOTECHNICAL / SOILS INVESTIGATION REPORT WAS PREPARED BY LOR GEOTECHNICAL GROUP, INC DATED OCTOBER 20, 2021
8. FIRM MAP, NO. 06065C0765G, DATED AUGUST 28, 2008 ZONE X
9. CONSTRUCTION: TYPE B SPRINKLERED
10. OCCUPANCY: APARTMENTS R-2; CLUB HOUSE B; CARPORTS U

LAND USE SUMMARY:

LAND USE	ACREAGE (AC)	PERCENT (%)
APT BUILDINGS (1-9)	1.94 AC	19.4%
REC CENTER / POOL AREA	0.30 AC	3.0%
TRASH DISPOSAL	0.05 AC	0.5%
OPEN SPACE / CORRIDORS	2.68 AC	26.8%
PARKING / INTERIOR STREETS	3.05 AC	30.5%
ALESSANDRO BOULEVARD	1.02 AC	10.2%
LASSELLE STREET	0.68 AC	6.80%
COPPER COVE LANE	0.28 AC	2.8%
	10.00 AC	100%

ADJACENT PROPERTIES:

NORTH
479-631-010

EAST
486-280-044

SOUTH
484-072-106
484-072-105
484-072-085
484-072-084
484-072-063
484-072-062

WEST
484-030-27

UNIT SUMMARY:

BLDG	TYPE	1 BED/FLR	2 BED/FLR	BATH/FLR	FLOORS	TOTAL UNITS	TOTAL BED	TOTAL BATH
1	C	4	4	12	3	24	36	36
2	D	–	8	16	3	24	48	48
3	C	4	4	12	3	24	36	36
4	A	8	–	8	2	16	16	16
5	B	8	–	8	3	24	24	24
6	A	8	–	8	2	16	16	16
7	C	4	4	12	3	24	36	36
8	D	–	8	16	3	24	48	48
9	D	–	8	16	3	24	48	48
TOTAL	–	–	–	–	–	200	308	308

PARKING SUMMARY:

PARKING PROVIDED:	
ADA PARKING SPOTS	8
EV PARKING	2
COVERED PARKING	200
UNCOVERED PARKING	151
TOTAL	361

PARKING REQUIRED:

PLAN 1	92 UNITS x 1.5 SPACES / UNIT	138 SPACES
PLAN 2	108 UNITS x 2.0 SPACES / UNIT	216 SPACES
	TOTAL	354 SPACES

APPLICANT/DEVELOPER

EMPIRE CONSTRUCTION MANAGEMENT
2280 WARDLOW CIRCLE, SUITE 250
CORONA, CA 92878
TEL: (951) 498-4939
CONTACT: BRIAN KING

OWNER

FB CRYSTAL COVE, LLC
2280 WARDLOW CIRCLE, SUITE 250
CORONA, CA 92878
TEL: (951) 498-4939
CONTACT: JAMES WALTERS

ENGINEER

MDS CONSULTING
17320 REDHILL AVENUE, SUITE 350
IRVINE, CA 92614
TEL: (949) 251-8821
CONTACT: ED LENTH

SOILS ENGINEER

LOR GEOTECHNICAL GROUP, INC.
6121 QUAIL VALLEY COURT
RIVERSIDE, CA 92507
TEL: (951) 653-1740
CONTACT: ROBERT MARKOFF

GRAPHIC SCALE
30 0 15 30 60 120
(IN FEET)
1 inch = 30 ft.

CRYSTAL COVE
SITE PLAN

DATE PREPARED: JANUARY 20, 2022

CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA
SHEET 1 OF 1

PREPARED FOR:

Empire Construction Management, A Subsidiary of Fairbrook Communities LLC
FAIRBROOK COMMUNITIES LLC

PREPARED BY:

MDS CONSULTING — MORSE SCHULTZ
17320 Redhill Avenue Suite 350 Irvine, CA 92614 Voice: 949-251-8821
PLANNERS ENGINEERS SURVEYORS

REGISTERED PROFESSIONAL ENGINEER — EDWARD J. LENTH No. 052496 Exp. 12-31-22 CIVIL — STATE OF CALIFORNIA

1-20-22

EDWARD J. LENTH RCE 052496
EXP. DATE: DECEMBER 31, 2022

Date	By	REVISIONS	App'd

SITE PLAN, SITE PLAN EXHIBIT

PROJECT: Crystal Cove, Moreno Valley, California
PROJECT NO.: 33767.11
ENCLOSURE: 1
CLIENT: Empire CM, Inc.
DATE: March 2022
SCALE: 1" ≈ 90'

LOR GEOTECHNICAL GROUP, INC.

BOREHOLE METHOD PERCOLATION TEST RESULTS

Project:	Crystal Cove, Moreno Valley	Test Date:	March 15, 2022
Project No.:	33767.11	Test Hole No.:	P-3
Soil Classificaiton:	(SM) Silty sand	Effective Hole Dia.*:	4.8 in.
Depth of Test Hole:	9.92 ft.	Date Excavated:	March 14, 2022
Tested By:	T.G.		

READING	TIME START	TIME STOP	TIME INTERVAL		TOTAL TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	INITIAL HOLE DEPTH	FINAL HOLE DEPTH	CHANGE IN WATER LEVEL	AVERAGE WETTED DEPTH	PERCOLATION RATE
			min	hr.	hr.	in.	in.	in.	in.	in.	in.	(min/in)
1	8:58 AM	9:23 AM	25	0.42	0.42	71.00	72.00	119.04	119.00	1.00	47.52	25.0
2	9:24 AM	9:54 AM	30	0.50	0.92	72.00	78.00	119.00	119.00	6.00	44.00	5.0
3	9:55 AM	10:25 AM	30	0.50	1.42	78.00	80.00	119.00	119.00	2.00	40.00	15.0
4	10:25 AM	10:55 AM	30	0.50	1.92	80.00	82.00	119.00	119.00	2.00	38.00	15.0
5	10:55 AM	11:25 AM	30	0.50	2.42	82.00	83.00	119.00	119.00	1.00	36.50	30.0
6	11:25 AM	11:55 AM	30	0.50	2.92	82.00	83.00	119.00	119.00	1.00	36.50	30.0
7	11:55 AM	12:25 PM	30	0.50	3.42	82.00	83.00	119.00	119.00	1.00	36.50	30.0
8	12:25 PM	12:55 PM	30	0.50	3.92	83.00	84.00	119.00	119.00	1.00	35.50	30.0
9	12:55 PM	1:25 PM	30	0.50	4.42	84.00	86.00	119.00	119.00	2.00	34.00	15.0
10	1:25 PM	1:55 PM	30	0.50	4.92	86.00	88.00	119.00	119.00	2.00	32.00	15.0
11	1:55 PM	2:25 PM	30	0.50	5.42	88.00	89.00	119.00	119.00	1.00	30.50	30.0
12	2:25 PM	2:55 PM	30	0.50	5.92	88.00	89.00	119.00	119.00	1.00	30.50	30.0

PERCOLATION RATE CONVERSION (Porchet Method):

H_O	31.00	
H_f	30.00	
ΔH	1.00	
H_{avg}	30.50	
I_t	**0.08**	in/hr (clear water rate)

* diameter adjusted to an effective diameter due to the loss in volume of water because of gravel packing

BOREHOLE METHOD PERCOLATION TEST RESULTS

Project:	Crystal Cove, Moreno Valley	Test Date:	March 15, 2022
Project No.:	33767.11	Test Hole No.:	P-4
Soil Classificaiton:	(SM) Silty sand	Effective Hole Dia.*:	4.8 in.
Depth of Test Hole:	11.58 ft.	Date Excavated:	March 14, 2022
Tested By:	T.G.		

READING	TIME START	TIME STOP	TIME INTERVAL		TOTAL TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	INITIAL HOLE DEPTH	FINAL HOLE DEPTH	CHANGE IN WATER LEVEL	AVERAGE WETTED DEPTH	PERCOLATION RATE
			min	hr.	hr.	in.	in.	in.	in.	in.	in.	(min/in)
1	9:03 AM	9:28 AM	25	0.42	0.42	91.00	102.00	138.96	139.00	11.00	42.48	2.3
2	9:30 AM	9:55 AM	25	0.42	0.83	102.00	116.00	139.00	139.00	14.00	30.00	1.8
3	9:59 AM	10:09 AM	10	0.17	1.00	89.00	93.00	139.00	139.00	4.00	48.00	2.5
4	10:09 AM	10:19 AM	10	0.17	1.17	88.00	93.00	139.00	139.00	5.00	48.50	2.0
5	10:19 AM	10:29 AM	10	0.17	1.33	93.00	98.00	139.00	139.00	5.00	43.50	2.0
6	10:29 AM	10:39 AM	10	0.17	1.50	98.00	103.00	139.00	139.00	5.00	38.50	2.0
7	10:40 AM	10:50 AM	10	0.17	1.67	103.00	107.00	139.00	139.00	4.00	34.00	2.5
8	10:50 AM	11:00 AM	10	0.17	1.83	107.00	111.00	139.00	139.00	4.00	30.00	2.5

PERCOLATION RATE CONVERSION (Porchet Method):

H_O	32.00	
H_f	28.00	
ΔH	4.00	
H_{avg}	30.00	
I_t	**0.92**	in/hr (clear water rate)

* diameter adjusted to an effective diameter due to the loss in volume of water because of gravel packing

BOREHOLE METHOD PERCOLATION TEST RESULTS

Project:	Crystal Cove, Moreno Valley	Test Date:	March 15, 2022
Project No.:	33767.11	Test Hole No.:	P-5
Soil Classificaiton:	(SM) Silty sand	Effective Hole Dia.*:	4.8 in.
Depth of Test Hole:	9.92 ft.	Date Excavated:	March 14, 2022
Tested By:	T.G.		

READING	TIME START	TIME STOP	TIME INTERVAL		TOTAL TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	INITIAL HOLE DEPTH	FINAL HOLE DEPTH	CHANGE IN WATER LEVEL	AVERAGE WETTED DEPTH	PERCOLATION RATE
			min	hr.	hr.	in.	in.	in.	in.	in.	in.	(min/in)
1	9:08 AM	9:32 AM	24	0.40	0.40	57.00	61.00	119.04	119.00	4.00	60.02	6.0
2	9:33 AM	10:03 AM	30	0.50	0.90	61.00	70.00	119.00	119.00	9.00	53.50	3.3
3	10:03 AM	10:33 AM	30	0.50	1.40	70.00	74.00	119.00	119.00	4.00	47.00	7.5
4	10:33 AM	11:03 AM	30	0.50	1.90	74.00	77.00	119.00	119.00	3.00	43.50	10.0
5	11:03 AM	11:33 AM	30	0.50	2.40	77.00	79.00	119.00	119.00	2.00	41.00	15.0
6	11:33 AM	12:03 PM	30	0.50	2.90	79.00	81.00	119.00	119.00	2.00	39.00	15.0
7	12:03 PM	12:33 PM	30	0.50	3.40	81.00	84.00	119.00	119.00	3.00	36.50	10.0
8	12:33 PM	1:03 PM	30	0.50	3.90	84.00	86.00	119.00	119.00	2.00	34.00	15.0
9	1:03 PM	1:33 PM	30	0.50	4.40	86.00	88.00	119.00	119.00	2.00	32.00	15.0
10	1:33 PM	2:03 PM	30	0.50	4.90	88.00	90.00	119.00	119.00	2.00	30.00	15.0
11	2:03 PM	2:33 PM	30	0.50	5.40	90.00	92.00	119.00	119.00	2.00	28.00	15.0
12	2:33 PM	3:03 PM	30	0.50	5.90	92.00	94.00	119.00	119.00	2.00	26.00	15.0

PERCOLATION RATE CONVERSION (Porchet Method):

H_O	27.00	
H_f	25.00	
ΔH	2.00	
H_{avg}	26.00	
I_t	**0.18**	in/hr (clear water rate)

* diameter adjusted to an effective diameter due to the loss in volume of water because of gravel packing

BOREHOLE METHOD PERCOLATION TEST RESULTS

Project:	Crystal Cove, Moreno Valley	Test Date:	March 15, 2022
Project No.:	33767.11	Test Hole No.:	P-6
Soil Classificaiton:	(SM) Silty sand	Effective Hole Dia.*:	4.8 in.
Depth of Test Hole:	11.75 ft.	Date Excavated:	March 14, 2022
Tested By:	T.G.		

READING	TIME START	TIME STOP	TIME INTERVAL		TOTAL TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	INITIAL HOLE DEPTH	FINAL HOLE DEPTH	CHANGE IN WATER LEVEL	AVERAGE WETTED DEPTH	PERCOLATION RATE
			min	hr.	hr.	in.	in.	in.	in.	in.	in.	(min/in)
1	9:12 AM	9:38 AM	26	0.43	0.43	91.00	94.00	141.00	141.00	3.00	48.50	8.7
2	9:38 AM	10:08 AM	30	0.50	0.93	94.00	103.00	141.00	141.00	9.00	42.50	3.3
3	10:11 AM	10:41 AM	30	0.50	1.43	88.00	90.00	141.00	141.00	2.00	52.00	15.0
4	10:41 AM	11:11 AM	30	0.50	1.93	90.00	94.00	141.00	141.00	4.00	49.00	7.5
5	11:11 AM	11:41 AM	30	0.50	2.43	94.00	100.00	141.00	141.00	6.00	44.00	5.0
6	11:43 AM	12:13 PM	30	0.50	2.93	85.00	91.00	141.00	141.00	6.00	53.00	5.0
7	12:13 PM	12:43 PM	30	0.50	3.43	91.00	98.00	141.00	141.00	7.00	46.50	4.3
8	12:43 PM	1:13 PM	30	0.50	3.93	98.00	101.00	141.00	141.00	3.00	41.50	10.0
9	1:13 PM	1:43 PM	30	0.50	4.43	98.00	101.00	141.00	141.00	3.00	41.50	10.0
10	1:43 PM	2:13 PM	30	0.50	4.93	89.00	92.00	141.00	141.00	3.00	50.50	10.0
11	2:13 PM	2:43 PM	30	0.50	5.43	88.00	90.00	141.00	141.00	2.00	52.00	15.0
12	2:43 PM	3:13 PM	30	0.50	5.93	88.00	90.00	141.00	141.00	2.00	52.00	15.0

PERCOLATION RATE CONVERSION (Porchet Method):

H_O	53.00	
H_f	49.00	
ΔH	4.00	
H_{avg}	51.00	
I_t	**0.18**	in/hr (clear water rate)

* diameter adjusted to an effective diameter due to the loss in volume of water because of gravel packing

LOR GEOTECHNICAL GROUP, INC.
Soil Engineering ▲ Geology ▲ Environmental

PRELIMINARY GEOTECHNICAL AND INFILTRATION FEASIBILITY INVESTIGATION PROPOSED CRYSTAL COVE MULTI-FAMILY RESIDENTIAL DEVELOPMENT, APN 484-030-028, MORENO VALLEY, CALIFORNIA

PROJECT NO. 33767.1
OCTOBER 20, 2021

Prepared For:

Empire CM, Inc.
151 Kalmus Drive, Suite A202
Costa Mesa, California 92626

Attention: Mr. Josh Gause

October 20, 2021

Empire CM, Inc.
151 Kalmus Drive, Suite A202
Costa Mesa, California 92626

Project No. 33767.1

Attention: Mr. Josh Gause

Subject: Preliminary Geotechnical and Infiltration Feasibility Investigation, Proposed Crystal Cove Multi-Family Residential Development, APN 484-030-028, Moreno Valley, California.

LOR Geotechnical Group, Inc., is pleased to present this report of our geotechnical investigation for the subject project. In summary, it is our opinion that the proposed development is feasible from a geotechnical perspective, provided the recommendations presented in the attached report are incorporated into design and construction. However, the contents of this summary should not be solely relied upon.

To provide adequate support for the proposed structures, we recommend that a compacted fill mat be constructed beneath footings and slabs. The compacted fill mat will provide a dense, high-strength soil layer to uniformly distribute the anticipated foundation loads over the underlying soils. Any undocumented fill material and any loose alluvial materials should be removed from structural areas and areas to receive engineered compacted fills. The data developed during this investigation indicates that removals on the order of approximately 5 feet will be required from currently planned development areas. The given removal depths are preliminary and the actual depths of the removals should be determined during the grading operation by observation and/or in-place density testing.

Very low expansion potential, poor R-value quality, and negligible soluble sulfate content generally characterize the onsite materials tested. Near completion and/or at the completion of site grading, additional foundation and subgrade soils should be tested as necessary, to verify their expansion potential, soluble sulfate content, and R-value quality.

Poor infiltration rates were obtained for the soils tested.

LOR Geotechnical Group, Inc.

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INTRODUCTION

During September and October of 2021, a Preliminary Geotechnical and Infiltration Feasibility Investigation was performed by LOR Geotechnical Group, Inc., for the proposed Crystal Cove Multi-Family Residential development of Assessor Parcel Number (APN) 484-030-028, Moreno Valley, California. The purpose of this investigation was to provide a technical evaluation of the geologic setting of the site and to provide geotechnical design recommendations for the proposed development. The scope of our services included:

- Review of available geotechnical literature, reports, maps, and agency information pertinent to the study area;
- Interpretation of aerial photographs of the site and surrounding regions dated 1966 through 2020;
- Geologic field reconnaissance mapping to verify the areal distribution of earth units and significance of surficial features as compiled from documents, literature, and reports reviewed;
- A subsurface field investigation to determine the physical soil conditions pertinent to the proposed development;
- Percolation testing via the borehole test method;
- Laboratory testing of selected soil samples obtained during the field investigation;
- Development of geotechnical recommendations for site grading and foundation design; and
- Preparation of this report summarizing our findings, and providing conclusions and recommendations for site development.

The approximate location of the site is shown on the attached Index Map, Enclosure A-1, within Appendix A.

PROJECT CONSIDERATIONS

To orient our investigation at the site, a Site Plan was furnished for our use. The proposed building configuration and associated driveways, parking, and landscape areas were

indicated on this plan. The Site Plan was utilized as a base map for our field investigation and is presented as Enclosure A-2, within Appendix A.

As noted on the site plan, development of the site will include nine, 2-and 3-story apartment buildings, a clubhouse, swimming pool, and driveways, parking, and landscape areas. The buildings are anticipated to be of wood frame and stucco or similar type construction and light to moderate foundation loads are anticipated with these structures.

Grading plans have not yet been developed. However, based on the current topography of the site and adjacent areas, minor cuts and fills are anticipated to create level surfaces for the proposed development.

AERIAL PHOTO ANALYSIS

The aerial photographs reviewed consisted of vertical aerial photograph images of varying scales. We reviewed imagery available from Google Earth Pro (2021) computer software and from online Historic Aerials (2021).

To summarize briefly, the site has remained vacant land since 1966, the earliest photograph available. From 1966 to 1997, the site appeared to be dry land farmed in conjunction with the adjacent properties to the south and southwest. No evidence for the presence of faults traversing the site area or mass movement features was noted during our review of the photographs covering the site and nearby vicinity.

EXISTING SITE CONDITIONS

The subject site is approximately 9 acres of vacant land, roughly rectangular in shape, located at the southwest corner of the intersection of Alessandro Boulevard and Lasselle Street in Moreno Valley. The site is situated at elevations ranging from approximately 1,567 to 1,582 feet above mean sea level. The topography of the subject site is relatively planar in general with a gentle fall to the south-southwest. Along most of the west boundary, excluding the north end, is an approximately 6-foot high wall constructed of pilasters and wrought iron fencing. Natural vegetation onsite includes grasses and tumbleweeds up to approximately 4 feet high. Large swaths along the periphery of the subject site have been disced. A rectangular area within the central and east central portions of the subject site has not been disced for weed control. Bare areas of soil are present along/near the roadways for Copper Cove Lane and Lasselle Street. There are relatively minor amounts

of trash and debris onsite. In relatively close proximity to the southwest corner of the subject site are a few, relatively small piles of apparent dumped soils that include concrete and asphalt concrete debris.

Alessandro Boulevard, an asphalt-paved roadway, borders the site to the north, with vacant land beyond. Lasselle Street, an asphalt-paved roadway, borders the site on the east with vacant land beyond. Copper Cove Lane, an asphalt-paved roadway, borders the site on the south, with a tract of residential properties beyond. A church property is located adjacent to the site on the west.

SUBSURFACE FIELD INVESTIGATION

Our subsurface field exploration program was conducted on September 27, 2021. The work consisted of advancing a total of 6 exploratory borings using a truck-mounted drill rig equipped with 8-inch diameter hollow stem augers. The approximate locations of our exploratory borings are presented on Enclosure A-2, within Appendix A.

The subsurface conditions encountered in the exploratory borings were logged by a geologist from this firm. The borings were drilled to maximum depths of 15.33 to 30.33 feet below the existing ground surface. Relatively undisturbed and bulk samples were obtained at a maximum depth interval of 5 feet, and returned to our geotechnical laboratory in sealed containers for further testing and evaluation.

A detailed description of the subsurface field exploration program and the boring logs is presented in Appendix B.

LABORATORY TESTING PROGRAM

Selected soil samples obtained during the field investigation were subjected to geotechnical laboratory testing to evaluate their physical and engineering properties. Laboratory testing included in-place moisture content and dry density, laboratory compaction characteristics, direct shear, sieve analysis, sand equivalent, R-value, consolidation, expansion index, and soluble sulfate content. A detailed description of the geotechnical laboratory testing program and the test results are presented in Appendix C.

GEOLOGIC CONDITIONS

Regional Geologic Setting

The subject site is situated within the northeastern portion of the Peninsular Ranges Geomorphic Province of Southern California. This province incorporates several northwest-trending mountain ranges, such as the Santa Ana and San Jacinto Mountains, which extend from the Transverse Ranges Geomorphic Province, northeast of Los Angeles, into the Baja California Peninsula. Lying in between these small ranges are a series of valleys and basins, such as the Perris Plain. The Perris Plain is composed of rocks of the Peninsular Ranges batholith, a very large mass composed primarily of batholithic crystalline igneous rocks, with lesser amounts of metasedimentary and metavolcanic rocks which predate the intrusion of the batholith. The batholithic rocks actually consist of numerous separate plutonic intrusions which range in composition from gabbro to granite, with tonalite the predominate lithology. While the floor of the Perris Plain is relatively flat, it is dotted with small remnant hills composed of rocks highly resistant to erosion, as observed offsite to the east across Lasselle Street. Erosion of the hills has resulted in the covering of a thin to thick veneer of various ages of alluvial fan materials across the flanks of the hills and out into the adjoining valley floor.

The interior of the Perris Plain is considered to be relatively stable with few known active faults. However, this Plain is bounded by active faults. These include the Elsinore fault zone on the west, the San Jacinto fault zone on the northeast, the Cucamonga fault zone on the north, and the Agua-Tibia fault zone on the south. As the subject site is located near the northeastern margin of Perris Plain, the San Jacinto fault is the closest known active fault in relation to the site. At its closest approach, the San Jacinto fault is located approximately 6.6 kilometers (4.1 miles) to the northeast of the subject site.

The geology of the subject site and immediate surrounding vicinity have been largely mapped as underlain by very old alluvial fan deposits of early Pleistocene age which are mostly well-dissected, well-indurated, and reddish brown sand deposits containing minor gravel, commonly containing duripans and locally silcretes (Morton and Matti, 2001). Offsite and across Lasselle Street to the east, a bedrock unit of tonalite (undifferentiated) of Cretaceous age has also been mapped.

The site and the regional geologic setting are shown on Enclosure A-3 within Appendix A.

Site Geologic Conditions

Fill: Fill materials were encountered within all of our exploratory borings to depths of approximately 2 feet. These materials are believed to be associated with past site use for dry land farming and current and past weed abatement (discing) practices at the site. As encountered, the fill materials were comprised of silty sand which was predominantly brown, dry, and in a loose state. Expansion index testing of these materials indicates a very low expansion potential.

Older Alluvium: Older alluvial materials were encountered underlying the fill materials described above within all of our exploratory borings to the maximum depths explored. These units were noted to mainly consist of silty sand with minor units of sandy silt, clayey sand, and lean clay with sand at depths greater than 7 feet. These materials were typically red brown in color, contained pinhole porosity and calcite stringers, and damp. The older alluvial materials were in a relatively loose to medium dense upon first encounter, becoming dense to very dense quickly with depth based on our equivalent Standard Penetration Test (SPT) data and in-place density testing. Consolidation testing of these materials showed that the upper portions of the older alluvial units to a depth of approximately 5 feet have a moderate to moderately severe potential for collapse. Consolidation testing of the older alluvial units beneath this depth indicate a negligible potential for collapse. Hydro-collapsible soils are primarily defined as unsaturated materials in a low density state that is maintained by apparent cohesion due to clays or accumulated soluble salts at their intergranular contacts. These soils are relatively strong at their natural water contents but experience a significant decrease in volume (settlement) due to softening of the binder upon the introduction of water.

A detailed description of the subsurface soil conditions as encountered within our exploratory borings, is presented on the Boring Logs within Appendix B.

Groundwater Hydrology

Groundwater was not encountered within any our exploratory borings advanced to a maximum depth of approximately 30 feet below the existing ground surface nor was any groundwater seepage observed during our site reconnaissance.

Local water level measurements were researched at the California Department of Water Resources (DWR) online Water Data Library, California State Water Resources Control Board (SWRCB) online GeoTracker database, and Spring 2021 Cooperative Well Measuring Program (California DWR, California SWRCB, and Watermaster Support

Services et al., 2021). The closest well found in the DWR online Water Data Library is Well EMWD25695, located approximately 2.1 kilometers (1.3 miles) to the southeast of the subject site. Groundwater levels measured in this wells have ranged from approximately 40 to 67 feet bgs (1,440 to 1,467 feet above mean sea level [amsl]) within the time period from November 2011 to March 2021. The closest wells in the SWRCB GeoTracker database are associated with a Leaking Underground Storage Tank (LUST) case at a gasoline station (TOSCO/76 Station #6962), addressed 25020 Alessandro Boulevard, located approximately 1.3 kilometers (0.8 mile) west-northwest of the subject site. Twelve groundwater monitoring wells at this LUST site have measurements over the time period from 2000 to 2010 ranging from approximately 25 to 36 feet bgs, with corresponding elevations ranging from approximately 1,530 to 1,540 feet amsl. The closest groundwater wells for which the Cooperative Well Measuring Program has water level data are the monitoring wells associated with the TOSCO/76 Station #6962 LUST site approximately 1.3 kilometers (0.8 mile) west-northwest of the subject site. Based on the lowest subject site ground surface elevation of 1,567 feet amsl, the groundwater associated with the EMWD well to the southeast would imply groundwater at approximately 100 feet bgs at the subject site. However, the closer LUST site groundwater monitoring wells, with shallowest groundwater elevation at approximately 1,540 feet amsl, would imply groundwater at approximately 27 feet bgs at the subject site. However, based on the relatively shallow igneous bedrock (tonalite) encountered at the subject site at depths ranging from approximately 7.5 to 23 feet bgs and the lack of bedrock encountered at the LUST site maximum exploration depth up to 65 feet bgs, and the distance between the subject site and the LUST site, it is difficult to accurately estimate where groundwater may be present beneath the subject site. If groundwater is present beneath the subject site, it would be anticipated as infilling of cracks and fissures within the igneous bedrock at depth. Our exploration boring, B-6, advanced to approximately 30.33 feet bgs from a ground surface elevation of approximately 1,568 feet amsl, suggests no groundwater is present beneath the subject site down to an elevation of approximately 1,538 feet amsl.

The local groundwater flow direction is estimated towards the San Jacinto River, generally in a southerly direction, coincident with the fall in local ground surface topography.

Mass Movement

The site lies on a relatively flat surface. The occurrence of mass movement failures such as landslides, rockfalls, or debris flows within such areas is generally not considered common, and no evidence of mass movement was observed on the site.

Faulting

No active or potentially active faults are known to exist at the subject site. In addition, the subject site does not lie within a current State of California Earthquake Fault Zone (Hart and Bryant, 2003) nor does the site lie within a County of Riverside fault zone (CRTLMA, 2021). No evidence of faulting projecting into or crossing the site was noted during our aerial photograph review or our review of published geologic maps.

As previously mentioned, the closest known active earthquake fault with a documented location is the San Jacinto fault located approximately 6.6 kilometers (4.1 miles) to the northeast. In addition, other relatively close active faults include the San Andreas fault located approximately 22.0 kilometers (13.7 miles) to the northeast, and the Elsinore fault located approximately 29.0 kilometers (18.0 miles) to the southwest.

The San Jacinto fault zone is a sub-parallel branch of the San Andreas fault zone, extending from the northwestern San Bernardino area, southward into the El Centro region. This fault has been active in recent times with several large magnitude events. It is believed that the San Jacinto fault is capable of producing an earthquake magnitude on the order of 6.5 or larger.

The San Andreas fault is considered to be the major tectonic feature of California, separating the Pacific Plate and the North American Plate. While estimates vary, the San Andreas fault is generally thought to have an average slip rate on the order of 24mm/yr and capable of generating large magnitude events on the order of 7.5.

The Elsinore fault zone is one of the largest in southern California. At its northern end it splays into two segments and at its southern end it is cut by the Yuba Wells fault. The primary sense of slip along the Elsinore fault is right lateral strike-slip. It is believed that the Elsinore fault zone is capable of producing an earthquake magnitude on the order of 6.5 to 7.5.

Current standards of practice included a discussion of all potential earthquake sources within a 100 kilometer (62 mile) radius. However, while there are other large earthquake faults within a 100 kilometer (62-mile) radius of the site, none of these are considered as relevant to the site as the faults described above, due to their closer distance and larger anticipated magnitudes.

Historical Seismicity

In order to obtain a general perspective of the historical seismicity of the site and surrounding region a search was conducted for seismic events at and around the area within various radii. This search was conducted utilizing the historical seismic search website of the U.S.G.S. (2021). This website conducts a search of a user selected cataloged seismic events database, within a specified radius and selected magnitudes, and then plots the events onto a map. At the time of our search, the database contained data from January 1, 1932 through October 8, 2021.

In our first search, the general seismicity of the region was analyzed by selecting an epicenter map listing all events of magnitude 4.0 and greater, recorded since 1932, within a 100 kilometer (62 mile) radius of the site, in accordance with guidelines of the California Division of Mines and Geology. This map illustrates the regional seismic history of moderate to large events. As depicted on Enclosure A-4, within Appendix A, the site lies within a relatively active region associated with the San Jacinto fault to the northeast.

In the second search, the micro seismicity of the area lying within a 10 kilometer (6.2 miles) radius of the site was examined by selecting an epicenter map listing events on the order of 1.0 and greater since 1978. The results of this search is a map that presents the seismic history around the area of the site with much greater detail, not permitted on the larger map. The reason for limiting the time period for the events on the detail map is to enhance the accuracy of the map. Events recorded prior to the mid to late1970's are generally considered to be less accurate due to advancements in technology. As depicted on this map, Enclosure A-5, the San Jacinto fault zone to the northeast appears to be the source of numerous events.

In summary, the historical seismicity of the site entails numerous small to medium magnitude earthquake events occurring in the region around the subject site. Any future developments at the subject site should anticipate that moderate to large seismic events could occur very near the site.

Secondary Seismic Hazards

Other secondary seismic hazards generally associated with severe ground shaking during an earthquake include liquefaction, seismic-induced settlement, seiches and tsunamis, earthquake induced flooding, landsliding, and rockfalls.

Liquefaction: The site lies within an area mapped by the County of Riverside has having a very low potential for liquefaction (CRTLMA, 2021). The potential for liquefaction generally occurs during strong ground shaking within granular loose sediments where the groundwater is usually less than 50 feet below the ground surface. Since groundwater does not lie within 50 feet beneath the site, as found during this investigation, and the site is underlain by relatively dense to very dense older alluvial materials and hard igneous bedrock, the possibility of liquefaction at the site is considered nil.

Seiches/Tsunamis: The potential for the site to be affected by a seiche or tsunami (earthquake generated wave) is considered nil due to absence of any large bodies of water near the site.

Flooding (Water Storage Facility Failure): There are no large water storage facilities located on or near the site which could possibly rupture during in earthquake and affect the site by flooding.

Seismically-Induced Landsliding: Due to the low relief of the site and surrounding region, the potential for landslides to occur at the site is considered nil.

Rockfalls: No large, exposed, loose or unrooted boulders are present above the site that could affect the integrity of the site.

Seismically-Induced Settlement: Settlement generally occurs within areas of loose, granular soils with relatively low density. Since the site is underlain by relatively dense to very dense older alluvial materials and hard igneous bedrock, the potential for settlement is considered very low. In addition, the recommended earthwork operations to be conducted during the development of the site should mitigate any near surface loose soil conditions.

SOILS AND SEISMIC DESIGN CRITERIA (California Building Code 2019)

Design requirements for structures can be found within Chapter 16 of the 2019 California Building Code (CBC) based on building type, use, and/or occupancy. The classification of use and occupancy of all proposed structures at the site, shall be the responsibility of the building official.

Site Classification

Chapter 20 of the ASCE 7-16 defines six possible site classes for earth materials that

underlie any given site. Bedrock is assigned one of three of these six site classes and these are: A, B, or C. Soil is assigned as C, D, E, or F. Per ASCE 7-16, Site Class A and Site Class B shall be measured on-site or estimated by a geotechnical engineer, engineering geologist or seismologist for competent rock with moderate fracturing and weathering. Site Class A and Site Class B shall not be used if more than 10 feet of soil is between the rock surface and bottom of the spread footing or mat foundation. Site Class C can be used for very dense soil and soft rock with Ñ values greater than 50 blows per foot. Site Class D can be used for stiff soil with Ñ values ranging from 15 to 50 blows per foot. Site Class E is for soft clay soils with Ñ values less than 15 blows per foot. Our investigation, mapping by others, and our experience in the site region indicates that the materials beneath the site are considered Site Class C soil and soft rock.

CBC Earthquake Design Summary

Earthquake design criteria have been formulated in accordance with the 2019 CBC and ASCE 7-16 for the site based on the results of our investigation to determine the Site Class and an assumed Risk Category II. However, these values should be reviewed and the final design should be performed by a qualified structural engineer familiar with the region. In addition, the building official should confirm the Risk Category utilized in our design (Risk Category II). Our design values are provided below:

CBC 2019 SEISMIC DESIGN SUMMARY* Site Location (USGS WGS84) 33.91638, -117.21011, Risk Category II	
Site Class Definition Chapter 20 ASCE 7	C
$\mathbf{S_s}$ Mapped Spectral Response Acceleration at 0.2s Period	1.714
$\mathbf{S_1}$ Mapped Spectral Response Acceleration at 1s Period	0.669
$\mathbf{S_{MS}}$ Adjusted Spectral Response Acceleration at 0.2s Period	2.0557
$\mathbf{S_{M1}}$ Adjusted Spectral Response Acceleration at 1s Period	0.937
$\mathbf{S_{DS}}$ Design Spectral Response Acceleration at 0.2s Period	1.371
$\mathbf{S_{D1}}$ Design Spectral Response Acceleration at 1s Period	0.625
$\mathbf{F_a}$ Short Period Site Coefficient at 0.2s Period	1.2
$\mathbf{F_v}$ Long Period Site Coefficient at 1s Period	1.4
PGA_M	0.87
Seismic Design Category	D
*Values obtained from OSHPD Seismic Design Maps tool	

INFILTRATION TESTING AND TEST RESULTS

Infiltration Testing

Two borehole percolation tests were conducted in general accordance with the Shallow Percolation Test procedure as outlined in the Design Handbook for Low Impact Development Best Management Practices (CRFCWCD, 2011). The general locations of our tests are illustrated on Enclosure A-2 and were conducted at the requested locations. Test borings were drilled to depths of approximately 5 feet below the existing ground surface on September 27, 2021. Subsequent to drilling, a 3-inch diameter, perforated PVC pipe wrapped in filter fabric was placed within each test hole and 3/4-inch gravel was placed between the outside of the pipe and the hole wall. Test holes were pre-soaked the same day as drilling. Testing took place the next day, September 28, 2021, within 26 hours but not before 15 hours, of the pre-soak. The holes were filled using water from a 200 gallon water tank. Test periods consisted of allowing the water to drop in 30-minute intervals. After each reading, the hole was refilled. Testing was terminated after a total of 12 readings were recorded.

Infiltration test results are summarized in the following table:

Test No.	Depth*	Infiltration Rate** (in/hr)
P-1	4.8	2.6
P-2	4.9	1.0

* depth measured below existing ground surface
** Porchet Method determined rate

The results of this testing are presented as Enclosures D-1 and D-2 in Appendix D. The test results indicate poor infiltration characteristics for the soils tested.

CONCLUSIONS

This investigation provides a broad overview of the geotechnical and geologic factors which are expected to influence future site planning and development. On the basis of our field investigation and testing program, it is the opinion of LOR Geotechnical Group, Inc., that the proposed development of the site for the proposed use is feasible from a geotechnical standpoint, provided the recommendations presented in this report are incorporated into design and implemented during grading and construction.

It should be noted that the subsurface conditions encountered in our exploratory borings are indicative of the locations explored and the subsurface conditions may vary. If conditions are encountered during the construction of the project that differ significantly from those presented in this report, this firm should be notified immediately so we may assess the impact to the recommendations provided.

Foundation Support

To provide adequate support for the proposed structure, we recommend that a compacted fill mat be constructed beneath footings and slabs. The compacted fill mat will provide a dense, high-strength soil layer to uniformly distribute the anticipated foundation loads over the underlying soils. The construction of this compacted fill mat will allow for the removal of the existing fill material which was loose and any current subsurface improvements, such as utilities, foundations, etc., that may be present locally.

Conventional foundation systems utilizing either individual spread footings and/or continuous wall footings will provide adequate support for the anticipated downward and lateral loads when utilized in conjunction with the recommended fill mat.

Soil Expansiveness

Our expansion index testing of a representative sample of the on-site soils indicates a very low expansion potential. For very low expansive soils, no specialized construction procedures to resist expansive soil activity are necessary.

Careful evaluation of onsite soils and any import fill for their expansion potential should be conducted during the grading operation.

Sulfate Protection

The results of the soluble sulfate tests conducted on selected subgrade soils expected to be encountered at foundation levels indicate that there is a negligible sulfate exposure to concrete elements in contact with the on site soils per the 2019 CBC. Therefore, no specific recommendations are given for concrete elements to be in contact with the onsite soils.

Infiltration

The results of our field investigation and test data indicates the site soils have a poor infiltration rate. Recommendations for design and maintenance of the proposed system are presented within the **RECOMMENDATIONS** section of this report.

Geologic Mitigations

No special mitigation methods are deemed necessary at this time, other than the geotechnical recommendations provided in the following sections.

Seismicity

Seismic ground rupture is generally considered most likely to occur along pre-existing active faults. Since no known faults are known to exist at, or project into the site, the probability of ground surface rupture occurring at the site is considered nil.

Due to the site's close proximity to the faults described above, it is reasonable to expect a relatively strong ground motion seismic event to occur during the lifetime of the proposed development on the site. Large earthquakes could occur on other faults in the general area, but because of their lesser anticipated magnitude and/or greater distance, they are considered less significant than the faults described above from a ground motion standpoint.

The effects of ground shaking anticipated at the subject site should be mitigated by the seismic design requirements and procedures outlined in Chapter 16 of the California Building Code. However, it should be noted that the current building code requires the minimum design to allow a structure to remain standing after a seismic event, in order to allow for safe evacuation. A structure built to code may still sustain damage which might ultimately result in the demolishing of the structure (Larson and Slosson, 1992).

No secondary seismic hazards are anticipated to impact the proposed development.

RECOMMENDATIONS

Geologic Recommendations

No special geologic recommendations are deemed necessary at this time, other than the geotechnical recommendations provided in the following sections.

General Site Grading

It is imperative that no clearing and/or grading operations be performed without the presence of a qualified geotechnical engineer. An onsite, pre-job meeting with the developer, the contractor, the jurisdictional agency, and the geotechnical engineer should occur prior to all grading related operations. Operations undertaken at the site without the geotechnical engineer present may result in exclusions of affected areas from the final compaction report for the project.

Grading of the subject site should be performed in accordance with the following recommendations as well as applicable portions of the California Building Code, and/or applicable local ordinances.

All areas to be graded should be stripped of significant vegetation and other deleterious materials.

Any undocumented fill encountered during grading should be completely removed, cleaned of significant deleterious materials, and may be reused as compacted fill. It is our recommendation that any existing fills under any proposed flatwork and paved areas be removed and replaced with engineered compacted fill. If this is not done, premature structural distress (settlement) of the flatwork and pavement may occur.

Cavities created by removal of subsurface obstructions, which are anticipated in areas of the site which were previously developed, should be thoroughly cleaned of loose soil, organic matter and other deleterious materials, shaped to provide access for construction equipment, and backfilled as recommended in the following Engineered Compacted Fill section of this report.

Initial Site Preparation

The existing fill material and any loose older alluvial soils, if encountered, should be removed from all proposed structural and/or fill areas. The data developed during this investigation indicates that removals on the order of 5 feet deep, exclusive of the end dump stockpiles, will be required from proposed development areas in order to encounter competent older alluvium upon which engineered compacted fill can be placed. The given removal depths are preliminary. Deeper fills are anticipated to be present locally, primarily in areas of previous improvements. Removals should expose alluvial materials with an in-situ relative compaction of at least 85 percent (ASTM D 1557). The actual depths of the removals should be determined during the grading operation by observation and/or in-place density testing.

Preparation of Fill Areas

Prior to placing fill, the surfaces of all areas to receive fill should be scarified to a minimum depth of 12 inches. The scarified soil should be brought to near optimum moisture content and compacted to a relative compaction of at least 90 percent (ASTM D 1557).

Engineered Compacted Fill

The onsite soils should provide adequate quality fill material, provided they are free from oversized and/or organic matter and other deleterious materials. Unless approved by the geotechnical engineer, rock or similar irreducible material with a maximum dimension greater than 6 inches should not be buried or placed in fills.

If required, import fill should be inorganic, non-expansive granular soils free from rocks or lumps greater than 6 inches in maximum dimension. Sources for import fill should be approved by the geotechnical engineer prior to their use. Fill should be spread in maximum 8-inch uniform, loose lifts, each lift brought to near optimum moisture content, and compacted to a relative compaction of at least 90 percent in accordance with ASTM D 1557.

Preparation of Foundation Areas

All footings should rest upon at least 24 inches of properly compacted fill material placed over competent alluvium. In areas where the required fill thickness is not accomplished by the recommended removals or by site rough grading, the footing areas should be further subexcavated to a depth of at least 24 inches below the proposed footing base grade, with the subexcavation extending at least 5 feet beyond the footing lines. The bottom of all excavations should be scarified to a depth of 12 inches, brought to near optimum moisture content, and recompacted to at least 90 percent relative compaction (ASTM D 1557) prior to the placement of compacted fill.

Concrete floor slabs should bear on a minimum of 24 inches of compacted soil. This should be accomplished by the recommendations provided above. The final pad surfaces should be rolled to provide smooth, dense surfaces upon which to place the concrete.

Short-Term Excavations

Following the California Occupational and Safety Health Act (CAL-OSHA) requirements, excavations 5 feet deep and greater should be sloped or shored. All excavations and

shoring should conform to CAL-OSHA requirements. Short-term excavations of 5 feet deep and greater shall conform to Title 8 of the California Code of Regulations, Construction Safety Orders, Section 1504 and 1539 through 1547. Based on our exploratory borings, it appears that Type C soils are the predominant type of soil in the upper 7 feet on the project and all short-term excavations should be based on this type of soil.

Deviation from the standard short-term slopes are permitted using option 4, Design by a Registered Professional Engineer (Section 1541.1).

Short-term excavation construction and maintenance are the responsibility of the contractor and should be a consideration of his methods of operation and the actual soil conditions encountered.

Slope Construction

Preliminary data indicates that cut and fill slopes should be constructed no steeper than two horizontal to one vertical. Fill slopes should be overfilled during construction and then cut back to expose fully compacted soil. A suitable alternative would be to compact the slopes during construction, then roll the final slopes to provide dense, erosion-resistant surfaces.

Slope Protection

Since the site soil materials are susceptible to erosion by running water, measures should be provided to prevent surface water from flowing over slope faces. Slopes at the project should be planted with a deep rooted ground cover as soon as possible after completion. The use of succulent ground covers such as iceplant or sedum is not recommended. If watering is necessary to sustain plant growth on slopes, then the watering operation should be monitored to assure proper operation of the irrigation system and to prevent over watering.

Soil Expansiveness

The upper materials encountered during this investigation were tested and found to have a very low expansion potential. Therefore, specialized construction procedures to specifically resist expansive soil activity are not anticipated at this time.

Additional evaluation of on-site and any imported soils for their expansion potential should be conducted following completion of the grading operation.

Foundation Design

If the site is prepared as recommended, the proposed structure may be safely founded on conventional shallow foundations, either individual spread footings and/or continuous wall footings, bearing on a minimum of 24 inches of engineered compacted fill placed over competent older alluvial materials. Foundations should have a minimum width of 12 inches and should be established a minimum of 12 inches below lowest adjacent grade.

For the minimum width and depth, footings may be designed using a maximum soil bearing pressure of 2,000 pounds per square foot (psf) for dead plus live loads. Footings at least 15 inches wide, placed at least 18 inches below the lowest adjacent final grade, may be designed for a maximum soil bearing pressure of 2,100 psf for dead plus live loads.

The above values are net pressures; therefore, the weight of the foundations and the backfill over the foundations may be neglected when computing dead loads. The values apply to the maximum edge pressure for foundations subjected to eccentric loads or overturning. The recommended pressures apply for the total of dead plus frequently applied live loads, and incorporate a factor of safety of at least 3.0. The allowable bearing pressures may be increased by one-third for temporary wind or seismic loading. The resultant of the combined vertical and lateral seismic loads should act within the middle one-third of the footing width. The maximum calculated edge pressure under the toe of foundations subjected to eccentric loads or overturning should not exceed the increased allowable pressure. The buildings should be setback from slopes as indicted within the California Building Code (2019).

Resistance to lateral loads will be provided by passive earth pressure and base friction. For footings bearing against compacted fill, passive earth pressure may be considered to be developed at a rate of 350 pounds per square foot per foot of depth. Base friction may be computed at 0.35 times the normal load. Base friction and passive earth pressure may be combined without reduction. These values are for dead load plus live load and may be increased by one-third for wind or seismic loading.

Settlement

Total settlement of individual foundations will vary depending on the width of the foundation and the actual load supported. Maximum settlement of shallow foundations designed and constructed in accordance with the preceding recommendations are estimated to be on the order of 0.50 inch. Differential settlements between adjacent footings should be about one-half of the total settlement. Settlement of all foundations is expected to occur rapidly,

primarily as a result of elastic compression of supporting soils as the loads are applied, and should be essentially completed shortly after initial application of the loads.

Building Area Slab-on-Grade

To provide adequate support, concrete floor slabs-on-grade should bear on a minimum of 24 inches of engineered fill compacted soil. The final pad surfaces should be rolled to provide smooth, dense surfaces.

Slabs to receive moisture-sensitive coverings should be provided with a moisture vapor retarder/barrier. We recommend that a vapor retarder/barrier be designed and constructed according to the American Concrete Institute 302.1R, Concrete Floor and Slab Construction, which addresses moisture vapor retarder/barrier construction. At a minimum, the vapor retarder/barrier should comply with ASTM E1745 and have a nominal thickness of at least 10 mils. The vapor retarder/barrier should be properly sealed, per the manufacturer's recommendations, and protected from punctures and other damage. Per the Portland Cement Association, for slabs with vapor-sensitive coverings, a layer of dry, granular material (sand) should be placed under the vapor retarder/barrier.

For slabs in humidity-controlled areas, a layer of dry, granular material (sand) should be placed above the vapor retarder/barrier.

The slabs should be protected from rapid and excessive moisture loss which could result in slab curling. Careful attention should be given to slab curing procedures, as the site area is subject to large temperature extremes, humidity, and strong winds.

Exterior Flatwork

To provide adequate support, exterior flatwork improvements should rest on a minimum of 12 inches of soil compacted to at least 90 percent (ASTM D 1557).

Flatwork surface should be sloped a minimum of 1 percent away from buildings and slopes, to approved drainage structures.

Wall Pressures

The design of footings for retaining walls should be performed in accordance with the recommendations described earlier under Preparation of Foundation Areas and Foundation Design. For design of retaining wall footings, the resultant of the applied loads

should act in the middle one-third of the footing, and the maximum edge pressure should not exceed the basic allowable value without increase.

For design of retaining walls unrestrained against movement at the top, we recommend an active pressure of 60 pounds per square foot (psf) per foot of depth be used.

This assumes level backfill consisting of compacted, non-expansive, on-site soils placed against the structures and within the back cut slope extending upward from the base of the stem at 35 degrees from the vertical or flatter.

Retaining structures subject to uniform surcharge loads within a horizontal distance behind the structures equal to the structural height should be designed to resist additional lateral loads equal to 0.50 times the surcharge load. Any isolated or line loads from adjacent foundations or vehicular loading will impose additional wall loads and should be considered individually.

To avoid over stressing or excessive tilting during placement of backfill behind walls, heavy compaction equipment should not be allowed within the zone delineated by a 45 degree line extending from the base of the wall to the fill surface. The backfill directly behind the walls should be compacted using light equipment such as hand operated vibrating plates and rollers. No material larger than three inches in diameter should be placed in direct contact with the wall.

Wall pressures should be verified prior to construction, when the actual backfill materials and conditions have been determined. Recommended pressures are applicable only to level, non-expansive, properly drained backfill with no additional surcharge loadings. If inclined backfills are proposed, this firm should be contacted to develop appropriate active earth pressure parameters.

Preliminary Pavement Design

Testing and design for preliminary onsite pavement was conducted in accordance with the California Highway Design Manual.

Based upon our preliminary sampling and testing, and upon an assumed Traffic Index generally used for similar projects, it appears that the structural sections tabulated below should provide satisfactory pavements for the subject on-site pavement improvements:

AREA	T.I.	DESIGN R-VALUE	PRELIMINARY SECTION
On site vehicular parking with minor truck traffic (ADTT=1)	5.0	15	0.25' AC / 0.65' AB or 4.5" JPCP / 4" AB
Occasional truck traffic (ADTT=10)	6.0	15	0.25'AC / 0.95'AB or 5" JPCP / 4" AB
AC - Asphalt Concrete AB - Class 2 Aggregate Base JPCP - Jointed Plain Concrete Pavement with MR ≥ 550 psi			

The above structural sections are predicated upon 90 percent relative compaction (ASTM D 1557) of all utility trench backfills and 95 percent relative compaction (ASTM D 1557) of the upper 12 inches of pavement subgrade soils and of any aggregate base utilized. In addition, the aggregate base should meet Caltrans specifications for Class 2 Aggregate Base.

In areas of the pavement which will receive high abrasion loads due to start-ups and stops, or where trucks will move on a tight turning radius, consideration should be given to installing concrete pads. Such pads should be a minimum of 5 inch thick concrete, with a 4 inch thick aggregate base. Concrete pads are also recommended in areas adjacent to trash storage areas where heavier loads will occur due to operation of trucks lifting trash dumpsters.

The recommended concrete pavement sections should have a minimum modulus of rupture (MR) of 550 pounds per square inch (psi). Transverse joints should be sawcut in the pavement at approximately 12 to 15-foot intervals within 4 to 6 hours of concrete placement, or preferably sooner. Sawcut depth should be equal to approximately one quarter of slab thickness. Construction joints should be constructed such that adjacent sections butt directly against each other and are keyed into each other. Parallel pavement sections should also be keyed into each other.

It should be noted that all of the above pavement design was based upon the results of preliminary sampling and testing, and should be verified by additional sampling and testing during construction when the actual subgrade soils are exposed.

Infiltration

Based upon our field investigation and infiltration test data, a clear water absorption rate of approximately 1 to 2.6 inches per hour was obtained. It is our opinion that a design clear water rate of 1 inch per hour is appropriate for the planned infiltration in the area and depth tested.

A factor of safety should be applied as indicated by the Design Handbook for Low Impact Development Best Management Practices (RCFCWCD, 2011). The design infiltration rate should be adjusted using a minimum factor of safety 3.0.

To ensure continued infiltration capability of the infiltration area, a program to maintain the facility should be considered. This program should include periodic removal of accumulated materials, which can slow the infiltration considerably and decrease the water quality. Materials to be removed from the catch basin areas typically consist of litter, dead plant matter, and soil fines (silts and clays). Proper maintenance of the system is critical. A maintenance program should be prepared and properly executed. At a minimum, the program should be as outlined in the Design Handbook for Low Impact Development Best Management Practices (RCFCWCD, 2011).

The program should also incorporate the recommendations contained within this report and any other jurisdictional agency requirements.

- Systems should be set back at least 10 feet from foundations or as required by the design engineer.

- Any geotextile filter fabric utilized should consist of such that it prevents soil piping but has greater permeability than the existing soil.

- During site development, care should be taken to not disturb the area(s) proposed for infiltration as changes in the soil structure could occur resulting in a change of the soil infiltration characteristics.

Construction Monitoring

Post investigative services are an important and necessary continuation of this investigation. Project plans and specifications should be reviewed by the project geotechnical consultant prior to construction to confirm that the intent of the

recommendations presented in this report have been incorporated into the design. Additional R-value, expansion, and soluble sulfate content testing may be needed after/during site rough grading.

During construction, sufficient and timely geotechnical observation and testing should be provided to correlate the findings of this investigation with the actual subsurface conditions exposed during construction. Items requiring observation and testing include, but are not necessarily limited to, the following:

1. Site preparation-stripping and removals.

2. Excavations, including approval of the bottom of excavations prior to the processing and preparation of the bottom areas for fill placement.

3. Scarifying and recompacting prior to fill placement.

4. Foundation excavations.

5. Subgrade preparation for pavements and slabs-on-grade.

6. Placement of engineered compacted fill and backfill, including approval of fill materials and the performance of sufficient density tests to evaluate the degree of compaction being achieved.

LIMITATIONS

This report contains geotechnical conclusions and recommendations developed solely for use by Empire CM, Inc. and their design consultants for the purposes described earlier. It may not contain sufficient information for other uses or the purposes of other parties. The contents should not be extrapolated to other areas or used for other facilities without consulting LOR Geotechnical Group, Inc.

The recommendations are based on interpretations of the subsurface conditions concluded from information gained from subsurface explorations and a surficial site reconnaissance. The interpretations may differ from actual subsurface conditions, which can vary horizontally and vertically across the site. If conditions are encountered during the construction of the project, which differ significantly from those presented in this report, this firm should be notified immediately so we may assess the impact to the recommendations provided. Due to possible subsurface variations, all aspects of field construction addressed in this report should be observed and tested by the project geotechnical consultant.

If parties other than LOR Geotechnical Group, Inc., provide construction monitoring services, they must be notified that they will be required to assume responsibility for the geotechnical phase of the project being completed by concurring with the recommendations provided in this report or by providing alternative recommendations.

The report was prepared using generally accepted geotechnical engineering practices under the direction of a state licensed geotechnical engineer. No warranty, expressed or implied, is made as to conclusions and professional advice included in this report. Any persons using this report for bidding or construction purposes should perform such independent investigations as deemed necessary to satisfy themselves as to the surface and subsurface conditions to be encountered and the procedures to be used in the performance of work on this project.

TIME LIMITATIONS

The findings of this report are valid as of this date. Changes in the condition of a property can, however, occur with the passage of time, whether they be due to natural processes or the work of man on this or adjacent properties. In addition, changes in the Standards-of-Practice and/or Governmental Codes may occur. Due to such changes, the findings of this report may be invalidated wholly or in part by changes beyond our control. Therefore, this report should not be relied upon after a significant amount of time without a review by LOR Geotechnical Group, Inc., verifying the suitability of the conclusions and recommendations.

CLOSURE

It has been a pleasure to assist you with this project. We look forward to being of further assistance to you as construction begins. Should conditions be encountered during construction that appear to be different than indicated by this report, please contact this office immediately in order that we might evaluate their effect.

Should you have any questions regarding this report, please do not hesitate to contact our office at your convenience.

Respectfully submitted,
LOR Geotechnical Group, Inc.

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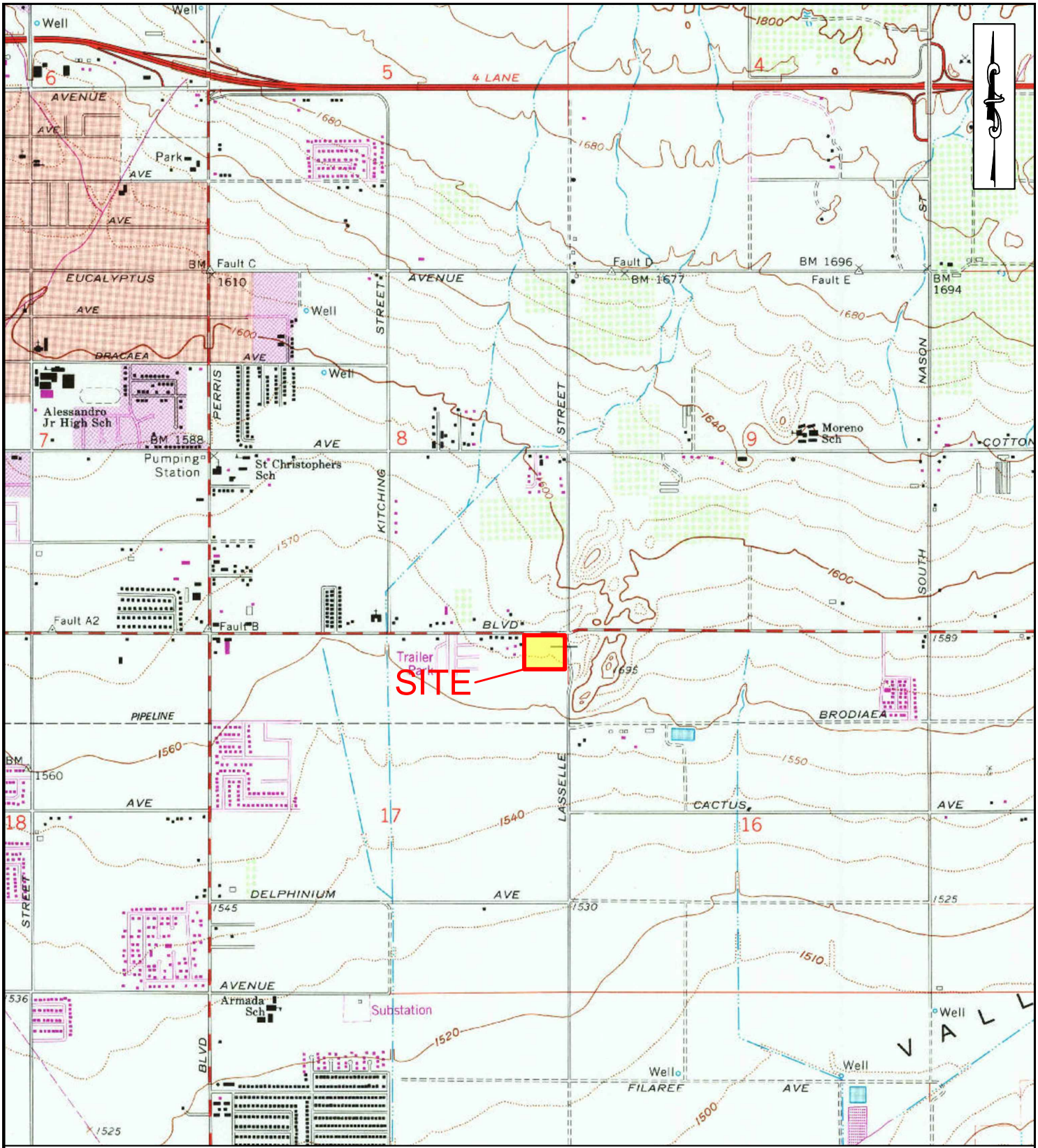
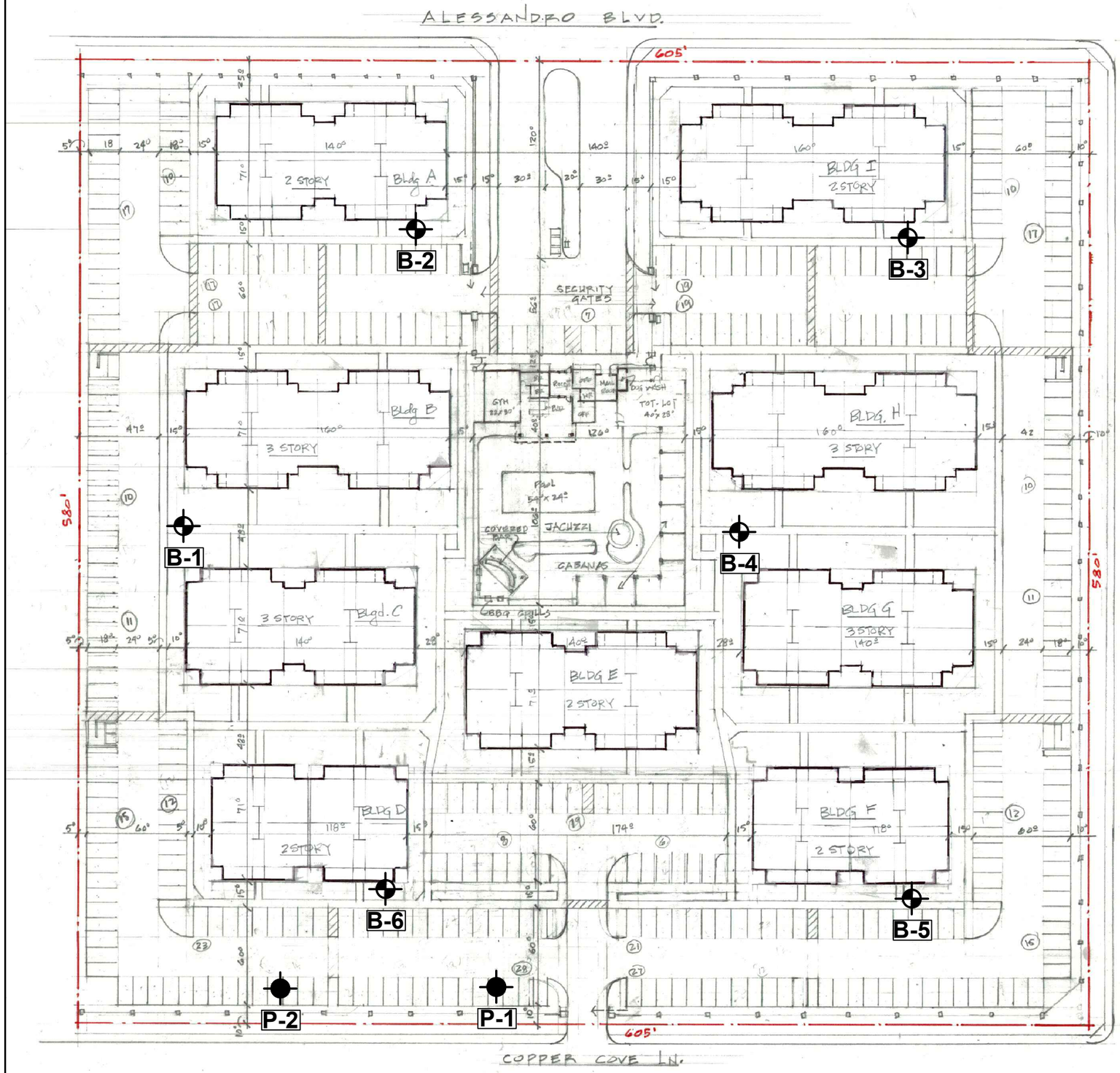
APPENDIX A

Index Map, Site Plan, Regional Geologic Map, and Historical Seismicity Maps



INDEX MAP

PROJECT:	Crystal Cove, Moreno Valley, California	**PROJECT NO.:**	33767.1
CLIENT:	Empire CM, Inc.	**ENCLOSURE:**	A-1
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	October 2021
		SCALE:	1" ≈ 2,000'



Legend

(Locations Approximate)

Map Symbols

- **B-6** - Exploratory Boring
- **P-2** - Percolation Test

CRYSTAL COVE
MORENO VALLEY
1" = 30'

UNIT COUNT:

		PARKING REQ'D	
1X1	72	1.6/UNIT	108
2X2	104	2.0/UNIT	208
	176	GUEST 1/4	44
		360 TOTAL PARKING	
		PARKING PROVIDED 362	

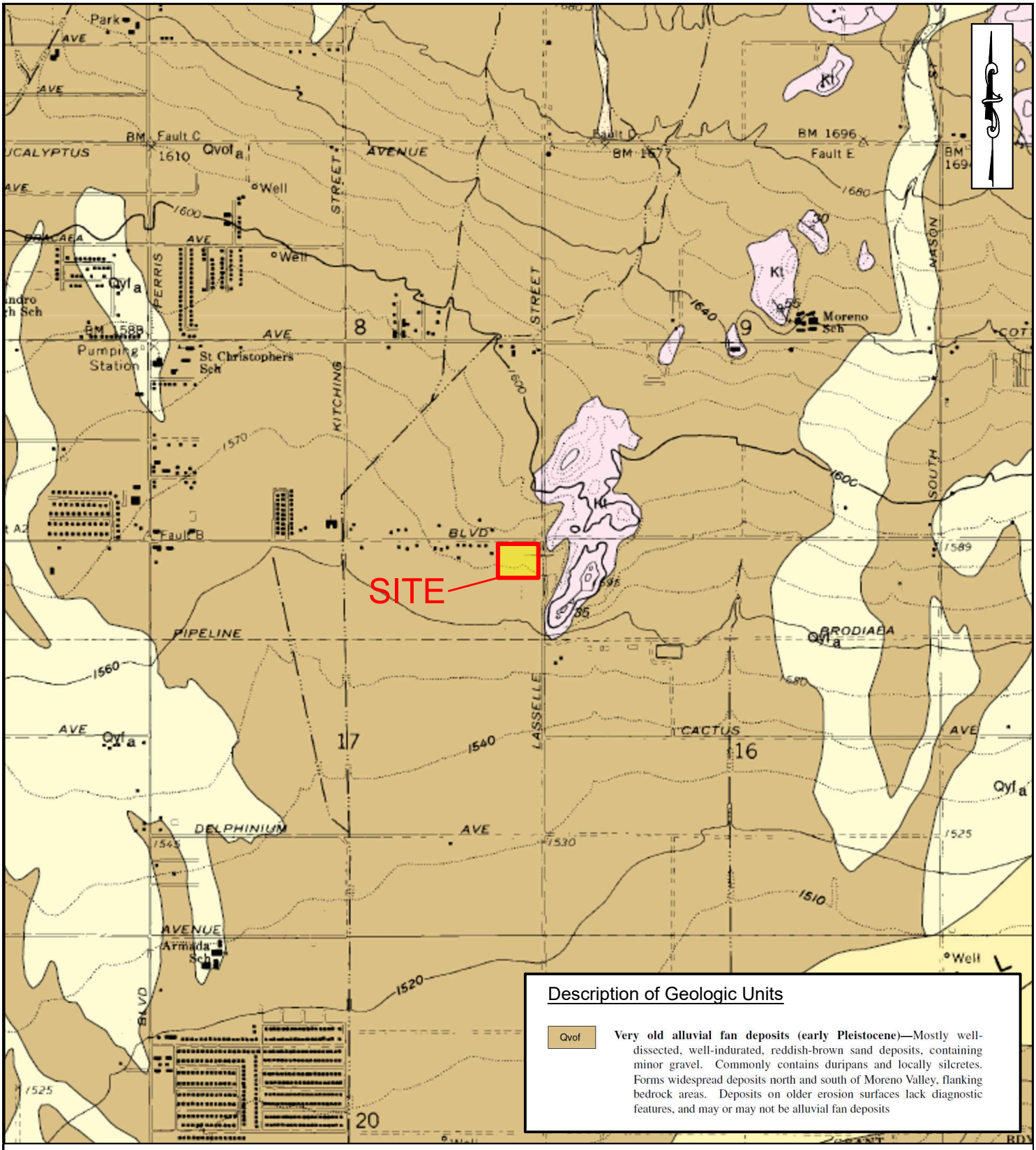
SITE PLAN

PROJECT NO:	33767.1
ENCLOSURE:	A-2
DATE:	October 2021
SCALE:	1" = 18'

PROJECT: Crystal Cove, Moreno Valley, California

CLIENT: Empire CM, Inc.

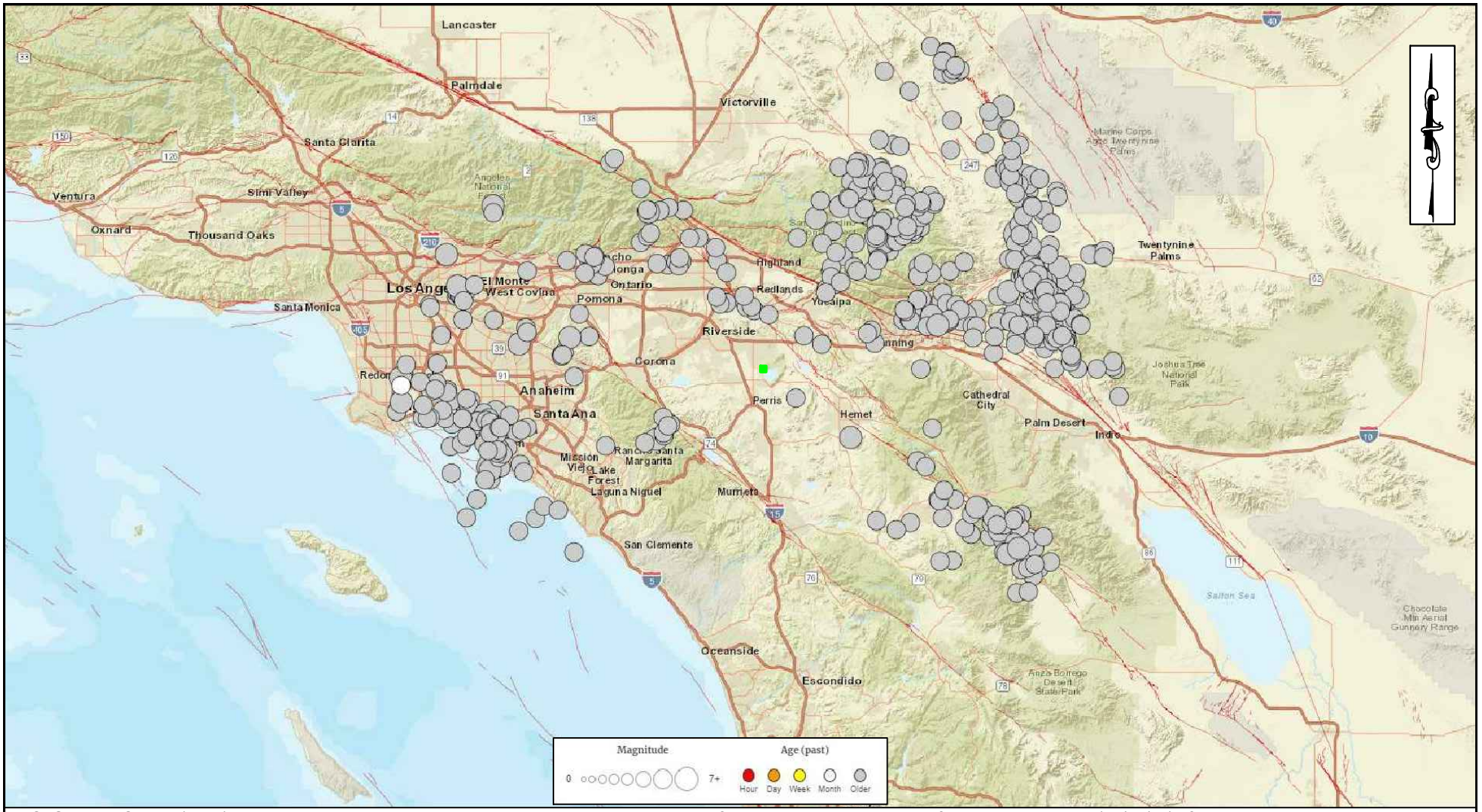
LOR GEOTECHNICAL GROUP, INC.



REGIONAL GEOLOGIC MAP

(Morton & Matti, 2001)

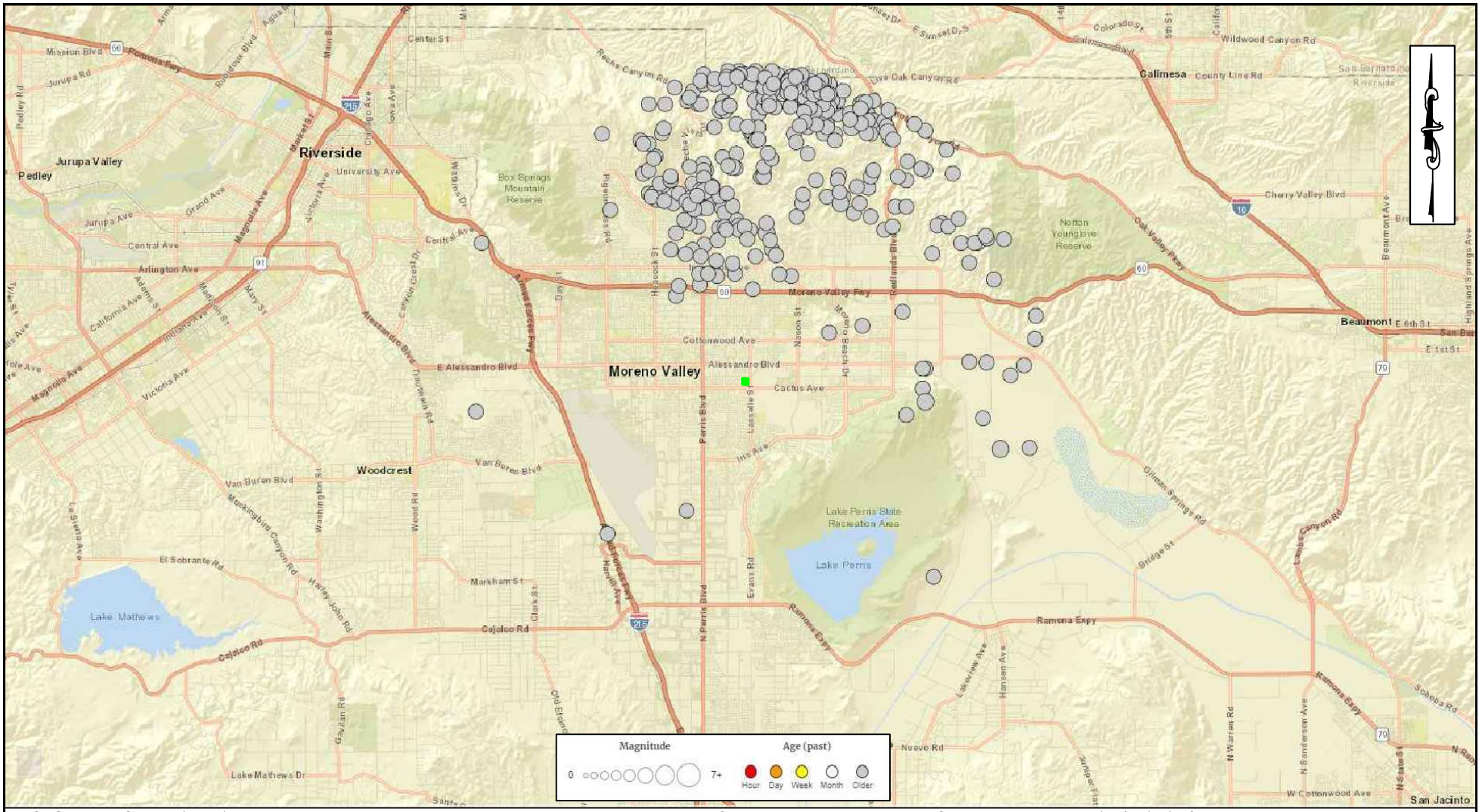
PROJECT:	Crystal Cove, Moreno Valley, California	**PROJECT NO.:**	33767.1
CLIENT:	Empire CM, Inc.	**ENCLOSURE:**	A-3
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	October 2021
		SCALE:	1" ≈ 2,000'



U.S. Geologic Survey (2021) real-time earthquake epicenter map. Plotted are 541 epicenters of instrument-recorded events from 1932 to present (10/08/21) of local magnitude greater than M4.0 within a radius of ~62 miles (100 kilometers) of the site. Location accuracy varies. The site is indicated by the green square. The selected magnitude corresponds to a threshold intensity value where very light damage potential begins. These evens are also generally widely felt by persons. Red lines mark the surface traces of known Quaternary-age faults.

HISTORICAL SEISMICITY MAP - 100km Radius

PROJECT:	Crystal Cove, Moreno Valley, California	**PROJECT NO.:**	33767.1
CLIENT:	Empire CM, Inc.	**ENCLOSURE:**	A-4
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	October 2021
		SCALE:	1" ≈ 40km



U.S. Geologic Survey (2021) real-time earthquake epicenter map. Plotted are 333 epicenters of instrument-recorded events from 1932 to present (10/08/21) of local magnitude greater than M1.0 within a radius of ~6.2 miles (10 kilometers) of the site. Location accuracy varies. The site is indicated by the green square. The selected magnitude corresponds to a threshold intensity value where very light damage potential begins. These evens are also generally widely felt by persons. Red lines mark the surface traces of known Quaternary-age faults.

HISTORICAL SEISMICITY MAP - 10km Radius

PROJECT:	Crystal Cove, Moreno Valley, California	**PROJECT NO.:**	33767.1
CLIENT:	Empire CM, Inc.	**ENCLOSURE:**	A-5
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	October 2021
		SCALE:	1" ≈ 7km

APPENDIX B

Field Investigation Program and Boring Logs

APPENDIX B
FIELD INVESTIGATION

Subsurface Exploration

Our subsurface exploration of the site consisted of drilling 6 exploratory borings to depths between approximately 15.33 and 30.33 feet below the existing ground surface using a Mobile B-61 drill rig on September 27, 2021. The approximate locations of the borings are shown on Enclosure A-2 within Appendix A.

The drilling exploration was conducted using a Mobile B-61 drill rig equipped with 8-inch diameter hollow stem augers. The soils were continuously logged by a geologist from this firm who inspected the site, created detailed logs of the borings, obtained undisturbed, as well as disturbed, soil samples for evaluation and testing, and classified the soils by visual examination in accordance with the Unified Soil Classification System.

Relatively undisturbed samples of the subsoils were obtained at a maximum interval of 5 feet. The samples were recovered by using a California split barrel sampler of 2.50 inch inside diameter and 3.25 inch outside diameter or a Standard Penetration Sampler (SPT) from the ground surface to the total depth explored. The samplers were driven by a 140 pound automatic trip hammer dropped from a height of 30 inches. The number of hammer blows required to drive the sampler into the ground the final 12 inches were recorded and further converted to an equivalent SPT N-value. Factors such as efficiency of the automatic trip hammer used during this investigation (80%), borehole diameter (8"), and rod length at the test depth were considered for further computing of equivalent SPT N-values corrected for field procedures (N60) which are included in the boring logs, Enclosures B-1 through B-6.

The undisturbed soil samples were retained in brass sample rings of 2.42 inches in diameter and 1.00 inch in height, and placed in sealed plastic containers. Disturbed soil samples were obtained at selected levels within the borings and placed in sealed containers for transport to our geotechnical laboratory.

All samples obtained were taken to our geotechnical laboratory for storage and testing. Detailed logs of the borings are presented on the enclosed Boring Logs, Enclosures B-1 through B-6. A Boring Log Legend is presented on Enclosure B-i. A Soil Classification Chart is presented as Enclosure B-ii.

CONSISTENCY OF SOIL

SANDS

SPT BLOWS	CONSISTENCY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
Over 50	Very Dense

COHESIVE SOILS

SPT BLOWS	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium
8-15	Stiff
15-30	Very Stiff
30-60	Hard
Over 60	Very Hard

SAMPLE KEY

Symbol	Description
	INDICATES CALIFORNIA SPLIT SPOON SOIL SAMPLE
	INDICATES BULK SAMPLE
	INDICATES SAND CONE OR NUCLEAR DENSITY TEST
	INDICATES STANDARD PENETRATION TEST (SPT) SOIL SAMPLE

TYPES OF LABORATORY TESTS

1	Atterberg Limits
2	Consolidation
3	Direct Shear (undisturbed or remolded)
4	Expansion Index
5	Hydrometer
6	Organic Content
7	Proctor (4", 6", or Cal216)
8	R-value
9	Sand Equivalent
10	Sieve Analysis
11	Soluble Sulfate Content
12	Swell
13	Wash 200 Sieve

BORING LOG LEGEND

PROJECT:	Crystal Cove, Moreno Valley, California	**PROJECT NO.:**	33767.1
CLIENT:	Empire CM, Inc.	**ENCLOSURE:**	B-i
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	October 2021

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS — MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND 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, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

PARTICLE SIZE LIMITS

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	
12"	3"	3/4"	No . 4	No. 10	No. 40	200	

(U.S. STANDARD SIEVE SIZE)

SOIL CLASSIFICATION CHART

PROJECT:	Crystal Cove, Moreno Valley, California	**PROJECT NO.:**	33767.1
CLIENT:	Empire CM, Inc.	**ENCLOSURE:**	B-ii
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	October 2021

LOG OF BORING B-1

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
0		3, 4, 7 9, 10, 11						SM	@ 0 feet, FILL/TOPSOIL: SILTY SAND, approximately 10% coarse grained sand, 35% medium grained sand, 35% fine grained sand, 20% silty fines, light brown, dry, loose, rodent burrows.
	14	2	4.0		111.1				@ 2 feet, OLDER ALLUVIUM: SILTY SAND, approximately 5% coarse grained sand, 25% medium grained sand, 40% fine grained sand, 30% silty fines with trace clay, red-brown, damp.
5	30		4.3		113.2				@ 5 feet, becomes slightly coarser grained, decrease in porosity, some thin calcite stringers.
	26		7.9		117.7				@ 7 feet, remains slightly porous, increase in moisture.
10	26		7.7		125.0			ML	@ 10 feet, SANDY SILT, approximately 5% course grained sand, 15% medium grained sand, 20% fine grained sand, 60% fines with trace clay, red-brown, damp, trace pinhole porosity.
	83 for 9"		4.5		120.0				@ 12 feet, BEDROCK: TONALITE, course grained, speckled white-tan, damp, friable.
15	46 for 5"		2.6		118.1				@ 15 feet, becomes less weathered, remains friable.
20	73 for 4"		2.4						@ 20 feet, becomes dry, remains somewhat friable. END OF BORING @ 20.33' Fill to 2' No groundwater Bedrock @ 12'
25									

TEST DATA

PROJECT:	Crystal Cove	**PROJECT NO.:**	33767.1	
CLIENT:	Empire CM, Inc.	**ELEVATION:**	1572	
LOR GEOTECHNICAL GROUP, INC.		**DATE DRILLED:**	September 27, 2021	
		EQUIPMENT:	Mobile B-61	
		HOLE DIA.: 8"	**ENCLOSURE:**	B-1

LOG OF BORING B-2

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
0	10		5.5		112.5			SM	@ 0 feet, FILL/TOPSOIL: SILTY SAND, approximately 10% coarse grained sand, 35% medium grained sand, 35% fine grained sand, 20% silty fines, light brown, dry, loose, rodent burrows.
									@ 2 feet, OLDER ALLUVIUM: SILTY SAND, approximately 15% coarse grained sand, 30% medium grained sand, 30% fine grained sand, 25% silty fines with trace clay, red-brown, damp, some pinhole porosity.
5	18		9.0		115.5				@ 5 feet, trace pinhole porosity.
	23		7.9		116.3			SC	@ 7 feet, CLAYEY SAND, approximately 15% coarse grained sand, 25% medium grained sand, 30% fine grained sand, 30% clayey fines of low plasticity, red-brown, damp, trace pinhole porosity, trace thin calcite stringers.
10	33		8.3		117.3				@ 10 feet, becomes gray-brown, trace pinhole porosity, trace thin calcite stringers.
15	65 for 11"		7.4		122.2			SM	@ 15 feet, SILTY SAND, approximately 20% coarse grained sand, 25% medium grained sand, 35% fine grained sand, 20% silty fines, red-brown, damp.
									@ 17 feet, BEDROCK: becomes TONALITE, coarse grained, speckled white-tan, dry, friable.
20	73 for 4"		1.9						@ 20 feet, less friable.
25	73 for 3"		2.3						END OF BORING @ 25.25'
									Fill to 2'
									No groundwater
30									Bedrock @ 17'

TEST DATA

PROJECT:	Crystal Cove	**PROJECT NO.:**	33767.1
CLIENT:	Empire CM, Inc.	**ELEVATION:**	1574
		DATE DRILLED:	September 27, 2021
LOR GEOTECHNICAL GROUP, INC.		**EQUIPMENT:**	Mobile B-61
		HOLE DIA.: 8"	**ENCLOSURE:** B-2

LOG OF BORING B-3

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
0		9, 10, 11						SM	@ 0 feet, FILL/TOPSOIL: SILTY SAND, approximately 10% coarse grained sand, 35% medium grained sand, 35% fine grained sand, 20% silty fines, light brown, dry, loose, rodent burrows.
	20		4.0		112.7				@ 2 feet, OLDER ALLUVIUM: SILTY SAND, approximately 10% coarse grained sand, 30% medium grained sand, 35% fine grained sand, 25% silty fines with trace clay, red-brown, damp, trace pinhole porosity.
5	43		5.8		117.4				@ 5 feet, SILTY SAND, approximately 20% coarse grained sand, 25% medium grained sand, 30% fine grained sand, 25% silty fines, red-brown, damp, micaceous.
10	46 for 4"		2.8						@ 10 feet, BEDROCK: TONALITE, coarse grained, speckled white-tan, dry, friable, rings disturbed.
15	65 for 6"		3.0						@ 15 feet, becomes slightly less weathered, remains friable.
20	73 for 6"		4.2						@ 20 feet, less weathered, slightly friable.
									END OF BORING @ 20.5'
									Fill to 2'
									No groundwater
									Bedrock @ 10'
25									

TEST DATA

PROJECT:	Crystal Cove	**PROJECT NO.:**	33767.1	
CLIENT:	Empire CM, Inc.	**ELEVATION:**	1576	
LOR GEOTECHNICAL GROUP, INC.		**DATE DRILLED:**	September 27, 2021	
		EQUIPMENT:	Mobile B-61	
		HOLE DIA.: 8"	**ENCLOSURE:**	B-3

LOG OF BORING B-4

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
0	21		3.4		113.3			SM	@ 0 feet, FILL/TOPSOIL: **SILTY SAND, approximately 10% coarse grained sand, 35% medium grained sand, 35% fine grained sand, 20% silty fines, light brown, dry, loose, rodent burrows.**
									@ 2 feet, OLDER ALLUVIUM: **SILTY SAND, approximately 15% coarse grained sand, 20% medium grained sand, 35% fine grained sand, 30% silty fines with trace clay, red-brown, damp, some pinhole porosity, trace root hairs.**
5	31		5.1		113.7				@ 5 feet, **slightly coarser grained, porosity slightly larger than pinhole, some secondary calcite.**
10	66		7.3		119.1				@ 10 feet, **SILTY SAND, approximately 20% coarse grained sand, 25% medium grained sand, 35% fine grained sand, 20% silty fines, red-brown, damp, micaceous.**
									@ 12 feet, BEDROCK: **TONALITE, coarse grained, speckled white-tan, dry, friable.**
15	65 for 6"		3.5						
20	73 for 4"		2.6						**END OF BORING @ 20.33'**
									Fill to 2'
									No groundwater
									Bedrock @ 12'
25									

TEST DATA

PROJECT:	Crystal Cove	**PROJECT NO.:**	33767.1	
CLIENT:	Empire CM, Inc.	**ELEVATION:**	1572	
LOR GEOTECHNICAL GROUP, INC.		**DATE DRILLED:**	September 27, 2021	
		EQUIPMENT:	Mobile B-61	
		HOLE DIA.: 8"	**ENCLOSURE:**	B-4

LOG OF BORING B-5

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
0	7	2	5.2		114.0			SM	@ 0 feet, FILL/TOPSOIL: SILTY SAND, approximately 10% coarse grained sand, 35% medium grained sand, 35% fine grained sand, 20% silty fines, light brown, dry, loose, rodent burrows.
									@ 2 feet, OLDER ALLUVIUM: SILTY SAND, approximately 15% coarse grained sand, 25% medium grained sand, 35% fine grained sand, 25% silty fines with trace clay, red-brown, damp, some pinhole porosity.
5	16	2	6.1		117.2				@ 5 feet, SILTY SAND, approximately 25% coarse grained sand, 30% medium grained sand, 30% fine grained sand, 15% silty fines, red-brown, damp, micaceous.
	55		6.0		124.0				@ 7.5 feet, BEDROCK: TONALITE, coarse grained, speckled white-tan, damp, friable.
10	65 for 6"		3.8						
15	65 for 4"		2.7						END OF BORING @ 15.33'
									Fill to 2'
									No groundwater
									Bedrock @ 7.5'
20									

TEST DATA

PROJECT:	Crystal Cove	**PROJECT NO.:**	33767.1	
CLIENT:	Empire CM, Inc.	**ELEVATION:**	1569	
LOR GEOTECHNICAL GROUP, INC.		**DATE DRILLED:**	September 27, 2021	
		EQUIPMENT:	Mobile B-61	
		HOLE DIA.: 8"	**ENCLOSURE:**	B-5

LOG OF BORING B-6

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
0		9, 10, 11						SM	@ 0 feet, FILL/TOPSOIL: **SILTY SAND**, approximately 10% coarse grained sand, 35% medium grained sand, 35% fine grained sand, 20% silty fines, light brown, dry, loose, rodent burrows.
	10	2	4.6		107.9				@ 2 feet, OLDER ALLUVIUM: **SILTY SAND**, approximately 15% coarse grained sand, 20% medium grained sand, 35% fine grained sand, 30% silty fines with trace clay, red-brown, damp, some pinhole porosity.
5	14		3.6		111.3				@ 5 feet, pinhole porosity remains, trace root hairs.
	20		7.3		118.6				@ 7 feet, pinhole porosity and trace root hairs.
10	37		5.2		122.2				@ 10 feet, no visible pinholes, no root hairs, micaceous.
	63 for 10"		11.8					CL	@ 12 feet, **LEAN CLAY with SAND**, 5% coarse grained sand, 10% medium grained sand, 30% fine grained sand, 55% clayey fines of low plasticity, red-brown, damp.
15	33		11.3						
20	71		12.1					SC	@ 20 feet, **CLAYEY SAND**, approximately 25% coarse grained sand, 25% medium grained sand, 25% fine grained sand, 25% clayey fines of low plasticity, red-brown, damp.
									@ 23 feet, BEDROCK: **TONALITE**, coarse grained, speckled white-black, dry, friable.
25	73 for 3"		2.6						
30	77 for 4"		3.6						**END OF BORING @30.33'** **Fill to 2'** **No groundwater** **Bedrock @ 23'**
35									

TEST DATA

PROJECT:	Crystal Cove	**PROJECT NO.:**	33767.1
CLIENT:	Empire CM, Inc.	**ELEVATION:**	1568
		DATE DRILLED:	September 27, 2021
LOR GEOTECHNICAL GROUP, INC.		**EQUIPMENT:**	Mobile B-61
		HOLE DIA.: 8"	**ENCLOSURE:** B-6

APPENDIX C

Laboratory Testing Program and Test Results

APPENDIX C
LABORATORY TESTING

General

Selected soil samples obtained from the borings were tested in our geotechnical laboratory to evaluate the physical properties of the soils affecting foundation design and construction procedures. The laboratory testing program performed in conjunction with our investigation included moisture content, dry density, laboratory compaction characteristics, direct shear, sieve analysis, sand equivalent, R-value, consolidation, expansion index, and soluble sulfate content. Descriptions of the laboratory tests are presented in the following paragraphs:

Moisture Density Tests

The moisture content and dry density information provides an indirect measure of soil consistency for each stratum, and can also provide a correlation between soils on this site. The dry unit weight and field moisture content were determined for selected undisturbed samples, in accordance with ASTM D 2921 and ASTM D 2216, respectively, and the results are shown on the boring logs, Enclosures B-1 through B-6 for convenient correlation with the soil profile.

Laboratory Compaction

A selected soil sample was tested in the laboratory to determine compaction characteristics using the ASTM D 1557 compaction test method. The results are presented in the following table:

LABORATORY COMPACTION				
Boring Number	**Sample Depth (feet)**	**Soil Description (U.S.C.S.)**	**Maximum Dry Density (pcf)**	**Optimum Moisture Content (percent)**
B-1	0-3	(SM) Silty Sand	136.5	7.0

Direct Shear Test

Shear tests are performed in general accordance with ASTM D 3080 with a direct shear machine at a constant rate-of-strain (0.04 inches/minute). The machine is designed to test a sample partially extruded from a sample ring in single shear. Samples are tested at varying normal loads in order to evaluate the shear strength parameters, angle of internal friction and cohesion. Samples are tested in remolded condition (90 percent relative compaction per ASTM D 1557) and soaked, to represent the worse case conditions expected in the field.

The results of the shear test on a selected soil sample is presented in the following table:

DIRECT SHEAR TEST				
Boring Number	**Sample Depth (feet)**	**Soil Description (U.S.C.S.)**	**Apparent Cohesion (psf)**	**Angle of Internal Friction (degrees)**
B-1	0-3	(SM) Silty Sand	450	25

Sieve Analysis

A quantitative determination of the grain size distribution was performed for selected samples in accordance with the ASTM D 422 laboratory test procedure. The determination is performed by passing the soil through a series of sieves, and recording the weights of retained particles on each screen. The results of the grain size distribution analyses are presented graphically on Enclosure C-1.

Sand Equivalent

The sand equivalent of selected soils were evaluated using the California Sand Equivalent Test Method, Caltrans Number 217. The results of the sand equivalent tests are presented with the grain size distribution analyses on Enclosure C-1.

R-Value Test

A soil sample was obtained at probable pavement subgrade level, and was tested to determine its R-value using the California R-Value Test Method, Caltrans Number 301. The results of the R-value test is presented on Enclosure C-1.

Consolidation Tests

The apparatus used for the consolidation tests (odometer) is designed to test a one-inch high portion of the undisturbed soil sample as contained in a sample ring. Porous stones and filler paper are placed in contact with the top and bottom of the specimen to permit the addition or release of water. Loads are applied to the test specimen in specified increments, and the resulting axial deformations are recorded. The results are plotted as log of axial pressure versus consolidation or compression, expressed as strain or sample height.

Samples are tested at field and greater-than field moisture contents. The results are shown on Enclosures C-2 through C-5.

Expansion Index Test

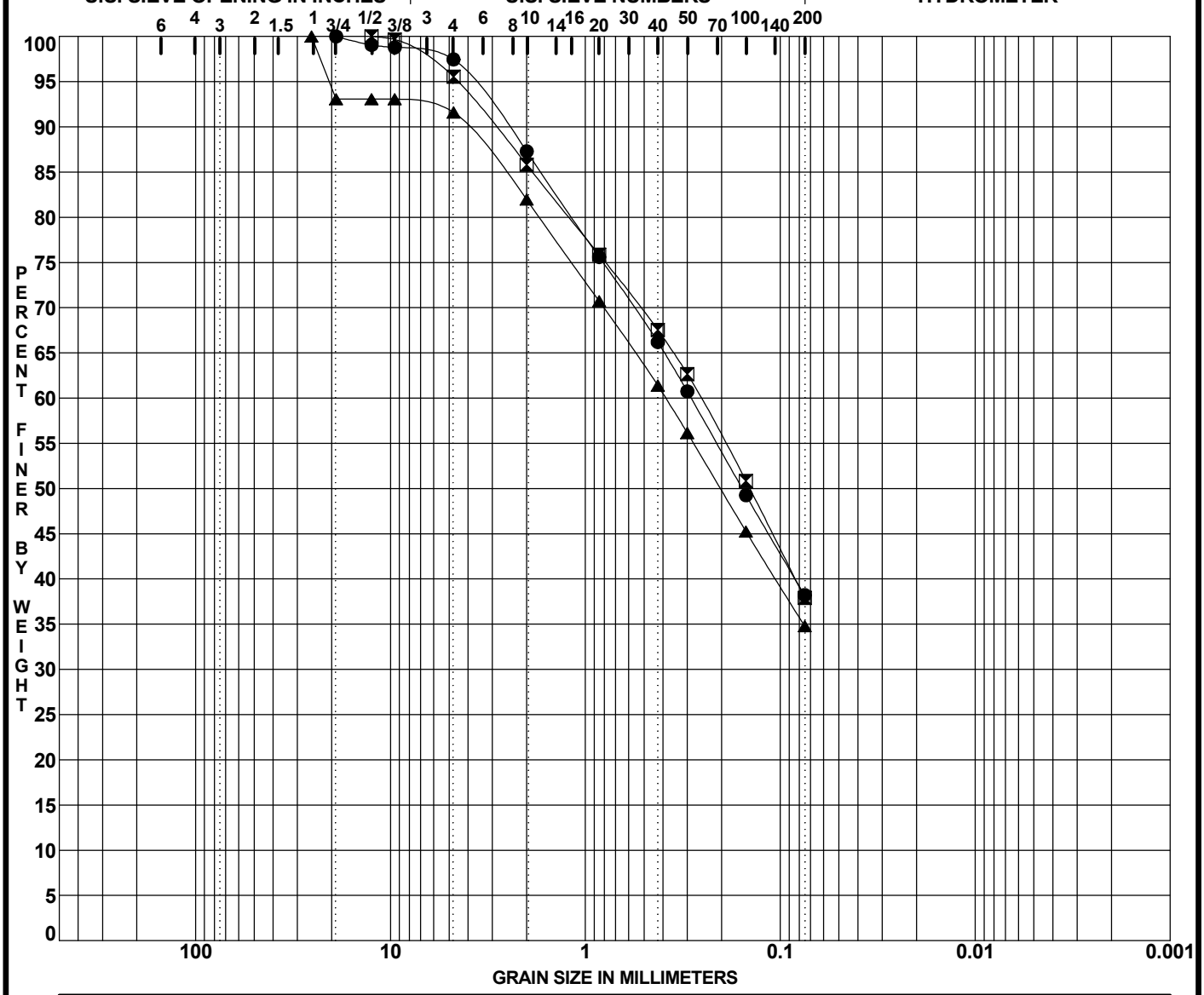
Remolded samples are tested to determine their expansion potential in accordance with the Expansion Index (EI) test. The test is performed in accordance with the Uniform Building Code Standard 18-2. The test result for a select soil sample is presented in the following table:

EXPANSION INDEX TEST				
Boring Number	**Sample Depth (feet)**	**Soil Description (U.S.C.S.)**	**Expansion Index (EI)**	**Expansion Potential**
B-1	0-3	(SM) Silty Sand	11	Very Low
Expansion Index:	0-20 Very low	21-50 Low	51-90 Medium	91-130 High

Soluble Sulfate Content Test

The soluble sulfate content of a selected subgrade soil was evaluated. The concentration of soluble sulfates in the soil was determined by measuring the optical density of a barium sulfate precipitate. The precipitate results from a reaction of barium chloride with water extractions from the soil sample. The measured optical density is correlated with readings on precipitates of known sulfate concentrations. The test result is presented in the following table:

SOLUBLE SULFATE CONTENT TEST			
Boring Number	**Sample Depth (feet)**	**Soil Description (U.S.C.S.)**	**Sulfate Content (% by weight)**
B-1	0-3	(SM) Silty Sand	< 0.005
B-3	0-3	(SM) Silty Sand	< 0.005
B-6	0-3	(SM) Silty Sand	< 0.005



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Soil Classification	SE	RV	PL	PI	Cc	Cu
●	B-1	@ 0-3'	(SM) Silty Sand	15	17				
⊠	B-3	@ 0-3'	(SM) Silty Sand	17	--				
▲	B-6	@ 0-3'	(SM) Silty Sand	18	--				

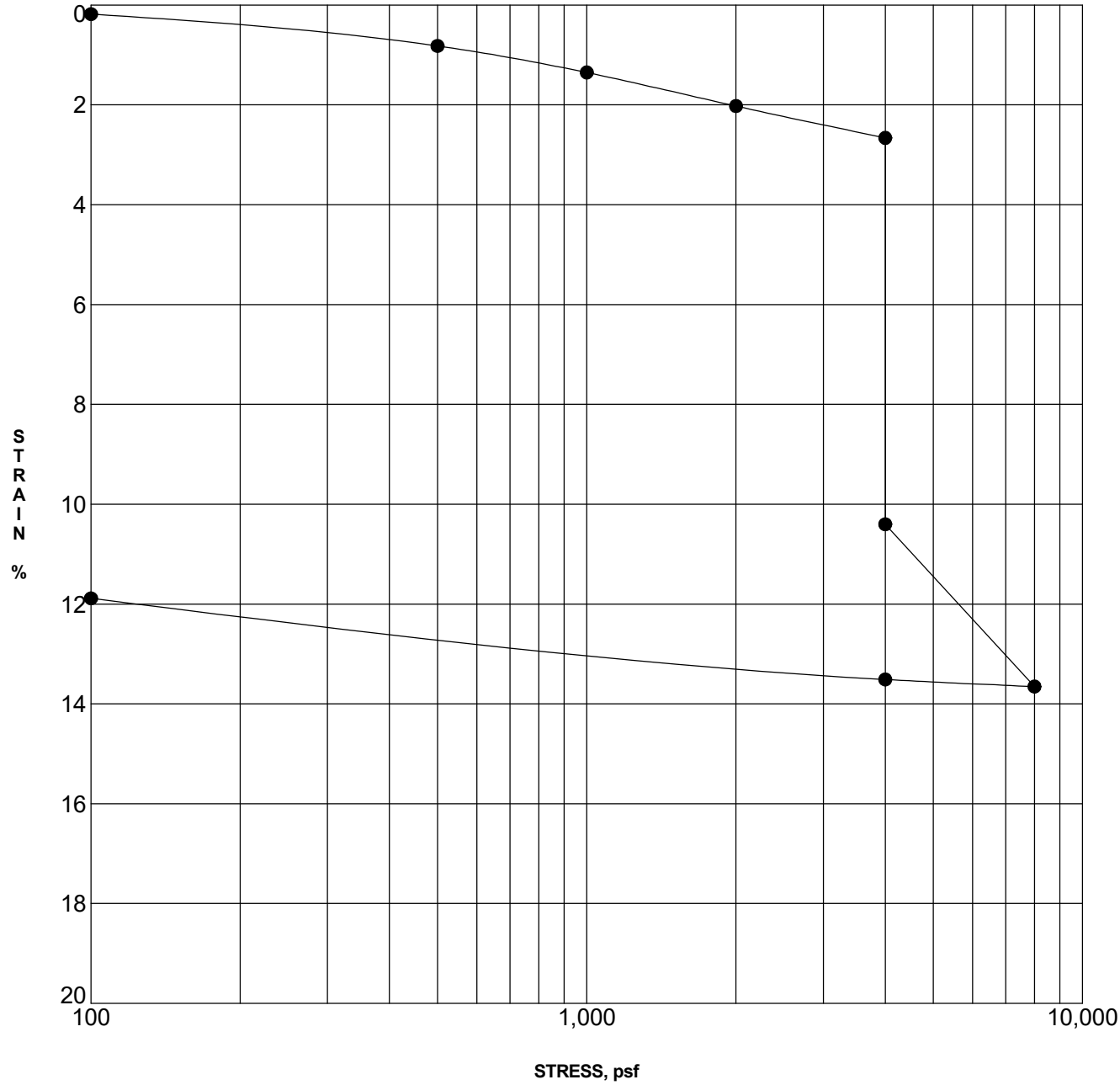
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1	@ 0-3'	19.00	0.29			2.5	59.2	38.2	
⊠	B-3	@ 0-3'	12.50	0.26			4.5	57.6	37.9	
▲	B-6	@ 0-3'	25.40	0.39			8.4	56.8	34.8	

PROJECT:	Crystal Cove	**PROJECT NO.:**	33767.1
CLIENT:	Empire CM, Inc.	**DATE:**	October 2021

GRADATION CURVES

LOR GEOTECHNICAL GROUP, INC.

ENCLOSURE: C-1



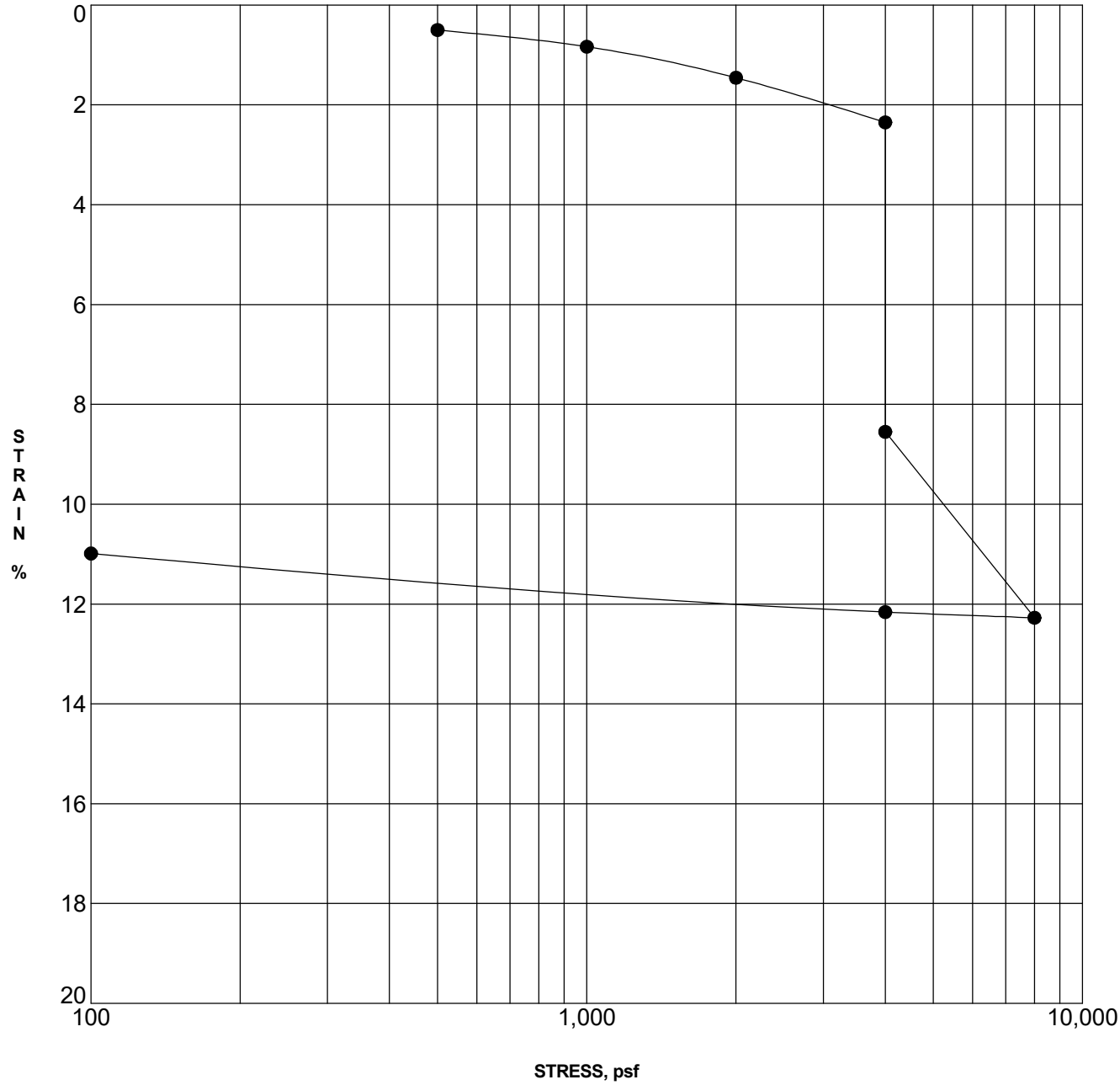
Specimen Identification		Classification	DD	MC%
● B-1 @ 2'		*(SM) Silty Sand*	106	4

PROJECT:	Crystal Cove	**PROJECT NO.:**	33767.1
CLIENT:	Empire CM, Inc.	**DATE:**	October 2021

CONSOLIDATION TEST

LOR GEOTECHNICAL GROUP, INC.

ENCLOSURE: C-2



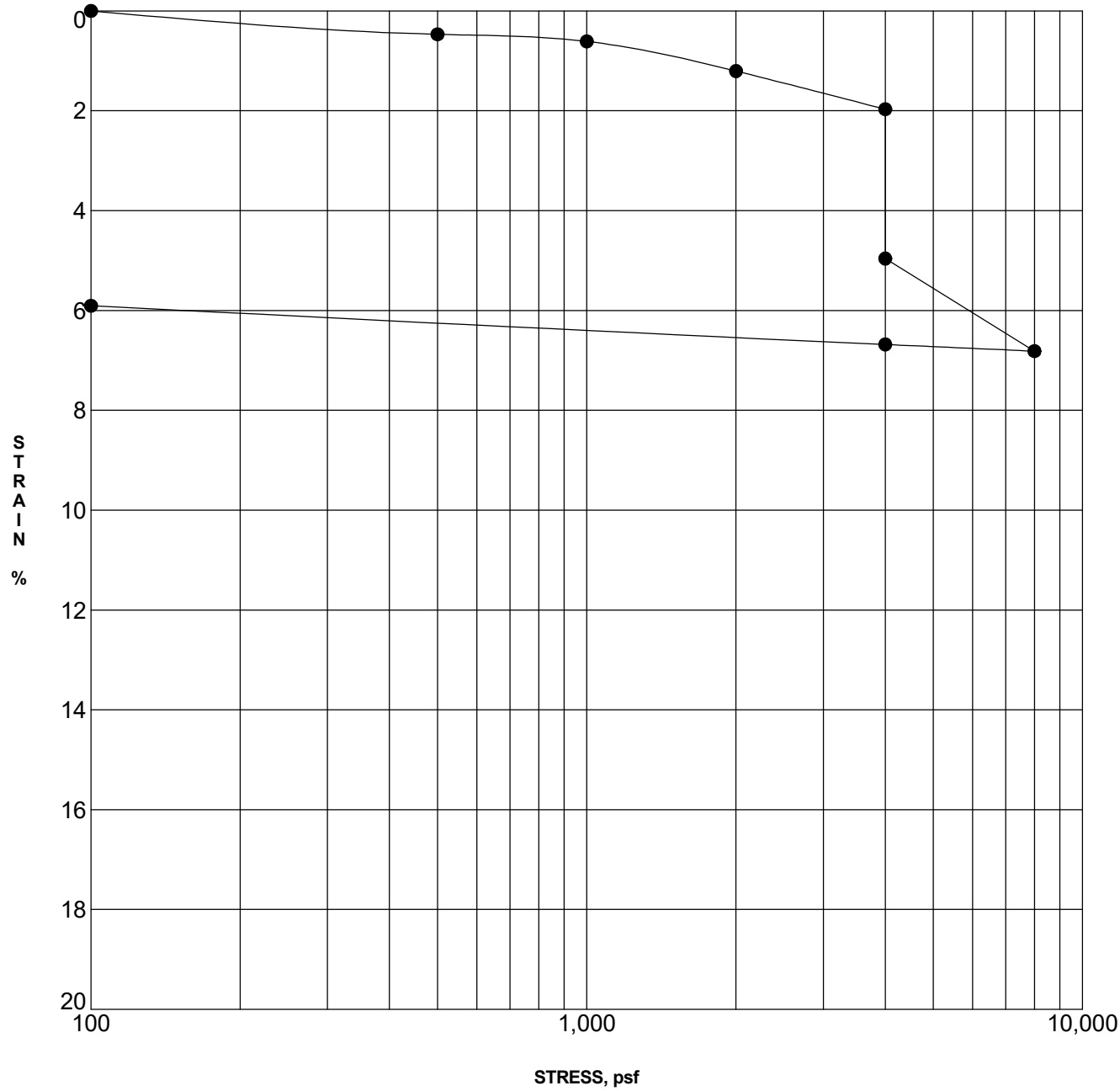
Specimen Identification		Classification	DD	MC%
● B-5 @ 2'		*(SM) Silty Sand*	111	5

PROJECT:	Crystal Cove	**PROJECT NO.:**	33767.1
CLIENT:	Empire CM, Inc.	**DATE:**	October 2021

CONSOLIDATION TEST

LOR GEOTECHNICAL GROUP, INC.

ENCLOSURE: C-3



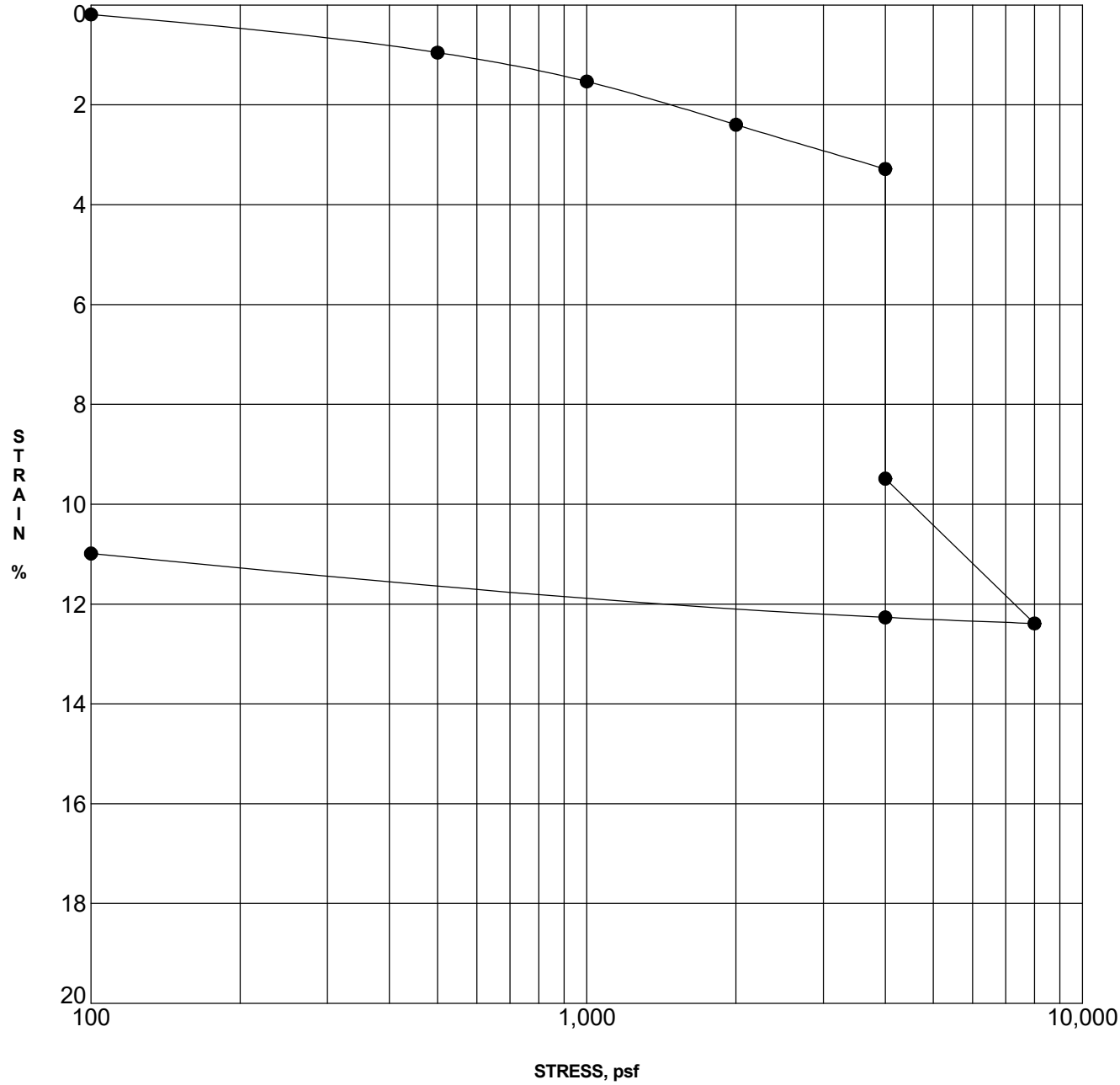
Specimen Identification		Classification	DD	MC%
● B-5 @ 5'		*(SM) Silty Sand*	110	6

PROJECT:	Crystal Cove	**PROJECT NO.:**	33767.1
CLIENT:	Empire CM, Inc.	**DATE:**	October 2021

CONSOLIDATION TEST

LOR GEOTECHNICAL GROUP, INC.

ENCLOSURE: C-4



Specimen Identification		Classification	DD	MC%
● B-6 @ 2'		*(SM) Silty Sand*	108	5

PROJECT:	Crystal Cove	**PROJECT NO.:**	33767.1
CLIENT:	Empire CM, Inc.	**DATE:**	October 2021

CONSOLIDATION TEST

LOR GEOTECHNICAL GROUP, INC.

ENCLOSURE: C-5

APPENDIX D

Percolation Test Results

BOREHOLE METHOD PERCOLATION TEST RESULTS

Project:	Crystal Cove, Moreno Valley	Test Date:	September 28, 2021
Project No.:	33767.1	Test Hole No.:	P-1
Soil Classificaiton:	(SM) Silty sand	Test Hole Diameter:	8.0 in.
Depth of Test Hole:	4.8 ft.	Date Excavated:	September 27, 2021
Tested By:	Andrew L.		

READING	TIME START	TIME STOP	TIME INTERVAL		TOTAL TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	INITIAL HOLE DEPTH	FINAL HOLE DEPTH	CHANGE IN WATER LEVEL	AVERAGE WETTED DEPTH	PERCOLATION RATE
			min	hr.	hr.	in.	in.	in.	in.	in.	in.	in/hr
1	9:07 AM	9:37 AM	30	0.50	0.50	25.00	44.00	57.60	57.00	19.00	22.80	38.0
2	9:37 AM	10:07 AM	30	0.50	1.00	26.00	44.00	57.00	57.00	18.00	22.00	36.0
3	10:07 AM	10:37 AM	30	0.50	1.50	26.00	42.00	57.00	57.00	16.00	23.00	32.0
4	10:37 AM	11:07 AM	30	0.50	2.00	26.00	42.00	57.00	57.00	16.00	23.00	32.0
5	11:07 AM	11:37 AM	30	0.50	2.50	25.00	42.00	57.00	57.00	17.00	23.50	34.0
6	11:37 AM	12:07 PM	30	0.50	3.00	26.00	42.00	57.00	57.00	16.00	23.00	32.0
7	12:07 PM	12:37 PM	30	0.50	3.50	27.00	43.00	57.00	57.00	16.00	22.00	32.0
8	12:37 PM	1:07 PM	30	0.50	4.00	26.00	42.50	57.00	57.00	16.50	22.75	33.0
9	1:07 PM	1:37 PM	30	0.50	4.50	25.00	42.00	57.00	57.00	17.00	23.50	34.0
10	1:37 PM	2:07 PM	30	0.50	5.00	27.00	43.00	57.00	57.00	16.00	22.00	32.0
11	2:07 PM	2:37 PM	30	0.50	5.50	26.00	42.00	57.00	57.00	16.00	23.00	32.0
12	2:37 PM	3:07 PM	30	0.50	6.00	26.00	42.00	57.00	57.00	16.00	23.00	32.0

PERCOLATION RATE CONVERSION (Porchet Method):

H_O	31.00	
H_f	15.00	
ΔH	16.00	
H_{avg}	23.00	
I_t	**2.56**	in/hr (clear water rate)

BOREHOLE METHOD PERCOLATION TEST RESULTS

Project:	Crystal Cove, Moreno Valley	Test Date:	September 28, 2021
Project No.:	33767.1	Test Hole No.:	P-2
Soil Classificaiton:	(SM) Silty sand	Test Hole Diameter:	8.0 in.
Depth of Test Hole:	4.9 ft.	Date Excavated:	September 27, 2021
Tested By:	Andrew L.		

READING	TIME START	TIME STOP	TIME INTERVAL		TOTAL TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	INITIAL HOLE DEPTH	FINAL HOLE DEPTH	CHANGE IN WATER LEVEL	AVERAGE WETTED DEPTH	PERCOLATION RATE
			min	hr.	hr.	in.	in.	in.	in.	in.	in.	in/hr
1	9:08 AM	9:38 AM	30	0.50	0.50	20.00	25.00	58.80	59.00	5.00	36.40	10.0
2	9:38 AM	10:08 AM	30	0.50	1.00	25.00	33.00	59.00	59.00	8.00	30.00	16.0
3	10:08 AM	10:38 AM	30	0.50	1.50	25.00	32.50	59.00	59.00	7.50	30.25	15.0
4	10:38 AM	11:08 AM	30	0.50	2.00	25.00	32.00	59.00	59.00	7.00	30.50	14.0
5	11:08 AM	11:38 AM	30	0.50	2.50	24.00	31.00	59.00	59.00	7.00	31.50	14.0
6	11:38 AM	12:08 PM	30	0.50	3.00	24.00	29.00	59.00	59.00	5.00	32.50	10.0
7	12:08 PM	12:38 PM	30	0.50	3.50	26.00	33.00	59.00	59.00	7.00	29.50	14.0
8	12:38 PM	1:08 PM	30	0.50	4.00	26.00	33.50	59.00	59.00	7.50	29.25	15.0
9	1:08 PM	1:38 PM	30	0.50	4.50	26.00	34.00	59.00	59.00	8.00	29.00	16.0
10	1:38 PM	2:08 PM	30	0.50	5.00	27.00	35.00	59.00	59.00	8.00	28.00	16.0
11	2:08 PM	2:38 PM	30	0.50	5.50	25.00	33.00	59.00	59.00	8.00	30.00	16.0
12	2:38 PM	3:08 PM	30	0.50	6.00	26.00	34.00	59.00	59.00	8.00	29.00	16.0

PERCOLATION RATE CONVERSION (Porchet Method):

H_O	33.00	
H_f	25.00	
ΔH	8.00	
H_{avg}	29.00	
I_t	**1.03**	in/hr (clear water rate)

Appendix 4: Historical Site Conditions

Phase I Environmental Site Assessment or Other Information on Past Site Use

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

(Not Applicable)

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: MDS Consulting
Date: 10/6/2022
Designed by: JRW
Case No:
Company Project Number/Name: 92600 Crystal Cove

BMP Identification

BMP NAME / ID: 1

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.65 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
1A	*50152*	*Ornamental Landscaping*	*0.1*	*0.11*	*5539.7*			
1B	*28725*	*Concrete or Asphalt*	*1*	*0.89*	*25622.7*			
1C	*38999*	*Roofs*	*1*	*0.89*	*34787.1*			
1D	*70346*	*Concrete or Asphalt*	*1*	*0.89*	*62748.6*			
	188222	***Total***			**128698.1**	**0.65**	***6971.1***	***13226***

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

(Rev. 10-2011)

Legend: Required Entries | Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: MDS Consulting — Date: 10/6/2022

Designed by: JRW — Case No:

Company Project Number/Name:

BMP Identification

BMP NAME / ID: MWS UNIT 1

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity — I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

	DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
DMAs	*1A*	*50152*	*Ornamental Landscaping*	*0.1*	*0.11*	*5539.7*			
	1B	*28725*	*Concrete or Asphalt*	*1*	*0.892*	*25622.7*			
	1C	*38999*	*Roofs*	*1*	*0.892*	*34787.1*			
	1D	*70346*	*Concrete or Asphalt*	*1*	*0.892*	*62748.6*			
		188222	***Total***			**128698.1**	**0.20**	***0.6***	***0.7***

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: MDS Consulting | Date: 10/6/2022

Designed by: JRW | Case No:

Company Project Number/Name: 92600

BMP Identification

BMP NAME / ID: 2

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.65 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
2A	35524	Ornamental Landscaping	0.1	0.11	3923.9			
2B	22217	Concrete or Asphalt	1	0.89	19817.6			
2C	40559	Roofs	1	0.89	36178.6			
2D	62921	Concrete or Asphalt	1	0.89	56125.5			
	161221	**Total**			116045.6	0.65	6285.8	12,730

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: MDS Consulting | Date: 10/6/2022

Designed by: JRW | Case No:

Company Project Number/Name:

BMP Identification

BMP NAME / ID: MWS UNIT 2

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity: I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

	DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
DMAs	*2A*	*35524*	*Ornamental Landscaping*	*0.1*	*0.11*	*3923.9*			
	2B	*22217*	*Concrete or Asphalt*	*1*	*0.892*	*19817.6*			
	2C	*40559*	*Roofs*	*1*	*0.892*	*36178.6*			
	2D	*62921*	*Concrete or Asphalt*	*1*	*0.892*	*56125.5*			
		161221		***Total***		**116045.6**	**0.20**	***0.5***	***0.7***

Notes:

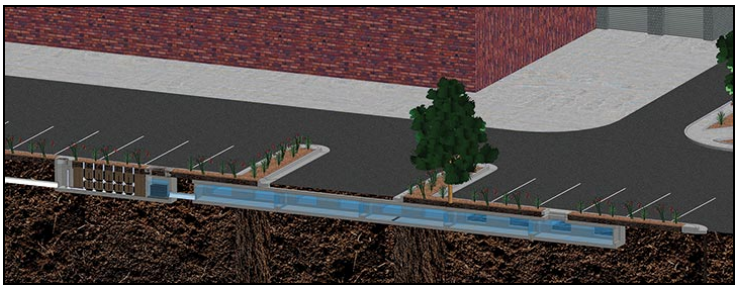
MWS Linear | *Sizing Options*

Flow Based Sizing

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

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

4 units

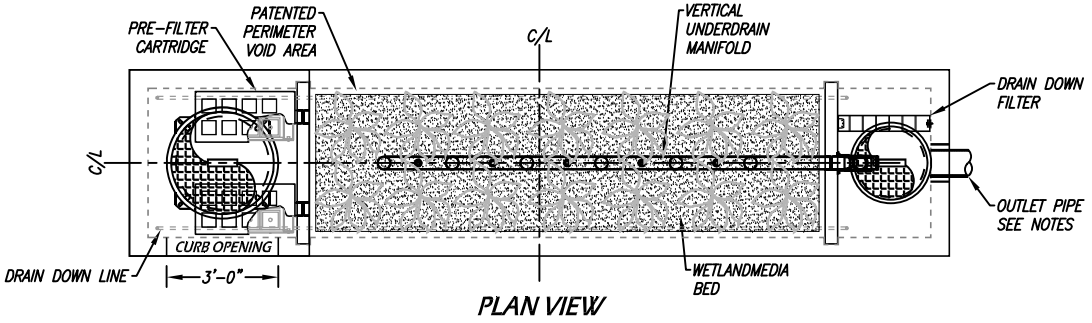


Volume Based Sizing

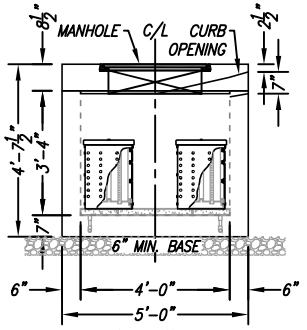
Many states require treatment of a water quality volume and do not offer the option of flow based design. The MWS Linear and its unique horizontal flow makes it the only biofilter that can be used in volume based design installed downstream of ponds, detention basins, and underground storage systems.

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

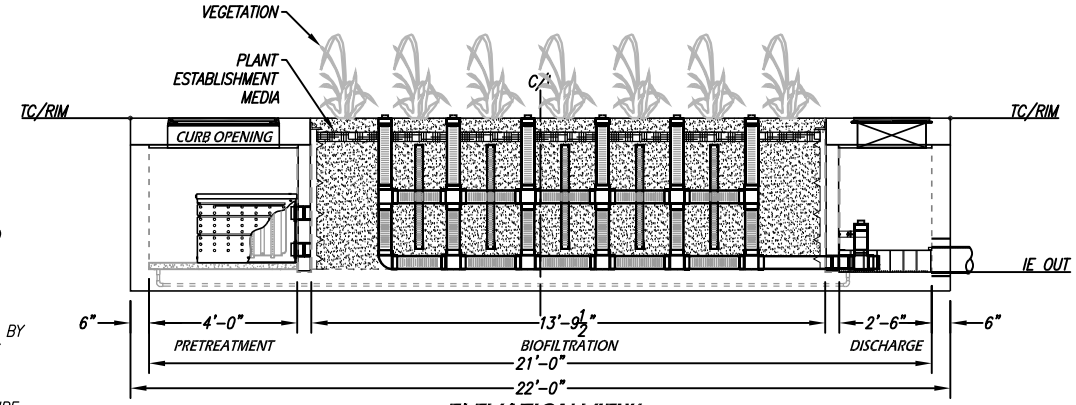
SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			7.63
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø2.34"
MAXIMUM PICK WEIGHT (LBS)			43000
NOTES:			



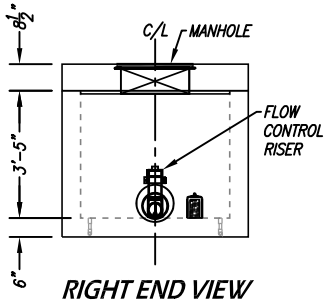
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

TREATMENT FLOW (CFS)	0.268
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

THE PRODUCT DESCRIBED MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

PROPRIETARY AND CONFIDENTIAL:

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MODULAR WETLANDS

www.ModularWetlands.com | (855) MOD WET

MWS-L-4-21-C

STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

(Rev. 10-2011)

Legend: Required Entries | Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: MDS Consulting | Date: 5/3/2022

Designed by: JRW | Case No:

Company Project Number/Name:

BMP Identification

BMP NAME / ID: Drainage Swale 1

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity: I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMAs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
1A	*2555*	*Ornamental Landscaping*	*0.1*	*0.11*	*282.2*			
1B	*35637*	*Concrete or Asphalt*	*1*	*0.892*	*31788.2*			
	38192	***Total***			**32070.4**	**0.20**	***0.1***	***0.1***

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: MDS Consulting
Date: 5/3/2022
Designed by: JRW
Case No:
Company Project Number/Name:

BMP Identification

BMP NAME / ID: Drainage Swale 2

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMAs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
2A	*1168*	*Ornamental Landscaping*	*0.1*	*0.11*	*129*			
2B	*5112*	*Concrete or Asphalt*	*1*	*0.892*	*4559.9*			
	6280	***Total***			**4688.9**	**0.20**	***0***	***0.1***

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

(Rev. 10-2011)

Legend: Required Entries | Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name MDS Consulting — Date 5/3/2022

Designed by JRW — Case No

Company Project Number/Name

BMP Identification

BMP NAME / ID Drainage Swale 3

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMAs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
2A	*1299*	*Ornamental Landscaping*	*0.1*	*0.11*	*143.5*			
2B	*8841*	*Concrete or Asphalt*	*1*	*0.892*	*7886.2*			
	10140	***Total***			**8029.7**	**0.20**	**0**	**0.1**

Notes:

MDS CONSULTING
MORSE SCHULTZ
17320 Redhill Ave.
Suite 350
Irvine, CA 92614
Voice: 949-251-8821
FAX: 949-251-0516
PLANNERS ENGINEERS SURVEYORS

Vegetated Swale Sizing Calculations

Step 1: Determine Design Flowrate (Q)

Flow rate has been sized using the Q_{bmp} worksheets provided in the WQMP TGD by Riverside county

Q = 0.1 CFS

Step 2: Estimate the Swale Bottom Width

$b = (Q \times nWQ) / (1.49 \times y^{1.67} \times s^{0.5})$

b = 1.5'

Where:

b = estimated swale bottom width, ft

Q = design flowrate, cfs

nWQ = Manning's roughness coefficient for shallow flow conditions, use 0.2 unless other information is available

y = design flow depth, ft (not to exceed 4 inches or 0.33 ft)

s = longitudinal slope in flow direction, ft/ft (not to exceed 0.06).

Step 3: Determine Design Flow Velocity

Calculate the design flow velocity using the following equation:

VWQ = Q / AWQ

VWQ = 0.108 cfs

Where:

VWQ = design flow velocity, fps

Q = design flowrate, cfs

AWQ = $by + Zy^2$ (cross sectional area of flow at design depth)

Z = side slope length per unit height **Z= 3:1**

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PLANNERS ENGINEERS SURVEYORS

Vegetated Swale Sizing Calculations

Note: If the design flow velocity exceeds 1 foot per second, design parameters in Step 2 should be adjusted

(slope, bottom width, or design flow depth) until VWQ is equal or less than 1 fps.

Step 4: Calculate Swale Length

Calculate the swale length needed to achieve a minimum hydraulic residence time of 10 minutes using the following equation:

$L = 60 \times tHR \times VWQ$

L = 64.5'

Where:

L = swale length, ft

tHR = hydraulic residence time, min (minimum 10 minutes)

VWQ = design flow velocity, fps

Step 5: If Needed, Adjust Swale Length to Site Constraints

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

(Not Applicable)

HCOC Applicability Map

Hydromodification Susceptibility Documentation Report and Mapping
Riverside County Flood Control and Water Conservation District

Map 2

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

Appendix 8

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

How to use this worksheet (also see instructions in Section **H** of the 20**18** SMR WQMP Template):

1. Review Column 1 and identify which of these potential sources of stormwater pollutants apply to your site. Check each box that applies.
2. Review Column 2 and incorporate all of the corresponding applicable BMPs in your WQMP Exhibit.
3. Review Columns 3 and 4 and incorporate all of the corresponding applicable permanent controls and operational BMPs in your WQMP. Use the format shown in Table H.1 of this WQMP Template. Describe your specific BMPs in an accompanying narrative, and explain any special conditions or situations that required omitting BMPs or substituting alternative BMPs for those shown here.

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☑ A. **On-site storm drain inlets**	☑ **Locations of inlets.**	☑ **Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify.**	☑ **Maintain and periodically repaint or replace inlet markings.** ☐ **Provide stormwater pollution prevention information to new site owners, lessees, or operators.** ☑ **See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com** ☐ **Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."**
☐ B. **Interior floor drains and elevator shaft sump pumps**		☐ **State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.**	☐ **Inspect and maintain drains to prevent blockages and overflow.**
☐ C. **Interior parking garages**		☐ **State that parking garage floor drains will be plumbed to the sanitary sewer.**	☐ **Inspect and maintain drains to prevent blockages and overflow.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☐ D1. **Need for future indoor & structural pest control**		☐ **Note building design features that discourage entry of pests.**	☐ **Provide Integrated Pest Management information to owners, lessees, and operators.**
☑ D2. **Landscape/ Outdoor Pesticide Use**	☐ **Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained.** ☑ **Show self-retaining landscape areas, if any.** ☐ **Show stormwater treatment and hydrograph modification management BMPs.**	**State that final landscape plans will accomplish all of the following.** ☐ **Preserve existing native trees, shrubs, and ground cover to the maximum extent possible.** ☐ **Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution.** ☐ **Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions.** ☑ **Consider using pest-resistant plants, especially adjacent to hardscape. To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.**	☑ **Maintain landscaping using minimum or no pesticides.** ☑ **See applicable operational BMPs in "What you should know for…..Landscape and Gardening"** at: http://www.rcwatershed.org/about/materials-library/#1450469138395-bb76dd39-d810 ☐ **Provide IPM information to new owners, lessees and operators.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☐ E. **Pools, spas, ponds, decorative fountains, and other water features.**	☐ **Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet. (Exception: Public pools must be plumbed according to County Department of Environmental Health Guidelines.)**	**If the Co-Permittee requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.**	☐ **See applicable operational BMPs in "Guidelines for Maintaining Your Swimming Pool, Jacuzzi and Garden Fountain" at:** http://www.rcwatershed.org/about/materials-library/#1450469201433-f5f358c9-6008
☐ F. **Food service**	☐ **For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment.** ☐ **On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.**	☐ **Describe the location and features of the designated cleaning area.** ☐ **Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.**	☐ **See the brochure, "The Food Service Industry Best Management Practices for: Restaurants, Grocery Stores, Delicatessens and Bakeries" at** http://www.rcwatershed.org/about/materials-library/#1450389926766-61e8af0b-53a9 **Provide this brochure to new site owners, lessees, and operators.**
☑ G. **Refuse areas**	☑ **Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas.** ☑ **If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area.** ☐ **Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.**	☐ **State how site refuse will be handled and provide supporting detail to what is shown on plans.** ☑ **State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.**	☑ **State how the following will be implemented:** **Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at** www.cabmphandbooks.com

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ H. **Industrial processes.**	❑ **Show process area.**	❑ **If industrial processes are to be located on site, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."**	❑ **See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com** See the brochure "Industrial & Commercial Facilities Best Management Practices for: Industrial, Commercial Facilities" at: **http://www.rcwatershed.org/about/materials-library/#1450389926766-61e8af0b-53a9**
❑ I. **Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)**	❑ **Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area.** ❑ **Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults.** ❑ **Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.**	❑ **Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains.** **Where appropriate, reference documentation of compliance with the requirements of Hazardous Materials Programs for:** ▪ **Hazardous Waste Generation** ▪ **Hazardous Materials Release Response and Inventory** ▪ **California Accidental Release (CalARP)** ▪ **Aboveground Storage Tank** ▪ **Uniform Fire Code Article 80 Section 103(b) & (c) 1991** ▪ **Underground Storage Tank** **www.cchealth.org/groups/hazmat/**	❑ **See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

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1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☑ J. **Vehicle and Equipment Cleaning**	☑ **Show on drawings as appropriate:** **(1) Commercial/industrial facilities having vehicle/equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses.** **(2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shut-off to discourage such use).** **(3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer.** **(4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.**	☑ **If a car wash area is not provided, describe any measures taken to discourage on-site car washing and explain how these will be enforced.**	**Describe operational measures to implement the following (if applicable):** ☑ **Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system. Refer to "Outdoor Cleaning Activities and Professional Mobile Service Providers" for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at: http://www.rcwatershed.org/about/materials-library/#1450389926766-61e8af0b-53a9** ☐ **Car dealerships and similar may rinse cars with water only.**

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☑ K. **Vehicle/Equipment Repair and Maintenance**	☑ **Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater.** ❑ **Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas.** ❑ **Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.**	☑ **State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area.** ❑ **State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.** ❑ **State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.**	**In the Stormwater Control Plan, note that all of the following restrictions apply to use the site:** ☑ **No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains.** ❑ **No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately.** ☑ **No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment.** **Refer to "Automotive Maintenance & Car Care Best Management Practices for Auto Body Shops, Auto Repair Shops, Car Dealerships, Gas Stations and Fleet Service Operations; "Outdoor Cleaning Activities;" and "Professional Mobile Service Providers" for many of the Potential Sources of Runoff Pollutants. Brochures can be found at: http://www.rcwatershed.org/about/materials-library/#1450389926766-61e8af0b-53a9**

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ L. **Fuel Dispensing Areas**	❑ **Fueling areas[6] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable.** ❑ **Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area[1].] The canopy [or cover] shall not drain onto the fueling area.**		❑ **The property owner shall dry sweep the fueling area routinely.** ❑ **See the Fact Sheet SD-30 , "Fueling Areas" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

[6] **The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.**

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❑ M. **Loading Docks**	❑ **Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer.** ❑ **Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation.** ❑ **Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.**		❑ **Move loaded and unloaded items indoors as soon as possible.** ❑ **See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

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❑ N. **Fire Sprinkler Test Water**		❑ **Provide a means to drain fire sprinkler test water to the sanitary sewer.**	❑ **See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**
O. **Miscellaneous Drain or Wash Water or Other Sources** ❑ **Boiler drain lines** ☑ **Condensate drain lines** ❑ **Rooftop equipment** ❑ **Drainage sumps** ☑ **Roofing, gutters, and trim.** ❑ **Other sources**		❑ **Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system.** ☑ **Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system.** ❑ **Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment.** ❑ **Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water.** ☑ **Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.** ❑ **Include controls for other sources as specified by local reviewer.**	

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1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☑ P. **Plazas, sidewalks, and parking lots.**			☑ **Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.**

Appendix 9: O&M

Operation and Maintenance Plan and Documentation of Finance, Maintenance and Recording Mechanisms

Non-Structural Source BMP Operation and Maintenance

Startup Date	BMP Description	Responsible Party	Procedure and Inspection Requirements	Frequency/Schedule
Upon site opening	**Education for Property Owners, Operators, Tenants, Occupants, or Employees**	Developer then HOA	Educational materials will be available to employees, maintenance crews and contractors. Materials will include environmental awareness such as proper use of chemicals, discharges of wastes, dry cleaning, catch basins and storm drain maintenance, watershed protection. Provide educational materials on an annual basis and upon hiring of employees or any new tenant	Annually
Upon site opening	**Activity Restrictions**	Developer then HOA	Once project has been turned over, certain restrictions may be enacted thru the formation of conditions and CCRs to protect surface water runoff. Provide copy of WQMP to all employees and contractors that do the maintenance work. o Prohibited from the blowing, sweeping, or hosing of debris (leaf litter, grass clippings, litter, etc.) into streets, storm drain inlets, or other conveyances. o Require dumpster lids to be closed at all times. o Prohibit vehicle washing, maintenance, or repair on the premises or restrict those activities (HOA to implement either to prohibit or restrict vehicle washing on residential areas; at a minimum HOA to follow city and state requirements).	Annually
Upon construction of landscaped areas and installation of irrigation system	**Irrigation System and Landscape Management**	Developer then HOA and Property Owners	Inspect all Common landscape areas and replace dead vegetation Properly manage pesticides and fertilizers per City/County Ordinances Inspect, adjust, and repair irrigation system. AB 1881 Compliant See CAQA BMP Factsheet SD 12- Efficient Irrigation (Public) *Fertilizer and pesticide usage will be consistent with the instructions contained on product labels and with*	Monthly during regular maintenance. Weekly during regular maintenance. Weekly, during regular maintenance

			regulations administered by California's Department of Pesticide Regulation. Landscape maintenance such as the replacement of dead vegetation, repair of erosion rills and proper disposal of green waste will be performed on a monthly basis or as needed. Irrigation system maintenance will include periodic testing and observation of the irrigation system to detect overspray, broken sprinkler heads and other system failures on a monthly basis.	
Upon site opening	**Common Area Litter Control**	Developer then Owner and/or Maintenance Contractors	The HOA will be responsible for funding the common areas and slopes within the development. The City of Moreno Valley will be responsible funding for areas within public right-of-way or property transferred to City (i.e. detention basins, riparian area, parks). Inspect and remove all litter and debris located in all common areas, including streets, parkways and sidewalks. Empty trash dumpsters located within delivery area.	Weekly
Upon site opening	**Street Sweeping Private Streets**	Developer then HOA	Inspect and remove all litter and debris. Clean up oil spills. Perform street cleaning during dry weather if possible. Avoid wet cleaning or flushing of street, and utilize dry methods where possible. Operate sweepers at manufacturer requested optimal speed levels to increase effectiveness. Post permanent street sweeping signs in problematic areas; use temporary signs if installation of permanent signs is not possible. Do not store swept material along the side of the street or near a storm drain inlet. Schedule street repair and maintenance such as pavement marking activites, saw cuts in pavement, patching, resurfacing and surface sealing for dry weather.	Twice a month

Upon installation of storm drain system	**Drainage Facility Inspection and Maintenance**	Developer then City of Moreno Valley	Inspect all catch basin and stormdrain pipes, remove litter, debris and any liquids Drainage facilities shall be cleaned if accumulated sediment/debris fills 25% or more of the sediment/debris capacity.	Minimum 3 times annually During the rainy season, beginning October 1st, inspections and maintenance activities shall be required following each rain event.

Structural Source Control BMP Operation and Maintenance

Startup Date	BMP Description	Responsible Party	Procedure and Inspection Requirements	Frequency/Schedule
Upon installation of storm drain system	**MS4 Stenciling and Signage**	Developer then City of Moreno Valley	Developer to provide stenciling or labeling of all storm drain inlets and catch basins for one year following completion of construction. At that time, the public storm drain inlets shall be maintained by the City of Moreno Valley. Catch Basin Stenciling shall include prohibitive language such as: "NO DUMPING, ONLY RAIN IN THE DRAIN" and/or graphical icons to discourage illegal dumping. Inspection/maintenance of the storm drain stenciling may be performed by the City employees or contracted maintenance personnel. During inspection, the inspector(s) shall check for the maintenance indicators given below: • Faded, vandalized, or otherwise unreadable concrete stamping There are no routine maintenance activities for the concrete stamping. If inspection indicates the storm drain stenciling is intact, no action is required. If inspection indicates the concrete stamping is not legible, the storm drain stenciling shall be repaired or replaced, as necessary.	Every 6 months or as needed
Upon construction of landscaped areas and installation of irrigation system	**Use efficient irrigation and landscape design**	Developer then Owner and HOA	Inspect and repair landscape irrigation timers. Inspect and repair all sprinkler heads as needed. Remove and replace dead vegetation as needed. A landscape plan consistent with the City's water conservation ordinance, which includes the use of water sensors and programmable irrigation times, will be implemented. Irrigation systems will be timed appropriately to minimize the runoff of excess irrigation water into the MS4. Drought tolerant plants will be planted in landscaped areas. Plants with similar water	Weekly

			requirements will be grouped together in order to reduce excess irrigation runoff and promote surface infiltration. Mulches will be implemented in planter areas without ground cover to minimize sediment in runoff. Irrigation systems will be inspected on a monthly basis and maintained as needed.	
Upon site opening	**Trash Storage Areas**	Developer then Owner HOA	A private contract shall be prepared between the HOA and CR&R, Incorporated (the current Trash Company). Listed below are minimal requirements from the Riverside County Water Quality Management Plan: • Paved with an impervious surface, designed not to allow run-on from adjoining areas, designed to divert Drainage from adjoining roofs and pavements diverted around the area, screened or walled to prevent offsite transport of trash. • Trash dumpsters shall be leak proof and have attached covers or lids. • Connection of trash area drains to MS4 is prohibited. • Trash compactors shall be roofed and set on a concrete pad. The pad shall be minimum of one foot larger all around than the trash compactor and sloped to drain to a sanitary sewer line.	Weekly

Post Development Site Design BMP Operation and Maintenance

Startup Date	BMP Description	Responsible Party	Procedure and Inspection Requirements	Frequency/Schedule
Upon installation	**Underground Infiltration and Detention Basin** **Stormtech Underground Chambers**	Developer then HOA	Inspect Isolator Row for sediment. Clean out Isolator Row using JetVac process. Replace all caps, lids and covers, record observation and actions. Inspect and clean catch basins and/or manholes upstream of the Stormtech System. See additional inspection and maintenance requirements per manufacturer O&M.	Minimum of twice a year; Prior to and after rainy season (October 15 – April 15).
Upon installation	**Hydrodynamic Separator – CDS unit or equivalent**	Developer then Owner and/or Maintenance Contractors	Inspect and remove blockages or obstructions in the inlet and separation screen. Measure with a dip stick the accumulated pollutant and if the level of sediment has reached 75% of capacity, sediment debris and trash should be removed. Generally the most effective way to remove pollutants is to use vacuum trucks. Remove manhole cover and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.	Minimum twice a year (spring and fall) Monthly during the rainy season (October 15 – April 15).

Appendix 10: Educational Materials

BMP Fact Sheets, Maintenance Guidelines and Other End-User BMP Information`

After the Storm

A Citizen's Guide to Understanding Stormwater

WHEN IT RAINS IT DRAINS

What is stormwater runoff?

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater from naturally soaking into the ground.

Why is stormwater runoff a problem?

Stormwater can pick up debris, chemicals, dirt, and other pollutants and flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water.

The effects of pollution

Polluted stormwater runoff can have many adverse effects on plants, fish, animals, and people.

- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.
- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.

- Debris—plastic bags, six-pack rings, bottles, and cigarette butts—washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.
- Polluted stormwater often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs.

Stormwater Pollution Solutions

Residential

Recycle or properly dispose of household products that contain chemicals, such as insecticides, pesticides, paint, solvents, and used motor oil and other auto fluids. Don't pour them onto the ground or into storm drains.

Lawn care

Excess fertilizers and pesticides applied to lawns and gardens wash off and pollute streams. In addition, yard clippings and leaves can wash into storm drains and contribute nutrients and organic matter to streams.

- Don't overwater your lawn. Consider using a soaker hose instead of a sprinkler.
- Use pesticides and fertilizers sparingly. When use is necessary, use these chemicals in the recommended amounts. Use organic mulch or safer pest control methods whenever possible.
- Compost or mulch yard waste. Don't leave it in the street or sweep it into storm drains or streams.
- Cover piles of dirt or mulch being used in landscaping projects.

Auto care

Washing your car and degreasing auto parts at home can send detergents and other contaminants through the storm sewer system. Dumping automotive fluids into storm drains has the same result as dumping the materials directly into a waterbody.

- Use a commercial car wash that treats or recycles its wastewater, or wash your car on your yard so the water infiltrates into the ground.
- Repair leaks and dispose of used auto fluids and batteries at designated drop-off or recycling locations.

Septic systems

Leaking and poorly maintained septic systems release nutrients and pathogens (bacteria and viruses) that can be picked up by stormwater and discharged into nearby waterbodies. Pathogens can cause public health problems and environmental concerns.

- Inspect your system every 3 years and pump your tank as necessary (every 3 to 5 years).
- Don't dispose of household hazardous waste in sinks or toilets.

Pet waste

Pet waste can be a major source of bacteria and excess nutrients in local waters.

- When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

Education is essential to changing people's behavior. Signs and markers near storm drains warn residents that pollutants entering the drains will be carried untreated into a local waterbody.

Residential landscaping

Permeable Pavement—Traditional concrete and asphalt don't allow water to soak into the ground. Instead these surfaces rely on storm drains to divert unwanted water. Permeable pavement systems allow rain and snowmelt to soak through, decreasing stormwater runoff.

Rain Barrels—You can collect rainwater from rooftops in mosquito-proof containers. The water can be used later on lawn or garden areas.

Rain Gardens and Grassy Swales—Specially designed areas planted with native plants can provide natural places for rainwater to collect and soak into the ground. Rain from rooftop areas or paved areas can be diverted into these areas rather than into storm drains.

Vegetated Filter Strips—Filter strips are areas of native grass or plants created along roadways or streams. They trap the pollutants stormwater picks up as it flows across driveways and streets.

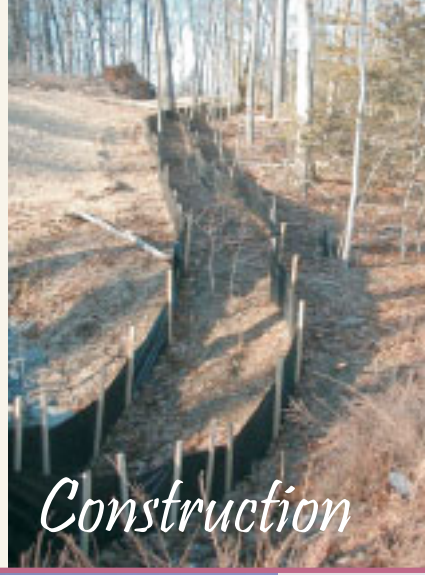
Commercial

Dirt, oil, and debris that collect in parking lots and paved areas can be washed into the storm sewer system and eventually enter local waterbodies.

- Sweep up litter and debris from sidewalks, driveways and parking lots, especially around storm drains.
- Cover grease storage and dumpsters and keep them clean to avoid leaks.
- Report any chemical spill to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming the environment.

Erosion controls that aren't maintained can cause excessive amounts of sediment and debris to be carried into the stormwater system. Construction vehicles can leak fuel, oil, and other harmful fluids that can be picked up by stormwater and deposited into local waterbodies.

- Divert stormwater away from disturbed or exposed areas of the construction site.
- Install silt fences, vehicle mud removal areas, vegetative cover, and other sediment and erosion controls and properly maintain them, especially after rainstorms.
- Prevent soil erosion by minimizing disturbed areas during construction projects, and seed and mulch bare areas as soon as possible.



Construction

Agriculture

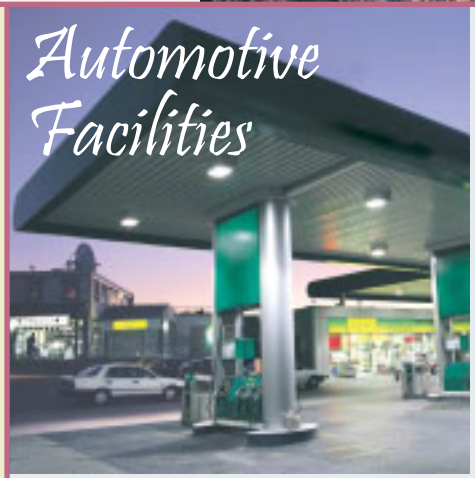
Lack of vegetation on streambanks can lead to erosion. Overgrazed pastures can also contribute excessive amounts of sediment to local waterbodies. Excess fertilizers and pesticides can poison aquatic animals and lead to destructive algae blooms. Livestock in streams can contaminate waterways with bacteria, making them unsafe for human contact.

- Keep livestock away from streambanks and provide them a water source away from waterbodies.
- Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- Vegetate riparian areas along waterways.
- Rotate animal grazing to prevent soil erosion in fields.
- Apply fertilizers and pesticides according to label instructions to save money and minimize pollution.

Forestry

Improperly managed logging operations can result in erosion and sedimentation.

- Conduct preharvest planning to prevent erosion and lower costs.
- Use logging methods and equipment that minimize soil disturbance.
- Plan and design skid trails, yard areas, and truck access roads to minimize stream crossings and avoid disturbing the forest floor.
- Construct stream crossings so that they minimize erosion and physical changes to streams.
- Expedite revegetation of cleared areas.



Automotive Facilities

Uncovered fueling stations allow spills to be washed into storm drains. Cars waiting to be repaired can leak fuel, oil, and other harmful fluids that can be picked up by stormwater.

- Clean up spills immediately and properly dispose of cleanup materials.
- Provide cover over fueling stations and design or retrofit facilities for spill containment.
- Properly maintain fleet vehicles to prevent oil, gas, and other discharges from being washed into local waterbodies.
- Install and maintain oil/water separators.

For more information contact:

or visit
www.epa.gov/npdes/stormwater
www.epa.gov/nps

EPA United States Environmental Protection Agency

THE YEAR OF CLEAN WATER
Celebration & Recommitment

EPA 833-B-03-002

January 2003

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For Information:

Local Sewering Agencies in Riverside County:

City of Beaumont	(909) 769-8520
Belair Homeowners Association	(909) 277-1414
City of Banning	(909) 922-3130
City of Blythe	(760) 922-6161
City of Coachella	(760) 391-5008
Coachella Valley Water District	(760) 398-2651
City of Corona	(909) 736-2259
Desert Center, CSA #51	(760) 227-3203
Eastern Municipal Water District	(909) 928-3777
Elsinore Valley MWD	(909) 674-3146
Farm Mutual Water Company	(909) 244-4198
Idyllwild Water District	(909) 659-2143
Jurupa Community Services Dist.	(909) 685-7434
Lake Hemet MWD	(909) 658-3241
Lee Lake Water District	(909) 277-1414
March Air Force Base	(909) 656-7000
Mission Springs Water District	(760) 329-6448
City of Palm Springs	(760) 323-8242
Rancho Caballero	(909) 780-9272
Rancho California Water Dist.	(909) 676-4101
Ripley, CSA #62	(760) 922-4909
Rubidoux Community Services Dist.	(909) 684-7580
City of Riverside	(909) 782-5341
Silent Valley Club, Inc	(909) 849-4501
Valley Sanitary District	(760) 347-2356
Western Municipal Water District	(909) 780-4170

Spill Response Agency:
Haz-Mat: (909) 358-5055
Hazardous Waste Disposal: (909) 358-5055
To Report Illegal Dumping or a Clogged Storm Drain: 1-800-506-2555

StormWater CleanWater
PROTECTION PROGRAM

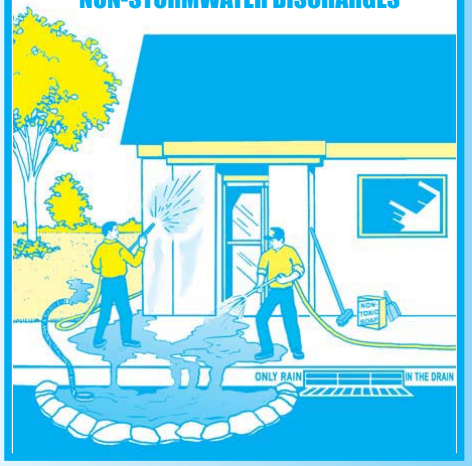
Riverside County gratefully acknowledges the Bay Area Stormwater Management Agencies Association and the Cleaning Equipment Trade Association for information provided in this brochure.

StormWater Pollution

What you should know for...

OUTDOOR CLEANING ACTIVITIES

NON-STORMWATER DISCHARGES



GUIDELINES for disposal of washwater from:

- Sidewalk, plaza or parking lot cleaning
- Vehicle washing or detailing
- Building exterior cleaning
- Waterproofing
- Equipment cleaning or degreasing

Do you know . . . where the water should go?

Riverside County has two drainage systems - sanitary sewers and storm drains. The storm drain system is designed to prevent flooding by carrying excess rainwater away from streets. . . it's not designed to be a waste disposal system. Since the storm drain system does not provide for water treatment, it often serves the unintended function of transporting pollutants directly to our waterways.

Unlike sanitary sewers, storm drains are not connected to a treatment plant - they flow directly to our local streams, rivers and lakes.

Non-stormwater discharges such as washwater generated from outdoor cleaning projects often transport harmful pollutants into storm drains and our local waterways. Polluted runoff contaminates local waterways and poses a threat to groundwater resources.

Soaps, degreasers, automotive fluids, litter, and a host of other materials washed off buildings, sidewalks, plazas, parking areas, vehicles, and equipment can all pollute our waterways.

The Cities and County of Riverside StormWater/CleanWater Protection Program

Since preventing pollution is much easier, and less costly than cleaning up "after the fact," the Cities and County of Riverside StormWater/CleanWater Protection Program informs residents and businesses of pollution prevention activities such as those described in this pamphlet.

The Cities and County of Riverside have adopted ordinances for stormwater management and discharge control. In accordance with state and federal law, these local stormwater ordinances **prohibit** the discharge of wastes into the storm drain system or local surface waters. This includes non-stormwater discharges containing oil, grease, detergents, degreasers, trash, or other waste materials.

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.

Help Protect Our Waterways!

Use These Guidelines For Outdoor Cleaning Activities and Washwater Disposal

DO . . . Dispose of **small amounts** of **washwater from cleaning building exteriors, sidewalks, or plazas** onto landscaped or unpaved surfaces provided you have the owner's permission and the discharge will not cause flooding or nuisance problems, or flow into a storm drain.

DO NOT . . . Discharge **large amounts** of these types of washwater onto landscaped areas or soil where water may run to a street or storm drain. Wastewater from exterior cleaning may be pumped to a sewer line with specific permission from the local sewering agency.

DO . . . Check with your local sewering agency's policies and requirements concerning waste water disposal. **Water from many outdoor cleaning activities** may be acceptable for disposal to the sewer system. See the list on the back of this flyer for phone numbers of the sewering agencies in your area.

DO NOT . . . Pour **hazardous wastes** or toxic materials into the storm drain or sewer system . . . properly dispose of it instead. When in doubt, contact the local sewering agency! The agency will tell you what types of liquid wastes can be accepted.

DO . . . Understand that **water (without soap) used to remove dust from clean vehicles** may be discharged to a street or storm drain. **Washwater from sidewalk, plaza, and building surface cleaning** may go into a street or storm drain if ALL of the following conditions are met:

1) The surface being washed is free of residual oil stains, debris and similar pollutants by using dry cleanup methods (sweeping, and cleaning any oil or chemical spills with rags or other absorbent materials before using water).
2) Washing is done with water only - no soap or other cleaning materials.
3) You have not used the water to remove paint from surfaces during cleaning.

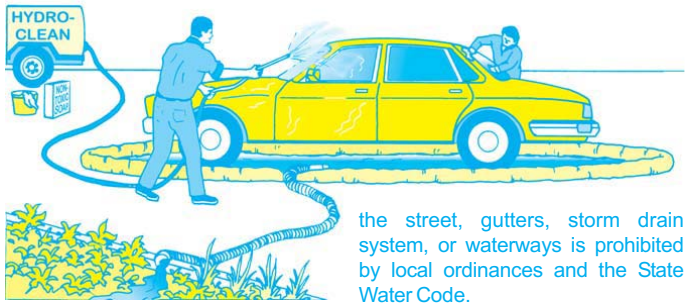
DO NOT . . . Dispose of water containing **soap or any other type of cleaning agent** into a storm drain or water body. This is a direct violation of state and/or local regulations. Because **wastewater from cleaning parking areas or roadways** normally contains metallic brake pad dust, oil and other automotive fluids, it should never be discharged to a street, gutter, or storm drain.

DO . . . Understand that **mobile auto detailers** should divert washwater to landscaped or dirt areas. Note: Be aware that soapy washwater may adversely affect landscaping; consult with the property owner. Residual washwater may remain on paved surfaces to evaporate; sweep up any remaining residue. If there is sufficient water volume to reach the storm drain, collect the runoff and obtain permission to pump it into the sanitary sewer. Follow local sewering agency's requirements for disposal.

DO NOT . . . Dispose of left over cleaning agents into the gutter, storm drain or sanitary sewer.

Regarding Cleaning Agents:

If you must use soap, use biodegradable/phosphate free cleaners. Avoid use of petroleum based cleaning products. Although the use of nontoxic cleaning products is strongly encouraged, ***do*** understand that these products can still degrade water quality and, therefore, the discharge of these products into



the street, gutters, storm drain system, or waterways is prohibited by local ordinances and the State Water Code.

Note: When cleaning surfaces with a high pressure washer or steam cleaning methods, additional precautions should be taken to prevent the discharge of pollutants into the storm drain system. These two methods of surface cleaning, as compared to the use of a low pressure hose, can remove additional materials that can contaminate local waterways.

Other Tips to Help Protect Our Water . . .

Screening Wash Water

A thorough dry cleanup before washing (without soap) surfaces such as building exteriors and decks without loose paint, sidewalks, or plaza areas, *should be sufficient to protect storm drains*. **However,** if any debris (solids) could enter storm drains or remain in the gutter or street after cleaning, washwater should first pass through a "20 mesh" or finer screen to catch the solid material, which should then be disposed of in the trash.

Drain Inlet Protection/ Containing & Collecting Wash Water

- Sand bags can be used to create a barrier around storm drain inlets.
- Plugs or rubber mats can be used to temporarily seal storm drain openings.
- You can also use vacuum booms, containment pads, or temporary berms to keep wash water away from the street, gutter, or storm drain.

Equipment and Supplies

Special materials such as absorbents, storm drain plugs and seals, small sump pumps, and vacuum booms are available from many vendors. For more information check catalogs such as New Pig (800-468-4647), Lab Safety Supply (800-356-0783), C&H (800-558-9966), and W.W. Grainger (800-994-9174); or call the Cleaning Equipment Trade Association (800-441-0111) or the Power Washers of North America (800-393-PWNA).

Stormwater Pollution Found in Your Area!

This is not a citation.

This is to inform you that our staff found the following pollutants in the storm sewer system in your area. This storm sewer system leads directly to

_____ .

- ❑ Motor oil
- ❑ Oil filters
- ❑ Antifreeze/ transmission fluid
- ❑ Paint
- ❑ Solvent/degreaser
- ❑ Cooking grease
- ❑ Detergent
- ❑ Home improvement waste (concrete, mortar)
- ❑ Pet waste
- ❑ Yard waste (leaves, grass, mulch)
- ❑ Excessive dirt and gravel
- ❑ Trash
- ❑ Construction debris
- ❑ Pesticides and fertilizers
- ❑ Other

_____

For more information or to report an illegal discharge of pollutants, please call:

WHEN IT RAINS IT DRAINS

www.epa.gov/npdes/stormwater

EPA
United States Environmental Protection Agency

EPA 833-F-03-002
April 2003

Stormwater runoff is precipitation from rain or snowmelt that flows over the ground. As it flows, it can pick up debris, chemicals, dirt, and other pollutants and deposit them into a storm sewer system or waterbody.

Anything that enters a storm sewer system is discharged *untreated* into the waterbodies we use for swimming, fishing, and providing drinking water.

Remember: Only Rain Down the Drain

To keep the stormwater leaving your home or workplace clean, follow these simple guidelines:

- Use pesticides and fertilizers sparingly.
- Repair auto leaks.
- Dispose of household hazardous waste, used auto fluids (antifreeze, oil, etc.), and batteries at designated collection or recycling locations.
- Clean up after your pet.
- Use a commercial car wash or wash your car on a lawn or other unpaved surface.
- Sweep up yard debris rather than hosing down areas. Compost or recycle yard waste when possible.
- Clean paint brushes in a sink, not outdoors. Properly dispose of excess paints through a household hazardous waste collection program.
- Sweep up and properly dispose of construction debris like concrete and mortar.

EPA
United States
Environmental Protection
Agency

EPA 841-F-03-003

Protecting Water Quality *from* URBAN RUNOFF

Clean Water Is Everybody's Business

In urban and suburban areas, much of the land surface is covered by buildings and pavement, which do not allow rain and snowmelt to soak into the ground. Instead, most developed areas rely on storm drains to carry large amounts of runoff from roofs and paved areas to nearby waterways. The stormwater runoff carries pollutants such as oil, dirt, chemicals, and lawn fertilizers directly to streams and rivers, where they seriously harm water quality. To protect surface water quality and groundwater resources, development should be designed and built to minimize increases in runoff.

The most recent National Water Quality Inventory reports that runoff from urbanized areas is the leading source of water quality impairments to surveyed estuaries and the third-largest source of impairments to surveyed lakes.

Did you know that because of impervious surfaces like pavement and rooftops, a typical city block generates more than 5 times more runoff than a woodland area of the same size?

How Urbanized Areas Affect Water Quality

Increased Runoff

The porous and varied terrain of natural landscapes like forests, wetlands, and grasslands traps rainwater and snowmelt and allows them to filter slowly into the ground. In contrast, impervious (nonporous) surfaces like roads, parking lots, and rooftops prevent rain and snowmelt from infiltrating, or soaking, into the ground. Most of the rainfall and snowmelt remains above the surface, where it runs off rapidly in unnaturally large amounts.

Storm sewer systems concentrate runoff into smooth, straight conduits. This runoff gathers speed and erosional power as it travels underground. When this runoff leaves the storm drains and empties into a stream, its excessive volume and power blast out streambanks, damaging streamside vegetation and wiping out aquatic habitat. These increased storm flows carry sediment loads from construction sites and other denuded surfaces and eroded streambanks. They often carry higher water temperatures from streets, roof tops, and parking lots, which are harmful to the health and reproduction of aquatic life.

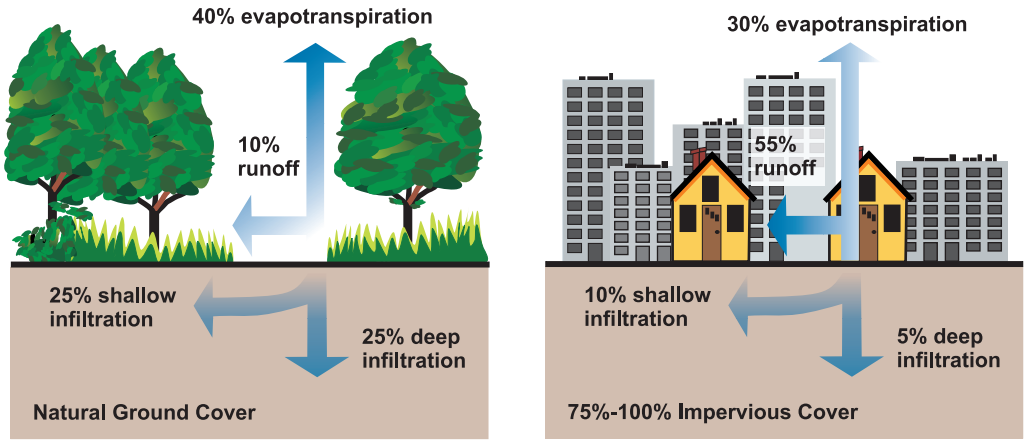
The loss of infiltration from urbanization may also cause profound groundwater changes. Although urbanization leads to great increases in flooding during and immediately after wet weather, in many instances it results in lower stream flows during dry weather. Many native fish and other aquatic life cannot survive when these conditions prevail.

Increased Pollutant Loads

Urbanization increases the variety and amount of pollutants carried into streams, rivers, and lakes. The pollutants include:

- Sediment
- Oil, grease, and toxic chemicals from motor vehicles
- Pesticides and nutrients from lawns and gardens
- Viruses, bacteria, and nutrients from pet waste and failing septic systems
- Road salts
- Heavy metals from roof shingles, motor vehicles, and other sources
- Thermal pollution from dark impervious surfaces such as streets and rooftops

These pollutants can harm fish and wildlife populations, kill native vegetation, foul drinking water supplies, and make recreational areas unsafe and unpleasant.



Relationship between impervious cover and surface runoff. Impervious cover in a watershed results in increased surface ruunoff. As little as 10 percent impervious cover in a watershed can result in stream degradation.

Managing Urban Runoff

What Homeowners Can Do

To decrease polluted runoff from paved surfaces, households can develop alternatives to areas traditionally covered by impervious surfaces. Porous pavement materials are available for driveways and sidewalks, and native vegetation and mulch can replace high maintenance grass lawns. Homeowners can use fertilizers sparingly and sweep driveways, sidewalks, and roads instead of using a hose. Instead of disposing of yard waste, they can use the materials to start a compost pile. And homeowners can learn to use Integrated Pest Management (IPM) to reduce dependence on harmful pesticides.

In addition, households can prevent polluted runoff by picking up after pets and using, storing, and disposing of chemicals properly. Drivers should check their cars for leaks and recycle their motor oil and antifreeze when these fluids are changed. Drivers can also avoid impacts from car wash runoff (e.g., detergents, grime, etc.) by using car wash facilities that do not generate runoff. Households served by septic systems should have them professionally inspected and pumped every 3 to 5 years. They should also practice water conservation measures to extend the life of their septic systems.

Controlling Impacts from New Development

Developers and city planners should attempt to control the volume of runoff from new development by using low impact development, structural controls, and pollution prevention strategies. Low impact development includes measures that conserve natural areas (particularly sensitive hydrologic areas like riparian buffers and infiltrable soils); reduce development impacts; and reduce site runoff rates by maximizing surface roughness, infiltration opportunities, and flow paths.

Controlling Impacts from Existing Development

Controlling runoff from existing urban areas is often more costly than controlling runoff from new developments. Economic efficiencies are often realized through approaches that target "hot spots" of runoff pollution or have multiple benefits, such as high-efficiency street sweeping (which addresses aesthetics, road safety, and water quality). Urban planners and others responsible for managing urban and suburban areas can first identify and implement pollution prevention strategies and examine source control opportunities. They should seek out priority pollutant reduction opportunities, then protect natural areas that help control runoff, and finally begin ecological restoration and retrofit activities to clean up degraded water bodies. Local governments are encouraged to take lead roles in public education efforts through public signage, storm drain marking, pollution prevention outreach campaigns, and partnerships with citizen groups and businesses. Citizens can help prioritize the clean-up strategies, volunteer to become involved in restoration efforts, and mark storm drains with approved "don't dump" messages.

Related Publications

Turn Your Home into a Stormwater Pollution Solution!

www.epa.gov/nps

This web site links to an EPA homeowner's guide to healthy habits for clean water that provides tips for better vehicle and garage care, lawn and garden techniques, home improvement, pet care, and more.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas

www.epa.gov/owow/nps/urbanmm

This technical guidance and reference document is useful to local, state, and tribal managers in implementing management programs for polluted runoff. Contains information on the best available, economically achievable means of reducing pollution of surface waters and groundwater from urban areas.

Onsite Wastewater Treatment System Resources

www.epa.gov/owm/onsite

This web site contains the latest brochures and other resources from EPA for managing onsite wastewater treatment systems (OWTS) such as conventional septic systems and alternative decentralized systems. These resources provide basic information to help individual homeowners, as well as detailed, up-to-date technical guidance of interest to local and state health departments.

Low Impact Development Center

www.lowimpactdevelopment.org

This center provides information on protecting the environment and water resources through integrated site design techniques that are intended to replicate preexisting hydrologic site conditions.

Stormwater Manager's Resource Center (SMRC)

www.stormwatercenter.net

Created and maintained by the Center for Watershed Protection, this resource center is designed specifically for stormwater practitioners, local government officials, and others that need technical assistance on stormwater management issues.

Strategies: Community Responses to Runoff Pollution

www.nrdc.org/water/pollution/storm/stoinx.asp

The Natural Resources Defense Council developed this interactive web document to explore some of the most effective strategies that communities are using around the nation to control urban runoff pollution. The document is also available in print form and as an interactive CD-ROM.

For More Information

U.S. Environmental Protection Agency
Nonpoint Source Control Branch (4503T)
1200 Pennsylvania Avenue, NW
Washington, DC 20460

www.epa.gov/nps

February 2003

Water-Efficient Landscaping:

Preventing Pollution & Using Resources Wisely

A Message from the Administrator

Christine Todd Whitman

I believe water is the biggest environmental issue we face in the 21st Century in terms of both quality and quantity. In the 30 years since its passage, the Clean Water Act has dramatically increased the number of waterways that are once again safe for fishing and swimming. Despite this great progress in reducing water pollution, many of the nation's waters still do not meet water quality goals. I challenge you to join with me to finish the business of restoring and protecting our nation's waters for present and future generations.

United States Environmental Protection Agency
Office of Water (4204M)
EPA832-F-02-002
September 2002
www.epa.gov/owm/water-efficiency/index.htm

Contents

What is Water-efficient Landscaping?

Water, many agree, is our most precious natural resource; without it, life ceases. Yet judging by our water use and consumption practices, many of us in the United States seem to take it for granted. A typical household uses approximately 260 gallons of water per day. "Water conscious" individuals often install high-efficiency shower heads and toilets and wash only full loads of clothes and dishes to reduce consumption. But in the summer, the amount of water used outdoors by a household can exceed the amount used for all other purposes in the entire year. This is especially true in hot, dry climates.

Gardening and lawn care account for the majority of this seasonal increase, but other outdoor activities, such as washing cars and filling swimming pools, also contribute. According to the U.S. Geological Survey, of the 26 billion gallons of water consumed daily in the United States[1], approximately 7.8 billion gallons, or 30 percent[2], is devoted to outdoor uses. The majority of this is used for landscaping. In fact, it is estimated that the typical suburban lawn consumes 10,000 gallons of water above and beyond rainwater each year (Vickers, p 140).

Many mistakenly believe that stunning gardens and beautiful lawns are only possible through extensive watering, fertilization, and pesticide application. As this booklet will demonstrate, eye-catching gardens and landscapes that save water, prevent pollution, and protect the environment are, in fact, easily achieved by employing water-efficient landscaping. Water-efficient landscaping produces attractive landscapes because it utilizes designs and plants suited to local conditions.

This booklet describes the benefits of water-efficient landscaping. It includes several examples of successful projects and programs, as well as contacts, references, and a short bibliography. For specific information about how to best apply water-efficient landscaping principles to your geographical area, consult with your county extension service and local garden and nursery centers. Local governments and water utilities also possess a wealth of information and suggestions for using water more efficiently in all aspects of your life, including landscaping.

Xeriscape garden at Denver Water

1 W.B. Solley, R.R. Pierce, and H.A. Perlman. 1998. *Estimated Use of Water in the United States in 1995* (USGS Circular 1200). USGS. Reston, VA. p.27.

2 Amy Vickers. 2001. *Handbook of Water Use and Conservation*. WaterPlow Press. Amherst, MA. p. 140.

Xeriscaped front yard in Colorado Springs

Many terms and schools of thought have been used to describe approaches to water-efficient landscaping. Some examples include "water-wise," "water-smart," "low-water," and "natural landscaping." While each of these terms varies in philosophy and approach, they are all based on the same principles and are commonly used interchangeably. One of the first conceptual approaches developed to formalize these principles is known as "Xeriscape[3] landscaping." Xeriscape landscaping is defined as "quality landscaping that conserves water and protects the environment." The word "Xeriscape" was coined and copyrighted by Denver Water Department in 1981 to help make water conserving landscaping an easily recognized concept. The word is a combination of the Greek word "*xeros*," which means "dry," and "landscape."

The seven principles upon which Xeriscape landscaping is based are:

- Proper planning and design
- Soil analysis and improvement
- Appropriate plant selection
- Practical turf areas
- Efficient irrigation
- Use of mulches
- Appropriate maintenance

The eight fundamentals of water-wise landscaping, below, illustrate the similarities in the underlaying concepts and principles of Xeriscape landscaping and other water-efficient approaches.

- Group plants according to their water needs.
- Use native and low-water-use plants.
- Limit turf areas to those needed for practical uses.
- Use efficient irrigation systems.
- Schedule irrigation wisely.
- Make sure soil is healthy.
- Remember to mulch.
- Provide regular maintenance.

In short, plan and maintain your landscape with these principles of water efficiency in mind and it will continue to conserve water and be attractive.

3 Denver Water welcomes the use of the term Xeriscape in books, articles, and speeches promoting water conserving landscape. EPA is using this term with permission from Denver Water. For permission to use "Xeriscape" in your publications, call Denver Water at 303 628-6330.

Why Use Water-efficient Landscaping?

Proper landscaping techniques not only create beautiful landscapes, but also benefit the environment and save water. In addition, attractive, water-efficient, low-maintenance landscapes can increase home values.

Water-efficient landscaping offers many economic and environmental benefits, including:

- Lower water bills from reduced water use.
- Conservation of natural resources and preservation of habitat for plants and wildlife such as fish and waterfowl.
- Decreased energy use (and air pollution associated with its generation) because less pumping and treatment of water is required.
- Reduced home or office heating and cooling costs through the careful placement of trees and plants.
- Reduced runoff of stormwater and irrigation water that carries top soils, fertilizers, and pesticides into lakes, rivers, and streams.
- Fewer yard trimmings to be managed or landfilled.
- Reduced landscaping labor and maintenance costs.
- Extended life for water resources infrastructure (e.g., reservoirs, treatment plants, groundwater aquifers), thus reduced taxpayer costs.

Meadow Sage (Salvia pratensis) *is the background for New Mexico Evening Primrose* (Oenothera berlandieri 'siskiyou')

How is Water-efficient Landscaping Applied?

Landscaping that conserves water and protects the environment is not limited to arid landscapes with only rocks and cacti. Through careful planning, landscapes can be designed to be both pleasing to the senses and kind to the environment. One simple approach to achieving this is applying and adopting the basic principles of water-efficient landscaping to suit your climatic region. The seven principles of Xeriscape landscaping are used below to describe these basic concepts in greater detail.

Dragon's Blood Sedum (Sedum spurium) *under Honeylocust Trees* (Gleditsia triaconthos)

Proper planning and design

Developing a landscape plan is the first and most important step in creating a water-efficient landscape. Your plan should take into account the regional and microclimatic conditions of the site, existing vegetation, topography, intended uses of the property, and most importantly, the grouping of plants by their water needs. Also consider the plants' sun or shade requirements and preferred soil conditions. A well-thought-out landscape plan can serve as your roadmap in creating beautiful, water-efficient landscapes and allow you to continually improve your landscape over time.

Soil analysis and improvements

Because soils vary from site to site, test your soil before beginning your landscape improvements. Your county extension service can analyze the pH levels; nutrient levels (e.g., nitrogen, phosphorus, potassium); and the sand, silt, clay, and organic matter content of your soil. It can also suggest ways to improve your soil's ability to support plants and retain water (e.g., through aeration or the addition of soil amendments or fertilizers).

Appropriate plant selection

Your landscape design should take into account your local climate as well as soil conditions. Focus on preserving as many existing trees and shrubs as possible because established plants usually require less water and maintenance. Choose plants native to your region. Native plants, once established, require very little to no additional water beyond normal rainfall. Also, because they are adapted to local soils and climatic conditions, native plants commonly do not require the addition of fertilizers and are more resistant to pests and disease.

When selecting plants, avoid those labeled "hard to establish," "susceptible to disease," or "needs frequent attention," as these types of plants frequently require large amounts of supplemental water, fertilizers, and pesticides. Be careful when selecting non-indigenous species as some of them may become invasive. An invasive plant might be a water guzzler and will surely choke out native species. Your state or county extension service or local nursery can help you select appropriate plants for your area.

The key to successful planting and transplanting is getting the roots to grow into the surrounding soil as quickly as possible. Knowing when and where to plant is crucial to speeding the establishment of new plants. The best time to plant will vary from species to species. Some plants will thrive when planted in a dormant or inactive state. Others succeed when planted during the season when root generation is highest and sufficient moisture is available to support new growth (generally, spring is the best season, but check plant tags or consult with your local nursery for specific species).

Wine Cup (Callirhoe involucrata) *and Sunset Hyssop* (Agastache rupestris) *in the Denver Water Xeriscape Garden*

Practical turf areas

How and where turf is placed in the landscape can significantly reduce the amount of irrigation water needed to support the landscape. Lawns require a large amount of supplemental water and generally greater maintenance than other vegetation. Use turf where it aesthetically highlights the house or buildings and where it has practical function, such as in play or recreation areas. Grouping turf areas can increase watering efficiency and significantly reduce evaporative and runoff losses. Select a type of grass that can withstand drought periods and become dormant during hot, dry seasons. Reducing or eliminating turf areas altogether further reduces water use.

Efficient irrigation

Efficient irrigation is a very important part of using water efficiently outdoors, and applies in any landscape—whether Xeriscape or conventional. For this reason, an entire section of this booklet addresses efficient irrigation; it can be found on page 6.

Use of mulches

Mulches aid in greater retention of water by minimizing evaporation, reducing weed growth, moderating soil temperatures, and preventing erosion. Organic mulches also improve the condition of your soil as they decompose. Mulches are typically composed of wood bark chips, wood grindings, pine straws, nut shells, small gravel, or shredded landscape clippings. Avoid using rock mulches in sunny areas or around non-arid climate plants, as they radiate large amounts of heat and promote water loss that can lead to scorching. Too much mulch can restrict water flow to plant roots and should be avoided.

Appropriate maintenance

Water and fertilize plants only as needed. Too much water promotes weak growth and increases pruning and mowing requirements. Like any landscape, a water-efficient yard will require regular pruning, weeding, fertilization, pest control, and irrigation. As your water-efficient landscape matures, however, it will require less maintenance and less water. Cutting turf grass only when it reaches two to three inches promotes deeper root growth and a more drought-resistant lawn. As a rule of thumb, mow your turf grass before it requires more than one inch to be removed. The proper cutting height varies, however, with the type of grass, so you should contact your county extension service or local nursery to find out the ideal cutting height for your lawn. Avoid shearing plants or giving them high nitrogen fertilizers during dry periods because these practices encourage water-demanding new growth.

Water-efficient Landscape Irrigation Methods

With common watering practices, a large portion of the water applied to lawns and gardens is not absorbed by the plants. It is lost through evaporation, runoff, or being pushed beyond the root zone because it is applied too quickly or in excess of the plants' needs. The goal of efficient irrigation is to reduce these losses by applying only as much water as is needed to keep your plants healthy. This goal is applicable whether you have a Xeriscape or a conventional landscape.

To promote the strong root growth that supports a plant during drought, water deeply and only when the plant needs water. For clay soils, watering less deeply and more often is recommended. Irrigating with consideration to soil type, the condition of your plants, the season, and weather conditions—rather than on a fixed schedule—significantly increases your watering efficiency. Grouping plants according to similar water needs also makes watering easier and more efficient.

Purple Fountain Grass (Pennisetum setaceum "Rubrum") *and Marigolds* (Calendula officinalis) *in planter bed*

Irrigating lawns, gardens, and landscapes can be accomplished either manually or with an automatic irrigation system. Manual watering with a hand-held hose tends to be the most water-efficient method. According to the AWWA Research Foundation's outdoor end use study, households that manually water with a hose typically use 33 percent less water outdoors than the average household. The study also showed that households with in-ground sprinkler systems used 35 percent more water, those with automatic timers used 47 percent more water, and those with drip irrigation systems used 16 percent more water than households without these types of systems. These results show that in-ground sprinkler and drip irrigation systems must be operated properly to be water-efficient.

You can use a hand-held hose or a sprinkler for manual irrigation. To reduce water losses from evaporation and wind, avoid sprinklers that produce a fine mist or spray high into the air. Soaker hoses can also be very efficient and effective when used properly. Use a hand-held soil moisture probe to determine when irrigation is needed.

To make automatic irrigation systems more efficient, install system controllers such as rain sensors that prevent sprinkler systems from turning on during and immediately after rainfall, or soil moisture sensors that activate sprinklers only when soil moisture levels drop below pre-programmed levels. You can also use a weather-

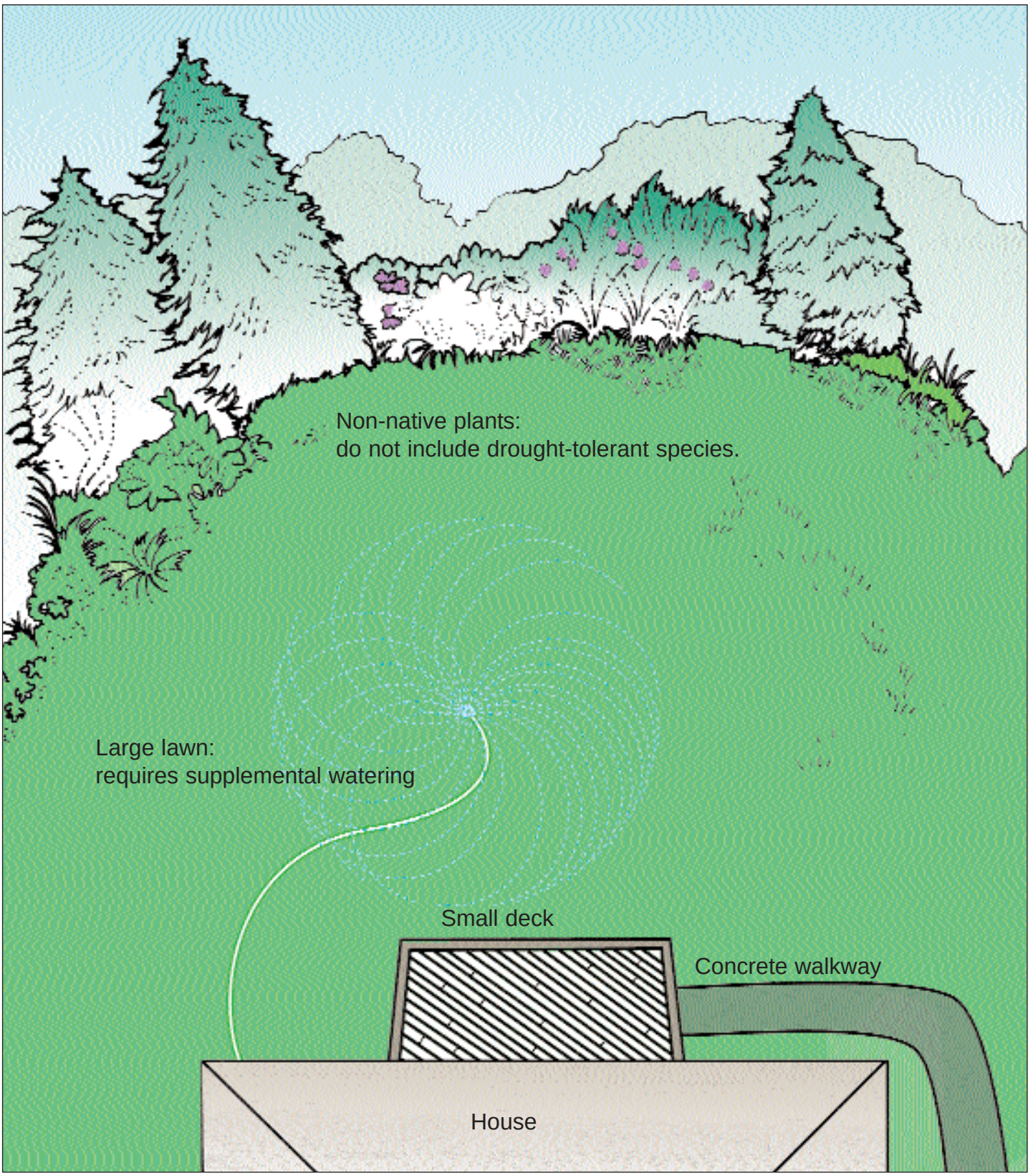
driven programming system. Drip-type irrigation systems are considered the most efficient of the automated irrigation methods because they deliver water directly to the plants' roots. It is also important to revise your watering schedule as the seasons change. Over-watering is most common during the fall when summer irrigation schedules have not been adjusted to the cooler temperatures.

To further reduce your water consumption, consider using alternative sources of irrigation water, such as gray water, reclaimed water, and collected rainwater. According to the AWWA Research Foundation, homes with access to alternative sources of irrigation reduce their water bills by as much as 25 percent.[4] Graywater is untreated household waste water from bathroom sinks, showers, bathtubs, and clothes washing machines. Graywater systems pipe this used water to a storage tank for later outdoor watering use. State and local graywater laws and policies vary, so you should investigate what qualifies as gray water and if any limitations or restrictions apply. Reclaimed water is waste water that has been treated to levels suitable for nonpotable uses. Check with local water officials to determine if it is available in your area. Collected rainwater is rainwater collected in cisterns, barrels, or storage tanks. Commercial rooftop collection systems are available, but simply diverting your downspout into a covered barrel is an easy, low-cost approach. When collecting rainwater, cover all collection vessels to prevent animals and children from entering and to prevent mosquito breeding. Some states might have laws which do not allow collection of rainwater, so be sure to check with your state's water resource agency before implementing a rainwater collection system.

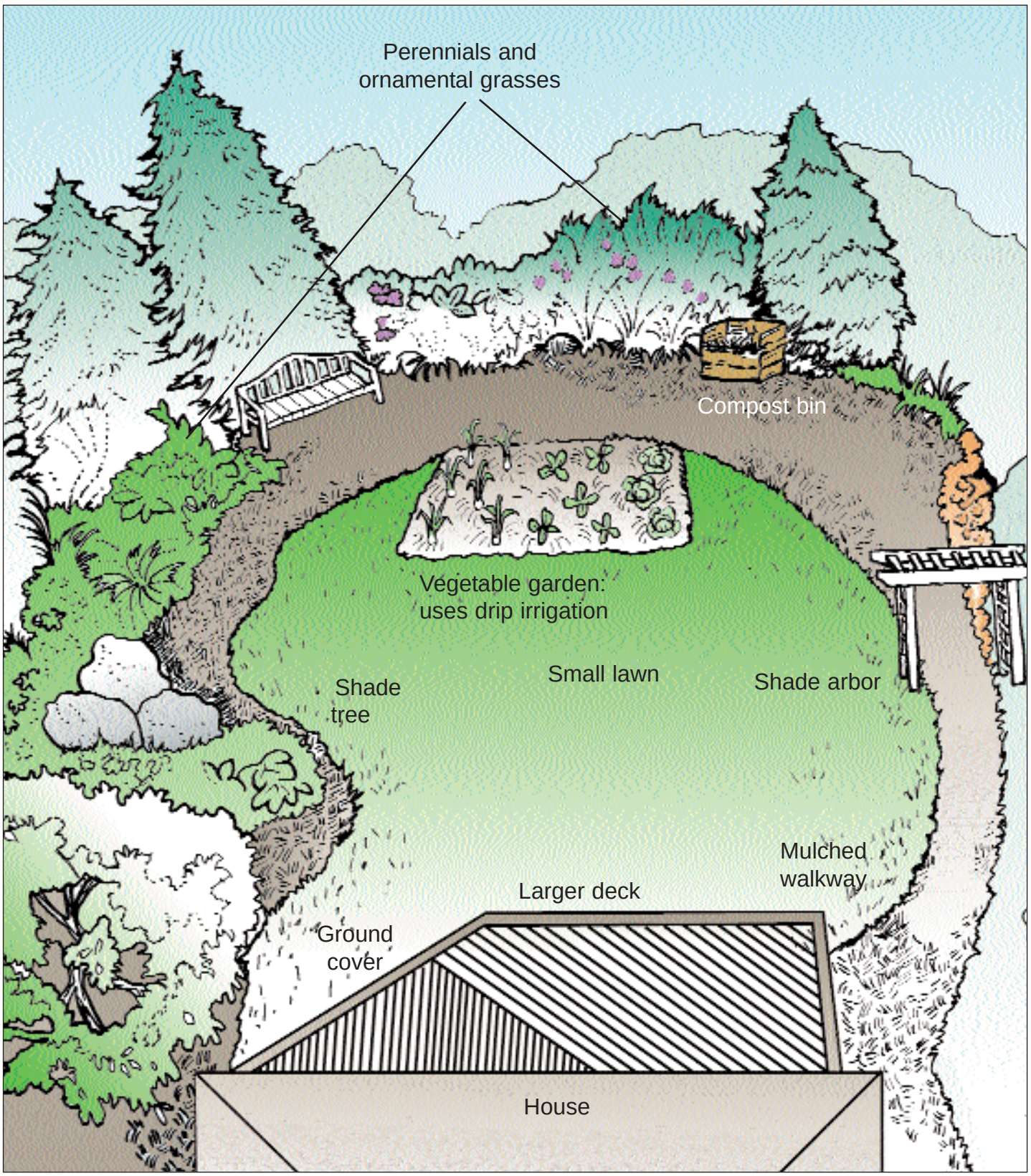
Red Valerian (Centranthus ruber)

4 AWWA Research Foundation. 1999. *Residential End Uses of Water*. <www.waterwiser.org>

Non-xeriscaping



Xeriscaping



Examples of Successful Water-efficient Landscaping Projects

Water-efficient landscaping techniques can be used by individuals, companies, state, tribal, and local governments, and businesses to physically enhance their properties, reduce long-term maintenance costs, and create environmentally conscious landscapes. The following examples illustrate how water-efficient landscapes can be used in various situations.

Oriental Poppies (Paparer orientale)

Homeowner–public/private partnership

- The South Florida Water Management District, the Florida Nurserymen and Growers Association, the Florida Irrigation Society, and local businesses worked together to produce a television video called "Plant It Smart with Xeriscape." The video shows how a typical Florida residential yard can be retrofitted with Xeriscape landscaping to save energy, time, and money. The showcase yard (selected from 70 applicants) had a history of heavy water use—more than 90,000 gallons per month. After the retrofit, the yard's aesthetic value was enhanced; plus it now uses 75 percent less water and relies on yard trimmings for mulch and compost.
- The Southwest Florida Water Management District (SWFWMD), the City of St. Petersburg, and Pinellas County, Florida, produced a video called "Xeriscape It!" It shows a landscape being installed using the seven Xeriscape principles. The SWFWMD also funded several Xeriscape demonstration sites and maintains a Xeriscape demonstration garden at its Brooksville, Florida, headquarters. The garden features a variety of native and non-native plants and is available for public viewing, along with a landscape plant identification guide.
- Residents of Glendale, Arizona, can receive a $100 cash rebate for installing or converting more than half of their landscapable area to non-grass vegetation. The Glendale Water Conservation Office conducts an inspection of the converted lawn to ensure compliance with rebate requirements and then issues a rebate check to the homeowner. The purpose of the Landscape Rebate Program is to permanently reduce the amount of water used to irrigate grass throughout Glendale.

State government

- Although perceived as a water-rich state, Florida became the first to enact a statewide Xeriscape law. Florida's legislature recognized that its growing population and vulnerable environment necessitated legal safeguards for its water resources. The Xeriscape law requires Florida's Departments of Management Ser-

vices and Transportation to use Xeriscape landscaping on all new public properties and to develop a 5-year program to phase in Xeriscape on properties constructed before July 1992. All local governments must also consider requiring the use of Xeriscape and offering incentives to install Xeriscaping.

- Texas also developed legislation requiring Xeriscape landscaping on new construction projects on state property beginning on or after January 1994. Additional legislation, enacted in 1995, requires the Department of Transportation to use Xeriscape practices in the construction and maintenance of roadside parks. All municipalities may consider enacting ordinances requiring Xeriscape to conserve water.

City government

In Las Vegas, Nevada, homeowners can receive up to $1,000 for converting their lawn to Xeriscape, while commercial landowners can receive up to a $50,000 credit on their water bill. The city and several other surrounding communities hope these eye-catching figures will help Las Vegas meet its goal of saving 25 percent of the water it would otherwise have used by the year 2010; to date, it has saved 17 percent. Local officials plan to reach the target with the assistance of incentive programs encouraging Xeriscape, a city ordinance limiting turf to no more than 50 percent of new landscapes, grassroots information programs, and a landscape awards program specifically for Xeriscaped properties. Preliminary results of a five-year study show that residents who converted a portion of their lawns to Xeriscape reduced total water consumption by an average of 33 percent. The xeric vegetation required less than a quarter of the water typically used and one-third the maintenance (both in labor and expenditures) compared to traditional turf.

Yellow Ice Plant (Delosperma nubigenum) *close-up*

Developers

Howard Hughes Properties (HHP), a developer and manager of more than 25,000 acres of residential, commercial, and office development property, has enthusiastically used drought tolerant landscaping on all of its properties since 1990. Most of the company's properties are located in Las Vegas, one of the country's fastest growing metropolitan areas. To conserve resources, the city and county have implemented regulations requiring developers to employ certain Xeriscape principles in new projects. Specifically, a limited percentage of grass can be used on projects, and it must be kept away from streets. As the area's first large-scale developer to recognize the need and value in incorporating drought tolerant landscaping in parks, streetscapes, and open spaces, HHP uses native and desert-adaptive plants that survive and thrive in the Las Vegas climate with minimal to moderate amounts of water.

Drip system irrigation controllers are linked to weather stations that monitor the evapotranspiration rate. This allows HHP to determine the correct amount of water to be applied to plants at any given time. HHP tests the irrigation systems regularly and adds appropriate soil amendments to promote healthy plant growth. The maintenance program also includes pest management, the use of mulching mowers, and the use of rock mulch top dressing on all non-turf planting areas. These measures combine to ensure a beautiful, healthy, and responsible landscape.

Public/private partnerships

Even the most water-conscious homeowners in Southern California are over-watering by 50 to 70 gallons per day. The excess water washes away fertilizers and pesticides, which pollute natural waterways. The quantity of water wasted (and the dollars that pay for it) are even more substantial for large-scale commercial properties and developments.

An innovative partnership in Orange County links landscape water management, green material management, and non-point source pollution prevention goals into one program—the Landscape Performance Certification Program. This program emphasizes efficient landscape irrigation and features a "landscape irrigation budget" based on a property's landscape area, type, and the daily weather. The Municipal Water District monitors actual water use through a system of 12,000 dedicated water meters installed by participating landscape managers.

Participants, including landscapers, property managers, and homeowner associations, can compare the actual cost of water used on their property with the calculated budget. Those staying within budget are awarded certification, a proven marketing tool. This new voluntary program is implemented by the Municipal Water District with input from the California Landscape Contractors' Association, the Orange County Integrated Management Department, the Metropolitan Water District of Southern California, and local nurseries and has the support of 32 retailing water suppliers. The program is already credited with increasing the use of arid-climate shrubs and landscaping to accommodate drip irrigation, and has resulted in cost savings to water customers.

Miscanthus sinensis (Miscanthus grass, also called Maiden grass) *variety with leaves turning yellow for fall.*

For More Information

The following list of organizations can provide more information on water-efficient landscaping. This is not meant to be an exhaustive list, rather it is intended to help you locate local information sources and possible technical assistance.

Turkish Speedwell (Veronica liwanensis) *in background and tulips in foreground.*

Water Management Districts or Utilities

Your local water management district often can provide information on water conservation, including water efficient landscaping practices. Your city, town, or county water management district can be found in the Blue Pages section of your local phone book or through your city, town, or county's Web site if it has one. If you do not know your city, town, or county's Web site, check for a link on your state's Web site. URLs for state Web sites typically follow this format: <www.state.(two letter state abbreviation).us>.

State/County Extension Services

Your state or county extension service is also an excellent source of information. Many extension services provide free publications and advice on home landscaping issues including tips on plant selection and soil improvement. Some also offer a soil analysis service for a nominal fee. Your county extension service can be found in the Blue Pages section of your local phone book under the county government section or through your county's Web site if it has one. The U.S. Department of Agriculture's Cooperative State Research, Education, and Extension Service (www.reeusda.gov/statepartners/usa.htm) provides an online directory of land-grant universities which can help you locate your state extension service. Government Guide (www.governmentguide.com) is yet another online resource that might prove helpful in locating state or local agencies.

Organizations

The following is a partial list of organizations located across the United States that provide helpful information on water-efficient landscaping.

American Water Works Association (AWWA)
6666 West Quincy Avenue
Denver, CO 80235
Telephone: 303 794-7711
and
1401 New York Avenue, NW, Suite 640
Washington, DC 20005
Telephone: 202 628-8303
Web: <www.awwa.org>

Arizona Municipal Water Users Association (AMWUA)
Web: <www.amwua.org/program-xeriscape.htm>

BASIN
City of Boulder Environmental Affairs
P.O. Box 791
Boulder, CO 80306
Phone: 303 441-1964
E-mail: basin@bcn.boulder.co. us
Web: <bcn.boulder.co.us/basin/local/seven.html>

Denver Water
1600 West 12th Avenue
Denver, CO 80204
Phone: 303 628-6000
Fax: 303 628-6199
TDDY: 303 534-4116
Office of Water Conservation hotline:
303 628-6343
E-mail: jane.earle@denverwater.org
Web: <www.water.denver.co.gov/conservation/conservframe.html>

New Mexico Water Conservation Program/Water Conservation Clearinghouse
P. O. Box 25102
Santa Fe, NM 87504
Phone: 800 WATER-NM
E-mail: waternm@ose.state.nm.us
Fax: 505 827-3813
Web: <www.ose.state.nm.us/water-info/conservation/index.html>

Project WET - Water Education for Teachers
201 Culbertson Hall
Montana State University
Bozeman, MT 59717
Phone: 406 994-5392
Web: <www.montana.edu/wwwwet>

Rocky Mountain Institute
1739 Snowmass Creek Road
Snowmass, CO 81654-9199
Phone: 970 927-3851
Web: <www.rmi.org>

Southern Nevada Water Authority
1001 S. Valley View Boulevard, Mailstop #440
Las Vegas, NV 89153
Phone: 702 258-3930
Web: <www.snwa.com>

Southwest Florida Water Management District
2379 Broad Street
Brooksville, FL 34604-6899
Phone: 352 796-7211 or 800 423-1476 (Florida only)
Web: <www.swfwmd.state.fl.us/watercon/xeris/swfxeris.html>

Sustainable Sources Green Building Program: Sustainable Building Source Book
E-mail: info@greenbuilder.com
Web: <www.greenbuilder.com/sourcebook/xeriscape.html>

Water Conservation Garden – San Diego County
12122 Cuyamaca College Drive West
El Cajon, CA 92019
Phone: 619 660-0614
Fax: 619 660-1687
E-mail: info@thegarden.org
Web: <www.thegarden.org/garden/xeriscape/index.html> and <www.sdcwa.org/manage/conservation-xeriscape.phtml>\

WaterWiser: The Water Efficiency Clearing House
(Operated by AWWA in cooperation with the U.S. Bureau of Reclamation)
6666 West Quincy Avenue
Denver, CO 80235
Phone: 800 559-9855
Fax: 303 794-6303
E-mail: bewiser@waterwiser.org
Web: <www.waterwiser.org>

Xeriscape Colorado!, Inc.
P.O. Box 40202
Denver, CO 80204-0202
Web: <www.xeriscape.org>

Resources

The following is a partial list of publications on resource efficient landscaping. For even more information, particularly on plants suited to your locale, consult your local library, county extension service, nursery, garden clubs, or water utility.

Ball, Ken and American Water Works Association Water Conservation Committee. *Xeriscape Programs for Water Utilities*. Denver: American Water Works Association, 1990.

Bennett, Jennifer. *Dry-Land Gardening: A Xeriscaping Guide for Dry-Summer, Cold-Winter Climates*. Buffalo: Firefly, 1998.

Bennett, Richard E. and Michael S. Hazinski. *Water-Efficient Landscape Guidelines*. Denver: American Water Works Association, 1993.

Brenzel, Kathleen N., ed. *Western Garden Book*, 2001 Edition. Menlo Park: Sunset Publishing Corporation, 2001.

City of Aurora, Colorado Utilities Department. *Landscaping for Water Conservation: Xeriscape!* Aurora: Colorado Utilities Department, 1989.

Johnson, Eric and Scott Millard. *The Low-Water Flower Gardener: 270 Unthirsty Plants for Color, Including Perennials, Ground Covers, Grasses & Shrubs*. Tucson: Ironwood Press, 1993.

Knopf, James M. *The Xeriscape Flower Gardener*. Boulder: Johnson Books, 1991.

Knopf, James M., ed. *Waterwise Landscaping with Trees, Shrubs, and Vines: A Xeriscape Guide for the Rocky Mountain Region, California, and the Desert Southwest*. Boulder: Chamisa Books, 1999.

Knox, Kim, ed. *Landscaping for Water Conservation: Xeriscape*. Denver: City of Aurora and Denver Water, 1989.

Nellis, David W. *Seashore Plants of South Florida and the Caribbean: A Guide to Identification and Propagation of Xeriscape Plants*. Sarasota: Pineapple Press, Inc., 1994.

Perry, Bob. *Landscape Plants for Western Regions: An Illustrated Guide to Plants for Water Conservation*. Claremont: Land Design Publishing, 1992.

Phillips, Judith. *Natural by Design: Beauty and Balance in Southwest Gardens*. Santa Fe: Museum of New Mexico Press, 1995.

Phillips, Judith. *Plants for Natural Gardens: Southwestern Native & Adaptive Trees, Shrubs, Wildflowers & Grasses*. Santa Fe: Museum of New Mexico Press, 1995.

Robinette, Gary O. *Water Conservation in Landscape Design and Maintenance*. New York: Nostrand Reinhold, 1984.

Rumary, Mark. *The Dry Garden*. New York: Sterling Publishing Co., Inc., 1995.

Springer, Lauren. *The Undaunted Garden: Planting for Weather-Resilient Beauty*. Golden: Fulcrum Publishing, 1994.

Springer, Lauren. *Waterwise Gardening*. New York: Prentice Hall Gardening, 1994.

Stephens, Tom, Doug Welsh, and Connie Ellefson. *Xeriscape Gardening, Water Conservation for the American Landscape*. New York: Macmillan Publishing, 1992.

Sunset Books, eds. *Waterwise Gardening: Beautiful Gardens with Less Water*. Menlo Park: Lane Publishing Company, 1989.

Vickers, Amy. *Handbook of Water Use and Conservation*. Amherst, MA: WaterPlow Press, 2001.

Weinstein, Gayle. *Xeriscape Handbook : A How-To Guide to Natural, Resource-Wise Gardening*. Golden: Fulcrum Publishing, 1998.

Williams, Sara. *Creating the Prairie Xeriscape*. Saskatchewan: University Extension Press, 1997.

Winger, David, ed. *Xeriscape Plant Guide: 100 Water-Wise Plants for Gardens and Landscapes*. Golden: Fulcrum Publishing, 1998.

Winger, David, ed. *Xeriscape Color Guide*. Golden: Fulcrum Publishing, 1998.

Winger, David, ed. *Evidence of Care: The Xeriscape Maintenance Journal, 2002, Vol. 1*, Colorado WaterWise Council, 2001.

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U.S. Environmental Protection Agency
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Washington, DC 20460

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U.S. Environmental Protection Agency
Ariel Rios Building, 1200 Pennsylvania Avenue, NW.
Washington, DC 20460
<www.epa.gov/OWM/water-efficiency/index.htm>

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